ANEJO Nº 6. ESTRUCTURAS

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   PASO INFERIOR CTRA. DE LA CARTUJA

   PASOS INFERIORES

   P.K. 9+917

   P.K. 10+835

   P.K. 13+595

   P.K. 13+932

   PASOS INFERIORES

   P.K. 3+350

   P.K. 4+500

MARCOS DE OBRAS DE RIEGO

   PASO INFERIORES PREFABRICADOS Y TUBOS DE □1800 mm.

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1. Cuadro resumen

CUADRO RESUMEN DE ESTRUCTURAS

ESTRUCTURA	SITUACIÓN	LONGITUD	VANOS	TIPOLOGÍA
E - 1	4 + 689,5 - 5 + 229,5 La Cartuja	540	20 + 20 x 25 + 20	Tablero de losa continua
E- 2	8 + 995 - 7 + 060 Bco. de La Concepción	65	20 + 25 + 20	Tablero de losa continua
E - 3	12 + 028,66 - 13 + 243,66 Val Palacín	120	27 + 2 x 33 + 27	Tablero de cajón hueco pretensado
E - 4	13 + 090,66 - 13 + 243,66 Val de Macho	153	27 + 3 x 33 + 27	Tablero de cajón hueco pretensado
E- 5	14 + 624,66 - 14 + 843,66 Val de Vares	219	27 + 5 x 33 + 27	Tablero de cajón hueco pretensado

2. Descripción: tipología, aparatos de apoyo, juntas, etc.

2. DESCRIPCIÓN: tipología, aparatos de apoyo, juntas, etc.

ESTRUCTURA E-1

ESTRUCTURA E-2

ESTRUCTURA E-3

ESTRUCTURA E-4

ESTRUCTURA E-5

IMPERMEABILIZACIÓN

APARATOS DE APOYO

- Cálculo de los aparatos de apoyo tipo “POT” unidireccionales y multidireccionales
- Reacciones y movimientos en los apoyos de las estructuras
- Tabla de aparatos de apoyo. Cargas y desplazamientos
- Método de cálculo
- Cálculos y planillas
- Método de instalación

ESTRUCTURA E - 1

Longitud: 540 m = 20 + 20 x 25 + 20

Cimentación

Las zapatas de las pilas a excepción de la pila 21 se apoyan en cuatro pilotes de ∅ 1,5 m.
Los pilotes se empotran en la roca de yeso 3 ∅ (4,5 m).
El Corte estratigráfico al ejecutar estos pilotes, estaba formado por unos 10 m de limos yesíferos colapsables en la zona superior, unos 15 m de gravas y luego aparecía la roca de yeso, donde se empotraban.
La media de profundidad de estos pilotes está en los 30 m, siendo el más profundo de 34 m.
La ejecución de los pilotes en esta estructura se realizó con camisa de chapa.
Inicialmente se excavaba, para posteriormente introducir la correspondiente armadura, que incluía los 4 tubos para el posterior control de integridad de los mismos, que se ejecutaba por el método de cross-hole.
Sobre estos pilotes apoyaban las zapatas, que en función de la altura de pilas eran de 8,20 (sentido transversal) x 6,75 (sentido longitudinal) x 2,50 de altura en las 6 primeras pilas y de 8,20 x 8,20 x 2,50 en las restantes a excepción de la 18, que por estar próxima a la carretera de acceso a la Tudor se ejecutó de 10 x 2,50 x 2,50 y la 21, que apoyaba directamente en el terreno y estaba próxima al Canal Imperial se ejecutó sé 11,20 x 6,00 x 2,00.El estribo 1 (lado Zaragoza) apoyaba sobre 7 pilotes de ∅ 1,5 m con una zapata de 14,50 x 7,50 x 2. El alzado alcanzó los 9 m de altura.
El estribo 2 (lado Lérida), donde se ancla el tablero tiene una cimentación de 17,70 x 18,60 x una altura variable, entre 2 y 3,5 m para de esta manera aumentar el rozamiento. El alzado de este estribo está en los 9 m.

Alzado Pilas

Cada pila está formada por dos fustes de sección próxima a un polígono octogonal, en el que se han sustituido los lados del polígono por arcos de circunferencia para conseguir un diseño estético aceptable. La pila se completa con un travesaño entre fustes que asegura una mayor rigidez del conjunto respecto a los esfuerzos transversales.
La altura máxima de pila no llegó a los 15 m.

Aparatos de Apoyo

Se han utilizado "pot" unidireccionales en el lado izquierdo y multidireccionales en el derecho.

Tablero

Losa continua de hormigón pretensado de anchura 13,70 m y canto 1,65 m. La losa va aligerada mediante 4 tubos de ∅ 1,15 m de "nervoacero".
El Pretensado está diseñado por 10 cables cada uno por 24 torones de 0,6" que alojaban dentro de una vaina de 110 mm de ∅ interior.
La ejecución del tablero se realizó con cimbra cuajada.

ESTRUCTURA E - 2

Longitud : 65 m = 20 + 25 + 20

Es una estructura exactamente igual a la E - 1. Destacar que la altura de pilas es algo inferior a los 10 m y en el corte estratigráfico de la vaguada no aparecen las gravas. (Solo hay limos y yesos). La longitud de los pilotes está en los 22 m.

ESTRUCTURA E - 3

Longitud : 120 m = 27 + 2 x 33 + 27

Cimentación

Sólo la pila 2 apoya sobre 5 pilotes de ∅ 1,5 m, siendo el resto de las cimentaciones directas.

La dimensión de la zapata de la pila 2 es de 8,30 x 8,30 x 2,70; mientras que las de las pilas 1 y 3 son de 10 x 8,20 x 2,50.
Los pilotes atraviesan los limos y se empotran en los yesos subyacentes, estando su longitud máxima en los 22 m.
El estribo 1 tiene unas dimensiones de cimentación de 13,70 x 6,60 x 2, 00; mientras que el estribo 2, (donde se ancla el tablero) tiene 15,70 x 10,25 x altura variable entre 2,50 y 3,25. Los alzados de ambos estribos están muy próximos a los 10 m.

Alzados pilas

Las pilas son de fuste único con un ensanchamiento en cabeza para alojamiento de los aparatos de apoyo.
La altura máxima de pila corresponde a la 2 con una altura algo superior a los 15 m, mientras que la 1 alcanza los 12,5 m y la 3 los 14,90 m.

Aparatos de apoyo

Se han utilizado los de tipo "pot".

Tablero

Es un cajón hueco pretensado de anchura 13,70 m y canto 2,45 m.
El pretensado está diseñado por 8 cables, formado cada uno por 27 torones de 0,6 " alojados dentro de una vaina de 110 mm de ∅ interior. Además existe un refuerzo de pretensado en los vanos intermedios en la zona inferior del tablero formado por dos cables con 15 torones cada uno de 0,6", alojados en unas vainas de 90 mm de ∅ interior.

ESTRUCTURA E - 4

Longitud : 153 m = 27 + 3 x 33 + 27

Cimentación

Como todas las estructuras las zapatas apoyan sobre pilotes de ∅ 1,5 m. En este caso se diseñaron 5.
El corte estratigráfico del terreno que atraviesan los pilotes está formado por limos y yesos donde se empotran 3 ∅ (4,5 m).
La longitud en este caso ha oscilado entre los 13 m de la pila 1 y los 18,60 de la 2.
El estribo 1 tiene unas dimensiones en cimentación de 13,70 x 6,20; mientras que el 2 (donde se ancla el tablero) tiene 14,70 x 12,00 x altura variable entre 2,80 y 3,70. Los alzados de ambos estribos están próximos a los 10 m.

Alzados Pilas

Las pilas son como las de la E- 1 y la E - 2, con una altura máxima en la pila 4 de 12,5 m.

Aparatos de Apoyo

Se han utilizado los de tipo "pot".

Tablero

Como en la E - 3. Cajón hueco pretensado de anchura 13,70 m y canto 2,45 m.
Idéntico pretensado (8 cables, formado cada uno por 27 torones de 0,6 " y un refuerzo intermedio de 2 cables de 15 torones cada uno de 0,6"). Las vainas son de ∅ interior de 110 y 90 mm respectivamente.

ESTRUCTURA E - 5

Longitud : 219 m = 27 + 5 x 33 + 27

Cimentación

Al igual que en el resto de las estructuras las zapatas apoyan sobre pilotes de ∅ 1,5 m.
La pila 0 sobre 5 y el resto sobre 6.
El corte estratigráfico es como el del resto de vales (valle) con la zona superior de limos y en el fondo la roca de yeso.
La longitud de los pilotes ha oscilado en este caso entre los 12 m de la pila 1 y los 35 de la 3.
El estribo 1 tiene unas dimensiones en cimentación de 15,70 x 8,20 x 2,50; mientras que el 2 (donde se ancla el tablero, como en todas) tiene 15,70 x 14,00 x altura variable entre 2,50 y 3,50. Los alzados de ambos estribos están entre 13 y 10,5 m respectivamente.

Alzados Pilas

Las pilas son como las de la E- 3, con un solo fuste. La altura de las pilas está entre los 15,70 de la pila 0 y los 31,90 m de la 4.

Aparatos de Apoyo

Se han utilizado los de tipo "pot".

Tablero

Como en la E - 3 y la E - 4. Cajón hueco pretensado de anchura 13,70 m y canto 2,45 m.

IMPERMEABILIZACIÓN

Todos los tableros se han impermeabilizado con BITUPOX, pintura bicomponente e impermeable a base de epoxi-bitumen.

La impermeabilización con este producto se consigue en forma de barreras adhesivas continuas y de endurecimiento a temperatura ambiente sobre hormigón, protegiendo la superficie del mismo frente al agua y a las sales de deshielos.

La espectativa de vida de este producto expuesto a la intemperie es de al menos dos años.

CÁLCULO DE LOS APARATOS DE APOYO TIPO "POT" UNIDIRECCIONALES Y MULTIDIRECCIONALES

A partir de las reacciones y movimientos en apoyos obtenidos del cálculo de las estructuras E-1, E-2, E-3, E-4 y E-5 que se recogen en los cuadros resumen que se incluyen a continuación, se ha realizado el cálculo para sustituir los aparatos de apoyo tipo neopreno zunchado y neopreno zunchado + teflón por aparatos de apoyo tipo "POT" unidireccionales y multidireccionales. Para ello, se ha elaborado una tabla de cargas y desplazamientos, para cada una de las pilas y estribos de las cinco estructuras anteriormente citadas, en la que se han agrupado los apoyos tipo "POT" a sustituir, por cargas semejantes o del mismo orden de magnitud para simplificar su diseño y fabricación.

Como puede observarse, las cargas consideradas para el cálculo de estos apoyos tipo "POT" son siempre superiores a las solicitaciones que resultan del cálculo en cada tablero.

Para la determinación de los movimientos admisibles de estos apoyos tipo "POT", se han mayorado con un coeficiente de 1,5 los desplazamientos que resultan de los cálculos y que se recogen en los cuadros resumen citados anteriormente.

Los desplazamientos reflejados en la tabla de cargas y desplazamientos corresponden a desplazamientos máximos con la placa de deslizamiento centrada en el eje de apoyo. Dado que los movimientos no son iguales en ambos sentidos, los apoyos se montarán en fábrica con un desplazamiento inicial que corrija la diferencia de desplazamientos entre los dos sentidos, de manera que los movimientos de cálculo mayorados con el coeficiente de 1,5 sean los que realmente puedan realizar los apoyos tipo "POT" una vez colocados en la estructura correspondiente.

Los datos necesarios para el cálculo de los aparatos de apoyo tipo "POT" y el cálculo de los mismos se recoge, a continuación, de acuerdo con el siguiente índice:

1. Cuadro resumen con las reacciones y los movimientos en cada uno de los apoyos para las cinco estructuras proyectadas (E-1, E-2, E-3, E-4 y E-5).

2. Tabla mayorada de cargas y deslizamientos a considerar en el cálculo de los aparatos de apoyo tipo "POT" UNIDIRECCIONALES Y MULTIDIRECCIONALES.

3. Memoria descriptiva del método empleado en el cálculo de cada uno de los aparatos de apoyo tipo "POT", que pueden sustituir a los de neopreno zunchado y neopreno zunchado + teflón.

4. Cálculos y planillas de cada uno de los aparatos de apoyo tipo "POT" considerados.

5. Método de instalación

NOTA:

El apartado nº 1 de esta documentación ha sido elaborado por el Proyectista de las cinco estructuras (SIEGRIST Y MORENO, S.L.)

Los apartados nºs 2, 3, 4 y 5 han sido elaborados por el suministrador de los aparatos de apoyo (CTT STRONGHOLD, S.A.).

REACCIONES Y MOVIMIENTOS EN
LOS APOYOS DE LAS ESTRUCTURAS:

- E-1
- E-2
- E-3
- E-4
- E-5

LINEA ALTA VELOCIDAD ZARAGOZA-LERIDA. SUBTRAMO I.
Reacciones y movimientos en apoyos.

ESTRUCTURA: E-1

APOYO	TIPO APOYO	Rv max. (t)	Rv perm. (t)	Rv min. (t)	SIN SISMO Rh long. (t)	SIN SISMO Rh transv. (t)	CON SISMO Rh long. (t)	CON SISMO Rh transv. (t)	ACORTAMIENTO (mm)	ALARGAMIENTO (mm)	GIRO (radx1000)
E-1	TEFLON	285	184	128	8,2	23,5	8,2	38,6	324	108	2,259
P-1	TEFLON	780	415	370	20,8	15,8	20,8	10,2	312	104	1,910
P-2	TEFLON	835	435	395	21,8	26,6	21,8	19,3	297	99	1,630
P-3	TEFLON	840	435	395	21,8	26,7	21,8	23,9	282	94	1,650
P-4	TEFLON	840	435	395	21,8	29,7	21,8	27,5	267	89	1,650
P-5	TEFLON	840	435	395	21,8	34,3	21,8	30,6	252	84	1,650
P-6	TEFLON	840	435	395	21,8	30,0	21,8	31,2	237	79	1,650
P-7	TEFLON	850	435	395	21,8	28,8	21,8	32,2	222	74	1,650
P-8	TEFLON	850	435	395	21,8	28,5	21,8	33,2	207	69	1,650
P-9	TEFLON	850	435	395	21,8	30,0	21,8	34,2	192	64	1,650
P-10	TEFLON	850	435	395	21,8	29,0	21,8	34,5	177	59	1,650
P-11	TEFLON	850	435	395	21,8	28,9	21,8	34,8	162	54	1,650
P-12	TEFLON	850	435	395	21,8	29,4	21,8	35,5	147	49	1,650
P-13	TEFLON	850	435	395	21,8	30,4	21,8	36,6	132	44	1,650
P-14	TEFLON	850	435	395	21,8	32,0	21,8	38,6	117	39	1,650
P-15	TEFLON	850	435	395	21,8	31,8	21,8	40,8	102	34	1,650
P-16	TEFLON	850	435	395	21,8	34,5	21,8	44,3	87	29	1,650
P-17	TEFLON	850	435	395	21,8	40,1	21,8	48,4	72	24	1,650
P-18	NEOPRENO	850	435	395	21,8	19,4	21,8	44,3	57	19	1,650
P-19	NEOPRENO	850	435	395	21,8	21,6	21,8	41,9	42	14	1,650
P-20	NEOPRENO	850	435	395	21,8	16,6	21,8	32,1	27	9	1,650
P-21	NEOPRENO	770	410	353	20,5	7,9	20,5	16,0	12	4	0,866
E-2	NEOPRENO(*)	290	172	133	---	42,2	---	69,2	---	---	1,487

(*) APOYO FIJO LONGITUDINALMENTE POR ANCLAJE DEL TABLERO AL ESTRIBO.
LAS REACCIONES SON POR APOYO, EXCEPTO Rh transv. QUE CORRESPONDE AL APOYO GUIADO EN APARATOS DESLIZANTES (TEFLON).
LAS REACCIONES Rh transv. CON SISMO SE OBTIENEN CONSIDERANDO EL 25% DE LA ACCION DEL VIENTO.
LOS GIROS Y MOVIMIENTOS TRANSVERSALES SON DESPRECIABLES.

ESTRUCTURA: E-2

APOYO	TIPO APOYO	Rv max. (t)	Rv perm. (t)	Rv min. (t)	SIN SISMO Rh long. (t)	SIN SISMO Rh transv. (t)	CON SISMO Rh long. (t)	CON SISMO Rh transv. (t)	ACORTAMIENTO (mm)	ALARGAMIENTO (mm)	GIRO (radx1000)
E-1	NEOPRENO	322	182	161	16,6	6,5	16,6	8,7	57	13	1,978
P-1	NEOPRENO	761	425	402	15,1	7,1	15,1	14,6	40	9	0,683
P-2	NEOPRENO	761	425	402	6,8	13,3	6,8	14,2	18	4	0,683
E-2	NEOPRENO(*)	329	187	166	---	11,7	---	7,3	---	---	1,978

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LOS GIROS Y MOVIMIENTOS TRANSVERSALES SON DESPRECIABLES.

ESTRUCTURA: E-3

APOYO	TIPO APOYO	Rv max. (t)	Rv perm. (t)	Rv min. (t)	SIN SISMO Rh long. (t)	SIN SISMO Rh transv. (t)	CON SISMO Rh long. (t)	CON SISMO Rh transv. (t)	ACORTAMIENTO (mm)	ALARGAMIENTO (mm)	GIRO (radx1000)
E-1	TEFLON	407	229	191	12,1	35,0	12,1	35,2	88	24	1,985
P-1	NEOPRENO	1005	552	502	35,7	2,3	35,7	21,8	68	19	1,590
P-2	NEOPRENO	1061	584	546	27,7	4,4	27,7	33,2	44	12	1,347
P-3	NEOPRENO	1003	550	499	17,1	4,1	17,1	22,0	20	5	0,851
E-2	NEOPRENO(*)	419	242	204	---	34,0	---	36,0	---	---	1,716

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LAS REACCIONES Rh transv. CON SISMO SE OBTIENEN CONSIDERANDO EL 25% DE LA ACCION DEL VIENTO.
LOS GIROS Y MOVIMIENTOS TRANSVERSALES SON DESPRECIABLES.

ESTRUCTURA: E-4

APOYO	TIPO APOYO	Rv max. (t)	Rv perm. (t)	Rv min. (t)	SIN SISMO Rh long. (t)	SIN SISMO Rh transv. (t)	CON SISMO Rh long. (t)	CON SISMO Rh transv. (t)	ACORTAMIENTO (mm)	ALARGAMIENTO (mm)	GIRO (radx1000)
E-1	TEFLON	399	222	191	11,7	79,4	11,7	71,6	112	31	2,024
P-1	NEOPRENO	995	545	504	29,7	3,2	29,7	11,0	92	25	1,671
P-2	NEOPRENO	1034	563	528	24,7	6,8	24,7	19,7	68	19	1,430
P-3	NEOPRENO	1040	569	523	18,7	8,5	18,7	20,1	44	12	1,520
P-4	NEOPRENO	998	548	492	9,5	6,4	9,5	11,6	20	5	0,868
E-2	NEOPRENO(*)	411	234	195	---	37,3	---	36,1	---	---	1,639

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LAS REACCIONES Rh transv. CON SISMO SE OBTIENEN CONSIDERANDO EL 25% DE LA ACCION DEL VIENTO.
LOS GIROS Y MOVIMIENTOS TRANSVERSALES SON DESPRECIABLES.

ESTRUCTURA: E-5

APOYO	TIPO APOYO	Rv max. (t)	Rv perm. (t)	Rv min. (t)	SIN SISMO Rh long. (t)	SIN SISMO Rh transv. (t)	CON SISMO Rh long. (t)	CON SISMO Rh transv. (t)	ACORTAMIENTO (mm)	ALARGAMIENTO (mm)	GIRO (radx1000)
E-1	TEFLON	408	229	191	12,1	85,1	12,1	74,2	160	44	1,844
P-0	TEFLON	1000	553	503	44,5	50,6	44,5	30,0	140	38	1,702
P-1	NEOPRENO	1043	578	537	33,0	4,5	33,0	7,7	116	32	1,511
P-2	NEOPRENO	1038	578	537	22,3	8,0	22,3	14,4	92	25	1,417
P-3	NEOPRENO	1039	570	533	17,1	10,0	17,1	16,8	68	19	1,448
P-4	NEOPRENO	1047	576	534	12,9	11,0	12,9	14,9	44	12	1,412
P-5	NEOPRENO	1003	550	499	13,1	10,9	13,1	9,1	20	5	0,979
E-2	NEOPRENO(*)	422	241	203	---	37	---	36,7	---	---	1,858

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LOS GIROS Y MOVIMIENTOS TRANSVERSALES SON DESPRECIABLES.

TABLA DE
APARATOS DE APOYO
CARGAS Y DESPLAZAMIENTOS

Obra: AVE. Zaragoza-LLeida. Subtramo 1

APARATOS DE APOYO
CARGAS Y DESPLAZAMIENTOS

Presión admisible en hormigón: Tablero: 22 N/mm2
Pila: 20 N/mm2

ESTRUC.	APOYO	V max. (KN)	V min. (KN)	Hx max. (KN)	Hy max. (KN)	Ex (mm)	Ey (mm)	ROTAC. (rad)	REFER. TIPO PU	REFER. TIPO PL
	E-1	2.850	1.280	85	386	± 324	± 10	0,010	U1E1	L1E1
	P-1	7.800	3.530	234	160	± 312	± 10	0,010	U2E1	L2E1
	P-2	8.500	3.950	255	484	± 297	± 10	0,010		
	P-3	8.500	3.950	255	484	± 282	± 10	0,010		
	P-4	8.500	3.950	255	484	± 267	± 10	0,010		
	P-5	8.500	3.950	255	484	± 252	± 10	0,010		
	P-6	8.500	3.950	255	484	± 237	± 10	0,010		
	P-7	8.500	3.950	255	484	± 222	± 10	0,010		
	P-8	8.500	3.950	255	484	± 207	± 10	0,010		
	P-9	8.500	3.950	255	484	± 192	± 10	0,010		
	P-10	8.500	3.950	255	484	± 177	± 10	0,010		
	P-11	8.500	3.950	255	484	± 162	± 10	0,010	U3E1	L3E1
	P-12	8.500	3.950	255	484	± 147	± 10	0,010		
	P-13	8.500	3.950	255	484	± 132	± 10	0,010		
	P-14	8.500	3.950	255	484	± 117	± 10	0,010		
	P-15	8.500	3.950	255	484	± 102	± 10	0,010		
	P-16	8.500	3.950	255	484	± 87	± 10	0,010		
	P-17	8.500	3.950	255	484	± 72	± 10	0,010		
	P-18	8.500	3.950	255	484	± 57	± 10	0,010		
	P-19	8.500	3.950	255	484	± 42	± 10	0,010		
	P-20	8.500	3.950	255	484	± 27	± 10	0,010		
	P-21	7.800	3.530	234	160	± 12	± 10	0,010	U2E1	L2E1
	E-2	2.900	1.330	87	692	± 10	± 10	0,010	UEE1	LEE1
	E-1	3.220	1.610	97	67	± 53	± 10	0,010	U1E2	L1E2
	P-1	7.800	3.530	234	160	± 37	± 10	0,010	U2E1	L2E1
	P-2	7.800	3.530	234	160	± 17	± 10	0,010		
	E-2	3.290	1.660	99	117	± 10	± 10	0,010	UEE2	LEE2
	E-1	4.070	2.290	122	352	± 84	± 10	0,010	U1E3	L1E3
	P-1	10.610	4.990	318	332	± 66	± 10	0,010		
	P-2	10.610	4.990	318	332	± 42	± 10	0,010	U2E3	L2E3
	P-3	10.610	4.990	318	332	± 19	± 10	0,010		
	E-2	4.190	1.950	126	373	± 10	± 10	0,010	UEE3	LEE3
	E-1	4.070	1.910	122	851	± 108	± 10	0,010	U1E4	L1E4
	P-1	10.070	4.920	302	116	± 88	± 10	0,010	U2E4	L2E3
	P-2	10.610	4.990	318	332	± 66	± 10	0,010	U2E3	L2E3
	P-3	10.610	4.990	318	332	± 42	± 10	0,010	U2E3	L2E3
	P-4	10.070	4.920	302	116	± 19	± 10	0,010	U2E4	L2E3
	E-2	4.190	1.950	126	373	± 10	± 10	0,010	UEE3	LEE3
	E-1	4.070	1.910	122	851	± 130	± 10	0,010	U1E4	L1E4
	P-0	10.070	4.990	318	332	± 135	± 10	0,010	U0E5	L2E3
	P-1	10.610	4.990	318	332	± 111	± 10	0,010	U2E3	L2E3
	P-2	10.610	4.990	318	332	± 88	± 10	0,010	U2E3	L2E3
	P-3	10.610	4.990	318	332	± 66	± 10	0,010	U2E3	L2E3
	P-4	10.610	4.990	318	332	± 42	± 10	0,010	U2E3	L2E3
	P-5	10.070	4.920	302	116	± 19	± 10	0,010	U2E4	L2E3
	E-2	4.190	1.950	126	373	± 10	± 10	0,010	UEE3	LEE3

MÉTODO DE CÁLCULO

MÉTODO DE CALCULO

1.- Presiones en el hormigón

La presión máxima en el hormigón, tanto en pila como en tablero, debida a la máxima carga vertical debe ser limitada a los valores admisibles dados por el proyectista en E.L.S. De acuerdo a la norma British Standard 5.400 podemos asumir una distribución de cargas a 60º a través de los componentes.

1.1.- Placa superior

$$\sigma avg. = \frac{4 * Vmax}{\pi * VO^2}$$

donde :

VO = D6+ (2 x tang 60º x (T5 + TA))

1.2.- Placa inferior

$$\sigma avg. = \frac{4 * Vmax}{\pi * VU^2}$$

donde :

VU = D2+ (2 x tang 60º x TU)

2.- Presión en el elastómero

La máxima presión en el elastómero, en apoyos Pot , debida a la máxima carga vertical se debe limitar a 35 N/mm^2 en E.L.S.

$$\sigma p = \frac{4 * Vmax}{\pi * D1^2}$$

donde :

D1 = diámetro del elastómero

3.- Deformación del elastómero

La rotación α de un apoyo Pot alrededor de cualquier eje horizontal debe ser limitada de manera que la deformación vertical inducida en el perimetro de la almohadilla elastomérica en estado límite de servicio no exceda el valor 0,15.

$$\varepsilon = \frac{\alpha * D1}{2 * H1} \leq 0{,}15$$

donde :

D1 = diámetro del elastómero
H1 = espesor del elastómero
α = max. ángulo de rotación en rad.

4.- Tensiones en la cazoleta

Tanto el anillo como la placa inferior por si solos deben ser capaces de soportar las fuerzas horizontales impuestas por la presión del elastómero y las cargas horizontales externas.

Tensión en la placa inferior : $\frac{Z}{Ap} \leq$ σ admisible (en ELS)

Tensión en el anillo : $\frac{Z}{Ar} \leq$ σ admisible (en ELS)

donde :

Fuerza debida al elastómero : Zr = D1 * H1 * σp

Fuerza horizontal total : $Zh = \sqrt{(Hx^2) + (Hy^2)}$

Fuerza total : Z = Zr + Zh

Área del anillo : Ar = (D2 - D1) * TR

Área de la placa inferior : Ap = D 1 * T1

D2 : diámetro externo del anillo

T1 : espesor de la placa inferior ≥ 12 mm.

5.- Presión en el PTFE

La máxima presión en el PTFE debida a la máxima carga vertical debe ser limitada tal como sigue :

todas las cargas : 45 N/mm^2
carga permanente solo : 30 N/mm^2

siendo :

para PL-tipo $\sigma = \frac{4 * V}{\pi * D6^2}$

para PU-tipo $\sigma = \frac{V}{(0{,}785 * D6^2) - (D1 * BF)}$

6.- Guía de deslizamiento (solo PU-tipo)

6.1.- Presión entre guía de deslizamiento y DU-metal

Max. presión entre la guía de deslizamiento y el DU-metal debe ser limitada a 100 N/mm^2 en E.L.S.

$$\sigma \text{ du} = \frac{Hy}{D1 * BDU}$$

6.2.- Soldadura de la guía de deslizamiento.

La tensión equivalente de comparación debida a la combinación de las tensiones normales y tensiones tangenciales debe ser limitada a la tensión admisible en E.L.S.

$$\sigma\ eq = \sqrt{\sigma^2 + (3 * \tau^2)} \leq \sigma \text{ adm.}$$

donde :

$$\tau = \frac{Hy}{2 * A5 * D1}$$

$$\sigma = \frac{Hy * e}{0.6 * A5 * D1 * BS}$$

BS = BF - A5

$$e = HF - \frac{BDU}{2}$$

7.- Flexión del pistón

La máxima tensión de flexión del pistón bajo la acción de fuerzas horizontales se debe limitar a la tensión admisible en E.L.S.

$$\sigma \text{ flexión} = \frac{6 * Ec * Hy}{2 * T3^2 * D1} * \left(\frac{D1 - BF}{D1}\right)^2 \leq \sigma \text{ adm.}$$

donde :

$$Ec = HF - \frac{BDU}{2} + T3 - \frac{H2}{2}$$

8.- Transmisión de fuerzas horizontales entre pistón y anillo

La máxima presión entre anillo y pistón se debe limitar a la tensión admisible en E.L.S. Se asume una distribución cosinoidal para computar la máxima presión entre pistón y anillo (cazoleta).

$$\sigma = \frac{po}{H2} \leq \sigma \text{ adm.}$$

donde :

po = 1.27 * Zh / D1 (distribución cosinoidal)

9.- Seguridad frente a deslizamiento con Vmin.

Con el fin de alcanzar un coeficiente de seguridad de S = 1.5 frente al deslizamiento del apoyo sobre la superficie de hormigón debemos satisfacer la condición siguiente :

$$\frac{\mu}{S} * Vmin + n * Hd \geq Zh$$

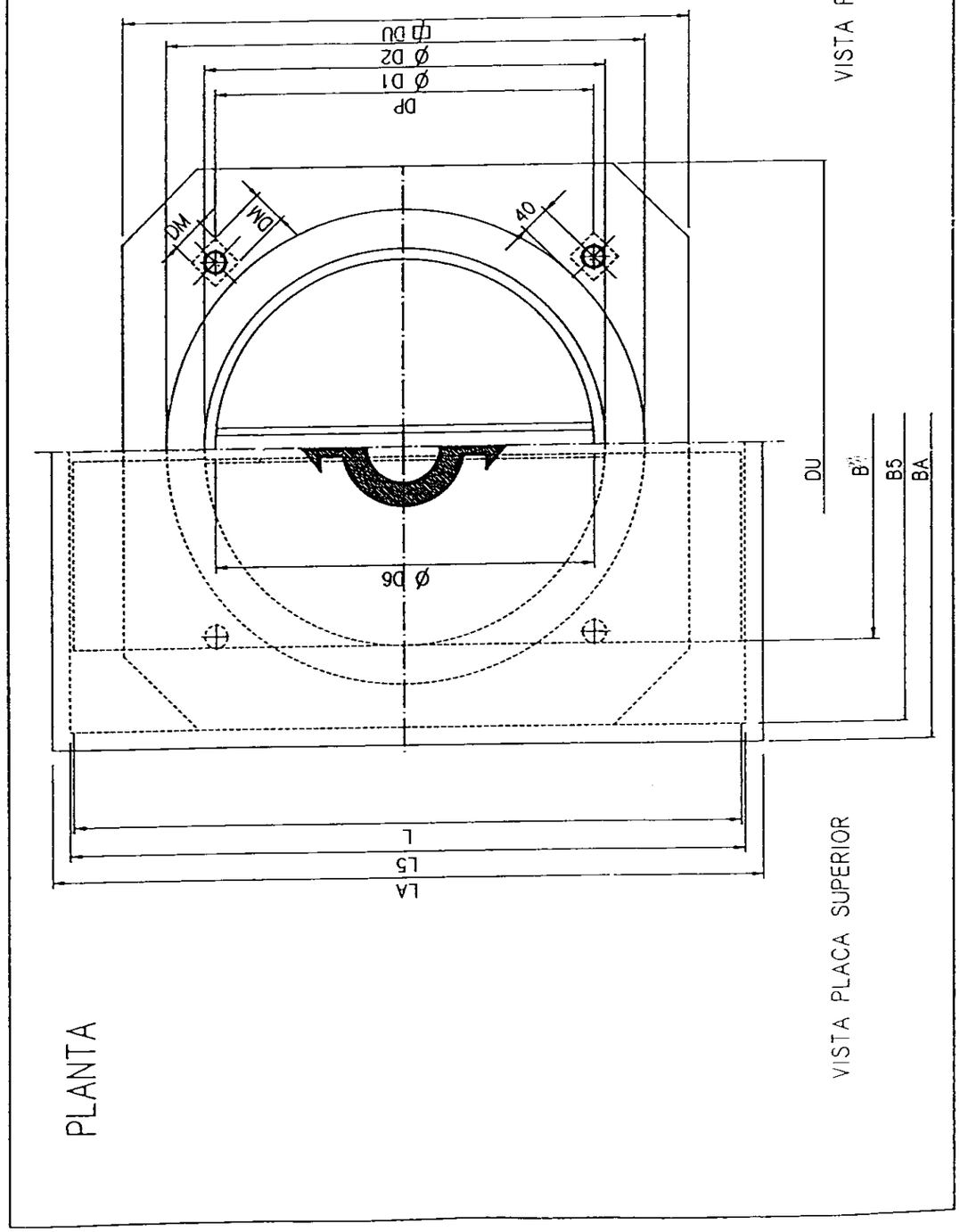
donde :

μ = 0.5 ..... coeficiente de rozamiento hormigón-acero
S=1.5 ..... coeficiente de seguridad
Hd = ... capacidad a cortante de cada tornillo/perno Nelson
n = ... número de tornillos o pernos Nelson
Zh = ... máxima fuerza horizontal concomitante con Vmin.

Barcelona, Julio de 1.997

Fdo.: Enrique Alonso Jiménez

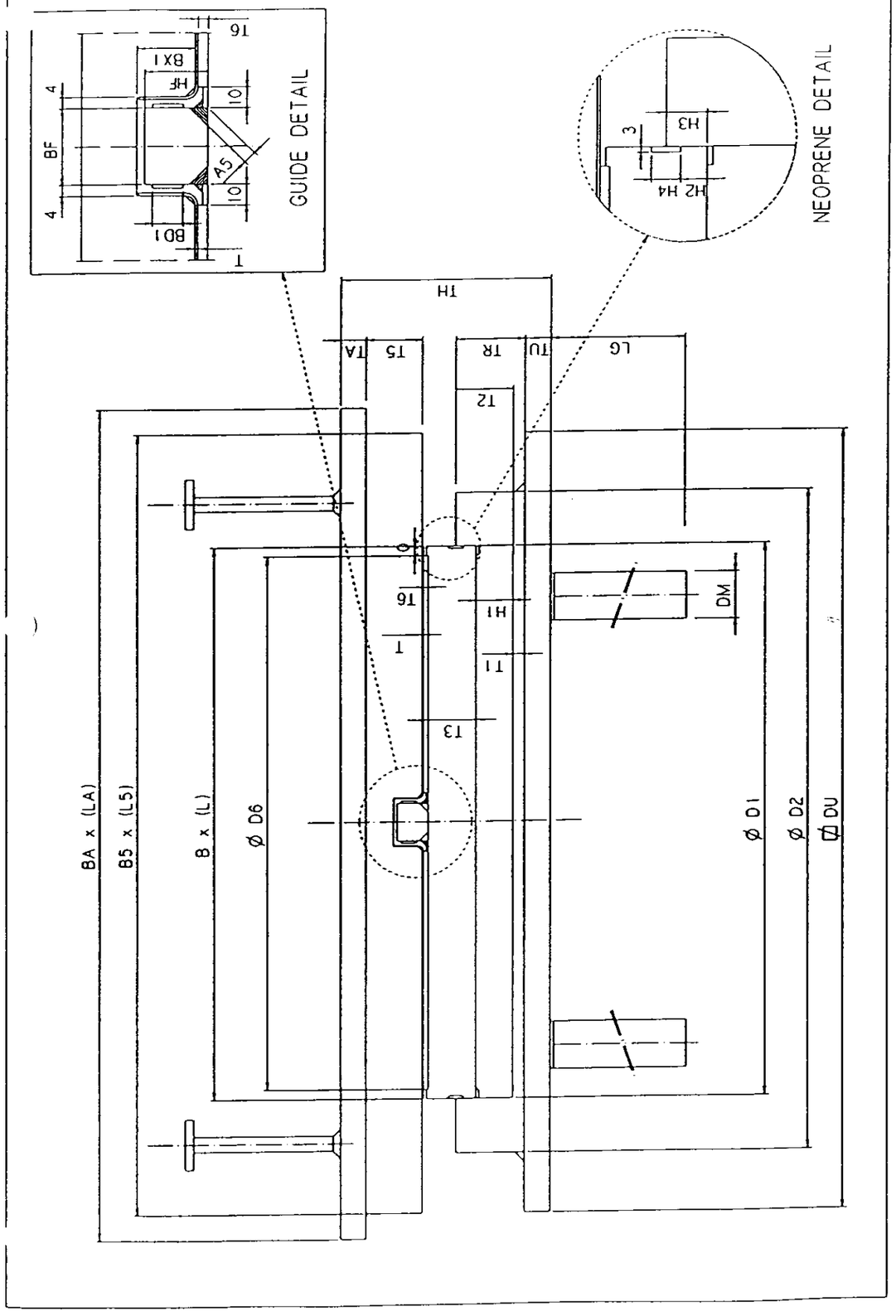
CTT-STRONGHOLD STRONGHOLD PRESTRESSING	DIMENSIONES APOYO POT SEGUN PROGRAMA DE CALCULO	14-11-95



CTT-STRONGHOLD
STRONGHOLD PRESTRESSING

DIMENSIONES DE APOYO POT
SEGUN PROGRAMA DE CALCULO

14-11-95
207-17-07



CÁLCULOS Y PLANILLAS

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L1E1 (E-1, E-1)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	398	DU =	398	TU =	20
Pot	D1 =	326	D2 =	378		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	10	T3 =	24	H3 =	5
PTFE	D6 =	306	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	984	B5 =	378	T5 =	30
Inox sheet	L =	974	B =	368	T =	2
Elastomer	D1 =	326	H1 =	16		
Top masonrey plate	LA =	1004	BA =	398	TA =	10
Dowels	Dm =	30	M =	12	QT =	8.8
	Lg =	150	N =	4		

Loads :

Vmax =	2.850 KN	S.L.S.
Hx max =	85 KN	S.L.S.
Hy max =	85 KN	S.L.S.
[illegible] =	1.640 KN	S.L.S.
Vmin =	1.280 KN	S.L.S.
Hx min =	59 KN	S.L.S.
Hy min =	59 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	324 mm.	10 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

L1E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S

2.- Elastomerpressure 34 N/mm^2

3.- Elastomerstrain 0,102

4.- Steelstress in the pot

Total force	298 KN.
Steel area plate	3.912 mm^2
Steel area ring	2.132 mm^2
Stress in the plate	76 N/mm^2
Stress in the ring	140 N/mm^2

5.- PTFE pressure

	Average
All loads	39 N/mm^2
Permanent loads	22 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 26 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	468 N/mm
Max. pressure	47 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN	
Total admissible force		616 KN	
Condition Zr > Zh	Zr =	1.163 KN	
	Zh =	120 KN	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L2E1 (E-1, P-1)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	717	DU =	717	TU =	20
Pot	D1 =	583	D2 =	677		
	T1 =	12	T2 =	34	TR =	46
Lidplate	H2 =	9	T3 =	24	H3 =	5
PTFE	D6 =	563	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	1217	B5 =	677	T5 =	32
Inox sheet	L =	1207	B =	667	T =	2
Elastomer	D1 =	583	H1 =	20		
Top masonrey plate	LA =	1237	BA =	697	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	7.800 KN	S.L.S.
Hx max =	234 KN	S.L.S.
Hy max =	234 KN	S.L.S.
Vg =	4.250 KN	S.L.S.
Vmin =	3.530 KN	S.L.S.
Hx min =	164 KN	S.L.S.
Hy min =	164 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	312 mm.	10 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

L2E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S.

2.- Elastomerpressure 29 N/mm^2

3.- Elastomerstrain 0,146

4.- Steelstress in the pot

Total force	672 KN.
Steel area plate	6.996 mm^2
Steel area ring	4.324 mm^2
Stress in the plate	96 N/mm^2
Stress in the ring	155 N/mm^2

5.- PTFE pressure

	Average
All loads	31 N/mm^2
Permanent loads	17 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 41 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	721 N/mm
Max. pressure	80 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.033 KN.	
	Zh =	331 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L3E1 (E-1, P-11)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	717	DU =	717	TU =	20
Pot	D1 =	583	D2 =	677		
	T1 =	12	T2 =	34	TR =	46
Lidplate	H2 =	9	T3 =	24	H3 =	5
PTFE	D6 =	563	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	917	B5 =	677	T5 =	41
Inox sheet	L =	907	B =	667	T =	2
Elastomer	D1 =	583	H1 =	20		
Top masonrey plate	LA =	937	BA =	697	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	8.500 KN	S.L.S.
Hx max =	255 KN	S.L.S.
Hy max =	255 KN	S.L.S.
Vg =	4.350 KN	S.L.S.
Vmin =	3.950 KN	S.L.S.
Hx min =	178 KN	S.L.S.
Hy min =	178 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	162 mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

L3E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	19 N/mm^2	S.L.S.

2.- Elastomerpressure 32 N/mm^2

3.- Elastomerstrain 0,146

4.- Steelstress in the pot

Total force	732 KN.
Steel area plate	6.996 mm^2
Steel area ring	4.324 mm^2
Stress in the plate	105 N/mm^2
Stress in the ring	169 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	17 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 44 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	786 N/mm
Max. pressure	87 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.066 KN.	
	Zh =	361 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : LEE1 (E-1,E-2)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	435	DU =	435	TU =	20
Pot	D1 =	357	D2 =	415		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	337	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	415	B5 =	415	T5 =	23
Inox sheet	L =	405	B =	405	T =	2
Elastomer	D1 =	357	H1 =	16		
Top masonrey plate	LA =	435	BA =	435	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	2.900 KN	S.L.S.
Hx max =	87 KN	S.L.S.
Hy max =	87 KN	S.L.S.
Vg =	1.720 KN	S.L.S.
√min =	1.330 KN	S.L.S.
Hx min =	61 KN	S.L.S.
Hy min =	61 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	24 mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

LEE1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	16 N/mm^2	S.L.S.

2.- Elastomerpressure 29 N/mm^2

3.- Elastomerstrain 0,112

4.- Steelstress in the pot

Total force	289 KN.
Steel area plate	4.284 mm^2
Steel area ring	2.378 mm^2
Stress in the plate	67 N/mm^2
Stress in the ring	121 N/mm^2

5.- PTFE pressure

	Average
All loads	33 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 28 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	438 N/mm
Max. pressure	55 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.189 KN.	
	Zh =	123 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L1E2 (E-2, E-1)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	435	DU =	435	TU =	20
Pot	D1 =	357	D2 =	415		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	337	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	477	B5 =	415	T5 =	28
Inox sheet	L =	467	B =	405	T =	2
Elastomer	D1 =	357	H1 =	16		
Top masonrey plate	LA =	497	BA =	435	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	3.220	KN	S.L.S.
Hx max =	97	KN	S.L.S.
Hy max =	97	KN	S.L.S.
V =	1.820	KN	S.L.S.
Vmin =	1.610	KN	S.L.S.
Hx min =	68	KN	S.L.S.
Hy min =	68	KN	S.L.S.
Rotation =	0,01	rad.	
Movement = (+/-)	55	mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

L1E2

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	17 N/mm^2	S.L.S.

2.- Elastomerpressure 32 N/mm^2

3.- Elastomerstrain 0,112

4.- Steelstress in the pot

Total force	321 KN.
Steel area plate	4.284 mm^2
Steel area ring	2.378 mm^2
Stress in the plate	75 N/mm^2
Stress in the ring	135 N/mm^2

5.- PTFE pressure

	Average
All loads	36 N/mm^2
Permanent loads	20 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 31 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	488 N/mm
Max. pressure	61 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.223 KN.	
	Zh =	137 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : LEE2 (E2, E-2)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	435	DU =	435	TU =	20
Pot	D1 =	357	D2 =	415		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	337	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	415	B5 =	415	T5 =	29
Inox sheet	L =	405	B =	405	T =	2
Elastomer	D1 =	357	H1 =	16		
Top masonrey plate	LA =	435	BA =	435	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	3.290	KN	S.L.S.
Hx max =	99	KN	S.L.S.
Hy max =	99	KN	S.L.S.
Vg =	1.870	KN	S.L.S.
Vmin =	1.660	KN	S.L.S.
Hx min =	69	KN	S.L.S.
Hy min =	69	KN	S.L.S.
Rotation =	0,01	rad.	
Movement = (+/-)	24	mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Bottlom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S.

2.- Elastomerpressure 33 N/mm^2

3.- Elastomerstrain 0,112

4.- Steelstress in the pot

Total force	328 KN.
Steel area plate	4.284 mm^2
Steel area ring	2.378 mm^2
Stress in the plate	77 N/mm^2
Stress in the ring	138 N/mm^2

5.- PTFE pressure

	Average
All loads	37 N/mm^2
Permanent loads	21 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 32 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	498 N/mm
Max. pressure	62 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.239 KN.	
	Zh =	140 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L1E3 (E-3, E-1)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	499	DU =	499	TU =	20
Pot	D1 =	413	D2 =	479		
	T1 =	12	T2 =	29	TR =	41
	H2 =	8	T3 =	21	H3 =	5
Lidplate	D6 =	393	T6 =	5		
PTFE	BF =	0	HF =	0	BDU =	0
Guide-bar	A5 =	0				
Welding on the guide-bar	L5 =	591	B5 =	479	T5 =	27
Sliding plate	L =	581	B =	469	T =	2
Inox sheet	D1 =	413	H1 =	16		
Elastomer	LA =	611	BA =	499	TA =	10
Top masonrey plate	Dm =	40	M =	16	QT =	8.8
Dowels	Lg =	200	N =	4		

Loads :

Vmax =	4.070 KN	S.L.S.
Hx max =	122 KN	S.L.S.
Hy max =	122 KN	S.L.S.
V =	2.290 KN	S.L.S.
Vmin =	1.910 KN	S.L.S.
Hx min =	85 KN	S.L.S.
Hy min =	85 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	84 mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

L1E3

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	18 N/mm^2	S.L.S.
1.2.- Bottom -plate	17 N/mm^2	S.L.S.

2.- Elastomerpressure 30 N/mm^2

3.- Elastomerstrain 0,129

4.- Steelstress in the pot

Total force	373 KN.
Steel area plate	4.956 mm^2
Steel area ring	2.706 mm^2
Stress in the plate	75 N/mm^2
Stress in the ring	138 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 34 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	531 N/mm
Max. pressure	66 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.379 KN.	
	Zh =	173 KN	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L2E3 (E-3, P-2)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	796	DU =	796	TU =	20
Pot	D1 =	652	D2 =	756		
	T1 =	14	T2 =	37	TR =	51
Lidplate	H2 =	10	T3 =	24	H3 =	5
PTFE	D6 =	632	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	775	B5 =	756	T5 =	44
Inox sheet	L =	765	B =	746	T =	2
Elastomer	D1 =	652	H1 =	22		
Top masonrey plate	LA =	795	BA =	776	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	10.610 KN	S.L.S.
Hx max =	318 KN	S.L.S.
Hy max =	318 KN	S.L.S.
Vg =	5.840 KN	S.L.S.
√min =	4.920 KN	S.L.S.
Hx min =	223 KN	S.L.S.
Hy min =	223 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	56,5 mm.	10 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S
DU-pressure		100		S.L.S

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	20 N/mm^2	S.L.S.

2.- Elastomerpressure 32 N/mm^2

3.- Elastomerstrain 0,148

4.- Steelstress in the pot

Total force	906 KN.
Steel area plate	9.128 mm^2
Steel area ring	5.304 mm^2
Stress in the plate	99 N/mm^2
Stress in the ring	171 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 48 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	876 N/mm
Max. pressure	88 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.563 KN.	
	Zh =	450 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : LEE3 (E-3, E-2)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	499	DU =	499	TU =	20
Pot	D1 =	413	D2 =	479		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	393	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	479	B5 =	479	T5 =	29
Inox sheet	L =	469	B =	469	T =	2
Elastomer	D1 =	413	H1 =	16		
Top masonrey plate	LA =	499	BA =	499	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	4.190 KN	S.L.S.
Hx max =	126 KN	S.L.S.
Hy max =	126 KN	S.L.S.
Vg =	2.420 KN	S.L.S.
Vmin =	1.950 KN	S.L.S.
Hx min =	88 KN	S.L.S.
Hy min =	88 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	28 mm.	10 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S
DU-pressure		100		S.L.S

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	18 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S.

2.- Elastomerpressure 31 N/mm^2

3.- Elastomerstrain 0,129

4.- Steelstress in the pot

Total force	385 KN.
Steel area plate	4.956 mm^2
Steel area ring	2.706 mm^2
Stress in the plate	78 N/mm^2
Stress in the ring	142 N/mm^2

5.- PTFE pressure

	Average
All loads	35 N/mm^2
Permanent loads	20 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 35 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	548 N/mm
Max. pressure	68 N/mm^2

9.- Safety against sliding at Vmin

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1 423 KN.	
	Zh =	178 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : L1E4 (E-4, E-1)

Bearing type : PL

Bearingdimensions :

Masonrey plate	DU1 =	519	DU =	519	TU =	20
Pot	D1 =	413	D2 =	479		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	393	T6 =	5		
Guide-bar	BF =	0	HF =	0	BDU =	0
Welding on the guide-bar	A5 =	0				
Sliding plate	L5 =	639	B5 =	479	T5 =	27
Inox sheet	L =	629	B =	469	T =	2
Elastomer	D1 =	413	H1 =	16		
Top masonrey plate	LA =	659	BA =	499	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	4.070 KN	S.L.S.
Hx max =	122 KN	S.L.S.
Hy max =	122 KN	S.L.S.
Vg =	2.290 KN	S.L.S.
'min =	1.910 KN	S.L.S.
Hx min =	85 KN	S.L.S.
Hy min =	85 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	108 mm.	10 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	18 N/mm^2	S.L.S.
1.2.- Bottom -plate	17 N/mm^2	S.L.S.

2.- Elastomerpressure 30 N/mm^2

3.- Elastomerstrain 0,129

4.- Steelstress in the pot

Total force	373 KN.
Steel area plate	4.956 mm^2
Steel area ring	2.706 mm^2
Stress in the plate	75 N/mm^2
Stress in the ring	138 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	##### N/mm^2
6.2.- Welding on the guide	
Shear stress	##### N/mm^2
Traction stress	##### N/mm^2
Equivalent stress	##### N/mm^2

7.- Bending of the lidplate 34 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	531 N/mm
Max. pressure	66 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN	
Total admissible force		616 KN	
Condition Zr > Zh	Zr =	1.379 KN	
	Zh =	173 KN	OK.

Jou : AVE Zaragoza - Lleida. Subtramo 1

Reference : U1E1 (E-1, E-1)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	435	DU =	435	TU =	20
Pot	D1 =	357	D2 =	415		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	337	T6 =	5		
Guide-bar	BF =	33	HF =	19	BDU =	11
Welding on the guide-bar	A5 =	6				
Sliding plate	L5 =	1015	B5 =	415	T5 =	31
Inox sheet	L =	1005	B =	405	T =	2
Elastomer	D1 =	357	H1 =	16		
Top masonrey plate	LA =	1035	BA =	435	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	2.850 KN	S.L.S.
Hx max =	85 KN	S.L.S.
Hy max =	386 KN	S.L.S.
Vmin =	1.640 KN	S.L.S.
Vmin =	1.280 KN	S.L.S.
Hx min =	59 KN	S.L.S.
Hy min =	270 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	324 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U1E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	15 N/mm^2	S.L.S.
1.2.- Bottom -plate	15 N/mm^2	S.L.S.

2.- Elastomerpressure 28 N/mm^2

3.- Elastomerstrain 0,112

4.- Steelstress in the pot

Total force	558 KN.
Steel area plate	4.284 mm^2
Steel area ring	2.378 mm^2
Stress in the plate	130 N/mm^2
Stress in the ring	235 N/mm^2

5.- PTFE pressure

	Average
All loads	37 N/mm^2
Permanent loads	21 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	98 N/mm^2
6.2.- Welding on the guide	
Shear stress	90 N/mm^2
Traction stress	150 N/mm^2
Equivalent stress	217 N/mm^2

7.- Bending of the lidplate 185 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	1.406 N/mm
Max. pressure	176 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.163 KN.	
	Zh =	395 KN	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U2E1 (E-1, P-1)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	717	DU =	717	TU =	20
Pot	D1 =	583	D2 =	677		
	T1 =	12	T2 =	34	TR =	46
Lidplate	H2 =	9	T3 =	24	H3 =	5
PTFE	D6 =	563	T6 =	5		
Guide-bar	BF =	25	HF =	15	BDU =	6
Welding on the guide-bar	A5 =	4				
Sliding plate	L5 =	1217	B5 =	677	T5 =	34
Inox sheet	L =	1207	B =	667	T =	2
Elastomer	D1 =	583	H1 =	20		
Top masonrey plate	LA =	1237	BA =	697	TA =	10
Dowels	Dm =	60	M =	24	QT =	8.8
	Lg =	300	N =	4		

Loads :

Vmax =	7.800 KN	S.L.S.
Hx max =	234 KN	S.L.S.
Hy max =	160 KN	S.L.S.
Vg =	4.250 KN	S.L.S.
Vmin =	3.530 KN	S.L.S.
Hx min =	164 KN	S.L.S.
Hy min =	112 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	312 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U2E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	18 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S.

2.- Elastomerpressure 29 N/mm^2

3.- Elastomerstrain 0,146

4.- Steelstress in the pot

Total force	624 KN.
Steel area plate	6.996 mm^2
Steel area ring	4.324 mm^2
Stress in the plate	89 N/mm^2
Stress in the ring	144 N/mm^2

5.- PTFE pressure

	Average
All loads	33 N/mm^2
Permanent loads	18 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	46 N/mm^2
6.2.- Welding on the guide	
Shear stress	34 N/mm^2
Traction stress	65 N/mm^2
Equivalent stress	88 N/mm^2

7.- Bending of the lidplate 41 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	618 N/mm
Max. pressure	69 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.033 KN.	
	Zh =	283 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U3E1 (E-1, P-11)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	717	DU =	717	TU =	20
Pot	D1 =	583	D2 =	677		
	T1 =	12	T2 =	34	TR =	46
Lidplate	H2 =	9	T3 =	24	H3 =	5
PTFE	D6 =	563	T6 =	5		
Guide-bar	BF =	28	HF =	16	BDU =	9
Welding on the guide-bar	A5 =	5				
Sliding plate	L5 =	917	B5 =	677	T5 =	41
Inox sheet	L =	907	B =	667	T =	2
Elastomer	D1 =	583	H1 =	20		
Top masonrey plate	LA =	937	BA =	697	TA =	10
Dowels	Dm =	60	M =	24	QT =	8.8
	Lg =	300	N =	4		

Loads :

Vmax =	8.500 KN	S.L.S.
Hx max =	255 KN	S.L.S.
Hy max =	484 KN	S.L.S.
Vg =	4.350 KN	S.L.S.
min =	3.950 KN	S.L.S.
Hx min =	178 KN	S.L.S.
Hy min =	339 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	162 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U3E1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	19 N/mm^2	S.L.S.
2.- Elastomerpressure	32 N/mm^2	
3.- Elastomerstrain	0,146	

4.- Steelstress in the pot

Total force	918 KN.
Steel area plate	6.996 mm^2
Steel area ring	4.324 mm^2
Stress in the plate	131 N/mm^2
Stress in the ring	212 N/mm^2

5.- PTFE pressure

	Average
All loads	37 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	92 N/mm^2
6.2.- Welding on the guide	
Shear stress	83 N/mm^2
Traction stress	138 N/mm^2
Equivalent stress	200 N/mm^2

7.- Bending of the lidplate 121 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	1.192 N/mm
Max. pressure	132 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.066 KN.	
	Zh =	547 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : UEE1 (E-1, E-2)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	494	DU =	494	TU =	20
Pot	D1 =	386	D2 =	474		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	10	T3 =	29	H3 =	3
PTFE	D6 =	366	T6 =	5		
Guide-bar	BF =	48	HF =	25	BDU =	18
Welding on the guide-bar	A5 =	9				
Sliding plate	L5 =	474	B5 =	474	T5 =	40
Inox sheet	L =	464	B =	464	T =	2
Elastomer	D1 =	386	H1 =	16		
Top masonrey plate	LA =	494	BA =	494	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	2.900 KN	S.L.S.
Hx max =	87 KN	S.L.S.
Hy max =	692 KN	S.L.S.
Vg =	1.720 KN	S.L.S.
Vmin =	1.330 KN	S.L.S.
Hx min =	61 KN	S.L.S.
Hy min =	484 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	39 mm.	0 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

UEE1

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	12 N/mm^2	S.L.S.
1.2.- Bottom -plate	13 N/mm^2	S.L.S.

2.- Elastomerpressure 25 N/mm^2

3.- Elastomerstrain 0,121

4.- Steelstress in the pot

Total force	850 KN.
Steel area plate	4.632 mm^2
Steel area ring	3.608 mm^2
Stress in the plate	184 N/mm^2
Stress in the ring	236 N/mm^2

5.- PTFE pressure

	Average
All loads	33 N/mm^2
Permanent loads	20 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	100 N/mm^2
6.2.- Welding on the guide	
Shear stress	100 N/mm^2
Traction stress	136 N/mm^2
Equivalent stress	220 N/mm^2

7.- Bending of the lidplate 196 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	2.295 N/mm
Max. pressure	229 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.189 KN.	
	Zh =	697 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U1E2 (E-2, E-1)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	435	DU =	435	TU =	20
Pot	D1 =	357	D2 =	415		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	337	T6 =	5		
Guide-bar	BF =	25	HF =	15	BDU =	6
Welding on the guide-bar	A5 =	4				
Sliding plate	L5 =	477	B5 =	415	T5 =	28
Inox sheet	L =	467	B =	405	T =	2
Elastomer	D1 =	357	H1 =	16		
Top masonrey plate	LA =	497	BA =	435	TA =	10
Dowels	Dm =	40	M =	16	QT =	8.8
	Lg =	200	N =	4		

Loads :

Vmax =	3.220 KN	S.L.S.
Hx max =	97 KN	S.L.S.
Hy max =	67 KN	S.L.S.
Vg =	1.820 KN	S.L.S.
Vmin =	1.610 KN	S.L.S.
Hx min =	68 KN	S.L.S.
Hy min =	47 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	55 mm.	0 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Bottom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U1E2

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	17 N/mm^2	S.L.S.

2.- Elastomerpressure 32 N/mm^2

3.- Elastomerstrain 0,112

4.- Steelstress in the pot

Total force	302 KN.
Steel area plate	4.284 mm^2
Steel area ring	2.378 mm^2
Stress in the plate	70 N/mm^2
Stress in the ring	127 N/mm^2

5.- PTFE pressure

	Average
All loads	40 N/mm^2
Permanent loads	23 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	31 N/mm^2
6.2.- Welding on the guide	
Shear stress	23 N/mm^2
Traction stress	45 N/mm^2
Equivalent stress	60 N/mm^2

7.- Bending of the lidplate 32 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	419 N/mm
Max. pressure	52 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.223 KN.	
	Zh =	118 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : UEE2 (E-2, E-2)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	468	DU =	468	TU =	20
Pot	D1 =	386	D2 =	448		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	366	T6 =	5		
Guide-bar	BF =	25	HF =	15	BDU =	6
Welding on the guide-bar	A5 =	4				
Sliding plate	L5 =	448	B5 =	448	T5 =	27
Inox sheet	L =	438	B =	438	T =	2
Elastomer	D1 =	386	H1 =	16		
Top masonrey plate	LA =	468	BA =	468	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	3.290 KN	S.L.S.
Hx max =	99 KN	S.L.S.
Hy max =	117 KN	S.L.S.
Vg =	1.870 KN	S.L.S.
Vmin =	1.660 KN	S.L.S.
Hx min =	69 KN	S.L.S.
Hy min =	82 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	26 mm.	0 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S

UEE2

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	16 N/mm^2	S.L.S.
1.2.- Bottom -plate	16 N/mm^2	S.L.S.

2.- Elastomerpressure 28 N/mm^2

3.- Elastomerstrain 0,121

4.- Steelstress in the pot

Total force	327 KN.
Steel area plate	4.632 mm^2
Steel area ring	2.542 mm^2
Stress in the plate	71 N/mm^2
Stress in the ring	129 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	20 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	51 N/mm^2
6.2.- Welding on the guide	
Shear stress	38 N/mm^2
Traction stress	72 N/mm^2
Equivalent stress	98 N/mm^2

7.- Bending of the lidplate 52 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	504 N/mm
Max. pressure	63 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.239 KN.	
	Zh =	153 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U1E3 (E-3, E-1)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	499	DU =	499	TU =	20
Pot	D1 =	413	D2 =	479		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	393	T6 =	5		
Guide-bar	BF =	28	HF =	16	BDU =	9
Welding on the guide-bar	A5 =	5				
Sliding plate	L5 =	591	B5 =	479	T5 =	31
Inox sheet	L =	581	B =	469	T =	2
Elastomer	D1 =	413	H1 =	16		
Top masonrey plate	LA =	611	BA =	499	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	4.070 KN	S.L.S.
Hx max =	122 KN	S.L.S.
Hy max =	352 KN	S.L.S.
Vg =	2.290 KN	S.L.S.
Vmin =	1.910 KN	S.L.S.
Hx min =	85 KN	S.L.S.
Hy min =	246 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	84 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Bottom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U1E3

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	17 N/mm^2	S.L.S.

2.- Elastomerpressure	30 N/mm^2
3.- Elastomerstrain	0,129

4.- Steelstress in the pot

Total force	573 KN.
Steel area plate	4.956 mm^2
Steel area ring	2.706 mm^2
Stress in the plate	116 N/mm^2
Stress in the ring	212 N/mm^2

5.- PTFE pressure

	Average
All loads	37 N/mm^2
Permanent loads	21 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	95 N/mm^2
6.2.- Welding on the guide	
Shear stress	85 N/mm^2
Traction stress	142 N/mm^2
Equivalent stress	205 N/mm^2

7.- Bending of the lidplate	144 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	1.146 N/mm
Max. pressure	143 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.379 KN.	
	Zh =	373 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U2E3 (E-3, P-2)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	796	DU =	796	TU =	20
Pot	D1 =	652	D2 =	756		
	T1 =	14	T2 =	37	TR =	51
Lidplate	H2 =	10	T3 =	24	H3 =	5
PTFE	D6 =	632	T6 =	5		
Guide-bar	BF =	25	HF =	15	BDU =	6
Welding on the guide-bar	A5 =	4				
Sliding plate	L5 =	775	B5 =	756	T5 =	44
Inox sheet	L =	765	B =	746	T =	2
Elastomer	D1 =	652	H1 =	22		
Top masonrey plate	LA =	795	BA =	776	TA =	10
Dowels	Dm =	60	M =	24	QT =	8.8
	Lg =	300	N =	4		

Loads :

Vmax =	10.610 KN	S.L.S.
Hx max =	318 KN	S.L.S.
Hy max =	332 KN	S.L.S.
Vg =	5.840 KN	S.L.S.
Vmin =	4.990 KN	S.L.S.
Hx min =	223 KN	S.L.S.
Hy min =	232 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	56,5 mm.	0 mm.

Admissible stresses N/mm^2 :

Concretepressure	Top	Botttom	
average	22	20	S.L.S.
edge	27	25	S.L.S.
Steelpressure	240		S.L.S.
PTFE pressures	Average		
all loads	45		S.L.S.
deadload	30		S.L.S.
Elastomerpressure	35		S.L.S
DU-pressure	100		S.L.S

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	20 N/mm^2	S.L.S

2.- Elastomerpressure 32 N/mm^2

3.- Elastomerstrain 0,148

4.- Steelstress in the pot

Total force	916 KN.
Steel area plate	9.128 mm^2
Steel area ring	5.304 mm^2
Stress in the plate	100 N/mm^2
Stress in the ring	173 N/mm^2

5.- PTFE pressure

	Average
All loads	36 N/mm^2
Permanent loads	20 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	85 N/mm^2
6.2.- Welding on the guide	
Shear stress	64 N/mm^2
Traction stress	121 N/mm^2
Equivalent stress	164 N/mm^2

7.- Bending of the lidplate 76 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	895 N/mm
Max. pressure	90 N/mm^2

9.- Safety against sliding at Vmin

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.563 KN.	
	Zh =	460 KN.	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : UEE3 (E-3, E-2)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	499	DU =	499	TU =	20
Pot	D1 =	413	D2 =	479		
	T1 =	12	T2 =	29	TR =	41
Lidplate	H2 =	8	T3 =	21	H3 =	5
PTFE	D6 =	393	T6 =	5		
Guide-bar	BF =	33	HF =	18	BDU =	10
Welding on the guide-bar	A5 =	6				
Sliding plate	L5 =	479	B5 =	479	T5 =	32
Inox sheet	L =	469	B =	469	T =	2
Elastomer	D1 =	413	H1 =	16		
Top masonrey plate	LA =	499	BA =	499	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	4.190 KN	S.L.S.
Hx max =	126 KN	S.L.S.
Hy max =	373 KN	S.L.S.
Vg =	2.420 KN	S.L.S.
Vmin =	1.950 KN	S.L.S.
Hx min =	88 KN	S.L.S.
Hy min =	261 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	28 mm.	0 mm.

Admissible stresses N/mm^2 :

Concretepressure		Top	Botttom	
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S
DU-pressure		100		S L S

UEE3

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	17 N/mm^2	S.L.S.
1.2.- Bottom -plate	18 N/mm^2	S.L.S

2.- Elastomerpressure 31 N/mm^2

3.- Elastomerstrain 0,129

4.- Steelstress in the pot

Total force	600 KN.
Steel area plate	4.956 mm^2
Steel area ring	2.706 mm^2
Stress in the plate	121 N/mm^2
Stress in the ring	222 N/mm^2

5.- PTFE pressure

	Average
All loads	39 N/mm^2
Permanent loads	22 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	90 N/mm^2
6.2.- Welding on the guide	
Shear stress	75 N/mm^2
Traction stress	121 N/mm^2
Equivalent stress	178 N/mm^2

7.- Bending of the lidplate 156 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	1.211 N/mm
Max. pressure	151 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN	
Total admissible force		616 KN	
Condition Zr > Zh	Zr =	1.423 KN	
	Zh =	394 KN	OK.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U1E4 (E-4, E-1)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	557	DU =	557	TU =	20
Pot	D1 =	413	D2 =	517		
	T1 =	12	T2 =	31	TR =	43
Lidplate	H2 =	12	T3 =	34	H3 =	3
PTFE	D6 =	393	T6 =	5		
Guide-bar	BF =	53	HF =	28	BDU =	21
Welding on the guide-bar	A5 =	10				
Sliding plate	L5 =	639	B5 =	517	T5 =	45
Inox sheet	L =	629	B =	507	T =	2
Elastomer	D1 =	413	H1 =	16		
Top masonrey plate	LA =	659	BA =	537	TA =	10
Dowels	Dm =	50	M =	20	QT =	8.8
	Lg =	250	N =	4		

Loads :

Vmax =	4.070 KN	S.L.S.
Hx max =	122 KN	S.L.S.
Hy max =	851 KN	S.L.S.
Vg =	2.290 KN	S.L.S.
Vmin =	1.910 KN	S.L.S.
Hx min =	85 KN	S.L.S.
Hy min =	596 KN	S.L.S.

Rotation =	0,01 rad.	
Movement = (+/-)	108 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Bottlom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U1E4

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	14 N/mm^2	S.L.S.
1.2.- Bottom -plate	15 N/mm^2	S.L.S.

2.- Elastomerpressure	30 N/mm^2
3.- Elastomerstrain	0,129

4.- Steelstress in the pot

Total force	1.060 KN.
Steel area plate	4.956 mm^2
Steel area ring	4.472 mm^2
Stress in the plate	214 N/mm^2
Stress in the ring	237 N/mm^2

5.- PTFE pressure

	Average
All loads	41 N/mm^2
Permanent loads	23 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	98 N/mm^2
6.2.- Welding on the guide	
Shear stress	103 N/mm^2
Traction stress	140 N/mm^2
Equivalent stress	227 N/mm^2

7.- Bending of the lidplate	185 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	2 644 N/mm
Max. pressure	220 N/mm^2

9.- Safety against sliding at Vmin

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	1.379 KN.	
	Zh =	860 KN.	OK.

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	19 N/mm^2	S.L.S.
1.2.- Bottom -plate	19 N/mm^2	S.L.S.

2.- Elastomerpressure 30 N/mm^2

3.- Elastomerstrain 0,148

4.- Steelstress in the pot

Total force	756 KN.
Steel area plate	9.128 mm^2
Steel area ring	5.304 mm^2
Stress in the plate	83 N/mm^2
Stress in the ring	143 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	30 N/mm^2
6.2.- Welding on the guide	
Shear stress	22 N/mm^2
Traction stress	42 N/mm^2
Equivalent stress	57 N/mm^2

7.- Bending of the lidplate 27 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	630 N/mm
Max. pressure	63 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2 449 KN.	
	Zh =	324 KN	OK.

U2E4

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U2E4 (E-4, P-4)

Bearing type : PU

Bearingdimensions :

Masonrey plate	DU1 =	796	DU =	796	TU =	20	
Pot	D1 =	652	D2 =	756			
	T1 =	14	T2 =	37	TR =	51	
Lidplate	H2 =	10	T3 =	24	H3 =	5	
PTFE	D6 =	632	T6 =	5			
Guide-bar	BF =	25	HF =	15	BDU =	6	
Welding on the guide-bar	A5 =	4					
Sliding plate	L5 =	756	B5 =	756	T5 =	39	
Inox sheet	L =	746	B =	746	T =	2	
Elastomer	D1 =	652	H1 =	22			
Top masonrey plate	LA =	776	BA =	776	TA =	10	
Dowels	Dm =	60	M =	24	QT =	8.8	
	Lg =	300	N =	4			

Loads :

Vmax =	10.070 KN	S.L.S.
Hx max =	302 KN	S.L.S.
Hy max =	116 KN	S.L.S.
Vg =	5.500 KN	S.L.S.
Vmin =	4.920 KN	S.L.S.
Hx min =	211 KN	S.L.S.
Hy min =	81 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	47 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Botttom	
Concretepressure	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

Job : AVE Zaragoza - Lleida. Subtramo 1

Reference : U0E5 (E-5, P-0)

Bearing type : PU

Bearingsdimensions :

Masonrey plate	DU1 =	796	DU =	796	TU =	20		
Pot	D1 =	652	D2 =	756				
	T1 =	12	T2 =	37	TR =	49		
Lidplate	H2 =	8	T3 =	21	H3 =	5		
PTFE	D6 =	632	T6 =	5				
Guide-bar	BF =	25	HF =	48	BDU =	6		
Welding on the guide-bar	A5 =	5						
Sliding plate	L5 =	930	B5 =	756	T5 =	38		
Inox sheet	L =	920	B =	746	T =	2		
Elastomer	D1 =	652	H1 =	22				
Top masonrey plate	LA =	950	BA =	776	TA =	10		
Dowels:	Dm =	60	M =	24	QT =	8.8		
	Lg =	300	N =	4				

Loads :

Vmax =	10.070 KN	S.L.S.
Hx max =	302 KN	S.L.S.
Hy max =	506 KN	S.L.S.
V =	5.530 KN	S.L.S.
V min =	5.030 KN	S.L.S.
Hx min =	211 KN	S.L.S.
Hy min =	354 KN	S.L.S.
Rotation =	0,01 rad.	
Movement = (+/-)	134 mm.	0 mm.

Admissible stresses N/mm^2 :

		Top	Bottom	
Concretepressure				
	average	22	20	S.L.S.
	edge	27	25	S.L.S.
Steelpressure		240		S.L.S.
PTFE pressures		Average		
	all loads	45		S.L.S.
	deadload	30		S.L.S.
Elastomerpressure		35		S.L.S.
DU-pressure		100		S.L.S.

U0E5

Stresscalculations

1.- Concrete-pressures

1.1.- Top plate	16 N/mm^2	S.L.S.
1.2.- Bottom -plate	19 N/mm^2	S.L.S.

2.- Elastomerpressure 30 N/mm^2

3.- Elastomerstrain 0,148

4.- Steelstress in the pot

Total force	1.022 KN.
Steel area plate	7.624 mm^2
Steel area ring	5.096 mm^2
Stress in the plate	131 N/mm^2
Stress in the ring	201 N/mm^2

5.- PTFE pressure

	Average
All loads	34 N/mm^2
Permanent loads	19 N/mm^2

6.- Guide-bars

6.1.- Pressure guide - DU	97 N/mm^2
6.2.- Welding on the guide	
Shear stress	78 N/mm^2
Traction stress	181 N/mm^2
Equivalent stress	226 N/mm^2

7.- Bending of the lidplate 151 N/mm^2

8.- Transmission of horizontal loads between ring and lidplate

Cosine distribution po	1.148 N/mm
Max pressure	143 N/mm^2

9.- Safety against sliding at Vmin.

Admissible force in one BOLT		154 KN.	
Total admissible force		616 KN.	
Condition Zr > Zh	Zr =	2.293 KN.	
	Zh =	589 KN.	OK.

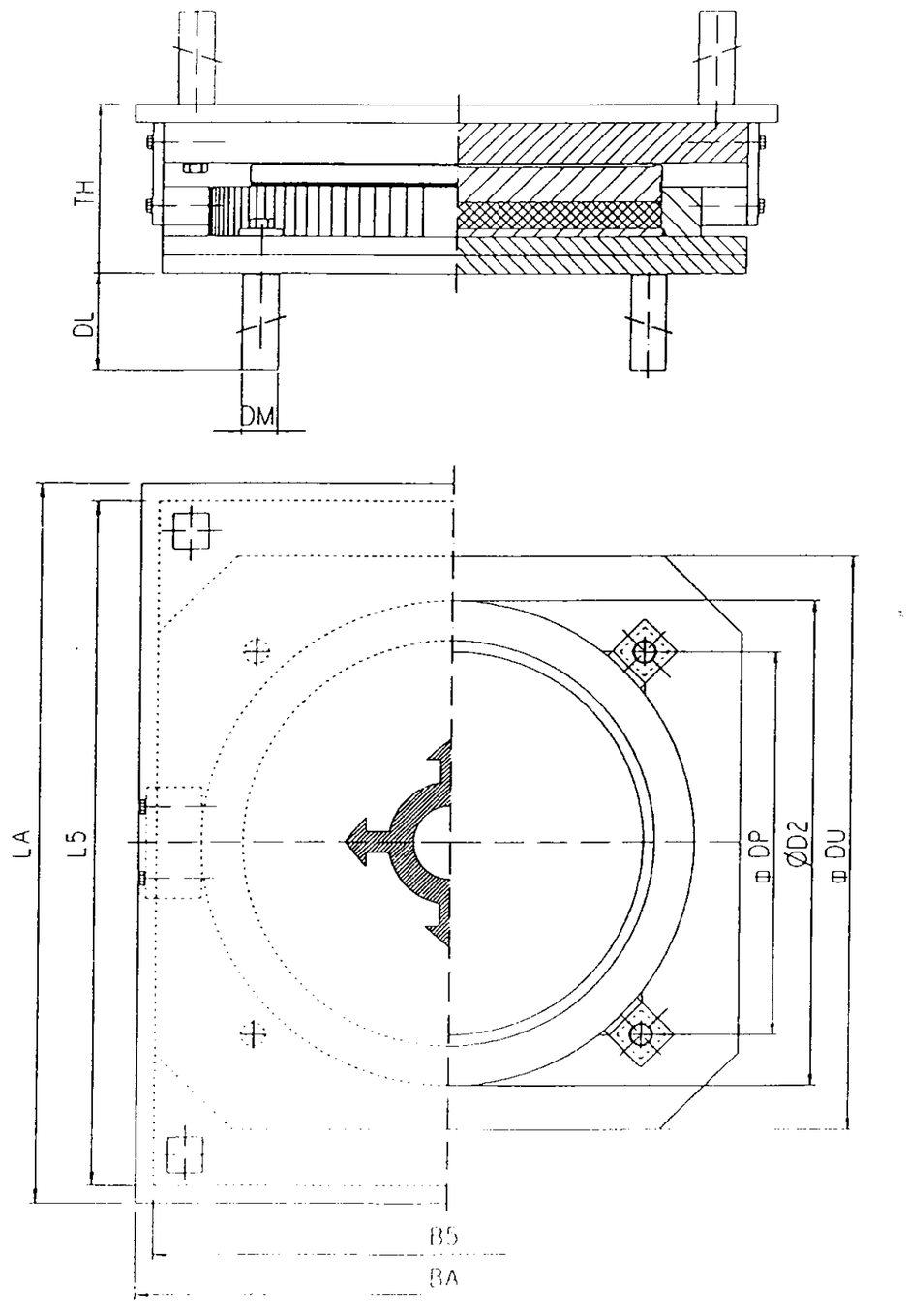
CTT-STRONGHOLD
STRONGHOLD PRESTRESSING

ESQUEMA DE APOYO POT TIPO PL

Obra LAIGSCO

FECHA 02-07-97

PLANO NR 207-66-03A



DIMENSIONES EN mm

PLANO SIN ESCALA

Tabla de dimensiones de los apoyos pot tipo : PL (MULTIDIRECCIONAL)

ESTRUC	APOYO	V max. (KN)	Ex (mm.) Ex +	Ex -	Ey mm	REF. PL	TH (mm)	DU (mm)	LA (mm)	BA (mm)	D2 (mm)	L5 (mm)	B5 (mm)	DP (mm)	DL (mm)	DM (mm)
E-1	E-1	2.850	486	162	10	L1E1	118,5	398	1004	398	378	984	378	317	150	30
	P-1	7.800	468	156	10	L2E1	124,5	717	1237	697	677	1217	677	528	250	50
	P-2	8.500	446	148	10		133,5	717	1207	697	677	1187	677	528	250	50
	P-3	8.500	423	141	10		133,5	717	1177	697	677	1157	677	528	250	50
	P-4	8.500	401	133	10		133,5	717	1147	697	677	1127	677	528	250	50
	P-5	8.500	378	126	10		133,5	717	1117	697	677	1097	677	528	250	50
	P-6	8.500	356	118	10		133,5	717	1087	697	677	1067	677	528	250	50
	P-7	8.500	333	111	10		133,5	717	1057	697	677	1037	677	528	250	50
	P-8	8.500	311	103	10		133,5	717	1027	697	677	1007	677	528	250	50
	P-9	8.500	288	96	10		133,5	717	997	697	677	977	677	528	250	50
	P-10	8.500	266	88	10		133,5	717	967	697	677	947	677	528	250	50
	P-11	8.500	243	81	10	L3E1	133,5	717	937	697	677	917	677	528	250	50
	P-12	8.500	221	73	10		133,5	717	907	697	677	887	677	528	250	50
	P-13	8.500	198	66	10		133,5	717	877	697	677	857	677	528	250	50
	P-14	8.500	176	58	10		133,5	717	847	697	677	827	677	528	250	50
	P-15	8.500	153	51	10		133,5	717	817	697	677	797	677	528	250	50
	P-16	8.500	131	43	10		133,5	717	787	697	677	767	677	528	250	50
	P-17	8.500	108	42	10		133,5	717	763	697	677	743	677	528	250	50
	P-18	8.500	86	42	10		133,5	717	741	697	677	721	677	528	250	50
	P-19	8.500	63	42	10		133,5	717	718	697	677	698	677	528	250	50
	P-20	8.500	42	42	10		133,5	717	697	697	677	677	677	528	250	50
	P-21	7.800	42	42	10	L2E1	124,5	717	697	697	677	677	677	528	250	50
	E-2	2.900	24	24	10	LEE1	108,5	435	435	435	415	415	415	343	200	40
E-2	E-1	3.220	86	24	10	L1E2	113,5	435	497	435	415	477	415	343	200	40
	P-1	7.800	60	42	10	L2E1	124,5	717	715	697	677	695	677	528	250	50
	P-2	7.800	42	42	10		124,5	717	697	697	677	677	677	528	250	50
	E-2	3.290	24	24	10	LEE2	114,5	435	435	435	415	415	415	343	200	40
E-3	E-1	4.070	132	36	10	L1E3	112,5	499	611	499	479	591	479	388	200	40
	P-1	10.610	102	47	10		141,5	796	831	776	756	811	756	584	250	50
	P-2	10.610	66	47	10	L2E3	141,5	796	795	776	756	775	756	584	250	50
	P-3	10.610	47	47	10		141,5	796	776	776	756	756	756	584	250	50
	E-2	4.190	28	28	10	LEE3	114,5	499	499	499	479	479	479	388	200	40
E-4	E-1	4.070	168	48	10	L1E4	112,5	519	659	499	479	639	479	388	200	40
	P-1	10.610	138	47	10	L2E3	141,5	796	867	776	756	847	756	584	250	50
	P-2	10.610	102	47	10	L2E3	141,5	796	831	776	756	811	756	584	250	50
	P-3	10.610	66	47	10	L2E3	141,5	796	795	776	756	775	756	584	250	50
	P-4	10.610	47	47	10	L2E3	141,5	796	776	776	756	756	756	584	250	50
	E-2	4.190	28	28	10	LEE3	114,5	499	499	499	479	479	479	388	200	40
E-5	E-1	4.070	204	56	10	L1E4	112,5	519	703	499	479	683	479	388	200	40
	P-0	10.610	210	54	10	L2E3	141,5	796	950	776	756	930	756	584	250	50
	P-1	10.610	174	48	10	L2E3	141,5	796	904	776	756	884	756	584	250	50
	P-2	10.610	138	47	10	L2E3	141,5	796	867	776	756	847	756	584	250	50
	P-3	10.610	102	47	10	L2E3	141,5	796	831	776	756	811	756	584	250	50
	P-4	10.610	66	47	10	L2E3	141,5	796	795	776	756	775	756	584	250	50
	P-5	10.610	47	47	10	L2E3	141,5	796	776	776	756	756	756	584	250	50
	E-2	4.190	28	28	10	LEE3	117,5	499	499	499	479	479	479	388	200	40

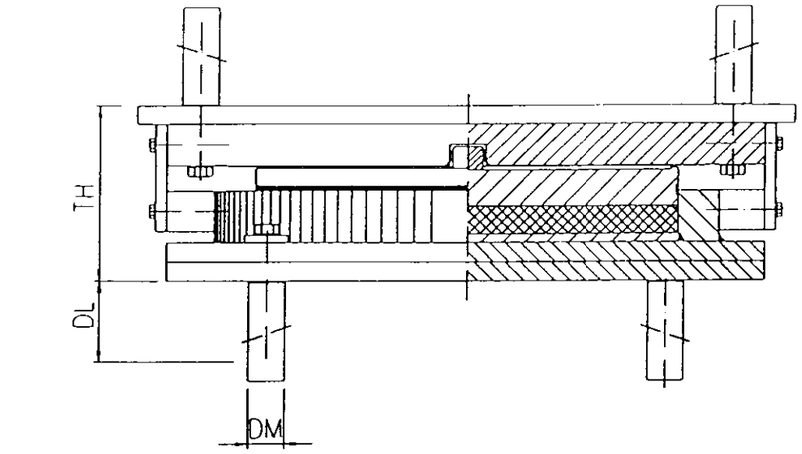
CTT-STRONGHOLD
STRONGHOLD PRESTRESSING

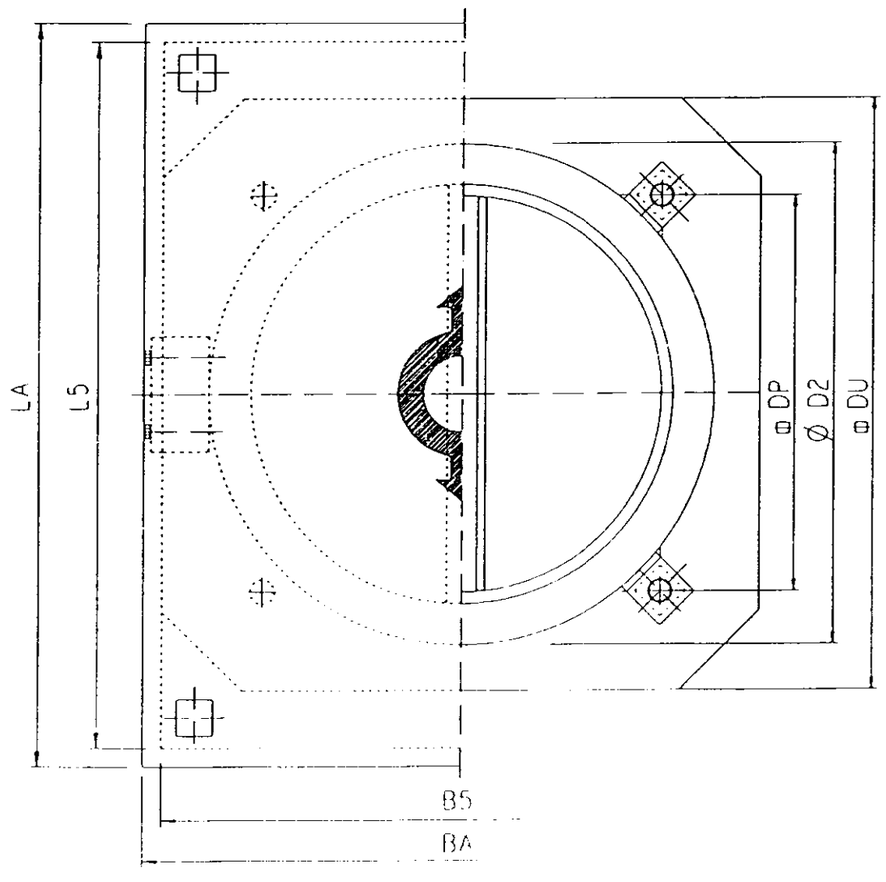
ESQUEMA DE APOYO POT TIPO PU

Obra LAHISCO

FECHA 02-07-97

PLANO NR.: 207-66-04A





DIMENSIONES EN mm

PLANO SIN ESCALA

Tabla de dimensiones de los apoyos pot tipo : PU (UNIDIRECCIONAL)

ESTRUC	APOYO	V max. (KN)	Ex (mm.) Ex +	Ex -	REF. PU	TH (mm)	DU (mm)	LA (mm)	BA (mm)	D2 (mm)	L5 (mm)	B5 (mm)	DP (mm)	DL (mm)	DM (mm)
E-1	E-1	2.850	486	162	U1E1	116,5	435	1035	435	415	1015	415	343	200	40
	P-1	7.800	468	156	U2E1	126,5	717	1237	697	677	1217	677	542	300	60
	P-2	8.500	446	148		133,5	717	1207	697	677	1187	677	542	300	60
	P-3	8.500	423	141		133,5	717	1177	697	677	1157	677	542	300	60
	P-4	8.500	401	133		133,5	717	1147	697	677	1127	677	542	300	60
	P-5	8.500	378	126		133,5	717	1117	697	677	1097	677	542	300	60
	P-6	8.500	356	118		133,5	717	1087	697	677	1067	677	542	300	60
	P-7	8.500	333	111		133,5	717	1057	697	677	1037	677	542	300	60
	P-8	8.500	311	103		133,5	717	1027	697	677	1007	677	542	300	60
	P-9	8.500	288	96		133,5	717	997	697	677	977	677	542	300	60
	P-10	8.500	266	88		133,5	717	967	697	677	947	677	542	300	60
	P-11	8.500	243	81	U3E1	133,5	717	937	697	677	917	677	542	300	60
	P-12	8.500	221	73		133,5	717	907	697	677	887	677	542	300	60
	P-13	8.500	198	66		133,5	717	877	697	677	857	677	542	300	60
	P-14	8.500	176	58		133,5	717	847	697	677	827	677	542	300	60
	P-15	8.500	153	51		133,5	717	817	697	677	797	677	542	300	60
	P-16	8.500	131	43		133,5	717	787	697	677	767	677	542	300	60
	P-17	8.500	108	42		133,5	717	763	697	677	743	677	542	300	60
	P-18	8.500	86	42		133,5	717	741	697	677	721	677	542	300	60
	P-19	8.500	63	42		133,5	717	718	697	677	698	677	542	300	60
	P-20	8.500	42	42		133,5	717	697	697	677	677	677	542	300	60
	P-21	7.800	42	42	U2E1	126,5	717	697	697	677	677	677	542	300	60
	E-2	2.900	39	39	UEE1	133,5	494	494	494	474	474	474	385	250	50
E-2	E-1	3.220	86	24	U1E2	113,5	435	497	435	415	477	415	343	200	40
	P-1	7.800	60	42	U2E1	126,5	717	715	697	677	695	677	542	300	60
	P-2	7.800	42	42		126,5	717	697	697	677	677	677	542	300	60
	E-2	3.290	26	26	UEE2	112,5	468	468	468	448	448	448	366	250	50
E-3	E-1	4.070	132	36	U1E3	116,5	499	611	499	479	591	479	388	250	50
	P-1	10.610	102	47		141,5	796	831	776	756	811	756	598	300	60
	P-2	10.610	66	47	U2E3	141,5	796	795	776	756	775	756	598	300	60
	P-3	10.610	47	47		141,5	796	776	776	756	756	756	598	300	60
	E-2	4.190	28	28	UEE3	117,5	499	499	499	479	479	479	388	250	50
E-4	E-1	4.070	168	48	U1E4	143,5	557	659	537	517	639	517	415	250	50
	P-1	10.070	138	47	U2E4	136,5	796	867	776	756	847	756	598	300	60
	P-2	10.610	102	47	U2E3	141,5	796	831	776	756	811	756	598	300	60
	P-3	10.610	66	47	U2E3	141,5	796	795	776	756	775	756	598	300	60
	P-4	10.070	47	47	U2E4	136,5	796	776	776	756	756	756	598	300	60
	E-2	4.190	28	28	UEE3	117,5	499	499	499	479	479	479	388	250	50
E-5	E-1	4.070	204	56	U1E4	143,5	557	703	537	517	683	517	415	250	50
	P-0	10.070	210	54	U0E5	136,5	796	950	776	756	930	756	598	300	60
	P-1	10.070	174	48	U2E4	136,5	796	904	776	756	884	756	598	300	60
	P-2	10.610	138	47	U2E3	141,5	796	867	776	756	847	756	598	300	60
	P-3	10.610	102	47	U2E3	141,5	796	831	776	756	811	756	598	300	60
	P-4	10.610	66	47	U2E3	141,5	796	795	776	756	775	756	598	300	60
	P-5	10.070	47	47	U2E4	136,5	796	776	776	756	756	756	598	300	60
	E-2	4.190	28	28	UEE3	117,5	499	499	499	479	479	479	388	250	50

MÉTODO DE INSTALACIÓN

MÉTODO DE INSTALACIÓN

Todos los apoyos Pot son suministrados a obra provistos de dos placas de fijación, pintadas de rojo y situadas en ambos laterales de cada apoyo , que unen y bloquean durante transporte y montaje en obra las dos partes independientes del apoyo, placa superior y cazoleta. Se retiran después del hormigonado del tablero.

Procedimiento de instalación

1.- Construcción de la pila dejando los alojamientos (esperas) para los pernos inferiores del apoyo según se indica en los planos/planillas del mismo.

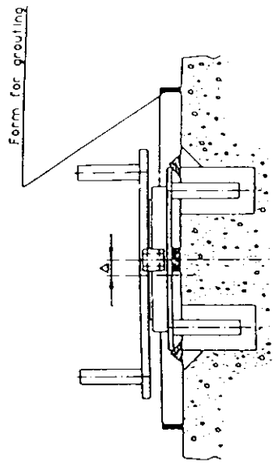
2.- Mediante unas cuñas de madera se procede a la nivelación horizontal del apoyo. Es importante asegurar que el eje x del apoyo quede perfectamente alineado con la dirección longitudinal del tablero.

3.- Instalación del encofrado perimetral entre pila y apoyo.

4.- Vertido de mortero autonivelante en el espacio existente entre pila y apoyo controlando que el nivel es el requerido.

5.- Instalación del encofrado inferior del tablero dejando embebidos los pernos superiores del apoyo para su posterior hormigonado.

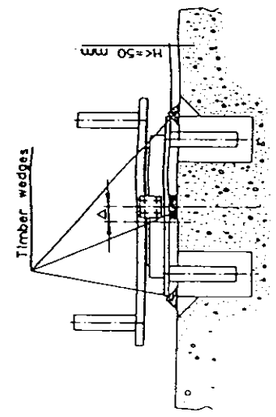
6.- Una vez desencofrado el tablero se extraen las placas laterales (color rojo) de fijación del apoyo.



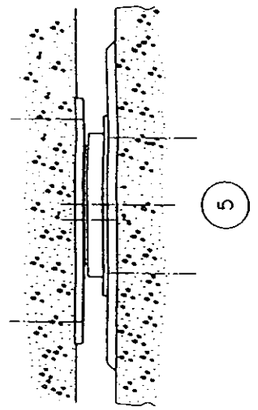
FORM FOR GROUTING INSTALLATION

BRIEF DESCRIPTION OF INSTALLATION

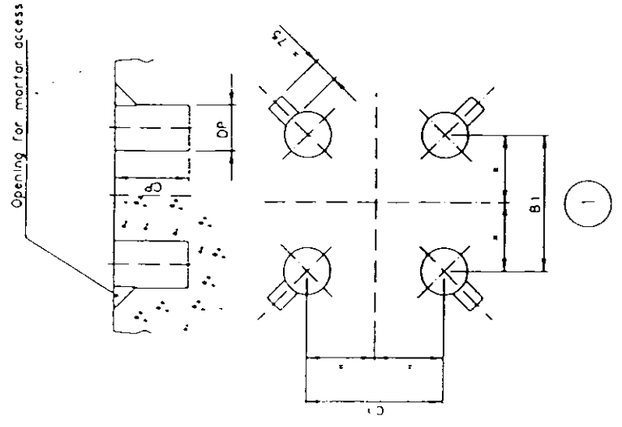
1. Built the piers leaving on them the required recesses according to the dimensions indicated on the drawings
2. Place the bottom masonry plate in its final position levelling it with timber wedges. Fill in the recesses controlling that the level is the required one
3. Install the form for grouting the space between pier and masonry plate
4. Grout the space between pier and masonry plate.
5. Place the top plate with its masonry plate on top of the pot and block the bearing if it is not a fixed type. Check that level is correct.
6. Pour the concrete of the deck of the bridge and unlock the bearings to allow the movements.



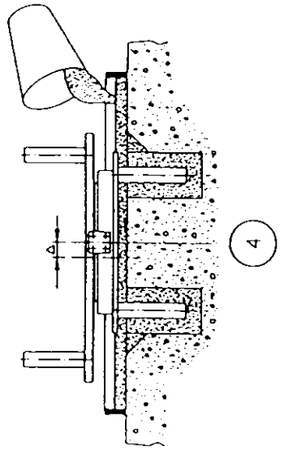
ELEVATION ACCORDING TO PROJECT SPECIFICATIONS.



UNLOCK OF THE TEMPORARY FIXATION



CONCRETE RECESS FORMING



GROUTING

JOB	DOC	CTT-STRONGHOLD	STRONGHOLD PRESTRESSING
		DRW N°: 190-04-86	DESCRIPTION: STANDARD METHOD POT BEARINGS INSTALLATION.
		SCALE: —	
		DATE: 14-10-93	

3. Definición geométrica

3. DEFINICIÓN GEOMÉTRICA

La definición geométrica de las estructuras están recogidas en el epígrafe 2. “Descripción, tipología, aparatos de apoyo …” etc. en lo que se refiere a las estructuras E-1, E-2, E-3, E-4 y E-5.

En el resto de las estructuras está en el epígrafe denominado Generalidades dentro de sus cálculos y en los planos respectivos.

4. Cálculos

ESTRUCTURA E-1

L.A.V. MADRID – BARCELONA
TRAMO ZARAGOZA-LÉRIDA
SUBTRAMO I

VIADUCTOS

INFORME SOBRE LA MODIFICACIÓN DE CARGAS EN LOS VIADUCTOS

ANTECEDENTES

Se trata de cinco viaductos con las luces siguientes:

Viaducto E-1 :	20-20x25-20	= 540 metros
Viaducto E-2 :	20-25-20	= 65 metros
Viaducto E-3 :	27-2x33-27	= 120 metros
Viaducto E-4 :	27-3x33-27	= 153 metros
Viaducto E-5 :	27-5x33-27	= 219 metros

El balasto aumenta 5 cm. de altura respecto de la prevista en el proyecto (de 0,30 metros a 0,35 metros bajo traviesa) y se dispone una capa de aglomerado bituminoso de 0,03 metros de espesor.

La separación de vías pasa de 4,50 a 4,70 metros.

MODIFICACIÓN DE CARGAS

El aumento de 5 cm. de balasto en 10,10 metros de ancho significa un aumento de carga permanente de:

$$\Delta p_1 = 10{,}10 \times 0{,}05 \times 1{,}6 = 0{,}81 \text{ t/m}$$

La capa de 3 cm. de aglomerado bituminoso en 10,10 metros de anchura significa un aumento de carga permanente de:

$$\Delta p_2 = 10{,}10 \times 0{,}03 \times 2{,}3 = 0{,}70 \text{ t/m}$$

Por tanto, el incremento total de carga permanente es de 1,51 t/m.

Teniendo en cuenta que la carga total de proyecto es del orden de 60 t/m, el incremento representa un 2,5% que claramente no modifica las condiciones de seguridad de las estructuras.

VIADUCTO E-1

Tomando un vano intermedio como punto de comparación (vano 4), tenemos:

$\Delta M^+ = 38{,}6$ mt	$\Delta\sigma_i = -1{,}3$ Kp/cm²	TRACCIÓN
$\Delta M^- = -76{,}9$ mt	$\Delta\sigma_s = -2{,}0$ Kp/cm²	

Esta variación de tensiones es despreciable.

Sobrecarga frecuente:

En fibra inferior teníamos 28 Kp/cm^2 que pasan a 26,7 Kp/ cm^2 (compresiones)

En fibra superior teníamos 24 Kp/cm^2 que pasan a 22,0 Kp/ cm^2 (compresiones)

Sobrecarga poco probable:

En fibra inferior teníamos -2 Kp/cm^2 que pasan a –3,3 Kp/ cm^2.

En fibra superior teníamos -8 Kp/cm^2 que pasan a –10,0 Kp/ cm^2.

Si se tiene en cuenta el gradiente térmico tenemos los siguientes valores:

Sobrecarga frecuente:

En fibra inferior teníamos 11,8 Kp/cm^2 que pasan a 10,5 Kp/ cm^2.

En fibra superior es más favorable.

Sobrecarga poco probable:

En fibra inferior teníamos –18,2 Kp/cm^2 que pasan a –20,2 Kp/ cm^2.

En fibra superior es más favorable.

Son tensiones admisibles. Son tensiones a tiempo ∞ con máximas pérdidas y 0,9 del pretensado. En el primer caso (sobrecarga frecuente) se cumple el estado de descompresión y en el segundo (sobrecarga poco probable) se cumple el estado de control de fisuras.

En cuanto a la seguridad a rotura se tenía:

	M_d antes (γ = 1,6)	M_d ahora	M_R de rotura	
PILA	-5123 mt	-5246 mt	-5898 mt	γ = 1,80
VANO	5087 mt	5149 mt	7273 mt	γ = 2,26

Siguen estando las secciones con un coeficiente de seguridad superior al exigido.

La influencia del aumento de cargas en pilas y cimentación es aún menos significativa.

En cuanto a la separación de las vías, no tiene ninguna influencia en el cálculo.

VIADUCTO E-2

Tomando los valores pésimos en punto de vano central y pilas, tenemos:

$\Delta M^+ = 39,6$ mt $\quad \Delta\sigma_i = -1,4$ Kp/cm^2 TRACCIÓN

$\Delta M^- = -75,9$ mt $\quad \Delta\sigma_s = -2,0$ Kp/cm^2

Esta variación de tensiones es despreciable.

Sobrecarga frecuente:

En fibra inferior teníamos 27 Kp/cm^2 que pasan a 25,6 Kp/ cm^2

En fibra superior teníamos 22 Kp/cm^2 que pasan a 20,0 Kp/ cm^2 (compresiones)

Sobrecarga poco probable:

En fibra inferior teníamos -3 Kp/cm² que pasan a –4,4 Kp/ cm².
En fibra superior teníamos 14 Kp/cm² que pasan a 12,0 Kp/ cm².

Si se tiene en cuenta el gradiente térmico, los valores anteriores en fibra inferior, ya que la fibra superior es más favorable, pasan a ser:

Sobrecarga frecuente: Teníamos 15,2 Kp/cm² que pasan a 13,8 Kp/ cm².
Sobrecarga poco probable: Teníamos -14,8 Kp/cm² que pasan a -16,8 Kp/ cm².

Son tensiones admisibles. Son tensiones a tiempo ∞ con máximas pérdidas y 0,9 del pretensado. Se mantiene el estado de descompresión para la sobrecarga frecuente, y el de control de fisuras para sobrecarga poco probable.

En cuanto a la seguridad a rotura se tenía:

	M_d antes ($\gamma = 1,6$)	M_d ahora	M_R de rotura	
PILA	-4656 mt	-4777 mt	-5746 mt	$\gamma = 1,92$
VANO	4916 mt	4979 mt	7274 mt	$\gamma = 2,34$

Siguen estando las secciones con un coeficiente de seguridad superior al exigido.

La influencia del aumento de cargas en pilas y cimentación es aún menos significativa.

En cuanto a la separación de las vías, no tiene ninguna influencia en el cálculo.

VIADUCTOS E-3, E-4 Y 3-5

Tomando un vano intermedio como punto de comparación, tenemos:

$\Delta M^+ = 68,6$ mt	$\Delta\sigma_i = -0,9$ Kp/cm²	TRACCIÓN
$\Delta M^- = -137,2$ mt	$\Delta\sigma_s = -3,0$ Kp/cm²	

Esta variación de tensiones es despreciable.

Sobrecarga frecuente:

En fibra inferior teníamos 11 Kp/cm² que pasan a 10,1 Kp/ cm²
En fibra superior teníamos 20 Kp/cm² que pasan a 17,0 Kp/ cm²

Sobrecarga poco probable:

En fibra inferior teníamos -11 Kp/cm² que pasan a –11,9 Kp/ cm².
En fibra superior teníamos -7 Kp/cm² que pasan a –10,0 Kp/ cm².

Si se tiene en cuenta el gradiente térmico, los valores anteriores en fibra inferior, ya que la fibra superior es más favorable, pasan a ser:

Sobrecarga frecuente: Teníamos 4,8 Kp/cm² que pasan a 3,9 Kp/ cm².
Sobrecarga poco probable: Teníamos -23,2 Kp/cm² que pasan a -24,1 Kp/ cm².

Son tensiones admisibles. Son tensiones a tiempo ∞ con máximas pérdidas y 0,9 del pretensado. Se cumple el estado de descompresión para el caso de sobrecarga frecuente, y el de control de fisuras para el caso de sobrecarga poco probable.

En cuanto a la seguridad a rotura se tenía:

	M_d antes ($\gamma = 1,6$)	M_d ahora	M_R de rotura	
PILA	-8613 mt	-8832 mt	-9613 mt	$\gamma = 1,74$
VANO	8248 mt	8358 mt	11229 mt	$\gamma = 2,15$

Siguen estando las secciones con un coeficiente de seguridad superior al exigido.

La influencia del aumento de cargas en pilas y cimentación es aún menos significativa.

En cuanto a la separación de las vías, no tiene ninguna influencia en el cálculo.

En el cálculo de la sección transversal, el acercar las cargas a los tabiques laterales de la sección disminuye incluso los esfuerzos de flexión en la losa superior, aunque de modo inapreciable.

En el cálculo transversal también influye el aumento de balasto que modifica ligeramente los momentos en la losa superior.

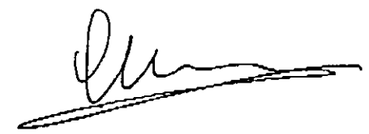
$\Delta M^+ = 0,24$ mt/m	$\Delta M_d^+ = 0,39$ mt/m	$0,35$ cm²/m
$\Delta M^- = -0,80$ mt/m	$\Delta M_d^- = -1,28$ mt/m	$0,58$ cm²/m

La armadura que se ha dispuesto, 24,55 cm²/m en cara inferior y 31,4 cm²/m en cara superior, resiste holgadamente el aumento de momentos.

CONCLUSIONES

Comprobada la influencia que la variación de las cargas puede tener en la seguridad de la obra, se puede concluir que dicha variación no modifica sustancialmente la seguridad y que en todos los casos se está dentro de los márgenes exigidos por las Instrucciones vigentes.

Madrid, 7 de abril de 2000



Fdo.: Carlos Siegrist Fernández

Colegiado nº 1920

L. A. V. ZARAGOZA-LLEIDA

SUBTRAMO 1

E-1

ANEJO DE CALCULO

1.- CALCULO TABLERO

2.- CALCULO REACCIONES Y APOYOS

3.- CALCULO PILAS

- 3.1.- Cálculo fustes
- 3.2.- Cálculo cimentación

4.- CALCULO ESTRIBOS

- 4.1.- Estribo 1 (Móvil)
- 4.2.- Estribo 2 (Fijo)

L.A.V. ZARAGOZA-LLEIDA

SUBTRAMO-I

E-1

GENERALIDADES

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Union Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril" de 25 de junio de 1975.
- "L.A.V. Zaragoza-Lérida. Proyecto de Estructuras de Puentes de Ferrocarril. Bases del Cálculo" de 29 de julio de 1993.
- "Instrucción EP-93, para el proyecto y ejecución de obras de hormigón pretensado".
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

. Encepados y zapatas..... fck $\geq$ 250 Kp/cm^2
. Pilotes..... fck $\geq$ 200 Kp/cm^2
. Alzados de estribos ..... fck $\geq$ 250 kp/cm^2
. Alzados de pilas ..... fck $\geq$ 300 Kp/cm^2
. Tablero postesado..... fck $\geq$ 350 kp/cm^2
. Coeficiente de seguridad ..... γ_c = 1,5

Armaduras activas

. Tensión de rotura $\geq$ 190 Kp/mm^2
. Límite elástico $\geq$ 170 Kp/mm^2
. Coeficiente de seguridad γ_s= 1,1

Armaduras pasivas

. Límite elástico $\geq$ 5100 Kp/cm^2
. Coeficiente de seguridad γ_s = 1,15

Cargas

Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

3.- Criterios generales de cálculo

Para el cálculo de la estructura se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

El cálculo del viaducto se ha realizado básicamente en las siguientes fases:

- Tablero:
  - Cálculo longitudinal
  - Cálculo transversal
- Reacciones y aparatos de apoyo
- Pilas
- Estribos

La obtención de esfuerzos que permiten realizar el análisis longitudinal del tablero, se ha realizado con la ayuda de un programa de cálculo matricial basado en el método de la rigidez, discretizándose el tablero como viga contínua, sometida a las acciones de peso propio, carga permanente, sobrecarga, gradiente térmico y pretensado, tanto inicial como final, con sus correspondientes coeficientes de ponderación. De este cálculo como viga se obtienen los estados tensionales en servicio y la comprobación a rotura por flexión y cortante.

En el análisis transversal, se ha estudiado la flexión transversal, la armadura necesaria en el voladizo, el rasante y las costillas sobre pilas y estribos, en particular el anclaje del tablero al estribo.

En cuanto al cálculo de pilas y estribos se han tenido en cuenta, además de las acciones verticales, las horizontales debidas a los acortamientos por retracción, fluencia y temperatura, frenado, viento, empuje de tierras y efectos sísmicos.

En la distribución de acciones horizontales en los distintos elementos se han tenido en cuenta las distintas rigideces de éstos, tanto para cargas rápidas como de larga duración.

En la comprobación de las pilas se ha empleado un programa que tiene en cuenta los efectos de 2º orden, considerando la no linealidad, tanto geométrica como del material.

En la comprobación de los elementos de hormigón armado y pretensado, se ha tenido en cuenta lo prescrito en las Instrucciones correspondientes EH-91 y EP-93, respectivamente.

4.- Equipo redactor del proyecto

El cálculo del proyecto ha sido realizado por la oficina **SIEGRIST Y MORENO, S.L.**

Madrid, 25 de junio de 1997

Fdo.: Carlos Siegrist Fernández

PROGRAMA GENERAL DE PUENTES CONTINUOS (VI-0)

- Objeto del programa y campo de aplicación: El programa está diseñado para el cálculo matricial en teoría de primer orden de una viga contínua recta, teniendo en cuenta el proceso constructivo de la estructura. Se aplica a estructuras de varios vanos cuyo comportamiento pueda considerarse tipo viga. Permite la introducción de un coeficiente de excentricidad para tener en cuenta los efectos de cargas locales que hagan que el comportamiento tipo viga no se real.

- Identificación: Este programa ha sido desarrollado en la oficina SIEGRIST Y MORENO S.L. por Juan Moreno Torres y Miguel Angel Utrilla Arroyo. La última revisión del mismo, utilizada en estos calculos, se realizó en enero de 1994.

- Datos de entrada:

  - Definición de **vanos, cargas y características de los materiales** que componen la estructura.
  - Definición de **secciones de cálculo** en la estructura final con sus características geométricas.
  - Definición de **estados de la estructura**. (Proceso constructivo).
  - Definición de los **cables de pretensado** con los puntos singulares del trazado y fuerzas de tesado.

- Resultados:

  - **Esfuerzos en las secciones de cálculo en las hipótesis:**

    . Peso propio estructura en cada uno de los estados constructivos y peso propio de la estructura completa en los estados inicial y final (teniendo en cuenta el reajuste por fluencia). En todos los casos se tiene en cuenta la construcción por fases.

    . Cargas muertas

    . Temperatura

    . Descenso de apoyos

    . Envolvente de cortantes y momentos para sobrecarga tipo renfe y tipo UIC.

  - Definición general de los **cables de pretensado**, con su replanteo.

  - **Esfuerzos unitarios producidos por los cables de pretensado**, tanto en las estructuras parciales como en la completa.

  - **Coeficientes de pérdidas de pretensado y resumen de familias de cables**.

  - **Esfuerzos de pretensado** en estado inicial y final.

  - **Tensiones en construcción** en cada uno de los estados evolutivos. En

cada fase se calculan cuatro hipótesis: Pretensado con pérdidas instantáneas ponderado y sin ponderar; peso propio; y la suma de peso propio y pretensado ponderado.

- **Tensiones en servicio** en estados inicial y final, ponderando el pretensado con 0,9 y 1,1 y considerando las diferentes envolventes de sobrecarga, así como la sobrecarga frecuente.

- **Reacciones y giros** en cada una de las hipótesis en que se han dado esfuerzos.

- **Comprobación a cortante**. En este apartado se detallan inicialmente los esfuerzos, tanto de cargas exteriores (envolvente de esfuerzos máximos y mínimos ponderados) como de pretensado, en cada una de las secciones de cálculo. A partir de estos esfuerzos el programa obtiene de acuerdo con la EP-93 el esfuerzo cortante reducido, así como la armadura necesaria en cada sección. También se obtiene la armadura mínima de las secciones y se comprueba la compresión en el hormigón (Vrd/Vu1).

- **Comprobación a rotura**. Se calcula el momento de cálculo, (envolventes de momentos máximos y mínimos), el momento hiperestático de pretensado y el momento último de cada sección. En este cálculo se tiene en cuenta tanto el pretensado como la armadura pasiva del tablero. En los momentos totales se suma a los momentos de cálculo el momento hiperestático ponderado por 1.1 o por 0.9 según sea desfavorable o favorable.

CALCULO TABLERO

CALCULO DEL TABLERO

Para el cálculo del tablero se han seguido los siguientes pasos:

- Sección transversal del tablero

- Cálculo longitudinal

  - Cálculo como viga contínua
  - Comprobación de tensiones
  - Comprobación a rotura por flexión
  - Combrobación a cortante
  - Cálculo a torsión

- Cálculo transversal

  - Armadura de voladizos
  - Armadura de rasante
  - Vigas riostras sobre pilas
  - Vigas riostras sobre estribos

- Cálculo de alargamientos de tesado

SECCION TRANSVERSAL

PROYECTO LAV ZARAGOZA - LERIDA
SUBTRAMO 1
PUENTES LOSA (E-1 y E-2)

FECHA

HOJA N.º

CALCULO DE VIENTO

Según la instrucción de acciones en puentes de ferrocarril:

presión básica: $p_w = 154\,(2 - 0.7\lambda) = 200\ kp/m^2$

$\lambda = \frac{A_u}{A_{bt}} = 1$

Superficie a considerar: 1.65 (canto tablero) + 0.75 (balasto + carril) + + 3.50 (tren) = $5.9\ m^2/m$

Presión sobre el dintel $0{,}2\ T/m^2 \times 5.9\ m^2 = \underline{1.18\ T/m}$

fustes: $S = 1.40\ m^2/m \Rightarrow$ Presión $= 0{,}2 \times 1.4 = \underline{0{,}28\ T/m}$

COEFICIENTE DE IMPACTO

- RENFE. Según la instrucción:

Tramos apoyados continuos: $I = 65\,\frac{\mu}{1-\mu+\mu^2} = 29.7$

$\mu = \frac{V \cdot T}{2L} = 0.3522$ Se toma 30% $\underline{I = 1.30}$

$V = 200\ Km/h = 55.56\ m/s$

$L = 25\ m$

$T = \frac{2\pi}{\omega}$ $\omega = \sqrt{\frac{EI\pi^4}{m l^4}}$ $EI = 3{,}5 \cdot 10^6 \times 2.097$

$T = 0.317$

$m = \frac{1}{9.8}\left(\underbrace{9.63 \times 25}_{\text{P. propio}} + \underbrace{10.686}_{\text{c. rea.}} + \underbrace{24}_{\text{sob}}\right) = 6.0$

UIC

$l_m = \frac{1}{22}(20 \times 2 + 25 \times 20) = 24{,}54\ m$ $L\phi = 1.5 \cdot l_m = 36.8$

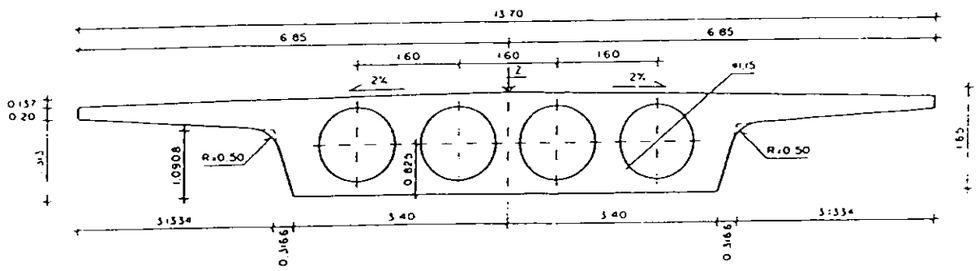
Tomando ϕ_2 para 30-40 $\rightarrow$ IMPACTO = 1.09

PROYECTO L.A.V ZARAGOZA - LERIDA
SUBTRAMO I
SECCION LOSA.

FECHA

HOJA N.º 1/5

SECCION TRANSVERSAL TIPO



Area: 9.634 m²

I_{LONG}: 2.697 m⁴

Y_{G_2} ↑: 0.939 m

SECCION: L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. LOSA ALIGERADA.

NUM. CONTORNOS	NUM. CIRCULOS
1	4

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.400	0.000
2	3.717	1.091
3	6.850	1.313
4	6.850	1.513
5	0.000	1.650
6	-6.850	1.513
7	-6.850	1.313
8	-3.717	1.091
9	-3.400	0.000

CIRCULOS 4	RADIOS	COORD. X	Y
1	0.575	-2.400	0.825
2	0.575	-0.800	0.825
3	0.575	0.800	0.825
4	0.575	2.400	0.825

FIBRA INFERIOR X	Y	FIBRA SUPERIOR X	Y
-0.000	0.000	-0.000	1.650

RESULTADOS

AREA = 9.63421 m2

CENTRO DE GRAVEDAD Xg= -0.00000 Yg= 0.93943

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 9.0506454	Ixx = 11.1995087	ANG. FI = 0.0000
My = -0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.6970758	ANG. FI = 0.0000
My = 0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.6970758	ANG. FI = 0.0000
My = 0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 0.93943		Ds = 0.71057	
Wi = 2.87098		Ws = 3.79564	
Radio Giro X-X =	0.52910	Radio Giro Y-Y=	3.10934

SECCION: L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. LOSA SECCION MACIZA.

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.400	0.000
2	3.717	1.091
3	6.850	1.313
4	6.850	1.513
5	0.000	1.650
6	-6.850	1.513
7	-6.850	1.313
8	-3.717	1.091
9	-3.400	0.000

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
-0.000	0.000	-0.000	1.650

RESULTADOS

AREA = 13.78897 m2

CENTRO DE GRAVEDAD Xg= -0.00000 Yg= 0.90495

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 12.4783272	Ixx = 14.3707619	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 3.0785017	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 3.0785017	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 0.90495 Ds = 0.74505

Wi = 3.40185 Ws = 4.13194

Radio Giro X-X = 0.47250 Radio Giro Y-Y= 2.78281

CALCULO LONGITUDINAL

CALCULO COMO VIGA CONTINUA

Los datos introducidos en el cálculo como viga contínua son:

- Definición de vanos de la estructura y estados de la misma.
- Hipótesis de cargas actuantes.
- Características de los materiales empleados.
- Características geométricas de las secciones en que se divide el tablero.
- Definición del pretensado (se introduce el cable medio).

A partir de estos datos se obtiene:

Esfuerzos en las secciones de la viga para las distintas hipótesis de carga consideradas

- Definición del pretensado, acciones unitarias de los cables y esfuerzos de pretensado
- Reacciones en las distintas hipótesis de cargas
- Tensiones ponderadas en los distintos estados de la estructura.

Cálculo a cortante

Comprobación a rotura

Programa general de puentes continuos (V1-0)

Proyecto : VIADUCTO 1 TAV

Definicion geometrica de vanos

	Longitud
Vano 1	20.0000 m
Vano 2	25.0000 m
Vano 3	25.0000 m
Vano 4	25.0000 m
Vano 5	25.0000 m
Vano 6	25.0000 m
Vano 7	20.0000 m

Definicion de cargas

Cargas muertas (t.I) ..... = 0.780 t/m2
Cargas muertas (t.II)..... = 0.000 t/m

Sobrecarga repartida ..... = 0.000 t/m2

Tanque :

	Coeficientes de excentricidad			
	Flexion		Cortante	
	C.Vano	Apoyos	C.Vano	Apoyos
Vano 1	1.00	1.00	1.00	1.00
Vano 2	1.00	1.00	1.00	1.00
Vano 3	1.00	1.00	1.00	1.00
Vano 4	1.00	1.00	1.00	1.00
Vano 5	1.00	1.00	1.00	1.00
Vano 6	1.00	1.00	1.00	1.00
Vano 7	1.00	1.00	1.00	1.00

Ancho de aceras	1.300 m
Coef. de impacto para tren de RENFE	1.300
Coef. de impacto para tren de U.I.C.	1.090
Numero de vias	2

Temperatura :

Coef. de dilatacion termica de	.1E-04
Gradiente lineal termico de	5.000 grad

Caracteristicas de los materiales

Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Densidad del hormigon	=	2.50	t/m3
Modulo de elasticidad del acero de pretensar ..	=	19000.00	kg/mm2
Tension de rotura de los cables	=	190.00	kg/mm2
Porcentaje a que se tesan los cables	=	75. /80 %	
		realizados 75 %	
Retraccion del hormigon	=	0.00025	
Coeficiente de relajacion del acero	=	0.06000	
Coeficiente de fluencia del hormigon	=	2.50000	
Coef. de ponderacion maximo del pretensado	=	1.1000	
Coef. de ponderacion minimo del pretensado	=	0.9000	
Coef. de perdidas finales en estado inicial ...	=	0.3000	

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
1	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	2.000	0.711	0.939	1.65	9.63	2.6970	13.70
	3	4.000	0.711	0.939	1.65	9.63	2.6970	13.70
	4	6.000	0.711	0.939	1.65	9.63	2.6970	13.70
	5	8.000	0.711	0.939	1.65	9.63	2.6970	13.70
	6	10.000	0.711	0.939	1.65	9.63	2.6970	13.70
	7	12.000	0.711	0.939	1.65	9.63	2.6970	13.70
	8	14.000	0.711	0.939	1.65	9.63	2.6970	13.70
	9	16.000	0.711	0.939	1.65	9.63	2.6970	13.70
	10	18.000	0.711	0.939	1.65	9.63	2.6970	13.70
	11	20.000	0.711	0.939	1.65	9.63	2.6970	13.70
2	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	8.333	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.416	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.499	0.711	0.939	1.65	9.63	2.6970	13.70
	7	14.582	0.711	0.939	1.65	9.63	2.6970	13.70
	8	16.665	0.711	0.939	1.65	9.63	2.6970	13.70
	9	18.748	0.711	0.939	1.65	9.63	2.6970	13.70
	10	21.873	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
3	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	8.333	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.416	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.499	0.711	0.939	1.65	9.63	2.6970	13.70
	7	14.582	0.711	0.939	1.65	9.63	2.6970	13.70
	8	16.665	0.711	0.939	1.65	9.63	2.6970	13.70
	9	18.748	0.711	0.939	1.65	9.63	2.6970	13.70
	10	21.873	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
4	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	8.333	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.416	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.499	0.711	0.939	1.65	9.63	2.6970	13.70
	7	14.582	0.711	0.939	1.65	9.63	2.6970	13.70
	8	16.665	0.711	0.939	1.65	9.63	2.6970	13.70
	9	18.748	0.711	0.939	1.65	9.63	2.6970	13.70
	10	21.873	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
5	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	8.333	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.416	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.499	0.711	0.939	1.65	9.63	2.6970	13.70
	7	14.582	0.711	0.939	1.65	9.63	2.6970	13.70
	8	16.665	0.711	0.939	1.65	9.63	2.6970	13.70
	9	18.748	0.711	0.939	1.65	9.63	2.6970	13.70
	10	21.873	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
6	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	8.333	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.416	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.499	0.711	0.939	1.65	9.63	2.6970	13.70
	7	14.582	0.711	0.939	1.65	9.63	2.6970	13.70
	8	16.665	0.711	0.939	1.65	9.63	2.6970	13.70
	9	18.748	0.711	0.939	1.65	9.63	2.6970	13.70
	10	21.873	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
7	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	3.125	0.711	0.939	1.65	9.63	2.6970	13.70
	3	6.250	0.711	0.939	1.65	9.63	2.6970	13.70
	4	7.969	0.711	0.939	1.65	9.63	2.6970	13.70
	5	9.688	0.711	0.939	1.65	9.63	2.6970	13.70
	6	11.407	0.711	0.939	1.65	9.63	2.6970	13.70
	7	13.126	0.711	0.939	1.65	9.63	2.6970	13.70
	8	14.845	0.711	0.939	1.65	9.63	2.6970	13.70
	9	16.564	0.711	0.939	1.65	9.63	2.6970	13.70
	10	18.283	0.711	0.939	1.65	9.63	2.6970	13.70
	11	20.000	0.711	0.939	1.65	9.63	2.6970	13.70

Definicion de estados de la estructura

		Numero de secciones	Numero de secciones activas
Estado	1	13	de 1 a 13
Estado	2	23	de 13 a 23
Estado	3	33	de 23 a 33
Estado	4	43	de 33 a 43
Estado	5	53	de 43 a 53
Estado	6	63	de 53 a 63
Estado	7	71	de 63 a 71

Cable Numero 1 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 13 (26.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 2 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 13 (26.250) Pasiva
Seccion final ..... = 23 (51.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 3 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 23 (51.250) Pasiva
Seccion final ..... = 33 (76.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 4 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (76.250) Pasiva
Seccion final ..... = 43 (101.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 5 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (101.250) Pasiva
Seccion final ..... = 53 (126.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 6 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (126.250) Pasiva
Seccion final ..... = 63 (151.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 7 (Pertenece a familia 7)

Definicion general

Seccion inicial ..... = 63 (151.250) Pasiva
Seccion final ..... = 71 (165.000) Activa

Fuerza de Pretensado ..... = 1495.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Cable Numero 8 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 13 (26.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 9 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 13 (26.250) Pasiva
Seccion final ..... = 23 (51.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 10 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 23 (51.250) Pasiva
Seccion final ..... = 33 (76.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 11 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (76.250) Pasiva
Seccion final ..... = 43 (101.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 12 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (101.250) Pasiva
Seccion final ..... = 53 (126.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 13 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (126.250) Pasiva
Seccion final ..... = 63 (151.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Cable Numero 14 (Pertenece a familia 7)

Definicion general

Seccion inicial ..... = 63 (151.250) Pasiva
Seccion final ..... = 71 (165.000) Activa

Fuerza de Pretensado ..... = 1495.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Esfuerzos acumulados por peso propio

Estado 1

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-217.33	0.00	0.00	0.00
	2	386.49	-169.16	0.00	10.19	-13.46
	3	676.64	-120.99	0.00	17.84	-23.56
	4	870.45	-72.82	0.00	22.95	-30.31
	5	967.91	-24.65	0.00	25.52	-33.70
	6	969.04	23.52	0.00	25.55	-33.74
	7	873.83	71.69	0.00	23.04	-30.42
	8	682.28	119.86	0.00	17.99	-23.75
	9	394.39	168.03	0.00	10.40	-13.73
	10	10.16	216.20	0.00	0.27	-0.35
	11	-470.41	264.37	0.00	-12.40	16.38
2	1	-470.41	-150.53	0.00	-12.40	16.38
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 2

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-181.60	0.00	0.00	0.00
	2	315.03	-133.43	0.00	8.30	-10.97
	3	533.72	-85.26	0.00	14.07	-18.58
	4	656.07	-37.09	0.00	17.30	-22.84
	5	682.08	11.08	0.00	17.98	-23.75
	6	611.74	59.25	0.00	16.13	-21.30
	7	445.07	107.42	0.00	11.73	-15.50
	8	182.06	155.59	0.00	4.80	-6.34
	9	-177.29	203.76	0.00	-4.67	6.17
	10	-632.98	251.93	0.00	-16.69	22.04
	11	-1185.01	300.10	0.00	-31.24	41.26
2	1	-1185.01	-329.65	0.00	-31.24	41.26
	2	-272.47	-254.38	0.00	-7.18	9.49
	3	404.87	-179.11	0.00	10.67	-14.10
	4	725.72	-128.95	0.00	19.13	-25.27
	5	942.06	-78.78	0.00	24.84	-32.80
	6	1053.90	-28.61	0.00	27.78	-36.69
	7	1061.24	21.56	0.00	27.98	-36.95
	8	964.08	71.73	0.00	25.42	-33.57
	9	762.41	121.90	0.00	20.10	-26.54
	10	263.87	197.17	0.00	6.96	-9.19
	11	-470.41	272.48	0.00	-12.40	16.38
3	1	-470.41	-150.53	0.00	-12.40	16.38
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 3

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-191.20	0.00	0.00	0.00
	2	334.23	-143.03	0.00	8.81	-11.64
	3	572.11	-94.86	0.00	15.08	-19.92
	4	713.66	-46.69	0.00	18.81	-24.85
	5	758.87	1.48	0.00	20.01	-26.42
	6	707.73	49.65	0.00	18.66	-24.64
	7	560.26	97.82	0.00	14.77	-19.51
	8	316.45	145.99	0.00	8.34	-11.02
	9	-23.70	194.16	0.00	-0.62	0.83
	10	-460.20	242.33	0.00	-12.13	16.02
	11	-993.03	290.50	0.00	-26.18	34.57
2	1	-993.03	-294.32	0.00	-26.18	34.57
	2	-190.88	-219.06	0.00	-5.03	6.65
	3	376.07	-143.79	0.00	9.91	-13.09
	4	623.34	-93.62	0.00	16.43	-21.70
	5	766.10	-43.45	0.00	20.20	-26.67
	6	804.36	6.72	0.00	21.21	-28.00
	7	738.12	56.89	0.00	19.46	-25.70
	8	567.37	107.06	0.00	14.96	-19.75
	9	292.13	157.22	0.00	7.70	-10.17
	10	-316.80	232.49	0.00	-8.35	11.03
	11	-1161.55	307.80	0.00	-30.62	40.44
3	1	-1161.55	-328.71	0.00	-30.62	40.44
	2	-251.93	-253.44	0.00	-6.64	8.77
	3	422.47	-178.18	0.00	11.14	-14.71
	4	741.36	-128.01	0.00	19.54	-25.81
	5	955.75	-77.84	0.00	25.20	-33.28
	6	1065.63	-27.67	0.00	28.09	-37.10
	7	1071.02	22.50	0.00	28.23	-37.29
	8	971.90	72.67	0.00	25.62	-33.84
	9	768.28	122.84	0.00	20.25	-26.75
	10	266.81	198.10	0.00	7.03	-9.29
	11	-470.41	273.42	0.00	-12.40	16.38
4	1	-470.41	-150.53	0.00	-12.40	16.38
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-188.63	0.00	0.00	0.00
	2	329.08	-140.46	0.00	8.68	-11.46
	3	561.82	-92.29	0.00	14.81	-19.56
	4	698.23	-44.11	0.00	18.41	-24.31
	5	738.29	4.05	0.00	19.46	-25.70
	6	682.01	52.22	0.00	17.98	-23.75
	7	529.39	100.39	0.00	13.96	-18.43
	8	280.43	148.57	0.00	7.39	-9.76
	9	-64.86	196.74	0.00	-1.71	2.26
	10	-506.50	244.90	0.00	-13.35	17.63
	11	-1044.48	293.08	0.00	-27.54	36.37
2	1	-1044.48	-303.79	0.00	-27.54	36.37
	2	-212.74	-228.52	0.00	-5.61	7.41
	3	383.79	-153.26	0.00	10.12	-13.36
	4	650.78	-103.09	0.00	17.16	-22.66
	5	813.26	-52.92	0.00	21.44	-28.31
	6	871.24	-2.75	0.00	22.97	-30.33
	7	824.71	47.42	0.00	21.74	-28.71
	8	673.69	97.59	0.00	17.76	-23.46
	9	418.16	147.76	0.00	11.02	-14.56
	10	-161.18	223.02	0.00	-4.25	5.61
	11	-976.32	298.34	0.00	-25.74	33.99
3	1	-976.32	-293.72	0.00	-25.74	33.99
	2	-176.04	-218.46	0.00	-4.64	6.13
	3	389.03	-143.19	0.00	10.26	-13.54
	4	635.04	-93.02	0.00	16.74	-22.11
	5	776.55	-42.85	0.00	20.47	-27.04
	6	813.56	7.32	0.00	21.45	-28.33
	7	746.07	57.49	0.00	19.67	-25.98
	8	574.07	107.66	0.00	15.13	-19.99
	9	297.57	157.82	0.00	7.84	-10.36
	10	-313.23	233.09	0.00	-8.26	10.91
	11	-1159.86	308.40	0.00	-30.58	40.38
4	1	-1159.86	-328.64	0.00	-30.58	40.38
	2	-250.46	-253.38	0.00	-6.60	8.72
	3	423.74	-178.11	0.00	11.17	-14.75
	4	742.49	-127.94	0.00	19.57	-25.85
	5	956.73	-77.77	0.00	25.22	-33.31
	6	1066.48	-27.60	0.00	28.12	-37.13
	7	1071.72	22.57	0.00	28.25	-37.31
	8	972.46	72.74	0.00	25.64	-33.86
	9	768.70	122.91	0.00	20.27	-26.76
	10	267.02	198.17	0.00	7.04	-9.30
	11	-470.41	273.49	0.00	-12.40	16.38
5	1	-470.41	-150.53	0.00	-12.40	16.38

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-189.31	0.00	0.00	0.00
	2	330.46	-141.14	0.00	8.71	-11.51
	3	564.58	-92.97	0.00	14.88	-19.66
	4	702.36	-44.80	0.00	18.52	-24.45
	5	743.80	3.37	0.00	19.61	-25.90
	6	688.90	51.54	0.00	18.16	-23.99
	7	537.66	99.71	0.00	14.17	-18.72
	8	290.08	147.88	0.00	7.65	-10.10
	9	-53.83	196.05	0.00	-1.42	1.87
	10	-494.09	244.22	0.00	-13.03	17.20
	11	-1030.69	292.39	0.00	-27.17	35.89
2	1	-1030.69	-301.25	0.00	-27.17	35.89
	2	-206.88	-225.99	0.00	-5.45	7.20
	3	381.72	-150.72	0.00	10.06	-13.29
	4	643.42	-100.55	0.00	16.96	-22.40
	5	800.62	-50.38	0.00	21.11	-27.87
	6	853.32	-0.21	0.00	22.50	-29.71
	7	801.51	49.96	0.00	21.13	-27.91
	8	645.20	100.13	0.00	17.01	-22.46
	9	384.39	150.29	0.00	10.13	-13.38
	10	-202.88	225.56	0.00	-5.35	7.06
	11	-1025.95	300.87	0.00	-27.05	35.72
3	1	-1025.95	-303.10	0.00	-27.05	35.72
	2	-196.38	-227.83	0.00	-5.18	6.84
	3	397.99	-152.57	0.00	10.49	-13.86
	4	663.53	-102.40	0.00	17.49	-23.10
	5	824.57	-52.23	0.00	21.74	-28.71
	6	881.10	-2.06	0.00	23.23	-30.68
	7	833.14	48.11	0.00	21.96	-29.01
	8	680.67	98.28	0.00	17.94	-23.70
	9	423.70	148.45	0.00	11.17	-14.75
	10	-157.81	223.71	0.00	-4.16	5.49
	11	-975.12	299.03	0.00	-25.71	33.95
4	1	-975.12	-293.68	0.00	-25.71	33.95
	2	-174.98	-218.41	0.00	-4.61	6.09
	3	389.96	-143.15	0.00	10.28	-13.58
	4	635.88	-92.98	0.00	16.76	-22.14
	5	777.30	-42.81	0.00	20.49	-27.06
	6	814.22	7.36	0.00	21.47	-28.35
	7	746.64	57.53	0.00	19.68	-26.00
	8	574.55	107.70	0.00	15.15	-20.00
	9	297.96	157.87	0.00	7.86	-10.37
	10	-312.97	233.13	0.00	-8.25	10.90
	11	-1159.74	308.45	0.00	-30.57	40.38
5	1	-1159.74	-328.64	0.00	-30.57	40.38
	2	-250.35	-253.37	0.00	-6.60	8.72

Esfuerzos acumulados por peso propio

tado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	423.83	-178.10	0.00	11.17	-14.76
	4	742.57	-127.93	0.00	19.58	-25.85
	5	956.80	-77.77	0.00	25.22	-33.31
	6	1066.54	-27.60	0.00	28.12	-37.13
	7	1071.77	22.57	0.00	28.25	-37.32
	8	972.50	72.74	0.00	25.64	-33.86
	9	768.73	122.91	0.00	20.27	-26.76
	10	267.04	198.18	0.00	7.04	-9.30
	11	-470.41	273.49	0.00	-12.40	16.38
6	1	-470.41	-150.53	0.00	-12.40	16.38
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 6

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-189.13	0.00	0.00	0.00
	2	330.09	-140.96	0.00	8.70	-11.49
	3	563.84	-92.79	0.00	14.86	-19.63
	4	701.25	-44.62	0.00	18.49	-24.42
	5	742.32	3.55	0.00	19.57	-25.85
	6	687.06	51.72	0.00	18.11	-23.92
	7	535.45	99.89	0.00	14.12	-18.64
	8	287.50	148.06	0.00	7.58	-10.01
	9	-56.79	196.23	0.00	-1.50	1.98
	10	-497.42	244.40	0.00	-13.11	17.32
	11	-1034.39	292.57	0.00	-27.27	36.01
2	1	-1034.39	-301.93	0.00	-27.27	36.01
	2	-208.45	-226.67	0.00	-5.50	7.26
	3	382.28	-151.40	0.00	10.08	-13.31
	4	645.39	-101.23	0.00	17.01	-22.47
	5	804.01	-51.06	0.00	21.20	-27.99
	6	858.12	-0.89	0.00	22.62	-29.88
	7	807.73	49.28	0.00	21.29	-28.12
	8	652.83	99.45	0.00	17.21	-22.73
	9	393.44	149.61	0.00	10.37	-13.70
	10	-191.70	224.88	0.00	-5.05	6.67
	11	-1012.66	300.19	0.00	-26.70	35.26
3	1	-1012.66	-300.58	0.00	-26.70	35.26
	2	-190.93	-225.32	0.00	-5.03	6.65
	3	395.59	-150.05	0.00	10.43	-13.77
	4	655.89	-99.88	0.00	17.29	-22.84
	5	811.70	-49.71	0.00	21.40	-28.26
	6	863.00	0.45	0.00	22.75	-30.05
	7	809.81	50.62	0.00	21.35	-28.19
	8	652.10	100.79	0.00	17.19	-22.70
	9	389.90	150.96	0.00	10.28	-13.58
	10	-199.45	226.23	0.00	-5.26	6.94
	11	-1024.62	301.54	0.00	-27.01	35.67
4	1	-1024.62	-303.05	0.00	-27.01	35.67
	2	-195.20	-227.78	0.00	-5.15	6.80
	3	399.01	-152.51	0.00	10.52	-13.89
	4	664.45	-102.35	0.00	17.52	-23.13
	5	825.38	-52.18	0.00	21.76	-28.74
	6	881.81	-2.01	0.00	23.25	-30.70
	7	833.74	48.16	0.00	21.98	-29.03
	8	681.17	98.33	0.00	17.96	-23.72
	9	424.10	148.50	0.00	11.18	-14.77
	10	-157.57	223.77	0.00	-4.15	5.49
	11	-975.04	299.08	0.00	-25.70	33.95
5	1	-975.03	-293.67	0.00	-25.70	33.95
	2	-174.90	-218.41	0.00	-4.61	6.09

Esfuerzos acumulados por peso propio

Estado 6

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	390.03	-143.14	0.00	10.28	-13.58
	4	635.94	-92.97	0.00	16.77	-22.14
	5	777.36	-42.80	0.00	20.49	-27.06
	6	814.27	7.36	0.00	21.47	-28.35
	7	746.68	57.53	0.00	19.68	-26.00
	8	574.59	107.70	0.00	15.15	-20.01
	9	297.99	157.87	0.00	7.86	-10.38
	10	-312.95	233.14	0.00	-8.25	10.90
	11	-1159.73	308.45	0.00	-30.57	40.38
6	1	-1159.72	-328.64	0.00	-30.57	40.38
	2	-250.34	-253.37	0.00	-6.60	8.72
	3	423.83	-178.10	0.00	11.17	-14.76
	4	742.57	-127.93	0.00	19.58	-25.85
	5	956.81	-77.76	0.00	25.22	-33.31
	6	1066.54	-27.60	0.00	28.12	-37.13
	7	1071.77	22.57	0.00	28.25	-37.32
	8	972.50	72.74	0.00	25.64	-33.86
	9	768.73	122.91	0.00	20.27	-26.76
	10	267.04	198.18	0.00	7.04	-9.30
	11	-470.41	273.49	0.00	-12.40	16.38
7	1	-470.41	-150.53	0.00	-12.40	16.38
	2	-117.60	-75.27	0.00	-3.10	4.09
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 7

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-189.16	0.00	0.00	0.00
	2	330.15	-140.99	0.00	8.70	-11.49
	3	563.96	-92.82	0.00	14.87	-19.64
	4	701.43	-44.65	0.00	18.49	-24.42
	5	742.56	3.52	0.00	19.58	-25.85
	6	687.36	51.69	0.00	18.12	-23.93
	7	535.81	99.86	0.00	14.13	-18.65
	8	287.92	148.03	0.00	7.59	-10.02
	9	-56.31	196.20	0.00	-1.48	1.96
	10	-496.88	244.37	0.00	-13.10	17.30
	11	-1033.79	292.54	0.00	-27.25	35.99
2	1	-1033.79	-301.82	0.00	-27.25	35.99
	2	-208.20	-226.56	0.00	-5.49	7.25
	3	382.19	-151.29	0.00	10.08	-13.31
	4	645.07	-101.12	0.00	17.01	-22.46
	5	803.46	-50.95	0.00	21.18	-27.97
	6	857.34	-0.78	0.00	22.60	-29.85
	7	806.72	49.39	0.00	21.27	-28.09
	8	651.59	99.56	0.00	17.18	-22.69
	9	391.97	149.72	0.00	10.33	-13.65
	10	-193.52	224.99	0.00	-5.10	6.74
	11	-1014.82	300.30	0.00	-26.75	35.33
3	1	-1014.81	-300.99	0.00	-26.75	35.33
	2	-191.81	-225.73	0.00	-5.06	6.68
	3	395.98	-150.46	0.00	10.44	-13.79
	4	657.13	-100.29	0.00	17.32	-22.88
	5	813.79	-50.12	0.00	21.45	-28.33
	6	865.94	0.05	0.00	22.83	-30.15
	7	813.59	50.22	0.00	21.45	-28.33
	8	656.74	100.38	0.00	17.31	-22.87
	9	395.39	150.55	0.00	10.42	-13.77
	10	-192.70	225.82	0.00	-5.08	6.71
	11	-1016.59	301.13	0.00	-26.80	35.39
4	1	-1016.59	-301.53	0.00	-26.80	35.39
	2	-191.92	-226.26	0.00	-5.06	6.68
	3	397.54	-150.99	0.00	10.48	-13.84
	4	659.81	-100.83	0.00	17.39	-22.97
	5	817.58	-50.66	0.00	21.55	-28.47
	6	870.84	-0.49	0.00	22.96	-30.32
	7	819.61	49.68	0.00	21.61	-28.54
	8	663.87	99.85	0.00	17.50	-23.11
	9	403.63	150.02	0.00	10.64	-14.05
	10	-182.78	225.29	0.00	-4.82	6.36
	11	-1005.01	300.60	0.00	-26.49	34.99
5	1	-1005.01	-299.35	0.00	-26.49	34.99
	2	-187.14	-224.08	0.00	-4.93	6.52

Esfuerzos acumulados por peso propio

Estado 7

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	395.51	-148.82	0.00	10.43	-13.77
	4	653.25	-98.65	0.00	17.22	-22.74
	5	806.48	-48.48	0.00	21.26	-28.08
	6	855.21	1.69	0.00	22.55	-29.78
	7	799.43	51.86	0.00	21.08	-27.83
	8	639.16	102.03	0.00	16.85	-22.25
	9	374.38	152.20	0.00	9.87	-13.03
	10	-218.84	227.46	0.00	-5.77	7.62
	11	-1047.87	302.78	0.00	-27.62	36.48
6	1	-1047.87	-307.46	0.00	-27.62	36.48
	2	-204.65	-232.20	0.00	-5.40	7.13
	3	403.36	-156.93	0.00	10.63	-14.04
	4	678.00	-106.76	0.00	17.87	-23.61
	5	848.13	-56.59	0.00	22.36	-29.53
	6	913.76	-6.42	0.00	24.09	-31.81
	7	874.90	43.75	0.00	23.06	-30.46
	8	731.52	93.91	0.00	19.28	-25.47
	9	483.65	144.08	0.00	12.75	-16.84
	10	-84.21	219.35	0.00	-2.22	2.93
	11	-887.86	294.66	0.00	-23.41	30.91
7	1	-887.86	-285.24	0.00	-23.41	30.91
	2	-114.08	-209.98	0.00	-3.01	3.97
	3	424.50	-134.71	0.00	11.19	-14.78
	4	620.48	-93.31	0.00	16.36	-21.60
	5	745.29	-51.91	0.00	19.65	-25.95
	6	798.94	-10.51	0.00	21.06	-27.82
	7	781.41	30.90	0.00	20.60	-27.21
	8	692.72	72.30	0.00	18.26	-24.12
	9	532.85	113.70	0.00	14.05	-18.55
	10	301.81	155.10	0.00	7.96	-10.51
	11	0.00	196.46	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-189.16	0.00	0.00	0.00
	2	330.15	-140.99	0.00	8.70	-11.49
	3	563.96	-92.82	0.00	14.87	-19.64
	4	701.43	-44.65	0.00	18.49	-24.42
	5	742.56	3.52	0.00	19.58	-25.85
	6	687.36	51.69	0.00	18.12	-23.93
	7	535.81	99.86	0.00	14.13	-18.65
	8	287.92	148.03	0.00	7.59	-10.02
	9	-56.31	196.20	0.00	-1.48	1.96
	10	-496.88	244.37	0.00	-13.10	17.30
	11	-1033.79	292.54	0.00	-27.25	35.99
2	1	-1033.79	-301.82	0.00	-27.25	35.99
	2	-208.20	-226.56	0.00	-5.49	7.25
	3	382.19	-151.29	0.00	10.08	-13.31
	4	645.07	-101.12	0.00	17.01	-22.46
	5	803.46	-50.95	0.00	21.18	-27.97
	6	857.34	-0.78	0.00	22.60	-29.85
	7	806.72	49.39	0.00	21.27	-28.09
	8	651.59	99.56	0.00	17.18	-22.69
	9	391.97	149.72	0.00	10.33	-13.65
	10	-193.52	224.99	0.00	-5.10	6.74
	11	-1014.82	300.30	0.00	-26.75	35.33
3	1	-1014.81	-300.99	0.00	-26.75	35.33
	2	-191.81	-225.73	0.00	-5.06	6.68
	3	395.98	-150.46	0.00	10.44	-13.79
	4	657.13	-100.29	0.00	17.32	-22.88
	5	813.79	-50.12	0.00	21.45	-28.33
	6	865.94	0.05	0.00	22.83	-30.15
	7	813.59	50.22	0.00	21.45	-28.33
	8	656.74	100.38	0.00	17.31	-22.87
	9	395.39	150.55	0.00	10.42	-13.77
	10	-192.70	225.82	0.00	-5.08	6.71
	11	-1016.59	301.13	0.00	-26.80	35.39
4	1	-1016.59	-301.53	0.00	-26.80	35.39
	2	-191.92	-226.26	0.00	-5.06	6.68
	3	397.54	-150.99	0.00	10.48	-13.84
	4	659.81	-100.83	0.00	17.39	-22.97
	5	817.58	-50.66	0.00	21.55	-28.47
	6	870.84	-0.49	0.00	22.96	-30.32
	7	819.61	49.68	0.00	21.61	-28.54
	8	663.87	99.85	0.00	17.50	-23.11
	9	403.63	150.02	0.00	10.64	-14.05
	10	-182.78	225.29	0.00	-4.82	6.36
	11	-1005.01	300.60	0.00	-26.49	34.99
5	1	-1005.01	-299.35	0.00	-26.49	34.99
	2	-187.14	-224.08	0.00	-4.93	6.52

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	395.51	-148.82	0.00	10.43	-13.77
	4	653.25	-98.65	0.00	17.22	-22.74
	5	806.48	-48.48	0.00	21.26	-28.08
	6	855.21	1.69	0.00	22.55	-29.78
	7	799.43	51.86	0.00	21.08	-27.83
	8	639.16	102.03	0.00	16.85	-22.25
	9	374.38	152.20	0.00	9.87	-13.03
	10	-218.84	227.46	0.00	-5.77	7.62
	11	-1047.87	302.78	0.00	-27.62	36.48
6	1	-1047.87	-307.46	0.00	-27.62	36.48
	2	-204.65	-232.20	0.00	-5.40	7.13
	3	403.36	-156.93	0.00	10.63	-14.04
	4	678.00	-106.76	0.00	17.87	-23.61
	5	848.13	-56.59	0.00	22.36	-29.53
	6	913.76	-6.42	0.00	24.09	-31.81
	7	874.90	43.75	0.00	23.06	-30.46
	8	731.52	93.91	0.00	19.28	-25.47
	9	483.65	144.08	0.00	12.75	-16.84
	10	-84.21	219.35	0.00	-2.22	2.93
	11	-887.86	294.66	0.00	-23.41	30.91
7	1	-887.86	-285.24	0.00	-23.41	30.91
	2	-114.08	-209.98	0.00	-3.01	3.97
	3	424.50	-134.71	0.00	11.19	-14.78
	4	620.48	-93.31	0.00	16.36	-21.60
	5	745.29	-51.91	0.00	19.65	-25.95
	6	798.94	-10.51	0.00	21.06	-27.82
	7	781.41	30.90	0.00	20.60	-27.21
	8	692.72	72.30	0.00	18.26	-24.12
	9	532.85	113.70	0.00	14.05	-18.55
	10	301.81	155.10	0.00	7.96	-10.51
	11	0.00	196.46	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-180.14	0.00	0.00	0.00
	2	312.11	-131.97	0.00	8.23	-10.87
	3	527.87	-83.80	0.00	13.92	-18.38
	4	647.30	-35.63	0.00	17.06	-22.54
	5	670.39	12.54	0.00	17.67	-23.34
	6	597.14	60.71	0.00	15.74	-20.79
	7	427.54	108.88	0.00	11.27	-14.89
	8	161.61	157.05	0.00	4.26	-5.63
	9	-200.66	205.22	0.00	-5.29	6.99
	10	-659.28	253.39	0.00	-17.38	22.95
	11	-1214.23	301.56	0.00	-32.01	42.28
2	1	-1214.23	-300.01	0.00	-32.01	42.28
	2	-394.30	-224.74	0.00	-10.39	13.73
	3	190.41	-149.48	0.00	5.02	-6.63
	4	449.53	-99.31	0.00	11.85	-15.65
	5	604.13	-49.14	0.00	15.93	-21.03
	6	654.24	1.03	0.00	17.25	-22.78
	7	599.84	51.20	0.00	15.81	-20.88
	8	440.95	101.37	0.00	11.62	-15.35
	9	177.55	151.54	0.00	4.68	-6.18
	10	-413.61	226.80	0.00	-10.90	14.40
	11	-1240.57	302.12	0.00	-32.70	43.19
3	1	-1240.57	-301.34	0.00	-32.70	43.19
	2	-416.50	-226.07	0.00	-10.98	14.50
	3	172.37	-150.80	0.00	4.54	-6.00
	4	434.24	-100.63	0.00	11.45	-15.12
	5	591.61	-50.47	0.00	15.60	-20.60
	6	644.48	-0.30	0.00	16.99	-22.44
	7	592.85	49.87	0.00	15.63	-20.64
	8	436.72	100.04	0.00	11.51	-15.20
	9	176.08	150.21	0.00	4.64	-6.13
	10	-410.93	225.48	0.00	-10.83	14.31
	11	-1233.74	300.79	0.00	-32.52	42.95
4	1	-1233.74	-301.10	0.00	-32.52	42.95
	2	-410.40	-225.84	0.00	-10.82	14.29
	3	177.73	-150.57	0.00	4.69	-6.19
	4	439.11	-100.40	0.00	11.58	-15.29
	5	595.99	-50.23	0.00	15.71	-20.75
	6	648.37	-0.06	0.00	17.09	-22.57
	7	596.25	50.11	0.00	15.72	-20.76
	8	439.63	100.28	0.00	11.59	-15.31
	9	178.50	150.44	0.00	4.71	-6.21
	10	-409.24	225.71	0.00	-10.79	14.25
	11	-1232.79	301.02	0.00	-32.50	42.92
5	1	-1232.79	-300.64	0.00	-32.50	42.92
	2	-410.88	-225.38	0.00	-10.83	14.31

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	175.82	-150.11	0.00	4.63	-6.12
	4	436.25	-99.94	0.00	11.50	-15.19
	5	592.18	-49.77	0.00	15.61	-20.62
	6	643.60	0.40	0.00	16.97	-22.41
	7	590.53	50.56	0.00	15.57	-20.56
	8	432.95	100.73	0.00	11.41	-15.07
	9	170.87	150.90	0.00	4.50	-5.95
	10	-418.30	226.17	0.00	-11.03	14.56
	11	-1243.28	301.48	0.00	-32.78	43.29
6	1	-1243.28	-302.70	0.00	-32.78	43.29
	2	-414.94	-227.44	0.00	-10.94	14.45
	3	178.20	-152.17	0.00	4.70	-6.20
	4	442.93	-102.00	0.00	11.68	-15.42
	5	603.15	-51.83	0.00	15.90	-21.00
	6	658.87	-1.67	0.00	17.37	-22.94
	7	610.09	48.50	0.00	16.08	-21.24
	8	456.80	98.67	0.00	12.04	-15.90
	9	199.02	148.84	0.00	5.25	-6.93
	10	-383.71	224.11	0.00	-10.12	13.36
	11	-1202.25	299.42	0.00	-31.69	41.86
7	1	-1202.25	-300.96	0.00	-31.69	41.86
	2	-379.34	-225.70	0.00	-10.00	13.21
	3	208.36	-150.43	0.00	5.49	-7.25
	4	431.36	-109.03	0.00	11.37	-15.02
	5	583.20	-67.63	0.00	15.37	-20.30
	6	663.86	-26.23	0.00	17.50	-23.11
	7	673.36	15.18	0.00	17.75	-23.44
	8	611.68	56.58	0.00	16.13	-21.30
	9	478.84	97.98	0.00	12.62	-16.67
	10	274.82	139.38	0.00	7.25	-9.57
	11	0.00	180.74	0.00	0.00	0.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-79.57	0.00	0.00	0.00
	2	137.76	-58.19	0.00	3.63	-4.80
	3	232.78	-36.82	0.00	6.14	-8.10
	4	285.05	-15.45	0.00	7.51	-9.92
	5	294.57	5.92	0.00	7.77	-10.26
	6	261.36	27.29	0.00	6.89	-9.10
	7	185.40	48.67	0.00	4.89	-6.45
	8	66.69	70.04	0.00	1.76	-2.32
	9	-94.76	91.41	0.00	-2.50	3.30
	10	-298.95	112.78	0.00	-7.88	10.41
	11	-545.89	134.15	0.00	-14.39	19.01
2	1	-545.89	-133.04	0.00	-14.39	19.01
	2	-182.33	-99.64	0.00	-4.81	6.35
	3	76.87	-66.25	0.00	2.03	-2.68
	4	191.69	-43.99	0.00	5.05	-6.67
	5	260.13	-21.73	0.00	6.86	-9.06
	6	282.21	0.53	0.00	7.44	-9.83
	7	257.93	22.79	0.00	6.80	-8.98
	8	187.28	45.05	0.00	4.94	-6.52
	9	70.27	67.31	0.00	1.85	-2.45
	10	-192.24	100.70	0.00	-5.07	6.69
	11	-559.37	134.11	0.00	-14.75	19.48
3	1	-559.37	-133.71	0.00	-14.75	19.48
	2	-193.71	-100.32	0.00	-5.11	6.74
	3	67.60	-66.92	0.00	1.78	-2.35
	4	183.82	-44.66	0.00	4.85	-6.40
	5	253.67	-22.40	0.00	6.69	-8.83
	6	277.16	-0.15	0.00	7.31	-9.65
	7	254.28	22.11	0.00	6.70	-8.85
	8	185.03	44.37	0.00	4.88	-6.44
	9	69.42	66.63	0.00	1.83	-2.42
	10	-190.98	100.02	0.00	-5.03	6.65
	11	-556.00	133.44	0.00	-14.66	19.36
4	1	-556.00	-133.57	0.00	-14.66	19.36
	2	-190.76	-100.18	0.00	-5.03	6.64
	3	70.13	-66.79	0.00	1.85	-2.44
	4	186.07	-44.53	0.00	4.91	-6.48
	5	255.64	-22.27	0.00	6.74	-8.90
	6	278.84	-0.01	0.00	7.35	-9.71
	7	255.68	22.25	0.00	6.74	-8.90
	8	186.16	44.51	0.00	4.91	-6.48
	9	70.26	66.77	0.00	1.85	-2.45
	10	-190.56	100.16	0.00	-5.02	6.63
	11	-556.00	133.57	0.00	-14.66	19.36
5	1	-556.00	-133.44	0.00	-14.66	19.36
	2	-191.18	-100.05	0.00	-5.04	6.66

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	69.29	-66.65	0.00	1.83	-2.41
	4	184.94	-44.39	0.00	4.88	-6.44
	5	254.23	-22.13	0.00	6.70	-8.85
	6	277.16	0.12	0.00	7.31	-9.65
	7	253.72	22.38	0.00	6.69	-8.83
	8	183.91	44.64	0.00	4.85	-6.40
	9	67.74	66.90	0.00	1.79	-2.36
	10	-193.51	100.29	0.00	-5.10	6.74
	11	-559.37	133.71	0.00	-14.75	19.48
6	1	-559.37	-134.12	0.00	-14.75	19.48
	2	-192.44	-100.72	0.00	-5.07	6.70
	3	70.13	-67.33	0.00	1.85	-2.44
	4	187.19	-45.07	0.00	4.93	-6.52
	5	257.89	-22.81	0.00	6.80	-8.98
	6	282.21	-0.55	0.00	7.44	-9.83
	7	260.18	21.71	0.00	6.86	-9.06
	8	191.78	43.97	0.00	5.06	-6.68
	9	77.01	66.23	0.00	2.03	-2.68
	10	-182.13	99.62	0.00	-4.80	6.34
	11	-545.88	133.04	0.00	-14.39	19.01
7	1	-545.88	-134.15	0.00	-14.39	19.01
	2	-178.83	-100.76	0.00	-4.71	6.23
	3	83.86	-67.37	0.00	2.21	-2.92
	4	183.88	-49.00	0.00	4.85	-6.40
	5	252.32	-30.63	0.00	6.65	-8.78
	6	289.18	-12.26	0.00	7.62	-10.07
	7	294.46	6.11	0.00	7.76	-10.25
	8	268.17	24.48	0.00	7.07	-9.34
	9	210.31	42.85	0.00	5.54	-7.32
	10	120.86	61.22	0.00	3.19	-4.21
	11	0.00	79.57	0.00	0.00	0.00

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-17.84	0.00	0.00	0.00
	2	35.69	-17.84	0.00	0.94	-1.24
	3	71.37	-17.84	0.00	1.88	-2.48
	4	107.06	-17.84	0.00	2.82	-3.73
	5	142.74	-17.84	0.00	3.76	-4.97
	6	178.43	-17.84	0.00	4.70	-6.21
	7	214.11	-17.84	0.00	5.64	-7.45
	8	249.80	-17.84	0.00	6.59	-8.70
	9	285.48	-17.84	0.00	7.53	-9.94
	10	321.17	-17.84	0.00	8.47	-11.18
	11	356.85	-17.84	0.00	9.41	-12.42
2	1	356.85	3.47	0.00	9.41	-12.42
	2	346.01	3.47	0.00	9.12	-12.05
	3	335.17	3.47	0.00	8.84	-11.67
	4	327.94	3.47	0.00	8.65	-11.42
	5	320.71	3.47	0.00	8.45	-11.17
	6	313.49	3.47	0.00	8.26	-10.91
	7	306.26	3.47	0.00	8.07	-10.66
	8	299.03	3.47	0.00	7.88	-10.41
	9	291.80	3.47	0.00	7.69	-10.16
	10	280.96	3.47	0.00	7.41	-9.78
	11	270.11	3.47	0.00	7.12	-9.40
3	1	270.11	-0.87	0.00	7.12	-9.40
	2	272.82	-0.87	0.00	7.19	-9.50
	3	275.53	-0.87	0.00	7.26	-9.59
	4	277.34	-0.87	0.00	7.31	-9.66
	5	279.14	-0.87	0.00	7.36	-9.72
	6	280.95	-0.87	0.00	7.41	-9.78
	7	282.76	-0.87	0.00	7.45	-9.84
	8	284.56	-0.87	0.00	7.50	-9.91
	9	286.37	-0.87	0.00	7.55	-9.97
	10	289.08	-0.87	0.00	7.62	-10.06
	11	291.79	-0.87	0.00	7.69	-10.16
4	1	291.79	0.00	0.00	7.69	-10.16
	2	291.79	0.00	0.00	7.69	-10.16
	3	291.80	0.00	0.00	7.69	-10.16
	4	291.80	0.00	0.00	7.69	-10.16
	5	291.80	0.00	0.00	7.69	-10.16
	6	291.80	0.00	0.00	7.69	-10.16
	7	291.80	0.00	0.00	7.69	-10.16
	8	291.80	0.00	0.00	7.69	-10.16
	9	291.81	0.00	0.00	7.69	-10.16
	10	291.81	0.00	0.00	7.69	-10.16
	11	291.81	0.00	0.00	7.69	-10.16
5	1	291.81	0.87	0.00	7.69	-10.16
	2	289.09	0.87	0.00	7.62	-10.07

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	286.37	0.87	0.00	7.55	-9.97
	4	284.56	0.87	0.00	7.50	-9.91
	5	282.74	0.87	0.00	7.45	-9.84
	6	280.93	0.87	0.00	7.41	-9.78
	7	279.12	0.87	0.00	7.36	-9.72
	8	277.30	0.87	0.00	7.31	-9.65
	9	275.49	0.87	0.00	7.26	-9.59
	10	272.77	0.87	0.00	7.19	-9.50
	11	270.05	0.87	0.00	7.12	-9.40
6	1	270.05	-3.48	0.00	7.12	-9.40
	2	280.93	-3.48	0.00	7.41	-9.78
	3	291.81	-3.48	0.00	7.69	-10.16
	4	299.06	-3.48	0.00	7.88	-10.41
	5	306.31	-3.48	0.00	8.08	-10.66
	6	313.57	-3.48	0.00	8.27	-10.92
	7	320.82	-3.48	0.00	8.46	-11.17
	8	328.07	-3.48	0.00	8.65	-11.42
	9	335.32	-3.48	0.00	8.84	-11.67
	10	346.20	-3.48	0.00	9.13	-12.05
	11	357.09	-3.48	0.00	9.41	-12.43
7	1	357.09	17.85	0.00	9.41	-12.43
	2	301.29	17.85	0.00	7.94	-10.49
	3	245.50	17.85	0.00	6.47	-8.55
	4	214.81	17.85	0.00	5.66	-7.48
	5	184.12	17.85	0.00	4.85	-6.41
	6	153.42	17.85	0.00	4.04	-5.34
	7	122.73	17.85	0.00	3.24	-4.27
	8	92.04	17.85	0.00	2.43	-3.20
	9	61.35	17.85	0.00	1.62	-2.14
	10	30.66	17.85	0.00	0.81	-1.07
	11	0.00	17.85	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	56.95	0.00	0.00	0.00	0.00
		Q(-)	-288.88	0.00	0.00	0.00	0.00
	2	Q(+)	56.95	-113.89	0.00	3.00	-3.97
		Q(-)	-225.13	514.01	0.00	-13.55	17.90
	3	Q(+)	56.95	-227.79	0.00	6.01	-7.93
		Q(-)	-161.38	900.52	0.00	-23.74	31.35
	4	Q(+)	56.95	-341.68	0.00	9.01	-11.90
		Q(-)	-97.63	1159.53	0.00	-30.57	40.37
	5	Q(+)	56.95	-455.57	0.00	12.01	-15.86
		Q(-)	-33.88	1291.03	0.00	-34.03	44.95
	6	Q(+)	86.74	466.45	0.00	-12.30	16.24
		Q(-)	-15.24	152.43	0.00	-4.02	5.31
	7	Q(+)	150.04	494.60	0.00	-13.04	17.22
		Q(-)	-15.24	182.91	0.00	-4.82	6.37
	8	Q(+)	213.79	130.77	0.00	-3.45	4.55
		Q(-)	-15.24	213.40	0.00	-5.63	7.43
	9	Q(+)	277.54	-360.56	0.00	9.51	-12.55
		Q(-)	-15.24	243.89	0.00	-6.43	8.49
	10	Q(+)	341.30	-979.40	0.00	25.82	-34.10
		Q(-)	-15.24	274.37	0.00	-7.23	9.55
	11	Q(+)	405.05	-1725.74	0.00	45.50	-60.08
		Q(-)	-15.24	304.86	0.00	-8.04	10.61
2	1	Q(+)	56.09	304.86	0.00	-8.04	10.61
		Q(-)	-433.05	-1734.71	0.00	45.73	-60.40
	2	Q(+)	56.09	129.56	0.00	-3.42	4.51
		Q(-)	-333.44	-537.08	0.00	14.16	-18.70
	3	Q(+)	56.09	-45.73	0.00	1.21	-1.59
		Q(-)	-233.82	349.26	0.00	-9.21	12.16
	4	Q(+)	56.09	-162.57	0.00	4.29	-5.66
		Q(-)	-167.43	767.16	0.00	-20.22	26.71
	5	Q(+)	56.09	-279.42	0.00	7.37	-9.73
		Q(-)	-104.40	808.78	0.00	-21.32	28.16
	6	Q(+)	56.09	-396.26	0.00	10.45	-13.80
		Q(-)	-48.84	968.38	0.00	-25.53	33.72
	7	Q(+)	111.54	925.23	0.00	-24.39	32.21
		Q(-)	-38.81	-199.31	0.00	5.25	-6.94
	8	Q(+)	177.94	623.73	0.00	-16.44	21.72
		Q(-)	-38.81	-118.46	0.00	3.12	-4.12
	9	Q(+)	244.34	183.93	0.00	-4.85	6.40
		Q(-)	-38.81	-37.61	0.00	0.99	-1.31
	10	Q(+)	343.95	-735.28	0.00	19.38	-25.60
		Q(-)	-38.81	83.69	0.00	-2.21	2.91
	11	Q(+)	443.63	-1966.65	0.00	51.85	-68.47
		Q(-)	-38.81	205.07	0.00	-5.41	7.14
3	1	Q(+)	55.37	293.12	0.00	-7.73	10.21
		Q(-)	-442.80	-1926.99	0.00	50.80	-67.09
	2	Q(+)	55.37	120.10	0.00	-3.17	4.18
		Q(-)	-343.19	-698.88	0.00	18.42	-24.33

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	55.37	-52.93	0.00	1.40	-1.84
		Q(-)	-243.58	217.93	0.00	-5.75	7.59
	4	Q(+)	55.37	-168.26	0.00	4.44	-5.86
		Q(-)	-177.18	656.14	0.00	-17.30	22.84
	5	Q(+)	55.37	-283.59	0.00	7.48	-9.87
		Q(-)	-116.46	693.50	0.00	-18.28	24.15
	6	Q(+)	57.66	849.15	0.00	-22.39	29.56
		Q(-)	-60.90	878.22	0.00	-23.15	30.58
	7	Q(+)	113.23	671.17	0.00	-17.69	23.37
		Q(-)	-52.81	-271.20	0.00	7.15	-9.44
	8	Q(+)	179.27	630.34	0.00	-16.62	21.95
		Q(-)	-52.81	-161.18	0.00	4.25	-5.61
	9	Q(+)	245.66	187.77	0.00	-4.95	6.54
		Q(-)	-52.81	-51.17	0.00	1.35	-1.78
	10	Q(+)	345.28	-735.57	0.00	19.39	-25.61
		Q(-)	-52.81	113.88	0.00	-3.00	3.96
	11	Q(+)	444.95	-1971.09	0.00	51.96	-68.63
		Q(-)	-52.81	279.03	0.00	-7.36	9.71
4	1	Q(+)	54.52	288.09	0.00	-7.59	10.03
		Q(-)	-444.27	-1956.07	0.00	51.57	-68.10
	2	Q(+)	54.52	117.71	0.00	-3.10	4.10
		Q(-)	-344.66	-723.38	0.00	19.07	-25.19
	3	Q(+)	54.52	-52.67	0.00	1.39	-1.83
		Q(-)	-245.04	198.03	0.00	-5.22	6.89
	4	Q(+)	54.52	-166.24	0.00	4.38	-5.79
		Q(-)	-178.65	639.30	0.00	-16.85	22.26
	5	Q(+)	54.52	-279.81	0.00	7.38	-9.74
		Q(-)	-116.20	686.35	0.00	-18.09	23.90
	6	Q(+)	60.58	870.65	0.00	-22.95	30.31
		Q(-)	-60.64	870.53	0.00	-22.95	30.31
	7	Q(+)	116.15	686.59	0.00	-18.10	23.90
		Q(-)	-54.52	-279.92	0.00	7.38	-9.75
	8	Q(+)	178.58	639.66	0.00	-16.86	22.27
		Q(-)	-54.52	-166.35	0.00	4.39	-5.79
	9	Q(+)	244.98	198.52	0.00	-5.23	6.91
		Q(-)	-54.52	-52.78	0.00	1.39	-1.84
	10	Q(+)	344.59	-722.69	0.00	19.05	-25.16
		Q(-)	-54.52	117.60	0.00	-3.10	4.09
	11	Q(+)	444.27	-1956.07	0.00	51.57	-68.10
		Q(-)	-54.52	288.09	0.00	-7.59	10.03
5	1	Q(+)	52.81	279.03	0.00	-7.36	9.71
		Q(-)	-444.95	-1971.09	0.00	51.96	-68.63
	2	Q(+)	52.81	113.98	0.00	-3.00	3.97
		Q(-)	-345.34	-736.26	0.00	19.41	-25.63
	3	Q(+)	52.81	-51.06	0.00	1.35	-1.78
		Q(-)	-245.73	187.28	0.00	-4.94	6.52
	4	Q(+)	52.81	-161.08	0.00	4.25	-5.61
		Q(-)	-179.33	629.98	0.00	-16.61	21.93
	5	Q(+)	52.81	-271.09	0.00	7.15	-9.44
		Q(-)	-113.28	670.94	0.00	-17.69	23.36

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	60.84	878.34	0.00	-23.16	30.58
		Q(-)	-57.72	849.04	0.00	-22.38	29.56
	7	Q(+)	116.41	693.73	0.00	-18.29	24.15
		Q(-)	-55.37	-283.70	0.00	7.48	-9.88
	8	Q(+)	177.12	656.50	0.00	-17.31	22.86
		Q(-)	-55.37	-168.37	0.00	4.44	-5.86
	9	Q(+)	243.51	218.42	0.00	-5.76	7.60
		Q(-)	-55.37	-53.04	0.00	1.40	-1.85
	10	Q(+)	343.13	-698.20	0.00	18.41	-24.31
		Q(-)	-55.37	119.99	0.00	-3.16	4.18
	11	Q(+)	442.80	-1926.99	0.00	50.80	-67.09
		Q(-)	-55.37	293.12	0.00	-7.73	10.21
6	1	Q(+)	38.81	205.07	0.00	-5.41	7.14
		Q(-)	-443.63	-1966.65	0.00	51.85	-68.47
	2	Q(+)	38.81	83.77	0.00	-2.21	2.92
		Q(-)	-344.02	-735.96	0.00	19.40	-25.62
	3	Q(+)	38.81	-37.53	0.00	0.99	-1.31
		Q(-)	-244.40	183.44	0.00	-4.84	6.39
	4	Q(+)	38.81	-118.38	0.00	3.12	-4.12
		Q(-)	-178.01	623.37	0.00	-16.43	21.70
	5	Q(+)	38.81	-199.24	0.00	5.25	-6.94
		Q(-)	-111.61	925.00	0.00	-24.39	32.21
	6	Q(+)	48.78	968.48	0.00	-25.53	33.72
		Q(-)	-56.09	-396.37	0.00	10.45	-13.80
	7	Q(+)	104.35	808.99	0.00	-21.33	28.17
		Q(-)	-56.09	-279.53	0.00	7.37	-9.73
	8	Q(+)	167.36	767.50	0.00	-20.23	26.72
		Q(-)	-56.09	-162.69	0.00	4.29	-5.66
	9	Q(+)	233.76	349.73	0.00	-9.22	12.18
		Q(-)	-56.09	-45.84	0.00	1.21	-1.60
	10	Q(+)	333.37	-536.41	0.00	14.14	-18.68
		Q(-)	-56.09	129.45	0.00	-3.41	4.51
	11	Q(+)	433.05	-1734.71	0.00	45.73	-60.40
		Q(-)	-56.09	304.86	0.00	-8.04	10.61
7	1	Q(+)	15.24	304.86	0.00	-8.04	10.61
		Q(-)	-405.05	-1725.74	0.00	45.50	-60.08
	2	Q(+)	15.24	257.22	0.00	-6.78	8.96
		Q(-)	-305.43	-615.61	0.00	16.23	-21.43
	3	Q(+)	15.24	209.59	0.00	-5.53	7.30
		Q(-)	-205.82	183.23	0.00	-4.83	6.38
	4	Q(+)	15.24	183.39	0.00	-4.83	6.38
		Q(-)	-151.03	489.94	0.00	-12.92	17.06
	5	Q(+)	15.24	157.18	0.00	-4.14	5.47
		Q(-)	-96.23	702.46	0.00	-18.52	24.46
	6	Q(+)	15.71	1119.84	0.00	-29.52	38.99
		Q(-)	-56.95	-489.34	0.00	12.90	-17.04
	7	Q(+)	69.77	1232.68	0.00	-32.50	42.92
		Q(-)	-56.95	-391.45	0.00	10.32	-13.63
	8	Q(+)	124.56	1065.66	0.00	-28.09	37.10
		Q(-)	-56.95	-293.56	0.00	7.74	-10.22

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
9		Q(+)	179.36	804.44	0.00	-21.21	28.01
		Q(-)	-56.95	-195.67	0.00	5.16	-6.81
10		Q(+)	234.15	449.02	0.00	-11.84	15.63
		Q(-)	-56.95	-97.78	0.00	2.58	-3.40
11		Q(+)	288.88	0.00	0.00	0.00	0.00
		Q(-)	-56.95	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-288.88	0.00	0.00	0.00
		M(-)	0.00	56.95	0.00	0.00	0.00
	2	M(+)	514.01	-225.13	0.00	13.55	-17.90
		M(-)	-113.89	56.95	0.00	-3.00	3.97
	3	M(+)	900.52	-161.38	0.00	23.74	-31.35
		M(-)	-227.79	56.95	0.00	-6.01	7.93
	4	M(+)	1159.53	-97.63	0.00	30.57	-40.37
		M(-)	-341.68	56.95	0.00	-9.01	11.90
	5	M(+)	1291.03	-33.88	0.00	34.03	-44.95
		M(-)	-455.57	56.95	0.00	-12.01	15.86
	6	M(+)	1295.03	29.88	0.00	34.14	-45.09
		M(-)	-569.47	56.95	0.00	-15.01	19.83
	7	M(+)	1171.52	93.63	0.00	30.88	-40.79
		M(-)	-683.36	56.95	0.00	-18.02	23.79
	8	M(+)	920.51	157.38	0.00	24.27	-32.05
		M(-)	-797.25	56.95	0.00	-21.02	27.76
	9	M(+)	542.00	221.13	0.00	14.29	-18.87
		M(-)	-911.14	56.95	0.00	-24.02	31.72
	10	M(+)	274.37	-15.24	0.00	7.23	-9.55
		M(-)	-1081.07	300.14	0.00	-28.50	37.64
	11	M(+)	304.86	-15.24	0.00	8.04	-10.61
		M(-)	-1734.71	353.49	0.00	-45.73	60.40
2	1	M(+)	304.86	56.09	0.00	8.04	-10.61
		M(-)	-1734.71	-433.05	0.00	-45.73	60.40
	2	M(+)	129.56	56.09	0.00	3.42	-4.51
		M(-)	-661.44	-298.89	0.00	-17.44	23.03
	3	M(+)	793.42	-209.56	0.00	20.92	-27.62
		M(-)	-522.72	-38.81	0.00	-13.78	18.20
	4	M(+)	1160.78	-143.16	0.00	30.60	-40.41
		M(-)	-486.20	-2.53	0.00	-12.82	16.93
	5	M(+)	1389.85	-76.77	0.00	36.64	-48.39
		M(-)	-486.57	2.89	0.00	-12.83	16.94
	6	M(+)	1480.60	-10.37	0.00	39.03	-51.55
		M(-)	-499.54	21.29	0.00	-13.17	17.39
	7	M(+)	1433.05	56.03	0.00	37.78	-49.89
		M(-)	-549.53	26.71	0.00	-14.49	19.13
	8	M(+)	1247.19	122.43	0.00	32.88	-43.42
		M(-)	-629.95	56.09	0.00	-16.61	21.93
	9	M(+)	923.03	188.82	0.00	24.33	-32.14
		M(-)	-746.79	56.09	0.00	-19.69	26.00
	10	M(+)	254.14	201.23	0.00	6.70	-8.85
		M(-)	-922.09	56.09	0.00	-24.31	32.10
	11	M(+)	293.12	-14.98	0.00	7.73	-10.21
		M(-)	-1966.65	443.63	0.00	-51.85	68.47
3	1	M(+)	293.12	55.37	0.00	7.73	-10.21
		M(-)	-1966.65	-394.32	0.00	-51.85	68.47
	2	M(+)	217.65	-192.40	0.00	5.74	-7.58
		M(-)	-876.30	-52.81	0.00	-23.10	30.51

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	872.36	-194.98	0.00	23.00	-30.37
		M(-)	-711.26	-52.81	0.00	-18.75	24.76
	4	M(+)	1209.35	-128.58	0.00	31.88	-42.11
		M(-)	-648.46	-17.01	0.00	-17.10	22.58
	5	M(+)	1408.03	-62.18	0.00	37.12	-49.02
		M(-)	-618.67	-11.59	0.00	-16.31	21.54
	6	M(+)	1493.80	-8.11	0.00	39.38	-52.01
		M(-)	-600.16	-6.18	0.00	-15.82	20.90
	7	M(+)	1441.55	58.29	0.00	38.00	-50.19
		M(-)	-607.18	15.47	0.00	-16.01	21.14
	8	M(+)	1250.99	124.68	0.00	32.98	-43.55
		M(-)	-645.05	20.89	0.00	-17.01	22.46
	9	M(+)	922.12	191.08	0.00	24.31	-32.10
		M(-)	-744.91	55.37	0.00	-19.64	25.94
	10	M(+)	277.04	189.16	0.00	7.30	-9.65
		M(-)	-917.94	55.37	0.00	-24.20	31.96
	11	M(+)	288.09	-14.62	0.00	7.59	-10.03
		M(-)	-1971.09	444.95	0.00	-51.96	68.63
4	1	M(+)	288.09	54.52	0.00	7.59	-10.03
		M(-)	-1971.09	-394.06	0.00	-51.96	68.63
	2	M(+)	266.52	-189.48	0.00	7.03	-9.28
		M(-)	-904.58	-54.52	0.00	-23.85	31.49
	3	M(+)	912.88	-191.96	0.00	24.07	-31.78
		M(-)	-734.20	-54.52	0.00	-19.36	25.56
	4	M(+)	1243.58	-125.56	0.00	32.78	-43.30
		M(-)	-652.24	-18.36	0.00	-17.19	22.71
	5	M(+)	1435.97	-59.16	0.00	37.86	-50.00
		M(-)	-619.64	-12.94	0.00	-16.34	21.57
	6	M(+)	1490.06	7.24	0.00	39.28	-51.88
		M(-)	-598.33	-7.53	0.00	-15.77	20.83
	7	M(+)	1436.09	59.10	0.00	37.86	-50.00
		M(-)	-619.62	12.94	0.00	-16.33	21.57
	8	M(+)	1243.83	125.50	0.00	32.79	-43.31
		M(-)	-652.21	18.35	0.00	-17.19	22.71
	9	M(+)	913.27	191.89	0.00	24.08	-31.80
		M(-)	-734.09	54.52	0.00	-19.35	25.56
	10	M(+)	266.90	189.42	0.00	7.04	-9.29
		M(-)	-904.47	54.52	0.00	-23.84	31.49
	11	M(+)	288.09	-54.52	0.00	7.59	-10.03
		M(-)	-1971.09	394.06	0.00	-51.96	68.63
5	1	M(+)	288.09	14.62	0.00	7.59	-10.03
		M(-)	-1971.09	-444.95	0.00	-51.96	68.63
	2	M(+)	276.67	-189.22	0.00	7.29	-9.63
		M(-)	-918.05	-55.37	0.00	-24.20	31.96
	3	M(+)	921.74	-191.14	0.00	24.30	-32.09
		M(-)	-745.03	-55.37	0.00	-19.64	25.94
	4	M(+)	1250.74	-124.75	0.00	32.97	-43.55
		M(-)	-645.09	-20.89	0.00	-17.01	22.46
	5	M(+)	1441.43	-58.35	0.00	38.00	-50.19
		M(-)	-607.21	-15.48	0.00	-16.01	21.14

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	1493.82	8.05	0.00	39.38	-52.01
		M(-)	-600.15	6.17	0.00	-15.82	20.90
	7	M(+)	1408.15	62.12	0.00	37.12	-49.03
		M(-)	-618.64	11.59	0.00	-16.31	21.54
	8	M(+)	1209.60	128.52	0.00	31.89	-42.11
		M(-)	-648.42	17.00	0.00	-17.09	22.58
	9	M(+)	872.75	194.91	0.00	23.01	-30.39
		M(-)	-711.15	52.81	0.00	-18.75	24.76
	10	M(+)	218.04	192.35	0.00	5.75	-7.59
		M(-)	-876.20	52.81	0.00	-23.10	30.51
	11	M(+)	293.12	-55.37	0.00	7.73	-10.21
		M(-)	-1966.66	394.32	0.00	-51.85	68.47
6	1	M(+)	293.12	14.98	0.00	7.73	-10.21
		M(-)	-1966.65	-443.63	0.00	-51.85	68.47
	2	M(+)	253.73	-201.28	0.00	6.69	-8.83
		M(-)	-922.20	-56.09	0.00	-24.31	32.11
	3	M(+)	922.66	-188.88	0.00	24.32	-32.12
		M(-)	-746.91	-56.09	0.00	-19.69	26.00
	4	M(+)	1246.95	-122.49	0.00	32.87	-43.41
		M(-)	-630.06	-56.09	0.00	-16.61	21.94
	5	M(+)	1432.94	-56.09	0.00	37.78	-49.89
		M(-)	-549.58	-26.71	0.00	-14.49	19.13
	6	M(+)	1480.62	10.31	0.00	39.03	-51.55
		M(-)	-499.58	-21.30	0.00	-13.17	17.39
	7	M(+)	1390.00	76.71	0.00	36.64	-48.39
		M(-)	-486.58	-2.89	0.00	-12.83	16.94
	8	M(+)	1161.07	143.10	0.00	30.61	-40.42
		M(-)	-486.19	2.52	0.00	-12.82	16.93
	9	M(+)	793.84	209.50	0.00	20.93	-27.64
		M(-)	-522.64	38.81	0.00	-13.78	18.20
	10	M(+)	129.45	-56.09	0.00	3.41	-4.51
		M(-)	-660.84	298.84	0.00	-17.42	23.01
	11	M(+)	304.86	-56.09	0.00	8.04	-10.61
		M(-)	-1734.71	433.05	0.00	-45.73	60.40
7	1	M(+)	304.86	15.24	0.00	8.04	-10.61
		M(-)	-1734.71	-353.50	0.00	-45.73	60.40
	2	M(+)	336.30	-249.02	0.00	8.87	-11.71
		M(-)	-960.97	-56.95	0.00	-25.33	33.46
	3	M(+)	958.86	-149.41	0.00	25.28	-33.38
		M(-)	-783.02	-56.95	0.00	-20.64	27.26
	4	M(+)	1168.60	-94.62	0.00	30.81	-40.69
		M(-)	-685.12	-56.95	0.00	-18.06	23.85
	5	M(+)	1284.16	-39.82	0.00	33.85	-44.71
		M(-)	-587.23	-56.95	0.00	-15.48	20.45
	6	M(+)	1305.52	14.97	0.00	34.42	-45.45
		M(-)	-489.34	-56.95	0.00	-12.90	17.04
	7	M(+)	1232.68	69.77	0.00	32.50	-42.92
		M(-)	-391.45	-56.95	0.00	-10.32	13.63
	8	M(+)	1065.66	124.56	0.00	28.09	-37.10
		M(-)	-293.56	-56.95	0.00	-7.74	10.22

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	9	M(+)	804.44	179.36	0.00	21.21	-28.01
		M(-)	-195.67	-56.95	0.00	-5.16	6.81
	10	M(+)	449.02	234.15	0.00	11.84	-15.63
		M(-)	-97.78	-56.95	0.00	-2.58	3.40
	11	M(+)	0.00	288.88	0.00	0.00	0.00
		M(-)	0.00	-56.95	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	40.68	0.00	0.00	0.00	0.00
		Q(-)	-197.36	0.00	0.00	0.00	0.00
	2	Q(+)	40.68	-81.36	0.00	2.14	-2.83
		Q(-)	-162.48	359.85	0.00	-9.49	12.53
	3	Q(+)	40.68	-162.73	0.00	4.29	-5.67
		Q(-)	-127.60	649.93	0.00	-17.13	22.63
	4	Q(+)	40.68	-244.09	0.00	6.43	-8.50
		Q(-)	-92.72	870.26	0.00	-22.94	30.30
	5	Q(+)	40.68	-325.45	0.00	8.58	-11.33
		Q(-)	-24.27	1011.58	0.00	-26.67	35.22
	6	Q(+)	61.62	255.83	0.00	-6.74	8.91
		Q(-)	-10.90	109.00	0.00	-2.87	3.80
	7	Q(+)	114.66	531.45	0.00	-14.01	18.50
		Q(-)	-10.90	130.80	0.00	-3.45	4.55
	8	Q(+)	183.12	209.35	0.00	-5.52	7.29
		Q(-)	-10.90	152.61	0.00	-4.02	5.31
	9	Q(+)	218.00	-191.76	0.00	5.06	-6.68
		Q(-)	-10.90	174.41	0.00	-4.60	6.07
	10	Q(+)	252.88	-662.63	0.00	17.47	-23.07
		Q(-)	-10.90	196.21	0.00	-5.17	6.83
	11	Q(+)	287.76	-1203.26	0.00	31.72	-41.89
		Q(-)	-10.90	218.01	0.00	-5.75	7.59
2	1	Q(+)	40.11	218.01	0.00	-5.75	7.59
		Q(-)	-294.00	-1232.35	0.00	32.49	-42.91
	2	Q(+)	40.11	92.65	0.00	-2.44	3.23
		Q(-)	-239.50	-398.75	0.00	10.51	-13.88
	3	Q(+)	40.11	-32.70	0.00	0.86	-1.14
		Q(-)	-185.00	264.54	0.00	-6.97	9.21
	4	Q(+)	40.11	-116.26	0.00	3.06	-4.05
		Q(-)	-148.68	612.07	0.00	-16.14	21.31
	5	Q(+)	40.11	-199.82	0.00	5.27	-6.96
		Q(-)	-77.31	877.56	0.00	-23.13	30.55
	6	Q(+)	40.11	-283.37	0.00	7.47	-9.87
		Q(-)	-31.84	556.96	0.00	-14.68	19.39
	7	Q(+)	82.44	811.75	0.00	-21.40	28.26
		Q(-)	-30.66	-157.45	0.00	4.15	-5.48
	8	Q(+)	153.77	535.70	0.00	-14.12	18.65
		Q(-)	-30.66	-93.58	0.00	2.47	-3.26
	9	Q(+)	190.10	177.56	0.00	-4.68	6.18
		Q(-)	-30.66	-29.71	0.00	0.78	-1.03
	10	Q(+)	244.60	-501.67	0.00	13.23	-17.47
		Q(-)	-30.66	66.11	0.00	-1.74	2.30
	11	Q(+)	299.14	-1351.80	0.00	35.64	-47.06
		Q(-)	-30.66	162.00	0.00	-4.27	5.64
3	1	Q(+)	39.72	210.28	0.00	-5.54	7.32
		Q(-)	-300.20	-1354.58	0.00	35.71	-47.16
	2	Q(+)	39.72	86.16	0.00	-2.27	3.00
		Q(-)	-245.70	-501.61	0.00	13.22	-17.46

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	39.72	-37.97	0.00	1.00	-1.32
		Q(-)	-191.20	181.05	0.00	-4.77	6.30
	4	Q(+)	39.72	-120.71	0.00	3.18	-4.20
		Q(-)	-154.87	541.49	0.00	-14.28	18.85
	5	Q(+)	39.72	-203.44	0.00	5.36	-7.08
		Q(-)	-83.51	819.89	0.00	-21.61	28.55
	6	Q(+)	39.72	-286.18	0.00	7.54	-9.96
		Q(-)	-39.37	502.58	0.00	-13.25	17.50
	7	Q(+)	83.61	817.78	0.00	-21.56	28.47
		Q(-)	-39.27	-201.65	0.00	5.32	-7.02
	8	Q(+)	154.95	539.29	0.00	-14.22	18.78
		Q(-)	-39.27	-119.85	0.00	3.16	-4.17
	9	Q(+)	191.27	178.71	0.00	-4.71	6.22
		Q(-)	-39.27	-38.05	0.00	1.00	-1.32
	10	Q(+)	245.77	-504.18	0.00	13.29	-17.55
		Q(-)	-39.27	84.67	0.00	-2.23	2.95
	11	Q(+)	300.31	-1357.97	0.00	35.80	-47.28
		Q(-)	-39.27	207.48	0.00	-5.47	7.22
4	1	Q(+)	39.66	209.58	0.00	-5.53	7.30
		Q(-)	-300.38	-1358.16	0.00	35.80	-47.29
	2	Q(+)	39.66	85.63	0.00	-2.26	2.98
		Q(-)	-245.88	-504.63	0.00	13.30	-17.57
	3	Q(+)	39.66	-38.32	0.00	1.01	-1.33
		Q(-)	-191.38	178.58	0.00	-4.71	6.22
	4	Q(+)	39.66	-120.94	0.00	3.19	-4.21
		Q(-)	-155.05	539.38	0.00	-14.22	18.78
	5	Q(+)	39.66	-203.56	0.00	5.37	-7.09
		Q(-)	-83.69	818.16	0.00	-21.57	28.49
	6	Q(+)	39.66	-286.18	0.00	7.54	-9.96
		Q(-)	-39.68	500.29	0.00	-13.19	17.42
	7	Q(+)	83.69	818.33	0.00	-21.57	28.49
		Q(-)	-39.66	-203.64	0.00	5.37	-7.09
	8	Q(+)	155.01	539.70	0.00	-14.23	18.79
		Q(-)	-39.66	-121.02	0.00	3.19	-4.21
	9	Q(+)	191.34	178.96	0.00	-4.72	6.23
		Q(-)	-39.66	-38.40	0.00	1.01	-1.34
	10	Q(+)	245.84	-504.14	0.00	13.29	-17.55
		Q(-)	-39.66	85.55	0.00	-2.26	2.98
	11	Q(+)	300.38	-1358.15	0.00	35.80	-47.29
		Q(-)	-39.66	209.58	0.00	-5.53	7.30
5	1	Q(+)	39.27	207.48	0.00	-5.47	7.22
		Q(-)	-300.31	-1357.97	0.00	35.80	-47.28
	2	Q(+)	39.27	84.75	0.00	-2.23	2.95
		Q(-)	-245.81	-504.67	0.00	13.30	-17.57
	3	Q(+)	39.27	-37.97	0.00	1.00	-1.32
		Q(-)	-191.31	178.32	0.00	-4.70	6.21
	4	Q(+)	39.27	-119.77	0.00	3.16	-4.17
		Q(-)	-154.98	538.98	0.00	-14.21	18.77
	5	Q(+)	39.27	-201.57	0.00	5.31	-7.02
		Q(-)	-83.61	817.60	0.00	-21.55	28.47

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	39.34	502.66	0.00	-13.25	17.50
		Q(-)	-39.72	-286.26	0.00	7.55	-9.97
	7	Q(+)	83.51	820.06	0.00	-21.62	28.55
		Q(-)	-39.72	-203.52	0.00	5.37	-7.09
	8	Q(+)	154.84	541.80	0.00	-14.28	18.86
		Q(-)	-39.72	-120.79	0.00	3.18	-4.21
	9	Q(+)	191.17	181.43	0.00	-4.78	6.32
		Q(-)	-39.72	-38.05	0.00	1.00	-1.32
	10	Q(+)	245.67	-501.12	0.00	13.21	-17.45
		Q(-)	-39.72	86.08	0.00	-2.27	3.00
	11	Q(+)	300.20	-1354.58	0.00	35.71	-47.16
		Q(-)	-39.72	210.28	0.00	-5.54	7.32
6	1	Q(+)	30.66	162.00	0.00	-4.27	5.64
		Q(-)	-299.14	-1351.80	0.00	35.64	-47.06
	2	Q(+)	30.66	66.17	0.00	-1.74	2.30
		Q(-)	-244.63	-502.15	0.00	13.24	-17.48
	3	Q(+)	30.66	-29.65	0.00	0.78	-1.03
		Q(-)	-190.13	177.17	0.00	-4.67	6.17
	4	Q(+)	30.66	-93.52	0.00	2.47	-3.26
		Q(-)	-153.81	535.39	0.00	-14.11	18.64
	5	Q(+)	30.66	-157.39	0.00	4.15	-5.48
		Q(-)	-82.44	811.58	0.00	-21.40	28.26
	6	Q(+)	31.80	557.03	0.00	-14.68	19.39
		Q(-)	-40.11	-283.45	0.00	7.47	-9.87
	7	Q(+)	77.31	877.71	0.00	-23.14	30.56
		Q(-)	-40.11	-199.90	0.00	5.27	-6.96
	8	Q(+)	148.64	612.36	0.00	-16.14	21.32
		Q(-)	-40.11	-116.34	0.00	3.07	-4.05
	9	Q(+)	184.97	264.91	0.00	-6.98	9.22
		Q(-)	-40.11	-32.78	0.00	0.86	-1.14
	10	Q(+)	239.47	-398.27	0.00	10.50	-13.87
		Q(-)	-40.11	92.57	0.00	-2.44	3.22
	11	Q(+)	294.00	-1232.34	0.00	32.49	-42.91
		Q(-)	-40.11	218.01	0.00	-5.75	7.59
7	1	Q(+)	10.90	218.01	0.00	-5.75	7.59
		Q(-)	-287.76	-1203.26	0.00	31.72	-41.89
	2	Q(+)	10.90	183.94	0.00	-4.85	6.40
		Q(-)	-233.26	-389.19	0.00	10.26	-13.55
	3	Q(+)	10.90	149.88	0.00	-3.95	5.22
		Q(-)	-178.76	254.58	0.00	-6.71	8.86
	4	Q(+)	10.90	131.14	0.00	-3.46	4.57
		Q(-)	-114.66	527.90	0.00	-13.92	18.38
	5	Q(+)	10.90	112.40	0.00	-2.96	3.91
		Q(-)	-67.06	235.75	0.00	-6.22	8.21
	6	Q(+)	24.27	1025.97	0.00	-27.05	35.72
		Q(-)	-40.68	-349.57	0.00	9.22	-12.17
	7	Q(+)	78.77	944.68	0.00	-24.90	32.89
		Q(-)	-40.68	-279.64	0.00	7.37	-9.74
	8	Q(+)	107.46	785.68	0.00	-20.71	27.35
		Q(-)	-40.68	-209.71	0.00	5.53	-7.30

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	9	Q(+)	137.44	575.19	0.00	-15.16	20.03
		Q(-)	-40.68	-139.78	0.00	3.68	-4.87
	10	Q(+)	167.42	313.17	0.00	-8.26	10.90
		Q(-)	-40.68	-69.85	0.00	1.84	-2.43
	11	Q(+)	197.36	0.00	0.00	0.00	0.00
		Q(-)	-40.68	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-197.36	0.00	0.00	0.00
		M(-)	0.00	40.68	0.00	0.00	0.00
	2	M(+)	359.85	-162.48	0.00	9.49	-12.53
		M(-)	-81.36	40.68	0.00	-2.14	2.83
	3	M(+)	649.93	-127.60	0.00	17.13	-22.63
		M(-)	-162.73	40.68	0.00	-4.29	5.67
	4	M(+)	870.26	-92.72	0.00	22.94	-30.30
		M(-)	-244.09	40.68	0.00	-6.43	8.50
	5	M(+)	1011.58	-24.27	0.00	26.67	-35.22
		M(-)	-325.45	40.68	0.00	-8.58	11.33
	6	M(+)	1016.52	30.23	0.00	26.80	-35.39
		M(-)	-406.81	40.68	0.00	-10.72	14.16
	7	M(+)	890.66	84.73	0.00	23.48	-31.01
		M(-)	-488.18	40.68	0.00	-12.87	17.00
	8	M(+)	628.42	153.18	0.00	16.57	-21.88
		M(-)	-569.54	40.68	0.00	-15.01	19.83
	9	M(+)	287.18	188.06	0.00	7.57	-10.00
		M(-)	-650.90	40.68	0.00	-17.16	22.66
	10	M(+)	196.21	-10.90	0.00	5.17	-6.83
		M(-)	-795.19	201.14	0.00	-20.96	27.69
	11	M(+)	218.01	-10.90	0.00	5.75	-7.59
		M(-)	-1232.35	236.02	0.00	-32.49	42.91
2	1	M(+)	218.01	40.11	0.00	5.75	-7.59
		M(-)	-1232.35	-294.00	0.00	-32.49	42.91
	2	M(+)	93.68	-124.54	0.00	2.47	-3.26
		M(-)	-508.76	-30.66	0.00	-13.41	17.71
	3	M(+)	550.53	-163.77	0.00	14.51	-19.17
		M(-)	-412.94	-30.66	0.00	-10.89	14.38
	4	M(+)	853.82	-127.44	0.00	22.51	-29.73
		M(-)	-349.07	-30.66	0.00	-9.20	12.15
	5	M(+)	1075.08	-56.07	0.00	28.34	-37.43
		M(-)	-285.20	-30.66	0.00	-7.52	9.93
	6	M(+)	1148.33	-1.57	0.00	30.27	-39.98
		M(-)	-283.37	40.11	0.00	-7.47	9.87
	7	M(+)	1081.74	52.93	0.00	28.52	-37.66
		M(-)	-366.93	40.11	0.00	-9.67	12.78
	8	M(+)	867.18	124.26	0.00	22.86	-30.19
		M(-)	-450.49	40.11	0.00	-11.88	15.68
	9	M(+)	570.52	160.58	0.00	15.04	-19.86
		M(-)	-534.04	40.11	0.00	-14.08	18.59
	10	M(+)	176.68	-10.75	0.00	4.66	-6.15
		M(-)	-659.40	40.11	0.00	-17.38	22.96
	11	M(+)	210.28	-10.75	0.00	5.54	-7.32
		M(-)	-1354.58	256.96	0.00	-35.71	47.16
3	1	M(+)	210.28	39.72	0.00	5.54	-7.32
		M(-)	-1354.58	-300.20	0.00	-35.71	47.16
	2	M(+)	136.32	8.22	0.00	3.59	-4.75
		M(-)	-651.58	-39.27	0.00	-17.18	22.69

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	570.20	-162.30	0.00	15.03	-19.85
		M(-)	-528.86	-39.27	0.00	-13.94	18.41
	4	M(+)	870.44	-125.98	0.00	22.95	-30.31
		M(-)	-447.06	-39.27	0.00	-11.79	15.56
	5	M(+)	1088.66	-54.61	0.00	28.70	-37.90
		M(-)	-365.25	-39.27	0.00	-9.63	12.72
	6	M(+)	1158.87	-0.11	0.00	30.55	-40.35
		M(-)	-286.18	39.72	0.00	-7.54	9.96
	7	M(+)	1089.23	54.39	0.00	28.72	-37.92
		M(-)	-368.92	39.72	0.00	-9.73	12.84
	8	M(+)	871.63	125.72	0.00	22.98	-30.35
		M(-)	-451.66	39.72	0.00	-11.91	15.73
	9	M(+)	571.92	162.04	0.00	15.08	-19.91
		M(-)	-534.39	39.72	0.00	-14.09	18.61
	10	M(+)	176.32	-10.64	0.00	4.65	-6.14
		M(-)	-658.52	39.72	0.00	-17.36	22.93
	11	M(+)	209.58	-10.64	0.00	5.53	-7.30
		M(-)	-1358.15	257.64	0.00	-35.80	47.29
4	1	M(+)	209.58	39.66	0.00	5.53	-7.30
		M(-)	-1358.16	-300.38	0.00	-35.80	47.29
	2	M(+)	174.59	10.52	0.00	4.60	-6.08
		M(-)	-658.08	-39.66	0.00	-17.35	22.91
	3	M(+)	571.60	-162.19	0.00	15.07	-19.90
		M(-)	-534.12	-39.66	0.00	-14.08	18.60
	4	M(+)	871.61	-125.86	0.00	22.98	-30.35
		M(-)	-451.50	-39.66	0.00	-11.90	15.72
	5	M(+)	1089.59	-54.50	0.00	28.72	-37.94
		M(-)	-368.88	-39.66	0.00	-9.72	12.84
	6	M(+)	1159.57	0.00	0.00	30.57	-40.37
		M(-)	-286.26	-39.66	0.00	-7.55	9.97
	7	M(+)	1089.70	54.50	0.00	28.73	-37.94
		M(-)	-368.80	39.66	0.00	-9.72	12.84
	8	M(+)	871.86	125.83	0.00	22.98	-30.36
		M(-)	-451.42	39.66	0.00	-11.90	15.72
	9	M(+)	571.92	162.16	0.00	15.08	-19.91
		M(-)	-534.04	39.66	0.00	-14.08	18.59
	10	M(+)	174.57	-10.52	0.00	4.60	-6.08
		M(-)	-657.99	39.66	0.00	-17.35	22.91
	11	M(+)	209.58	-39.66	0.00	5.53	-7.30
		M(-)	-1358.15	300.38	0.00	-35.80	47.29
5	1	M(+)	209.58	10.64	0.00	5.53	-7.30
		M(-)	-1358.16	-257.64	0.00	-35.80	47.29
	2	M(+)	176.35	10.64	0.00	4.65	-6.14
		M(-)	-658.60	-39.72	0.00	-17.36	22.93
	3	M(+)	571.60	-162.08	0.00	15.07	-19.90
		M(-)	-534.47	-39.72	0.00	-14.09	18.61
	4	M(+)	871.37	-125.75	0.00	22.97	-30.34
		M(-)	-451.74	-39.72	0.00	-11.91	15.73
	5	M(+)	1089.12	-54.39	0.00	28.71	-37.92
		M(-)	-369.00	-39.72	0.00	-9.73	12.85

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Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	1158.86	0.11	0.00	30.55	-40.35
		M(-)	-286.26	-39.72	0.00	-7.55	9.97
	7	M(+)	1088.76	54.61	0.00	28.70	-37.91
		M(-)	-365.17	39.27	0.00	-9.63	12.71
	8	M(+)	870.69	125.94	0.00	22.95	-30.31
		M(-)	-446.98	39.27	0.00	-11.78	15.56
	9	M(+)	570.52	162.27	0.00	15.04	-19.86
		M(-)	-528.78	39.27	0.00	-13.94	18.41
	10	M(+)	136.30	-8.22	0.00	3.59	-4.75
		M(-)	-651.50	39.27	0.00	-17.18	22.68
	11	M(+)	210.28	-39.72	0.00	5.54	-7.32
		M(-)	-1354.58	300.20	0.00	-35.71	47.16
6	1	M(+)	210.28	10.75	0.00	5.54	-7.32
		M(-)	-1354.58	-256.96	0.00	-35.71	47.16
	2	M(+)	176.70	10.75	0.00	4.66	-6.15
		M(-)	-659.48	-40.11	0.00	-17.39	22.96
	3	M(+)	570.19	-160.62	0.00	15.03	-19.85
		M(-)	-534.12	-40.11	0.00	-14.08	18.60
	4	M(+)	866.93	-124.29	0.00	22.85	-30.18
		M(-)	-450.57	-40.11	0.00	-11.88	15.69
	5	M(+)	1081.63	-52.93	0.00	28.51	-37.66
		M(-)	-367.01	-40.11	0.00	-9.68	12.78
	6	M(+)	1148.33	1.57	0.00	30.27	-39.98
		M(-)	-283.45	-40.11	0.00	-7.47	9.87
	7	M(+)	1075.19	56.07	0.00	28.34	-37.43
		M(-)	-285.13	30.66	0.00	-7.52	9.93
	8	M(+)	854.08	127.40	0.00	22.52	-29.74
		M(-)	-349.01	30.66	0.00	-9.20	12.15
	9	M(+)	550.86	163.73	0.00	14.52	-19.18
		M(-)	-412.88	30.66	0.00	-10.88	14.37
	10	M(+)	93.93	124.51	0.00	2.48	-3.27
		M(-)	-508.70	30.66	0.00	-13.41	17.71
	11	M(+)	218.01	-40.11	0.00	5.75	-7.59
		M(-)	-1232.34	294.00	0.00	-32.49	42.91
7	1	M(+)	218.01	10.90	0.00	5.75	-7.59
		M(-)	-1232.34	-236.02	0.00	-32.49	42.91
	2	M(+)	183.94	10.90	0.00	4.85	-6.40
		M(-)	-686.50	-40.68	0.00	-18.10	23.90
	3	M(+)	666.17	-148.82	0.00	17.56	-23.19
		M(-)	-559.37	-40.68	0.00	-14.75	19.48
	4	M(+)	888.04	-84.73	0.00	23.41	-30.92
		M(-)	-489.44	-40.68	0.00	-12.90	17.04
	5	M(+)	1007.09	-30.23	0.00	26.55	-35.06
		M(-)	-419.51	-40.68	0.00	-11.06	14.61
	6	M(+)	1025.97	24.27	0.00	27.05	-35.72
		M(-)	-349.57	-40.68	0.00	-9.22	12.17
	7	M(+)	944.68	78.77	0.00	24.90	-32.89
		M(-)	-279.64	-40.68	0.00	-7.37	9.74
	8	M(+)	785.68	107.46	0.00	20.71	-27.35
		M(-)	-209.71	-40.68	0.00	-5.53	7.30

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	9	M(+)	575.19	137.44	0.00	15.16	-20.03
		M(-)	-139.78	-40.68	0.00	-3.68	4.87
	10	M(+)	313.17	167.42	0.00	8.26	-10.90
		M(-)	-69.85	-40.68	0.00	-1.84	2.43
	11	M(+)	0.00	197.36	0.00	0.00	0.00
		M(-)	0.00	-40.68	0.00	0.00	0.00

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	56.95	0.00	0.00	0.00	0.00
		Q(-)	-288.88	0.00	0.00	0.00	0.00
	2	Q(+)	56.95	-113.89	0.00	-3.00	3.97
		Q(-)	-225.13	514.01	0.00	13.55	-17.90
	3	Q(+)	56.95	-227.79	0.00	-6.01	7.93
		Q(-)	-161.38	900.52	0.00	23.74	-31.35
	4	Q(+)	56.95	-341.68	0.00	-9.01	11.90
		Q(-)	-97.63	1159.53	0.00	30.57	-40.37
	5	Q(+)	56.95	-455.57	0.00	-12.01	15.86
		Q(-)	-33.88	1291.03	0.00	34.03	-44.95
	6	Q(+)	86.74	466.45	0.00	12.30	-16.24
		Q(-)	-15.24	152.43	0.00	4.02	-5.31
	7	Q(+)	150.04	494.60	0.00	13.04	-17.22
		Q(-)	-15.24	182.91	0.00	4.82	-6.37
	8	Q(+)	213.79	130.77	0.00	3.45	-4.55
		Q(-)	-15.24	213.40	0.00	5.63	-7.43
	9	Q(+)	277.54	-360.56	0.00	-9.51	12.55
		Q(-)	-15.24	243.89	0.00	6.43	-8.49
	10	Q(+)	341.30	-979.40	0.00	-25.82	34.10
		Q(-)	-15.24	274.37	0.00	7.23	-9.55
	11	Q(+)	405.05	-1725.74	0.00	-45.50	60.08
		Q(-)	-15.24	304.86	0.00	8.04	-10.61
2	1	Q(+)	56.09	304.86	0.00	8.04	-10.61
		Q(-)	-433.05	-1734.71	0.00	-45.73	60.40
	2	Q(+)	56.09	129.56	0.00	3.42	-4.51
		Q(-)	-333.44	-537.08	0.00	-14.16	18.70
	3	Q(+)	56.09	-45.73	0.00	-1.21	1.59
		Q(-)	-233.82	349.26	0.00	9.21	-12.16
	4	Q(+)	56.09	-162.57	0.00	-4.29	5.66
		Q(-)	-167.43	767.16	0.00	20.22	-26.71
	5	Q(+)	56.09	-279.42	0.00	-7.37	9.73
		Q(-)	-104.40	808.78	0.00	21.32	-28.16
	6	Q(+)	56.09	-396.26	0.00	-10.45	13.80
		Q(-)	-48.84	968.38	0.00	25.53	-33.72
	7	Q(+)	111.54	925.23	0.00	24.39	-32.21
		Q(-)	-38.81	-199.31	0.00	-5.25	6.94
	8	Q(+)	177.94	623.73	0.00	16.44	-21.72
		Q(-)	-38.81	-118.46	0.00	-3.12	4.12
	9	Q(+)	244.34	183.93	0.00	4.85	-6.40
		Q(-)	-38.81	-37.61	0.00	-0.99	1.31
	10	Q(+)	343.95	-735.28	0.00	-19.38	25.60
		Q(-)	-38.81	83.69	0.00	2.21	-2.91
	11	Q(+)	443.63	-1966.65	0.00	-51.85	68.47
		Q(-)	-38.81	205.07	0.00	5.41	-7.14
3	1	Q(+)	55.37	293.12	0.00	7.73	-10.21
		Q(-)	-442.80	-1926.99	0.00	-50.80	67.09
	2	Q(+)	55.37	120.10	0.00	3.17	-4.18
		Q(-)	-343.19	-698.88	0.00	-18.42	24.33

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	55.37	-52.93	0.00	-1.40	1.84
		Q(-)	-243.58	217.93	0.00	5.75	-7.59
	4	Q(+)	55.37	-168.26	0.00	-4.44	5.86
		Q(-)	-177.18	656.14	0.00	17.30	-22.84
	5	Q(+)	55.37	-283.59	0.00	-7.48	9.87
		Q(-)	-116.46	693.50	0.00	18.28	-24.15
	6	Q(+)	57.66	849.15	0.00	22.39	-29.56
		Q(-)	-60.90	878.22	0.00	23.15	-30.58
	7	Q(+)	113.23	671.17	0.00	17.69	-23.37
		Q(-)	-52.81	-271.20	0.00	-7.15	9.44
	8	Q(+)	179.27	630.34	0.00	16.62	-21.95
		Q(-)	-52.81	-161.18	0.00	-4.25	5.61
	9	Q(+)	245.66	187.77	0.00	4.95	-6.54
		Q(-)	-52.81	-51.17	0.00	-1.35	1.78
	10	Q(+)	345.28	-735.57	0.00	-19.39	25.61
		Q(-)	-52.81	113.88	0.00	3.00	-3.96
	11	Q(+)	444.95	-1971.09	0.00	-51.96	68.63
		Q(-)	-52.81	279.03	0.00	7.36	-9.71
4	1	Q(+)	54.52	288.09	0.00	7.59	-10.03
		Q(-)	-444.27	-1956.07	0.00	-51.57	68.10
	2	Q(+)	54.52	117.71	0.00	3.10	-4.10
		Q(-)	-344.66	-723.38	0.00	-19.07	25.19
	3	Q(+)	54.52	-52.67	0.00	-1.39	1.83
		Q(-)	-245.04	198.03	0.00	5.22	-6.89
	4	Q(+)	54.52	-166.24	0.00	-4.38	5.79
		Q(-)	-178.65	639.30	0.00	16.85	-22.26
	5	Q(+)	54.52	-279.81	0.00	-7.38	9.74
		Q(-)	-116.20	686.35	0.00	18.09	-23.90
	6	Q(+)	60.58	870.65	0.00	22.95	-30.31
		Q(-)	-60.64	870.53	0.00	22.95	-30.31
	7	Q(+)	116.15	686.59	0.00	18.10	-23.90
		Q(-)	-54.52	-279.92	0.00	-7.38	9.75
	8	Q(+)	178.58	639.66	0.00	16.86	-22.27
		Q(-)	-54.52	-166.35	0.00	-4.39	5.79
	9	Q(+)	244.98	198.52	0.00	5.23	-6.91
		Q(-)	-54.52	-52.78	0.00	-1.39	1.84
	10	Q(+)	344.59	-722.69	0.00	-19.05	25.16
		Q(-)	-54.52	117.60	0.00	3.10	-4.09
	11	Q(+)	444.27	-1956.07	0.00	-51.57	68.10
		Q(-)	-54.52	288.09	0.00	7.59	-10.03
5	1	Q(+)	52.81	279.03	0.00	7.36	-9.71
		Q(-)	-444.95	-1971.09	0.00	-51.96	68.63
	2	Q(+)	52.81	113.98	0.00	3.00	-3.97
		Q(-)	-345.34	-736.26	0.00	-19.41	25.63
	3	Q(+)	52.81	-51.06	0.00	-1.35	1.78
		Q(-)	-245.73	187.28	0.00	4.94	-6.52
	4	Q(+)	52.81	-161.08	0.00	-4.25	5.61
		Q(-)	-179.33	629.98	0.00	16.61	-21.93
	5	Q(+)	52.81	-271.09	0.00	-7.15	9.44
		Q(-)	-113.28	670.94	0.00	17.69	-23.36

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	60.84	878.34	0.00	23.16	-30.58
		Q(-)	-57.72	849.04	0.00	22.38	-29.56
	7	Q(+)	116.41	693.73	0.00	18.29	-24.15
		Q(-)	-55.37	-283.70	0.00	-7.48	9.88
	8	Q(+)	177.12	656.50	0.00	17.31	-22.86
		Q(-)	-55.37	-168.37	0.00	-4.44	5.86
	9	Q(+)	243.51	218.42	0.00	5.76	-7.60
		Q(-)	-55.37	-53.04	0.00	-1.40	1.85
	10	Q(+)	343.13	-698.20	0.00	-18.41	24.31
		Q(-)	-55.37	119.99	0.00	3.16	-4.18
	11	Q(+)	442.80	-1926.99	0.00	-50.80	67.09
		Q(-)	-55.37	293.12	0.00	7.73	-10.21
6	1	Q(+)	38.81	205.07	0.00	5.41	-7.14
		Q(-)	-443.63	-1966.65	0.00	-51.85	68.47
	2	Q(+)	38.81	83.77	0.00	2.21	-2.92
		Q(-)	-344.02	-735.96	0.00	-19.40	25.62
	3	Q(+)	38.81	-37.53	0.00	-0.99	1.31
		Q(-)	-244.40	183.44	0.00	4.84	-6.39
	4	Q(+)	38.81	-118.38	0.00	-3.12	4.12
		Q(-)	-178.01	623.37	0.00	16.43	-21.70
	5	Q(+)	38.81	-199.24	0.00	-5.25	6.94
		Q(-)	-111.61	925.00	0.00	24.39	-32.21
	6	Q(+)	48.78	968.48	0.00	25.53	-33.72
		Q(-)	-56.09	-396.37	0.00	-10.45	13.80
	7	Q(+)	104.35	808.99	0.00	21.33	-28.17
		Q(-)	-56.09	-279.53	0.00	-7.37	9.73
	8	Q(+)	167.36	767.50	0.00	20.23	-26.72
		Q(-)	-56.09	-162.69	0.00	-4.29	5.66
	9	Q(+)	233.76	349.73	0.00	9.22	-12.18
		Q(-)	-56.09	-45.84	0.00	-1.21	1.60
	10	Q(+)	333.37	-536.41	0.00	-14.14	18.68
		Q(-)	-56.09	129.45	0.00	3.41	-4.51
	11	Q(+)	433.05	-1734.71	0.00	-45.73	60.40
		Q(-)	-56.09	304.86	0.00	8.04	-10.61
7	1	Q(+)	15.24	304.86	0.00	8.04	-10.61
		Q(-)	-405.05	-1725.74	0.00	-45.50	60.08
	2	Q(+)	15.24	257.22	0.00	6.78	-8.96
		Q(-)	-305.43	-615.61	0.00	-16.23	21.43
	3	Q(+)	15.24	209.59	0.00	5.53	-7.30
		Q(-)	-205.82	183.23	0.00	4.83	-6.38
	4	Q(+)	15.24	183.39	0.00	4.83	-6.38
		Q(-)	-151.03	489.94	0.00	12.92	-17.06
	5	Q(+)	15.24	157.18	0.00	4.14	-5.47
		Q(-)	-96.23	702.46	0.00	18.52	-24.46
	6	Q(+)	24.27	1025.97	0.00	27.05	-35.72
		Q(-)	-56.95	-489.34	0.00	-12.90	17.04
	7	Q(+)	78.77	944.68	0.00	24.90	-32.89
		Q(-)	-56.95	-391.45	0.00	-10.32	13.63
	8	Q(+)	124.56	1065.66	0.00	28.09	-37.10
		Q(-)	-56.95	-293.56	0.00	-7.74	10.22

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	9	Q(+)	179.36	804.44	0.00	21.21	-28.01
		Q(-)	-56.95	-195.67	0.00	-5.16	6.81
	10	Q(+)	234.15	449.02	0.00	11.84	-15.63
		Q(-)	-56.95	-97.78	0.00	-2.58	3.40
	11	Q(+)	288.88	0.00	0.00	0.00	0.00
		Q(-)	-56.95	0.00	0.00	0.00	0.00

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-197.36	0.00	0.00	0.00
		M(-)	0.00	40.68	0.00	0.00	0.00
	2	M(+)	514.01	-225.13	0.00	13.55	-17.90
		M(-)	-113.89	56.95	0.00	-3.00	3.97
	3	M(+)	900.52	-161.38	0.00	23.74	-31.35
		M(-)	-227.79	56.95	0.00	-6.01	7.93
	4	M(+)	1159.53	-97.63	0.00	30.57	-40.37
		M(-)	-341.68	56.95	0.00	-9.01	11.90
	5	M(+)	1291.03	-33.88	0.00	34.03	-44.95
		M(-)	-455.57	56.95	0.00	-12.01	15.86
	6	M(+)	1295.03	29.88	0.00	34.14	-45.09
		M(-)	-569.47	56.95	0.00	-15.01	19.83
	7	M(+)	1171.52	93.63	0.00	30.88	-40.79
		M(-)	-683.36	56.95	0.00	-18.02	23.79
	8	M(+)	920.51	157.38	0.00	24.27	-32.05
		M(-)	-797.25	56.95	0.00	-21.02	27.76
	9	M(+)	542.00	221.13	0.00	14.29	-18.87
		M(-)	-911.14	56.95	0.00	-24.02	31.72
	10	M(+)	274.37	-15.24	0.00	7.23	-9.55
		M(-)	-1081.07	300.14	0.00	-28.50	37.64
	11	M(+)	304.86	-15.24	0.00	8.04	-10.61
		M(-)	-1734.71	353.49	0.00	-45.73	60.40
2	1	M(+)	304.86	56.09	0.00	8.04	-10.61
		M(-)	-1734.71	-433.05	0.00	-45.73	60.40
	2	M(+)	129.56	56.09	0.00	3.42	-4.51
		M(-)	-661.44	-298.89	0.00	-17.44	23.03
	3	M(+)	793.42	-209.56	0.00	20.92	-27.62
		M(-)	-522.72	-38.81	0.00	-13.78	18.20
	4	M(+)	1160.78	-143.16	0.00	30.60	-40.41
		M(-)	-486.20	-2.53	0.00	-12.82	16.93
	5	M(+)	1389.85	-76.77	0.00	36.64	-48.39
		M(-)	-486.57	2.89	0.00	-12.83	16.94
	6	M(+)	1480.60	-10.37	0.00	39.03	-51.55
		M(-)	-499.54	21.29	0.00	-13.17	17.39
	7	M(+)	1433.05	56.03	0.00	37.78	-49.89
		M(-)	-549.53	26.71	0.00	-14.49	19.13
	8	M(+)	1247.19	122.43	0.00	32.88	-43.42
		M(-)	-629.95	56.09	0.00	-16.61	21.93
	9	M(+)	923.03	188.82	0.00	24.33	-32.14
		M(-)	-746.79	56.09	0.00	-19.69	26.00
	10	M(+)	254.14	201.23	0.00	6.70	-8.85
		M(-)	-922.09	56.09	0.00	-24.31	32.10
	11	M(+)	293.12	-14.98	0.00	7.73	-10.21
		M(-)	-1966.65	443.63	0.00	-51.85	68.47
3	1	M(+)	293.12	55.37	0.00	7.73	-10.21
		M(-)	-1966.65	-394.32	0.00	-51.85	68.47
	2	M(+)	217.65	-192.40	0.00	5.74	-7.58
		M(-)	-876.30	-52.81	0.00	-23.10	30.51

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	872.36	-194.98	0.00	23.00	-30.37
		M(-)	-711.26	-52.81	0.00	-18.75	24.76
	4	M(+)	1209.35	-128.58	0.00	31.88	-42.11
		M(-)	-648.46	-17.01	0.00	-17.10	22.58
	5	M(+)	1408.03	-62.18	0.00	37.12	-49.02
		M(-)	-618.67	-11.59	0.00	-16.31	21.54
	6	M(+)	1493.80	-8.11	0.00	39.38	-52.01
		M(-)	-600.16	-6.18	0.00	-15.82	20.90
	7	M(+)	1441.55	58.29	0.00	38.00	-50.19
		M(-)	-607.18	15.47	0.00	-16.01	21.14
	8	M(+)	1250.99	124.68	0.00	32.98	-43.55
		M(-)	-645.05	20.89	0.00	-17.01	22.46
	9	M(+)	922.12	191.08	0.00	24.31	-32.10
		M(-)	-744.91	55.37	0.00	-19.64	25.94
	10	M(+)	277.04	189.16	0.00	7.30	-9.65
		M(-)	-917.94	55.37	0.00	-24.20	31.96
	11	M(+)	288.09	-14.62	0.00	7.59	-10.03
		M(-)	-1971.09	444.95	0.00	-51.96	68.63
4	1	M(+)	288.09	54.52	0.00	7.59	-10.03
		M(-)	-1971.09	-394.06	0.00	-51.96	68.63
	2	M(+)	266.52	-189.48	0.00	7.03	-9.28
		M(-)	-904.58	-54.52	0.00	-23.85	31.49
	3	M(+)	912.88	-191.96	0.00	24.07	-31.78
		M(-)	-734.20	-54.52	0.00	-19.36	25.56
	4	M(+)	1243.58	-125.56	0.00	32.78	-43.30
		M(-)	-652.24	-18.36	0.00	-17.19	22.71
	5	M(+)	1435.97	-59.16	0.00	37.86	-50.00
		M(-)	-619.64	-12.94	0.00	-16.34	21.57
	6	M(+)	1490.06	7.24	0.00	39.28	-51.88
		M(-)	-598.33	-7.53	0.00	-15.77	20.83
	7	M(+)	1436.09	59.10	0.00	37.86	-50.00
		M(-)	-619.62	12.94	0.00	-16.33	21.57
	8	M(+)	1243.83	125.50	0.00	32.79	-43.31
		M(-)	-652.21	18.35	0.00	-17.19	22.71
	9	M(+)	913.27	191.89	0.00	24.08	-31.80
		M(-)	-734.09	54.52	0.00	-19.35	25.56
	10	M(+)	266.90	189.42	0.00	7.04	-9.29
		M(-)	-904.47	54.52	0.00	-23.84	31.49
	11	M(+)	288.09	-54.52	0.00	7.59	-10.03
		M(-)	-1971.09	394.06	0.00	-51.96	68.63
5	1	M(+)	288.09	14.62	0.00	7.59	-10.03
		M(-)	-1971.09	-444.95	0.00	-51.96	68.63
	2	M(+)	276.67	-189.22	0.00	7.29	-9.63
		M(-)	-918.05	-55.37	0.00	-24.20	31.96
	3	M(+)	921.74	-191.14	0.00	24.30	-32.09
		M(-)	-745.03	-55.37	0.00	-19.64	25.94
	4	M(+)	1250.74	-124.75	0.00	32.97	-43.55
		M(-)	-645.09	-20.89	0.00	-17.01	22.46
	5	M(+)	1441.43	-58.35	0.00	38.00	-50.19
		M(-)	-607.21	-15.48	0.00	-16.01	21.14

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	1493.82	8.05	0.00	39.38	-52.01
		M(-)	-600.15	6.17	0.00	-15.82	20.90
	7	M(+)	1408.15	62.12	0.00	37.12	-49.03
		M(-)	-618.64	11.59	0.00	-16.31	21.54
	8	M(+)	1209.60	128.52	0.00	31.89	-42.11
		M(-)	-648.42	17.00	0.00	-17.09	22.58
	9	M(+)	872.75	194.91	0.00	23.01	-30.39
		M(-)	-711.15	52.81	0.00	-18.75	24.76
	10	M(+)	218.04	192.35	0.00	5.75	-7.59
		M(-)	-876.20	52.81	0.00	-23.10	30.51
	11	M(+)	293.12	-55.37	0.00	7.73	-10.21
		M(-)	-1966.66	394.32	0.00	-51.85	68.47
6	1	M(+)	293.12	14.98	0.00	7.73	-10.21
		M(-)	-1966.65	-443.63	0.00	-51.85	68.47
	2	M(+)	253.73	-201.28	0.00	6.69	-8.83
		M(-)	-922.20	-56.09	0.00	-24.31	32.11
	3	M(+)	922.66	-188.88	0.00	24.32	-32.12
		M(-)	-746.91	-56.09	0.00	-19.69	26.00
	4	M(+)	1246.95	-122.49	0.00	32.87	-43.41
		M(-)	-630.06	-56.09	0.00	-16.61	21.94
	5	M(+)	1432.94	-56.09	0.00	37.78	-49.89
		M(-)	-549.58	-26.71	0.00	-14.49	19.13
	6	M(+)	1480.62	10.31	0.00	39.03	-51.55
		M(-)	-499.58	-21.30	0.00	-13.17	17.39
	7	M(+)	1390.00	76.71	0.00	36.64	-48.39
		M(-)	-486.58	-2.89	0.00	-12.83	16.94
	8	M(+)	1161.07	143.10	0.00	30.61	-40.42
		M(-)	-486.19	2.52	0.00	-12.82	16.93
	9	M(+)	793.84	209.50	0.00	20.93	-27.64
		M(-)	-522.64	38.81	0.00	-13.78	18.20
	10	M(+)	129.45	-56.09	0.00	3.41	-4.51
		M(-)	-660.84	298.84	0.00	-17.42	23.01
	11	M(+)	304.86	-56.09	0.00	8.04	-10.61
		M(-)	-1734.71	433.05	0.00	-45.73	60.40
7	1	M(+)	304.86	15.24	0.00	8.04	-10.61
		M(-)	-1734.71	-353.50	0.00	-45.73	60.40
	2	M(+)	336.30	-249.02	0.00	8.87	-11.71
		M(-)	-960.97	-56.95	0.00	-25.33	33.46
	3	M(+)	958.86	-149.41	0.00	25.28	-33.38
		M(-)	-783.02	-56.95	0.00	-20.64	27.26
	4	M(+)	1168.60	-94.62	0.00	30.81	-40.69
		M(-)	-685.12	-56.95	0.00	-18.06	23.85
	5	M(+)	1284.16	-39.82	0.00	33.85	-44.71
		M(-)	-587.23	-56.95	0.00	-15.48	20.45
	6	M(+)	1305.52	14.97	0.00	34.42	-45.45
		M(-)	-489.34	-56.95	0.00	-12.90	17.04
	7	M(+)	1232.68	69.77	0.00	32.50	-42.92
		M(-)	-391.45	-56.95	0.00	-10.32	13.63
	8	M(+)	1065.66	124.56	0.00	28.09	-37.10
		M(-)	-293.56	-56.95	0.00	-7.74	10.22

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	9	M(+)	804.44	179.36	0.00	21.21	-28.01
		M(-)	-195.67	-56.95	0.00	-5.16	6.81
	10	M(+)	449.02	234.15	0.00	11.84	-15.63
		M(-)	-97.78	-56.95	0.00	-2.58	3.40
	11	M(+)	0.00	197.36	0.00	0.00	0.00
		M(-)	0.00	-40.68	0.00	0.00	0.00

Cable Numero 1

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 13 (26.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.

1	0.000	0.463	1.187	-0.248	-0.1797

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.000	0.818	0.832	0.107	-0.1608
3	4.000	1.086	0.564	0.375	-0.1072
4	6.000	1.246	0.404	0.535	-0.0536
5	8.000	1.300	0.350	0.589	0.0000
6	10.000	1.272	0.378	0.561	0.0283
7	12.000	1.187	0.463	0.476	0.0567
8	14.000	1.045	0.605	0.334	0.0850
9	16.000	0.847	0.803	0.136	0.1133
10	18.000	0.592	1.058	-0.119	0.1417
11	20.000	0.450	1.200	-0.261	0.0000
12	23.125	0.452	1.198	-0.259	-0.0131
13	26.250	0.830	0.820	0.119	-0.1500

13	26.250	0.830	0.820	0.119	-0.1500

Cable Numero 2

Definicion general

Seccion inicial ..... = 13 (26.250) Pasiva
Seccion final ..... = 23 (51.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	28.333	1.142	0.508	0.431	-0.1476
15	30.416	1.383	0.267	0.672	-0.0811
16	32.499	1.470	0.180	0.759	0.0000
17	34.582	1.432	0.218	0.721	0.0363
18	36.665	1.319	0.331	0.608	0.0726
19	38.748	1.130	0.520	0.419	0.1090
20	41.873	0.704	0.946	-0.007	0.1635
21	45.000	0.380	1.270	-0.331	0.0000
22	48.125	0.409	1.241	-0.302	-0.0656
23	51.250	0.830	0.820	0.119	-0.1500

Cable Numero 3

Definicion general

Seccion inicial ..... = 23 (51.250) Pasiva
Seccion final ..... = 33 (76.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.

23	51.250	0.830	0.820	0.119	-0.1500

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	53.333	1.142	0.508	0.431	-0.1476
25	55.416	1.383	0.267	0.672	-0.0811
26	57.499	1.470	0.180	0.759	0.0000
27	59.582	1.432	0.218	0.721	0.0363
28	61.665	1.319	0.331	0.608	0.0726
29	63.748	1.130	0.520	0.419	0.1090
30	66.873	0.704	0.946	-0.007	0.1635
31	70.000	0.380	1.270	-0.331	0.0000
32	73.125	0.409	1.241	-0.302	-0.0656
33	76.250	0.830	0.820	0.119	-0.1500

33	76.250	0.830	0.820	0.119	-0.1500

Cable Numero 4

Definicion general

Seccion inicial ..... = 33 (76.250) Pasiva
Seccion final ..... = 43 (101.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 4

Se.	X	Y (s)	Y (i)	Exce.	Pend.

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	78.333	1.142	0.508	0.431	-0.1476
35	80.416	1.383	0.267	0.672	-0.0811
36	82.499	1.470	0.180	0.759	0.0000
37	84.582	1.432	0.218	0.721	0.0363
38	86.665	1.319	0.331	0.608	0.0726
39	88.748	1.130	0.520	0.419	0.1090
40	91.873	0.704	0.946	-0.007	0.1635
41	95.000	0.380	1.270	-0.331	0.0000
42	98.125	0.409	1.241	-0.302	-0.0656
43	101.250	0.830	0.820	0.119	-0.1500

Cable Numero 5

Definicion general

Seccion inicial ..... = 43 (101.250) Pasiva
Seccion final ..... = 53 (126.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 5

Se.	X	Y (s)	Y (i)	Exce.	Pend.

43	101.250	0.830	0.820	0.119	-0.1500

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	103.333	1.142	0.508	0.431	-0.1481
45	105.416	1.389	0.261	0.678	-0.0837
46	107.499	1.470	0.180	0.759	0.0039
47	109.582	1.427	0.223	0.716	0.0374
48	111.665	1.313	0.337	0.602	0.0720
49	113.748	1.126	0.524	0.415	0.1076
50	116.873	0.704	0.946	-0.007	0.1630
51	120.000	0.380	1.270	-0.331	0.0000
52	123.125	0.409	1.241	-0.302	-0.0656
53	126.250	0.830	0.820	0.119	-0.1500

53	126.250	0.830	0.820	0.119	-0.1500

Cable Numero 6

Definicion general

Seccion inicial ..... = 53 (126.250) Pasiva
Seccion final ..... = 63 (151.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 6

Se.	X	Y (s)	Y (i)	Exce.	Pend.

Se.	X	Y (s)	Y (i)	Exce.	Pend.
54	128.333	1.142	0.508	0.431	-0.1476
55	130.416	1.383	0.267	0.672	-0.0811
56	132.499	1.470	0.180	0.759	0.0000
57	134.582	1.432	0.218	0.721	0.0363
58	136.665	1.319	0.331	0.608	0.0726
59	138.748	1.130	0.520	0.419	0.1090
60	141.873	0.704	0.946	-0.007	0.1635
61	145.000	0.380	1.270	-0.331	0.0000
62	148.125	0.409	1.241	-0.302	-0.0656
63	151.250	0.830	0.820	0.119	-0.1500

Cable Numero 7

Definicion general

Seccion inicial ..... = 63 (151.250) Pasiva
Seccion final ..... = 71 (165.000) Activa

Fuerza de Pretensado ..... = 1495.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.309	-.1836
2	1.150	-0.671	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.750	-0.450	0.0000
7	24.250	-0.530	-.1500
8	26.250	-0.830	-.1500
9	28.250	-1.130	-.1500
10	32.500	-1.470	0.0000
11	42.500	-0.598	0.1744
12	45.000	-0.380	0.0000
13	47.250	-0.380	0.0000
14	49.250	-0.530	-.1500
15	51.250	-0.830	-.1500
16	53.250	-1.130	-.1500
17	57.500	-1.470	0.0000
18	67.500	-0.598	0.1744
19	70.000	-0.380	0.0000
20	72.250	-0.380	0.0000
21	74.250	-0.530	-.1500
22	76.250	-0.830	-.1500
23	78.250	-1.130	-.1500
24	82.500	-1.470	0.0000
25	92.500	-0.598	0.1744
26	95.000	-0.380	0.0000
27	97.250	-0.380	0.0000
28	99.250	-0.530	-.1500
29	101.250	-0.830	-.1500
30	103.250	-1.130	-.1500
31	107.250	-1.470	0.0000
32	117.500	-0.598	0.1744
33	120.000	-0.380	0.0000
34	122.250	-0.380	0.0000
35	124.250	-0.530	-.1500
36	126.250	-0.830	-.1500
37	128.250	-1.130	-.1500
38	132.500	-1.470	0.0000
39	142.500	-0.598	0.1744
40	145.000	-0.380	0.0000
41	147.250	-0.380	0.0000
42	149.250	-0.530	-.1500
43	151.250	-0.830	-.1500
44	153.250	-1.130	-.1500
45	157.000	-1.515	0.0000
46	163.850	-0.725	0.2306
47	165.850	-0.311	0.2306

Replanteo del cable : 7

Se.	X	Y (s)	Y (i)	Exce.	Pend.

63	151.250	0.830	0.820	0.119	-0.1500

Se.	X	Y (s)	Y (i)	Exce.	Pend.
64	152.969	1.088	0.562	0.377	-0.1500
65	154.688	1.338	0.312	0.627	-0.1317
66	156.407	1.501	0.149	0.790	-0.0458
67	158.126	1.494	0.156	0.783	0.0379
68	159.845	1.379	0.271	0.668	0.0958
69	161.564	1.164	0.486	0.453	0.1536
70	163.283	0.851	0.799	0.140	0.2115
71	165.000	0.489	1.161	-0.222	0.1958

Cable Numero 8

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 13 (26.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 8

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.968	0.682	0.257	-0.0234

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.000	1.176	0.474	0.465	-0.1252
3	4.000	1.319	0.331	0.608	-0.0276
4	6.000	1.323	0.327	0.612	0.0142
5	8.000	1.300	0.350	0.589	0.0000
6	10.000	1.272	0.378	0.561	0.0283
7	12.000	1.187	0.463	0.476	0.0567
8	14.000	1.045	0.605	0.334	0.0850
9	16.000	0.847	0.803	0.136	0.1133
10	18.000	0.592	1.058	-0.119	0.1417
11	20.000	0.450	1.200	-0.261	0.0000
12	23.125	0.944	0.706	0.233	-0.1939
13	26.250	1.280	0.370	0.569	-0.0850

Cable Numero 9

Definicion general

Seccion inicial ..... = 13 (26.250) Pasiva
Seccion final ..... = 23 (51.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000

52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 9

Se.	X	Y (s)	Y (i)	Exce.	Pend.
13	26.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	28.333	1.456	0.194	0.745	-0.0688
15	30.416	1.470	0.180	0.759	0.0000
16	32.499	1.470	0.180	0.759	0.0000
17	34.582	1.432	0.218	0.721	0.0363
18	36.665	1.319	0.331	0.608	0.0726
19	38.748	1.130	0.520	0.419	0.1090
20	41.873	0.704	0.946	-0.007	0.1635
21	45.000	0.380	1.270	-0.331	0.0000
22	48.125	0.932	0.718	0.221	-0.2137
23	51.250	1.280	0.370	0.569	-0.0850

Cable Numero 10

Definicion general

Seccion inicial ..... = 23 (51.250) Pasiva
Seccion final ..... = 33 (76.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 10

Se.	X	Y (s)	Y (i)	Exce.	Pend.
23	51.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	53.333	1.456	0.194	0.745	-0.0688
25	55.416	1.470	0.180	0.759	0.0000
26	57.499	1.470	0.180	0.759	0.0000
27	59.582	1.432	0.218	0.721	0.0363
28	61.665	1.319	0.331	0.608	0.0726
29	63.748	1.130	0.520	0.419	0.1090
30	66.873	0.704	0.946	-0.007	0.1635
31	70.000	0.380	1.270	-0.331	0.0000
32	73.125	0.932	0.718	0.221	-0.2137
33	76.250	1.280	0.370	0.569	-0.0850

Cable Numero 11

Definicion general

Seccion inicial ..... = 33 (76.250) Pasiva
Seccion final ..... = 43 (101.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000

52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 11

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	76.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	78.333	1.456	0.194	0.745	-0.0688
35	80.416	1.470	0.180	0.759	0.0000
36	82.499	1.470	0.180	0.759	0.0000
37	84.582	1.432	0.218	0.721	0.0363
38	86.665	1.319	0.331	0.608	0.0726
39	88.748	1.130	0.520	0.419	0.1090
40	91.873	0.704	0.946	-0.007	0.1635
41	95.000	0.380	1.270	-0.331	0.0000
42	98.125	0.932	0.718	0.221	-0.2137
43	101.250	1.280	0.370	0.569	-0.0850

Cable Numero 12

Definicion general

Seccion inicial ..... = 43 (101.250) Pasiva
Seccion final ..... = 53 (126.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 12

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	101.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	103.333	1.456	0.194	0.745	-0.0688
45	105.416	1.470	0.180	0.759	0.0000
46	107.499	1.470	0.180	0.759	0.0039
47	109.582	1.427	0.223	0.716	0.0374
48	111.665	1.313	0.337	0.602	0.0720
49	113.748	1.126	0.524	0.415	0.1076
50	116.873	0.704	0.946	-0.007	0.1630
51	120.000	0.380	1.270	-0.331	0.0000
52	123.125	0.932	0.718	0.221	-0.2137
53	126.250	1.280	0.370	0.569	-0.0850

Cable Numero 13

Definicion general

Seccion inicial ..... = 53 (126.250) Pasiva
Seccion final ..... = 63 (151.250) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000

52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 13

Se.	X	Y (s)	Y (i)	Exce.	Pend.
53	126.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
54	128.333	1.456	0.194	0.745	-0.0688
55	130.416	1.470	0.180	0.759	0.0000
56	132.499	1.470	0.180	0.759	0.0000
57	134.582	1.432	0.218	0.721	0.0363
58	136.665	1.319	0.331	0.608	0.0726
59	138.748	1.130	0.520	0.419	0.1090
60	141.873	0.704	0.946	-0.007	0.1635
61	145.000	0.380	1.270	-0.331	0.0000
62	148.125	0.932	0.718	0.221	-0.2137
63	151.250	1.280	0.370	0.569	-0.0850

Cable Numero 14

Definicion general

Seccion inicial ..... = 63 (151.250) Pasiva
Seccion final ..... = 71 (165.000) Activa

Fuerza de Pretensado ..... = 1495.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.897	-.1836
2	1.150	-1.046	-.1836
3	8.000	-1.300	0.0000
4	18.000	-0.592	0.1417
5	20.000	-0.450	0.0000
6	22.400	-0.794	-.2144
7	24.250	-1.110	-.0850
8	26.250	-1.280	-.0850
9	28.250	-1.450	-.0850
10	28.750	-1.470	0.0000
11	32.500	-1.470	0.0000
12	42.500	-0.598	0.1744
13	45.000	-0.380	0.0000
14	47.350	-0.753	-.2387
15	49.250	-1.110	-.0850
16	51.250	-1.280	-.0850
17	53.250	-1.450	-.0850
18	53.750	-1.470	0.0000
19	57.500	-1.470	0.0000
20	67.500	-0.598	0.1744
21	70.000	-0.380	0.0000
22	72.350	-0.753	-.2387
23	74.250	-1.110	-.0850
24	76.250	-1.280	-.0850
25	78.250	-1.450	-.0850
26	78.750	-1.470	0.0000
27	82.500	-1.470	0.0000
28	92.500	-0.598	0.1744
29	95.000	-0.380	0.0000
30	97.350	-0.753	-.2387
31	99.250	-1.110	-.0850
32	101.250	-1.280	-.0850
33	103.250	-1.450	-.0850
34	103.750	-1.470	0.0000
35	107.250	-1.470	0.0000
36	117.500	-0.598	0.1744
37	120.000	-0.380	0.0000
38	122.350	-0.753	-.2387
39	124.250	-1.110	-.0850
40	126.250	-1.280	-.0850
41	128.250	-1.450	-.0850
42	128.750	-1.470	0.0000
43	132.500	-1.470	0.0000
44	142.500	-0.598	0.1744
45	145.000	-0.380	0.0000
46	147.350	-0.753	-.2387
47	149.250	-1.110	-.0850
48	151.250	-1.280	-.0850
49	153.250	-1.450	-.0850
50	155.250	-1.515	0.0000
51	157.000	-1.515	0.0000
52	163.850	-1.099	0.1213
53	165.850	-0.857	0.1213

Replanteo del cable : 14

Se.	X	Y (s)	Y (i)	Exce.	Pend.
63	151.250	1.280	0.370	0.569	-0.0850

Se.	X	Y (s)	Y (i)	Exce.	Pend.
64	152.969	1.426	0.224	0.715	-0.0850
65	154.688	1.512	0.138	0.801	-0.0118
66	156.407	1.515	0.135	0.804	0.0000
67	158.126	1.504	0.146	0.793	0.0199
68	159.845	1.443	0.207	0.732	0.0504
69	161.564	1.331	0.319	0.620	0.0808
70	163.283	1.165	0.485	0.454	0.1113
71	165.000	0.960	0.690	0.249	0.1213

Definicion esfuerzos unitarios cable : 1

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	2388.113	-422.411	2350.458	-582.204	-422.411	2350.458
				32.721	45.650	-7.626
2	2372.932	-376.762	2342.831			
				-4.076	127.231	-15.236
3	2340.933	-249.531	2327.595			
				-10.519	125.941	-21.829
4	2309.076	-123.590	2305.766			
				-16.645	123.590	-28.258
5	2277.508	0.000	2277.508			
				-11.838	63.931	-20.104
6	2258.309	63.931	2257.404			
				-11.549	62.724	-21.700
7	2239.288	126.655	2235.703			
				-9.725	61.387	-23.215
8	2220.465	188.042	2212.489			
				-4.829	60.524	-19.403
9	2207.127	248.566	2193.085			
				0.241	63.696	10.600
10	2225.699	312.262	2203.686			
				-24.684	-312.262	94.573
11	2298.258	0.000	2298.258			
				-46.903	-30.365	15.236
12	2313.693	-30.365	2313.494			
				279.163	-324.169	50.064
13	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 2

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	13	2023.322	-300.141	2000.937	238.111	-300.141	2000.937
---					6.633	3.691	6.918
---	14	2029.621	-296.450	2007.855	33.602	129.771	48.633
---	15	2063.232	-166.679	2056.488	41.256	166.590	47.580
---	16	2104.068	-0.089	2104.068	15.345	77.225	20.289
---	17	2125.757	77.136	2124.357	12.038	78.452	17.615
---	18	2147.615	155.588	2141.972	7.914	79.433	14.873
---	19	2169.611	235.021	2156.844	4.242	120.340	17.081
---	20	2202.779	355.361	2173.926	-189.726	-355.361	124.333
---	21	2298.258	0.000	2298.258	-184.257	-153.187	36.018
---	22	2339.297	-153.187	2334.276	193.576	-201.347	29.282
---	23	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 3

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	23	2023.323	-300.141	2000.937	238.111	-300.141	2000.937
---					6.633	3.691	6.918
---	24	2029.622	-296.450	2007.855	33.601	129.771	48.633
---	25	2063.232	-166.679	2056.488	41.256	166.590	47.580
---	26	2104.068	-0.089	2104.068	15.345	77.225	20.289
---	27	2125.757	77.136	2124.357	12.038	78.452	17.615
---	28	2147.615	155.588	2141.972	7.914	79.433	14.873
---	29	2169.611	235.021	2156.844	4.242	120.340	17.081
---	30	2202.779	355.361	2173.926	-189.727	-355.361	124.333
---	31	2298.258	0.000	2298.258	-184.257	-153.187	36.018
---	32	2339.297	-153.187	2334.276	193.576	-201.347	29.282
---	33	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 4

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	33	2023.322	-300.141	2000.937	238.111	-300.141	2000.937
---					6.633	3.691	6.918
	34	2029.621	-296.450	2007.855			
---					33.602	129.771	48.633
	35	2063.232	-166.679	2056.488			
---					41.256	166.590	47.580
	36	2104.068	-0.089	2104.068			
---					15.345	77.225	20.289
	37	2125.757	77.136	2124.357			
---					12.038	78.452	17.615
	38	2147.615	155.588	2141.972			
---					7.914	79.433	14.873
	39	2169.611	235.021	2156.844			
---					4.242	120.340	17.081
	40	2202.779	355.361	2173.926			
---					-189.726	-355.361	124.333
	41	2298.258	0.000	2298.258			
---					-184.257	-153.187	36.018
	42	2339.297	-153.187	2334.276			
---					193.576	-201.347	29.282
	43	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 5

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	43	2023.322	-300.141	2000.937	238.111	-300.141	2000.937
---					5.616	2.812	6.593
	44	2029.429	-297.329	2007.530			
---					39.362	125.390	47.393
	45	2062.104	-171.939	2054.923			
---					32.737	180.224	50.886
	46	2105.826	8.285	2105.810			
---					14.693	71.257	18.961
	47	2126.259	79.542	2124.770			
---					11.902	74.647	17.011
	48	2147.325	154.188	2141.782			
---					8.175	77.856	14.767
	49	2168.997	232.044	2156.549			
---					5.621	122.296	17.331
	50	2202.568	354.340	2173.879			
---					-190.995	-354.340	124.379
	51	2298.258	0.000	2298.258			
---					-184.257	-153.187	36.018
	52	2339.297	-153.187	2334.276			
---					193.576	-201.347	29.282
	53	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 6

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	53	2023.322	-300.141	2000.937	238.111	-300.141	2000.937
---					6.632	3.690	6.918
	54	2029.621	-296.450	2007.855			
---					33.602	129.772	48.633
	55	2063.232	-166.679	2056.488			
---					41.256	166.589	47.580
	56	2104.068	-0.090	2104.068			
---					15.345	77.225	20.289
	57	2125.757	77.136	2124.357			
---					12.038	78.452	17.615
	58	2147.615	155.587	2141.972			
---					7.914	79.433	14.873
	59	2169.611	235.021	2156.844			
---					4.242	120.340	17.081
	60	2202.779	355.361	2173.926			
---					-189.726	-355.361	124.333
	61	2298.258	0.000	2298.258			
---					-184.257	-153.187	36.018
	62	2339.297	-153.187	2334.276			
---					193.576	-201.347	29.282
	63	2390.000	-354.534	2363.558	-281.263	354.534	-2363.558

Definicion esfuerzos unitarios cable : 7

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	63	1357.901	-201.432	1342.878	159.802	-201.432	1342.878
---					0.722	-0.437	2.912
	64	1360.845	-201.868	1345.790			
---					17.203	23.089	11.424
	65	1368.938	-178.780	1357.213			
---					42.080	114.852	37.991
	66	1396.668	-63.927	1395.205			
---					3.319	117.885	28.282
	67	1424.509	53.958	1423.487			
---					11.177	83.801	14.901
	68	1444.969	137.759	1438.388			
---					5.940	84.796	10.146
	69	1465.531	222.556	1448.533			
---					1.729	84.964	5.380
	70	1486.079	307.520	1453.913			
---					-18.445	-18.171	23.490
	71	1505.471	289.349	1477.403	327.978	-289.349	-1477.403

Definicion esfuerzos unitarios cable : 8

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	2311.918	-54.112	2311.285	594.016	-54.112	2311.285
---					146.189	-238.478	26.069
	2	2355.596	-292.591	2337.354			
---					-42.649	229.182	-35.932
	3	2302.295	-63.409	2301.422			
---					-37.223	95.674	-25.182
	4	2276.469	32.265	2276.240			
---					-20.461	-32.265	1.268
	5	2277.508	0.000	2277.508			
---					-11.838	63.931	-20.104
	6	2258.309	63.931	2257.404			
---					-11.549	62.724	-21.700
	7	2239.288	126.655	2235.703			
---					-9.725	61.387	-23.215
	8	2220.465	188.042	2212.489			
---					-6.133	59.931	-24.638
	9	2201.858	247.973	2187.850			
---					-0.578	58.367	-25.962
	10	2183.484	306.340	2161.888			
---					-12.285	-306.340	47.069
	11	2208.957	0.000	2208.957			
---					417.528	-443.063	76.347
	12	2327.857	-443.063	2285.304			
---					-186.820	240.643	96.109
	13	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 9

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	13	1952.015	-165.325	1945.001	1106.706	-165.325	1945.001
---					40.995	30.510	14.135
	14	1963.770	-134.815	1959.137			
---					-84.570	134.815	38.408
	15	1997.544	0.000	1997.544			
---					3.985	0.000	5.250
	16	2002.794	0.000	2002.794			
---					14.681	73.422	19.294
	17	2023.421	73.422	2022.088			
---					11.458	74.675	16.767
	18	2044.227	148.098	2038.855			
---					7.533	75.609	14.157
	19	2065.164	223.707	2053.012			
---					4.038	114.547	16.259
	20	2096.735	338.254	2069.271			
---					-180.593	-338.254	118.347
	21	2187.618	0.000	2187.618			
---					467.216	-484.637	79.715
	22	2318.549	-484.637	2267.332			
---					-218.863	282.217	114.080
	23	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 10

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
23	1952.015	-165.325	1945.002	1106.706	-165.325	1945.002
				40.995	30.510	14.135
24	1963.770	-134.815	1959.137			
				-84.570	134.815	38.408
25	1997.544	0.000	1997.544			
				3.985	0.000	5.250
26	2002.794	0.000	2002.794			
				14.681	73.422	19.294
27	2023.421	73.422	2022.088			
				11.458	74.675	16.766
28	2044.227	148.098	2038.855			
				7.533	75.609	14.157
29	2065.164	223.707	2053.012			
				4.037	114.547	16.258
30	2096.735	338.254	2069.271			
				-180.593	-338.254	118.347
31	2187.618	0.000	2187.618			
				467.216	-484.637	79.715
32	2318.549	-484.637	2267.332			
				-218.863	282.217	114.080
33	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 11

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
33	1952.015	-165.325	1945.002	1106.706	-165.325	1945.002
				40.995	30.510	14.135
34	1963.770	-134.815	1959.137			
				-84.570	134.815	38.408
35	1997.544	0.000	1997.544			
				3.985	0.000	5.250
36	2002.794	0.000	2002.794			
				14.681	73.422	19.294
37	2023.421	73.422	2022.088			
				11.458	74.675	16.766
38	2044.227	148.098	2038.855			
				7.533	75.609	14.157
39	2065.164	223.707	2053.012			
				4.037	114.547	16.258
40	2096.735	338.254	2069.271			
				-180.593	-338.254	118.347
41	2187.618	0.000	2187.618			
				467.216	-484.637	79.715
42	2318.549	-484.637	2267.332			
				-218.863	282.217	114.080
43	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 12

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
43	1952.015	-165.325	1945.001	1106.706	-165.325	1945.001
---				40.995	30.510	14.135
44	1963.770	-134.815	1959.137			
---				-84.570	134.815	38.408
45	1997.544	0.000	1997.544			
---				12.461	7.886	6.889
46	2004.449	7.886	2004.434			
---				13.986	67.827	18.048
47	2023.898	75.712	2022.482			
---				11.329	71.053	16.193
48	2043.950	146.765	2038.674			
---				7.781	74.108	14.056
49	2064.579	220.873	2052.730			
---				5.350	116.408	16.496
50	2096.534	337.282	2069.226			
---				-181.800	-337.282	118.391
51	2187.617	0.000	2187.617			
---				467.216	-484.637	79.715
52	2318.549	-484.637	2267.332			
---				-218.863	282.217	114.080
53	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 13

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
53	1952.015	-165.325	1945.002	1106.706	-165.325	1945.002
---				40.992	30.508	14.135
54	1963.770	-134.817	1959.136			
---				-84.572	134.817	38.408
55	1997.544	0.000	1997.544			
---				3.985	0.000	5.250
56	2002.794	0.000	2002.794			
---				14.681	73.422	19.294
57	2023.421	73.422	2022.088			
---				11.458	74.675	16.767
58	2044.227	148.097	2038.855			
---				7.533	75.609	14.157
59	2065.164	223.707	2053.012			
---				4.037	114.547	16.258
60	2096.735	338.254	2069.271			
---				-180.593	-338.254	118.347
61	2187.617	0.000	2187.617			
---				467.208	-484.640	79.713
62	2318.548	-484.640	2267.331			
---				-218.864	282.220	114.082
63	2390.000	-202.420	2381.413	-1355.024	202.420	-2381.413

Definicion esfuerzos unitarios cable : 14

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
63	1407.260	-119.187	1402.204	797.854	-119.187	1402.204
				1.952	-0.258	3.041
64	1410.312	-119.446	1405.245			
				27.642	102.565	29.870
65	1435.214	-16.881	1435.115			
				-4.961	16.881	6.768
66	1441.883	0.000	1441.883			
				15.736	28.936	8.902
67	1451.074	28.936	1450.785			
				8.450	44.717	10.895
68	1463.535	73.653	1461.680			
				6.609	45.268	9.594
69	1476.073	118.921	1471.274			
				4.546	45.697	8.266
70	1488.670	164.618	1479.540			
				-6.921	15.406	4.581
71	1495.000	180.024	1484.121	-369.555	-180.024	-1484.121

Coeficientes para perdidas de pretensado

```
Coef. de retraccion del hormigon ..................... = 0.0003
Coef. de relajacion del acero ........................ = 0.0600
Coef. de fluencia del hormigon ....................... = 2.5000

Coef. medio de perdidas elasticas instantaneas ....... = 0.9909 ( 0.9%)
Coef. medio de perdidas en estado inicial ............ = 0.9596 ( 4.0%)
Coef. medio de perdidas diferidas inicial ............ = 0.9509 ( 4.9%)
Coef. medio de perdidas diferidas .................... = 0.8654 (13.5%)
Coef. medio de perdidas totales ...................... = 0.8575 (14.2%)

Coef. de ponderacion maximo del pretensado ........... = 1.1000
Coef. de ponderacion minimo del pretensado ........... = 0.9000
Coef. de ponderacion para perdidas en estado inicial . = 0.3000
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Comprobacion de tensiones

```
Estado  1 Pretensado de   2390. tn  Familia  1
Estado  2 Pretensado de   2390. tn  Familia  2
Estado  3 Pretensado de   2390. tn  Familia  3
Estado  4 Pretensado de   2390. tn  Familia  4
Estado  5 Pretensado de   2390. tn  Familia  5
Estado  6 Pretensado de   2390. tn  Familia  6
Estado  7 Pretensado de   1495. tn  Familia  7
Estado  8 Pretensado de   2390. tn  Familia  1
Estado  9 Pretensado de   2390. tn  Familia  2
Estado 10 Pretensado de   2390. tn  Familia  3
Estado 11 Pretensado de   2390. tn  Familia  4
Estado 12 Pretensado de   2390. tn  Familia  5
Estado 13 Pretensado de   2390. tn  Familia  6
Estado 14 Pretensado de   1495. tn  Familia  7
```

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9509

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-11.23	411.6	-4432.8	45.72	46.40
		2	-1188.00	595.0	-4450.3	14.88	87.56
	2	2	-1188.00	595.0	-4450.3	14.88	87.56
		3	-1994.66	256.1	-4401.7	-6.90	115.14
	3	3	-1994.66	256.1	-4401.7	-6.90	115.14
		4	-2250.71	45.4	-4357.0	-14.11	123.59
	4	4	-2250.71	45.4	-4357.0	-14.11	123.59
		5	-2219.31	-41.5	-4331.3	-13.55	122.23
	5	5	-2219.31	-41.5	-4331.3	-13.55	122.23
		6	-1992.26	-163.1	-4293.1	-7.96	113.93
	6	6	-1992.26	-163.1	-4293.1	-7.96	113.93
		7	-1524.89	-282.3	-4251.8	3.93	97.22
	7	7	-1524.89	-282.3	-4251.8	3.93	97.22
		8	-824.95	-399.1	-4207.7	21.93	72.40
	8	8	-824.95	-399.1	-4207.7	21.93	72.40
		9	98.19	-513.6	-4165.8	45.83	39.82
	9	9	98.19	-513.6	-4165.8	45.83	39.82
		10	1241.84	-629.7	-4151.2	75.83	-0.15
	10	10	1241.84	-629.7	-4151.2	75.83	-0.15
		11	1948.17	-41.5	-4285.9	95.85	-23.34
2	11	11	1948.17	1.1	-4285.9	95.85	-23.34
		12	888.80	451.3	-4372.9	68.82	14.45
	12	12	888.80	451.3	-4372.9	68.82	14.45
		13	-733.45	530.7	-4511.9	27.50	72.37
	13	13	-456.29	443.7	-3752.1	26.92	54.83
		14	-1392.02	411.2	-3772.2	2.46	87.62
	14	14	-1392.02	411.2	-3772.2	2.46	87.62
		15	-1938.09	159.6	-3854.9	-11.08	107.49
	15	15	-1938.09	159.6	-3854.9	-11.08	107.49
		16	-2148.62	1.2	-3905.2	-16.11	115.34
	16	16	-2148.62	1.2	-3905.2	-16.11	115.34
		17	-2030.52	-142.0	-3942.8	-12.60	111.62
	17	17	-2030.52	-142.0	-3942.8	-12.60	111.62
		18	-1605.37	-287.6	-3975.5	-1.06	97.16
	18	18	-1605.37	-287.6	-3975.5	-1.06	97.16
		19	-867.36	-435.1	-4003.1	18.69	71.75
	19	19	-867.36	-435.1	-4003.1	18.69	71.75
		20	833.33	-658.4	-4034.8	63.85	12.87
	20	20	833.33	-658.4	-4034.8	63.85	12.87
		21	2213.12	1.1	-4265.6	102.62	-32.78
3	21	21	2213.12	-0.2	-4265.6	102.62	-32.78
		22	996.92	606.3	-4375.6	71.70	10.71
	22	22	996.92	606.3	-4375.6	71.70	10.71
		23	-753.68	529.4	-4511.9	26.96	73.07
	23	23	-476.52	442.4	-3752.1	26.38	55.54
		24	-1409.55	409.9	-3772.2	2.00	88.23
	24	24	-1409.55	409.9	-3772.2	2.00	88.23
		25	-1952.91	158.3	-3854.9	-11.47	108.01

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9509

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-1952.91	158.3	-3854.9	-11.47	108.01
		26	-2160.75	-0.1	-3905.2	-16.43	115.76
	26	26	-2160.75	-0.1	-3905.2	-16.43	115.76
		27	-2039.94	-143.3	-3942.8	-12.85	111.95
	27	27	-2039.94	-143.3	-3942.8	-12.85	111.95
		28	-1612.09	-288.9	-3975.5	-1.23	97.39
	28	28	-1612.09	-288.9	-3975.5	-1.23	97.39
		29	-871.38	-436.4	-4003.1	18.58	71.89
	29	29	-871.38	-436.4	-4003.1	18.58	71.89
		30	833.36	-659.7	-4034.8	63.85	12.87
	30	30	833.36	-659.7	-4034.8	63.85	12.87
		31	2217.21	-0.2	-4265.6	102.73	-32.92
4	31	31	2217.20	0.9	-4265.6	102.73	-32.92
		32	997.67	607.4	-4375.6	71.72	10.68
	32	32	997.67	607.4	-4375.6	71.72	10.68
		33	-756.25	530.5	-4511.9	26.90	73.16
	33	33	-479.10	443.5	-3752.1	26.32	55.63
		34	-1414.34	411.0	-3772.2	1.87	88.40
	34	34	-1414.34	411.0	-3772.2	1.87	88.40
		35	-1959.92	159.4	-3854.9	-11.65	108.25
	35	35	-1959.92	159.4	-3854.9	-11.65	108.25
		36	-2169.98	1.0	-3905.2	-16.67	116.09
	36	36	-2169.98	1.0	-3905.2	-16.67	116.09
		37	-2051.39	-142.3	-3942.8	-13.15	112.35
	37	37	-2051.39	-142.3	-3942.8	-13.15	112.35
		38	-1625.75	-287.9	-3975.5	-1.59	97.87
	38	38	-1625.75	-287.9	-3975.5	-1.59	97.87
		39	-887.26	-435.3	-4003.1	18.16	72.44
	39	39	-887.26	-435.3	-4003.1	18.16	72.44
		40	814.16	-658.6	-4034.8	63.34	13.53
	40	40	814.16	-658.6	-4034.8	63.34	13.53
		41	2194.67	0.9	-4265.6	102.13	-32.13
5	41	41	2194.67	-3.1	-4265.6	102.13	-32.13
		42	987.52	603.4	-4375.6	71.45	11.04
	42	42	987.52	603.4	-4375.6	71.45	11.04
		43	-754.03	526.5	-4511.9	26.96	73.09
	43	43	-476.88	439.5	-3752.1	26.38	55.55
		44	-1403.77	407.9	-3771.9	2.14	88.03
	44	44	-1403.77	407.9	-3771.9	2.14	88.03
		45	-1952.67	160.4	-3853.4	-11.48	107.98
	45	45	-1952.67	160.4	-3853.4	-11.48	107.98
		46	-2143.54	-18.4	-3908.4	-15.94	115.20
	46	46	-2143.54	-18.4	-3908.4	-15.94	115.20
		47	-1994.66	-150.7	-3943.6	-11.65	110.38
	47	47	-1994.66	-150.7	-3943.6	-11.65	110.38
		48	-1558.57	-289.2	-3975.1	0.17	95.53
	48	48	-1558.57	-289.2	-3975.1	0.17	95.53
		49	-820.78	-433.7	-4002.6	19.91	70.12
	49	49	-820.78	-433.7	-4002.6	19.91	70.12
		50	878.86	-660.7	-4034.7	65.05	11.28

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9509

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	878.86	-660.7	-4034.7	65.05	11.28
		51	2271.16	-3.1	-4265.6	104.15	-34.80
6	51	51	2271.16	11.1	-4265.6	104.15	-34.80
		52	1019.64	617.6	-4375.6	72.30	9.92
	52	52	1019.64	617.6	-4375.6	72.30	9.92
		53	-766.27	540.7	-4511.9	26.63	73.51
	53	53	-489.11	453.7	-3752.1	26.05	55.98
		54	-1445.68	421.2	-3772.2	1.04	89.49
	54	54	-1445.68	421.2	-3772.2	1.04	89.49
		55	-2012.58	169.6	-3854.9	-13.04	110.08
	55	55	-2012.58	169.6	-3854.9	-13.04	110.08
		56	-2243.96	11.2	-3905.2	-18.62	118.66
	56	56	-2243.96	11.2	-3905.2	-18.62	118.66
		57	-2146.69	-132.0	-3942.8	-15.67	115.67
	57	57	-2146.69	-132.0	-3942.8	-15.67	115.67
		58	-1742.37	-277.6	-3975.5	-4.67	101.93
	58	58	-1742.37	-277.6	-3975.5	-4.67	101.93
		59	-1025.20	-425.1	-4003.1	14.52	77.25
	59	59	-1025.20	-425.1	-4003.1	14.52	77.25
		60	644.23	-648.4	-4034.8	58.86	19.45
	60	60	644.23	-648.4	-4034.8	58.86	19.45
		61	1992.74	11.1	-4265.6	96.81	-25.10
7	61	61	1992.74	29.0	-4265.6	96.81	-25.10
		62	685.27	635.5	-4375.6	63.48	21.56
	62	62	685.27	635.5	-4375.6	63.48	21.56
		63	-1156.60	558.6	-4511.9	16.34	87.10
	63	63	-511.30	333.9	-2610.3	13.62	44.90
		64	-1088.41	334.6	-2615.9	-1.54	65.05
	64	64	-1088.41	334.6	-2615.9	-1.54	65.05
		65	-1603.49	215.1	-2655.2	-14.71	83.39
	65	65	-1603.49	215.1	-2655.2	-14.71	83.39
		66	-1900.87	89.8	-2697.7	-22.11	94.18
	66	66	-1900.87	89.8	-2697.7	-22.11	94.18
		67	-1953.41	-49.8	-2733.1	-23.13	96.38
	67	67	-1953.41	-49.8	-2733.1	-23.13	96.38
		68	-1781.47	-172.0	-2757.6	-18.34	90.65
	68	68	-1781.47	-172.0	-2757.6	-18.34	90.65
		69	-1391.45	-295.7	-2776.4	-7.86	77.26
	69	69	-1391.45	-295.7	-2776.4	-7.86	77.26
		70	-782.38	-419.9	-2789.4	8.33	56.19
	70	70	-782.38	-419.9	-2789.4	8.33	56.19
		71	-39.54	-417.3	-2816.1	28.19	30.61

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8575

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-10.13	348.0	-3997.6	41.23	41.85
		2	-1024.84	513.3	-4013.4	14.64	77.34
	2	2	-1024.84	513.3	-4013.4	14.64	77.34
		3	-1705.79	207.7	-3969.5	-3.77	100.59
	3	3	-1705.79	207.7	-3969.5	-3.77	100.59
		4	-1890.20	17.7	-3929.2	-9.05	106.59
	4	4	-1890.20	17.7	-3929.2	-9.05	106.59
		5	-1815.37	-60.7	-3906.1	-7.31	103.75
	5	5	-1815.37	-60.7	-3906.1	-7.31	103.75
		6	-1564.10	-170.3	-3871.6	-1.05	94.64
	6	6	-1564.10	-170.3	-3871.6	-1.05	94.64
		7	-1096.10	-277.9	-3834.4	10.90	77.96
	7	7	-1096.10	-277.9	-3834.4	10.90	77.96
		8	-418.38	-383.2	-3794.5	28.36	53.95
	8	8	-418.38	-383.2	-3794.5	28.36	53.95
		9	460.64	-486.5	-3756.8	51.14	22.96
	9	9	460.64	-486.5	-3756.8	51.14	22.96
		10	1538.51	-591.1	-3743.6	79.42	-14.71
	10	10	1538.51	-591.1	-3743.6	79.42	-14.71
		11	2222.00	-60.7	-3865.1	98.70	-37.24
2	11	11	2222.00	8.4	-3865.1	98.70	-37.24
		12	1243.65	414.4	-3943.6	73.72	-2.37
	12	12	1243.65	414.4	-3943.6	73.72	-2.37
		13	-242.31	486.0	-4068.9	35.85	50.67
	13	13	7.63	407.5	-3383.8	35.32	34.86
		14	-851.55	378.2	-3401.8	12.86	64.96
	14	14	-851.55	378.2	-3401.8	12.86	64.96
		15	-1359.33	151.3	-3476.4	0.25	83.41
	15	15	-1359.33	151.3	-3476.4	0.25	83.41
		16	-1564.53	8.5	-3521.7	-4.69	91.03
	16	16	-1564.53	8.5	-3521.7	-4.69	91.03
		17	-1473.35	-120.7	-3555.7	-1.93	88.20
	17	17	-1473.35	-120.7	-3555.7	-1.93	88.20
		18	-1105.27	-252.0	-3585.2	8.08	75.70
	18	18	-1105.27	-252.0	-3585.2	8.08	75.70
		19	-455.05	-385.0	-3610.1	25.48	53.32
	19	19	-455.05	-385.0	-3610.1	25.48	53.32
		20	1055.67	-586.4	-3638.7	65.60	1.01
	20	20	1055.67	-586.4	-3638.7	65.60	1.01
		21	2276.98	8.4	-3846.8	99.96	-39.35
3	21	21	2276.98	-2.2	-3846.8	99.96	-39.35
		22	1186.54	544.8	-3946.0	72.24	-0.35
	22	22	1186.54	544.8	-3946.0	72.24	-0.35
		23	-385.82	475.4	-4068.9	32.06	55.67
	23	23	-135.88	397.0	-3383.8	31.54	39.85
		24	-973.06	367.6	-3401.8	9.66	69.19
	24	24	-973.06	367.6	-3401.8	9.66	69.19
		25	-1458.84	140.8	-3476.4	-2.37	86.88

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8575

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-1458.84	140.8	-3476.4	-2.37	86.88
		26	-1642.04	-2.1	-3521.7	-6.73	93.73
	26	26	-1642.04	-2.1	-3521.7	-6.73	93.73
		27	-1528.86	-131.3	-3555.7	-3.40	90.14
	27	27	-1528.86	-131.3	-3555.7	-3.40	90.14
		28	-1138.77	-262.6	-3585.2	7.19	76.86
	28	28	-1138.77	-262.6	-3585.2	7.19	76.86
		29	-466.56	-395.6	-3610.1	25.17	53.72
	29	29	-466.56	-395.6	-3610.1	25.17	53.72
		30	1077.16	-597.0	-3638.7	66.17	0.27
	30	30	1077.16	-597.0	-3638.7	66.17	0.27
		31	2331.49	-2.2	-3846.8	101.39	-41.25
4	31	31	2331.49	0.8	-3846.8	101.39	-41.25
		32	1231.61	547.8	-3946.0	73.43	-1.92
	32	32	1231.61	547.8	-3946.0	73.43	-1.92
		33	-350.21	478.4	-4068.9	33.00	54.43
	33	33	-100.26	400.0	-3383.8	32.48	38.61
		34	-943.74	370.7	-3401.8	10.43	68.17
	34	34	-943.74	370.7	-3401.8	10.43	68.17
		35	-1435.82	143.8	-3476.4	-1.77	86.08
	35	35	-1435.82	143.8	-3476.4	-1.77	86.08
		36	-1625.31	0.9	-3521.7	-6.29	93.14
	36	36	-1625.31	0.9	-3521.7	-6.29	93.14
		37	-1518.43	-128.3	-3555.7	-3.12	89.77
	37	37	-1518.43	-128.3	-3555.7	-3.12	89.77
		38	-1134.64	-259.6	-3585.2	7.30	76.72
	38	38	-1134.64	-259.6	-3585.2	7.30	76.72
		39	-468.72	-392.5	-3610.1	25.12	53.79
	39	39	-468.72	-392.5	-3610.1	25.12	53.79
		40	1065.55	-593.9	-3638.7	65.86	0.67
	40	40	1065.55	-594.0	-3638.7	65.86	0.67
		41	2310.44	0.8	-3846.8	100.84	-40.51
5	41	41	2310.44	-0.9	-3846.8	100.84	-40.51
		42	1216.08	546.0	-3946.0	73.02	-1.38
	42	42	1216.08	546.0	-3946.0	73.02	-1.38
		43	-360.21	476.7	-4068.9	32.74	54.78
	43	43	-110.27	398.2	-3383.7	32.22	38.96
		44	-949.98	369.6	-3401.5	10.26	68.38
	44	44	-949.98	369.6	-3401.5	10.26	68.38
		45	-1448.80	146.5	-3475.1	-2.12	86.51
	45	45	-1448.80	146.5	-3475.1	-2.12	86.51
		46	-1624.74	-14.8	-3524.6	-6.25	93.15
	46	46	-1624.74	-14.8	-3524.6	-6.25	93.15
		47	-1494.30	-134.1	-3556.4	-2.48	88.94
	47	47	-1494.30	-134.1	-3556.4	-2.48	88.94
		48	-1104.85	-259.0	-3584.9	8.08	75.68
	48	48	-1104.85	-259.0	-3584.9	8.08	75.68
		49	-443.31	-389.3	-3609.6	25.78	52.90
	49	49	-443.31	-389.3	-3609.6	25.78	52.90
		50	1083.73	-594.0	-3638.6	66.34	0.04

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8575

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	1083.73	-594.0	-3638.6	66.34	0.04
		51	2333.59	-0.9	-3846.8	101.45	-41.32
6	51	51	2333.59	3.2	-3846.8	101.45	-41.32
		52	1226.27	550.2	-3946.0	73.29	-1.74
	52	52	1226.27	550.2	-3946.0	73.29	-1.74
		53	-362.97	480.8	-4068.9	32.67	54.87
	53	53	-113.03	402.4	-3383.7	32.14	39.06
		54	-961.46	373.0	-3401.8	9.96	68.79
	54	54	-961.46	373.0	-3401.8	9.96	68.79
		55	-1458.50	146.2	-3476.4	-2.36	86.86
	55	55	-1458.50	146.2	-3476.4	-2.36	86.86
		56	-1652.94	3.3	-3521.7	-7.02	94.10
	56	56	-1652.94	3.3	-3521.7	-7.02	94.10
		57	-1551.02	-125.9	-3555.7	-3.98	90.91
	57	57	-1551.02	-125.9	-3555.7	-3.98	90.91
		58	-1172.18	-257.2	-3585.2	6.31	78.03
	58	58	-1172.18	-257.2	-3585.2	6.31	78.03
		59	-511.22	-390.2	-3610.1	24.00	55.27
	59	59	-511.22	-390.2	-3610.1	24.00	55.27
		60	1015.62	-591.6	-3638.7	64.54	2.41
	60	60	1015.62	-591.6	-3638.7	64.54	2.41
		61	2253.07	3.2	-3846.8	99.33	-38.51
7	61	61	2253.07	49.0	-3846.8	99.33	-38.51
		62	1002.72	595.9	-3946.0	67.39	6.05
	62	62	1002.72	595.9	-3946.0	67.39	6.05
		63	-729.56	526.6	-4068.9	23.00	67.64
	63	63	-147.61	323.9	-2354.0	20.54	29.57
		64	-707.25	324.5	-2359.1	5.84	49.11
	64	64	-707.25	324.5	-2359.1	5.84	49.11
		65	-1210.95	216.8	-2394.5	-7.07	67.02
	65	65	-1210.95	216.8	-2394.5	-7.07	67.02
		66	-1518.33	103.8	-2432.9	-14.77	78.12
	66	66	-1518.33	103.8	-2432.9	-14.77	78.12
		67	-1604.90	-22.1	-2464.8	-16.73	81.46
	67	67	-1604.90	-22.1	-2464.8	-16.73	81.46
		68	-1489.03	-132.3	-2486.9	-13.44	77.66
	68	68	-1489.03	-132.3	-2486.9	-13.44	77.66
		69	-1176.50	-243.8	-2503.8	-5.03	66.95
	69	69	-1176.50	-243.8	-2503.8	-5.03	66.95
		70	-666.42	-355.9	-2515.5	8.54	49.31
	70	70	-666.42	-355.9	-2515.5	8.54	49.31
		71	-35.65	-353.5	-2539.6	25.42	27.60

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO-I E-1

FECHA

HOJA N.º

COMPROBACION DE TENSIONES

A las tensiones obtenidas mediante el programa de viga continua se sumaran las producidas por el gradiente térmico y las fuerzas longitudinales reológicas

Las tensiones pésivas se obtienen en las juntas de construcción en las fases intermedias. Para reducir las tracciones en la zona del anclaje pasivo se tesan los cables al 80% y se anclan al 75%, consiguiendo reducir las pérdidas en esta zona.

Las tracciones son inferiores a la resistencia a tracción del hormigón : $0.45 * \sqrt[3]{350^2} = 22.4\ kg/cm^2$ en todas las secciones en estudio

A continuación se adjunta :

- Tensiones en construcción y servicio producidas por las sobrecargas + peso propio + diferencial
- Tensiones producidas por el gradiente térmico, fuerzas longitudinales reológicas y cables producidas por el frenado.
- Tensiones totales, obtenidas a tracciones y anchos resultantes con los cables tesados y anclados al 75%
- Tensiones totales, obtenidas a tracciones y anchos resultantes con los cables tesados al 80%

Tensiones en Construccion (kg/cm2) Estado 1

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	13.	94.	15.	104.	10.	-13.	25.	90.
	3	-12.	126.	-13.	139.	18.	-23.	5.	115.
	4	-22.	138.	-24.	152.	23.	-30.	-1.	122.
	5	-23.	139.	-26.	153.	25.	-33.	0.	120.
	6	-20.	134.	-22.	147.	25.	-33.	4.	114.
	7	-10.	119.	-11.	131.	23.	-30.	12.	101.
	8	7.	97.	8.	106.	18.	-24.	25.	83.
	9	30.	66.	32.	72.	10.	-14.	43.	59.
	10	59.	27.	64.	30.	0.	0.	65.	29.
	11	77.	6.	85.	6.	-12.	16.	73.	23.
2	1	77.	6.	85.	6.	-12.	16.	73.	23.
	2	49.	45.	54.	50.	-3.	4.	51.	54.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 2

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	16.	90.	18.	99.	8.	-11.	26.	89.
	3	-6.	118.	-7.	130.	14.	-18.	7.	112.
	4	-13.	126.	-14.	139.	17.	-23.	3.	116.
	5	-12.	124.	-13.	137.	18.	-24.	5.	113.
	6	-5.	115.	-6.	126.	16.	-21.	10.	105.
	7	8.	96.	9.	106.	12.	-15.	20.	91.
	8	27.	70.	30.	77.	5.	-6.	35.	70.
	9	53.	35.	58.	39.	-5.	6.	53.	45.
	10	85.	-7.	93.	-8.	-17.	22.	76.	14.
	11	106.	-32.	117.	-36.	-31.	41.	86.	5.
2	1	106.	-32.	117.	-36.	-31.	41.	86.	5.
	2	74.	12.	82.	13.	-7.	9.	75.	22.
	3	27.	67.	30.	74.	11.	-14.	41.	60.
	4	-1.	96.	-1.	105.	19.	-25.	18.	80.
	5	-17.	119.	-19.	131.	25.	-33.	6.	99.
	6	-25.	131.	-27.	144.	28.	-36.	0.	107.
	7	-23.	130.	-26.	143.	28.	-37.	2.	106.
	8	-14.	118.	-15.	130.	25.	-33.	10.	96.
	9	4.	95.	5.	104.	20.	-26.	25.	78.
	10	48.	38.	53.	42.	7.	-9.	60.	33.
	11	85.	-5.	93.	-6.	-12.	16.	81.	11.
3	1	85.	-5.	93.	-6.	-12.	16.	81.	11.
	2	53.	40.	58.	44.	-3.	4.	55.	48.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 3

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	15.	91.	17.	101.	9.	-12.	26.	89.
	3	-8.	120.	-8.	132.	15.	-20.	7.	113.
	4	-15.	129.	-17.	142.	19.	-25.	2.	118.
	5	-15.	128.	-16.	141.	20.	-26.	4.	115.
	6	-9.	120.	-10.	132.	18.	-24.	8.	107.
	7	3.	103.	3.	113.	15.	-19.	18.	94.
	8	22.	77.	24.	85.	8.	-11.	32.	74.
	9	46.	43.	51.	48.	-1.	1.	50.	48.
	10	78.	2.	85.	2.	-12.	16.	73.	18.
	11	98.	-22.	108.	-24.	-26.	34.	82.	10.
2	1	98.	-22.	108.	-24.	-26.	34.	82.	10.
	2	71.	16.	78.	18.	-5.	7.	73.	24.
	3	29.	66.	31.	73.	10.	-13.	41.	60.
	4	3.	90.	4.	99.	16.	-22.	20.	78.
	5	-10.	110.	-11.	121.	20.	-26.	9.	95.
	6	-15.	117.	-16.	129.	21.	-28.	5.	101.
	7	-10.	113.	-11.	124.	19.	-25.	8.	98.
	8	2.	97.	3.	106.	15.	-20.	17.	87.
	9	24.	69.	26.	76.	8.	-10.	33.	66.
	10	72.	7.	79.	7.	-8.	11.	70.	18.
	11	113.	-42.	124.	-46.	-30.	40.	94.	-6.
3	1	113.	-42.	124.	-46.	-30.	40.	94.	-6.
	2	77.	8.	85.	9.	-7.	9.	78.	17.
	3	27.	68.	29.	75.	11.	-15.	40.	61.
	4	-1.	96.	-1.	106.	19.	-26.	18.	81.
	5	-18.	120.	-19.	132.	25.	-33.	5.	99.
	6	-25.	131.	-28.	144.	28.	-37.	0.	108.
	7	-24.	130.	-26.	143.	28.	-37.	2.	107.
	8	-14.	118.	-15.	130.	25.	-34.	10.	97.
	9	4.	95.	5.	104.	20.	-27.	25.	78.
	10	48.	38.	53.	42.	7.	-9.	60.	33.
	11	85.	-5.	93.	-6.	-12.	16.	81.	11.
4	1	85.	-5.	93.	-6.	-12.	16.	81.	11.
	2	53.	40.	58.	44.	-3.	4.	55.	48.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	16.	91.	17.	100.	9.	-11.	26.	89.
	3	-7.	120.	-8.	132.	15.	-19.	7.	112.
	4	-15.	129.	-16.	141.	18.	-24.	2.	117.
	5	-14.	127.	-15.	140.	19.	-25.	4.	114.
	6	-8.	118.	-9.	130.	18.	-24.	9.	107.
	7	4.	101.	5.	111.	14.	-18.	19.	93.
	8	23.	75.	25.	83.	7.	-10.	33.	73.
	9	48.	41.	53.	45.	-2.	2.	51.	47.
	10	79.	-1.	87.	-1.	-13.	17.	74.	17.
	11	100.	-25.	110.	-27.	-27.	36.	83.	9.
2	1	100.	-25.	110.	-27.	-27.	36.	83.	9.
	2	72.	15.	79.	16.	-6.	7.	74.	24.
	3	28.	66.	31.	73.	10.	-13.	41.	60.
	4	2.	92.	3.	101.	17.	-22.	20.	78.
	5	-12.	113.	-13.	124.	21.	-28.	8.	96.
	6	-17.	121.	-19.	133.	23.	-30.	4.	103.
	7	-14.	117.	-15.	129.	22.	-28.	6.	101.
	8	-2.	102.	-2.	113.	18.	-23.	15.	89.
	9	18.	76.	20.	84.	11.	-14.	31.	69.
	10	65.	15.	72.	17.	-4.	6.	68.	22.
	11	105.	-32.	116.	-35.	-26.	34.	90.	-2.
3	1	105.	-32.	116.	-35.	-26.	34.	90.	-2.
	2	74.	12.	81.	13.	-5.	6.	77.	19.
	3	28.	67.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-10.	111.	-12.	122.	20.	-27.	9.	95.
	6	-15.	118.	-17.	130.	21.	-28.	5.	102.
	7	-11.	113.	-12.	124.	19.	-26.	8.	99.
	8	2.	97.	2.	107.	15.	-20.	17.	87.
	9	23.	70.	26.	77.	8.	-10.	33.	66.
	10	71.	7.	79.	8.	-8.	11.	70.	19.
	11	113.	-42.	124.	-46.	-30.	40.	94.	-6.
4	1	113.	-42.	124.	-46.	-30.	40.	94.	-6.
	2	77.	8.	85.	9.	-7.	9.	78.	17.
	3	27.	68.	29.	75.	11.	-15.	40.	61.
	4	-1.	97.	-2.	106.	19.	-26.	18.	81.
	5	-18.	120.	-20.	132.	25.	-33.	5.	99.
	6	-25.	131.	-28.	145.	28.	-37.	0.	108.
	7	-24.	130.	-26.	144.	28.	-37.	2.	107.
	8	-14.	118.	-15.	130.	25.	-34.	10.	97.
	9	4.	95.	5.	104.	20.	-27.	25.	78.
	10	48.	38.	53.	42.	7.	-9.	60.	33.
	11	85.	-5.	93.	-6.	-12.	16.	81.	11.
5	1	85.	-5.	93.	-6.	-12.	16.	81.	11.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	53.	40.	58.	44.	-3.	4.	55.	48.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 5

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	15.	91.	17.	100.	9.	-11.	26.	89.
	3	-7.	120.	-8.	132.	15.	-19.	7.	113.
	4	-15.	129.	-16.	142.	18.	-24.	2.	117.
	5	-14.	127.	-16.	140.	19.	-26.	4.	115.
	6	-8.	119.	-9.	131.	18.	-24.	9.	107.
	7	4.	101.	4.	112.	14.	-19.	18.	93.
	8	23.	76.	25.	83.	8.	-10.	33.	73.
	9	48.	42.	52.	46.	-1.	2.	51.	48.
	10	79.	0.	87.	0.	-13.	17.	74.	17.
	11	100.	-24.	110.	-27.	-27.	36.	83.	9.
2	1	100.	-24.	110.	-27.	-27.	36.	83.	9.
	2	72.	15.	79.	17.	-5.	7.	73.	24.
	3	28.	66.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-11.	112.	-13.	123.	21.	-28.	8.	95.
	6	-17.	120.	-18.	132.	22.	-29.	4.	103.
	7	-13.	116.	-14.	128.	21.	-28.	7.	100.
	8	-1.	101.	-1.	111.	17.	-22.	16.	89.
	9	20.	74.	22.	82.	10.	-13.	32.	69.
	10	67.	13.	74.	14.	-5.	7.	68.	21.
	11	107.	-35.	118.	-38.	-27.	35.	91.	-3.
3	1	107.	-35.	118.	-38.	-27.	35.	91.	-3.
	2	75.	11.	82.	12.	-5.	7.	77.	19.
	3	28.	67.	30.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	102.	17.	-23.	19.	79.
	5	-12.	113.	-14.	124.	22.	-28.	8.	96.
	6	-18.	121.	-20.	134.	23.	-30.	4.	103.
	7	-14.	118.	-16.	129.	22.	-29.	6.	101.
	8	-2.	103.	-2.	113.	18.	-23.	15.	90.
	9	18.	76.	20.	84.	11.	-15.	31.	69.
	10	65.	15.	72.	17.	-4.	5.	67.	22.
	11	105.	-32.	116.	-35.	-25.	34.	90.	-2.
4	1	105.	-32.	116.	-35.	-25.	34.	90.	-2.
	2	74.	12.	81.	13.	-5.	6.	77.	19.
	3	28.	67.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-10.	111.	-12.	122.	20.	-27.	9.	95.
	6	-15.	118.	-17.	130.	21.	-28.	5.	102.
	7	-11.	113.	-12.	124.	20.	-26.	8.	99.
	8	2.	97.	2.	107.	15.	-20.	17.	87.
	9	23.	70.	26.	77.	8.	-10.	33.	66.
	10	71.	7.	78.	8.	-8.	11.	70.	19.
	11	113.	-42.	124.	-46.	-30.	40.	94.	-6.
5	1	113.	-42.	124.	-46.	-30.	40.	94.	-6.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 5

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	77.	8.	85.	9.	-7.	9.	78.	18.
	3	27.	69.	29.	75.	11.	-15.	40.	61.
	4	-1.	97.	-2.	106.	19.	-26.	18.	81.
	5	-18.	121.	-20.	133.	25.	-33.	5.	100.
	6	-25.	131.	-28.	145.	28.	-37.	0.	108.
	7	-23.	130.	-26.	143.	28.	-37.	2.	106.
	8	-13.	118.	-15.	129.	25.	-34.	11.	96.
	9	5.	94.	5.	104.	20.	-27.	25.	77.
	10	48.	38.	53.	42.	7.	-9.	60.	33.
	11	85.	-5.	93.	-6.	-12.	16.	81.	11.
6	1	85.	-5.	93.	-6.	-12.	16.	81.	11.
	2	53.	40.	58.	44.	-3.	4.	55.	48.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 6

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	16.	91.	17.	100.	9.	-11.	26.	89.
	3	-7.	120.	-8.	132.	15.	-19.	7.	113.
	4	-15.	129.	-16.	142.	18.	-24.	2.	117.
	5	-14.	127.	-16.	140.	19.	-26.	4.	114.
	6	-8.	119.	-9.	131.	18.	-24.	9.	107.
	7	4.	101.	5.	111.	14.	-18.	19.	93.
	8	23.	75.	25.	83.	8.	-10.	33.	73.
	9	48.	41.	53.	46.	-1.	2.	51.	48.
	10	79.	0.	87.	0.	-13.	17.	74.	17.
	11	100.	-24.	110.	-27.	-27.	36.	83.	9.
2	1	100.	-24.	110.	-27.	-27.	36.	83.	9.
	2	72.	15.	79.	17.	-5.	7.	73.	24.
	3	28.	66.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-12.	112.	-13.	123.	21.	-28.	8.	96.
	6	-17.	120.	-18.	132.	22.	-30.	4.	103.
	7	-13.	116.	-14.	128.	21.	-28.	7.	100.
	8	-1.	101.	-1.	111.	17.	-23.	16.	89.
	9	19.	75.	21.	82.	10.	-14.	32.	69.
	10	66.	14.	73.	15.	-5.	7.	68.	21.
	11	107.	-34.	118.	-37.	-26.	35.	91.	-3.
3	1	107.	-34.	118.	-37.	-26.	35.	91.	-3.
	2	75.	11.	82.	12.	-5.	7.	77.	19.
	3	28.	67.	31.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	101.	17.	-23.	19.	78.
	5	-12.	112.	-13.	124.	21.	-28.	8.	96.
	6	-17.	120.	-19.	133.	23.	-30.	4.	103.
	7	-13.	116.	-15.	128.	21.	-28.	7.	100.
	8	-1.	101.	-1.	111.	17.	-22.	16.	89.
	9	20.	75.	22.	82.	10.	-13.	32.	69.
	10	67.	13.	73.	14.	-5.	7.	68.	21.
	11	107.	-35.	118.	-38.	-27.	35.	91.	-3.
4	1	107.	-35.	118.	-38.	-27.	35.	91.	-3.
	2	75.	11.	82.	12.	-5.	7.	77.	19.
	3	28.	67.	30.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	102.	17.	-23.	19.	79.
	5	-12.	113.	-14.	125.	22.	-28.	8.	96.
	6	-18.	122.	-20.	134.	23.	-30.	3.	103.
	7	-14.	118.	-16.	130.	22.	-29.	6.	101.
	8	-2.	103.	-3.	113.	18.	-24.	15.	90.
	9	18.	77.	20.	84.	11.	-15.	31.	70.
	10	65.	15.	72.	17.	-4.	5.	67.	22.
	11	105.	-32.	116.	-35.	-25.	34.	90.	-2.
5	1	105.	-32.	116.	-35.	-25.	34.	90.	-2.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 6

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	74.	12.	81.	13.	-5.	6.	77.	19.
	3	28.	67.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-11.	111.	-12.	122.	20.	-27.	8.	95.
	6	-15.	118.	-17.	130.	21.	-28.	5.	102.
	7	-10.	112.	-11.	124.	20.	-26.	8.	98.
	8	3.	96.	3.	106.	15.	-20.	18.	86.
	9	24.	69.	26.	76.	8.	-10.	34.	66.
	10	71.	7.	79.	8.	-8.	11.	70.	19.
	11	113.	-42.	124.	-46.	-30.	40.	94.	-6.
6	1	113.	-42.	124.	-46.	-30.	40.	94.	-6.
	2	77.	8.	85.	9.	-7.	9.	78.	17.
	3	27.	69.	29.	75.	11.	-15.	40.	61.
	4	-1.	97.	-2.	106.	19.	-26.	18.	81.
	5	-18.	120.	-20.	132.	25.	-33.	5.	99.
	6	-25.	131.	-28.	145.	28.	-37.	0.	108.
	7	-24.	130.	-26.	144.	28.	-37.	2.	107.
	8	-14.	118.	-15.	130.	25.	-34.	10.	97.
	9	4.	95.	5.	104.	20.	-27.	25.	78.
	10	48.	38.	53.	42.	7.	-9.	60.	33.
	11	85.	-5.	93.	-6.	-12.	16.	81.	11.
7	1	85.	-5.	93.	-6.	-12.	16.	81.	11.
	2	53.	40.	58.	44.	-3.	4.	55.	48.
	3AI	6.	105.	7.	116.	0.	0.	7.	116.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 7

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	48.	48.	52.	53.	0.	0.	52.	53.
	2	16.	91.	17.	100.	9.	-11.	26.	89.
	3	-7.	120.	-8.	132.	15.	-19.	7.	113.
	4	-15.	129.	-16.	142.	18.	-24.	2.	117.
	5	-14.	127.	-16.	140.	19.	-26.	4.	114.
	6	-8.	119.	-9.	131.	18.	-24.	9.	107.
	7	4.	101.	5.	111.	14.	-18.	19.	93.
	8	23.	75.	25.	83.	8.	-10.	33.	73.
	9	48.	41.	53.	46.	-1.	2.	51.	48.
	10	79.	0.	87.	0.	-13.	17.	74.	17.
	11	100.	-24.	110.	-27.	-27.	36.	83.	9.
2	1	100.	-24.	110.	-27.	-27.	36.	83.	9.
	2	72.	15.	79.	17.	-5.	7.	73.	24.
	3	28.	66.	31.	73.	10.	-13.	41.	60.
	4	3.	91.	3.	100.	17.	-22.	20.	78.
	5	-12.	112.	-13.	123.	21.	-28.	8.	95.
	6	-17.	120.	-18.	132.	22.	-30.	4.	103.
	7	-13.	116.	-14.	128.	21.	-28.	7.	100.
	8	-1.	101.	-1.	111.	17.	-22.	16.	89.
	9	19.	75.	21.	82.	10.	-14.	32.	69.
	10	67.	13.	73.	15.	-5.	7.	68.	21.
	11	107.	-34.	118.	-38.	-27.	35.	91.	-3.
3	1	107.	-34.	118.	-38.	-27.	35.	91.	-3.
	2	75.	11.	82.	12.	-5.	7.	77.	19.
	3	28.	67.	31.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	101.	17.	-23.	19.	78.
	5	-12.	113.	-13.	124.	21.	-28.	8.	96.
	6	-17.	121.	-19.	133.	23.	-30.	4.	103.
	7	-13.	117.	-15.	128.	21.	-28.	7.	100.
	8	-1.	101.	-1.	112.	17.	-23.	16.	89.
	9	19.	75.	21.	82.	10.	-14.	32.	69.
	10	67.	13.	73.	15.	-5.	7.	68.	21.
	11	107.	-34.	118.	-38.	-27.	35.	91.	-3.
4	1	107.	-34.	118.	-38.	-27.	35.	91.	-3.
	2	75.	11.	82.	12.	-5.	7.	77.	19.
	3	28.	67.	30.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	101.	17.	-23.	19.	79.
	5	-12.	113.	-13.	124.	21.	-28.	8.	96.
	6	-17.	121.	-19.	133.	23.	-30.	4.	103.
	7	-14.	117.	-15.	129.	21.	-28.	6.	101.
	8	-2.	102.	-2.	112.	17.	-23.	16.	89.
	9	19.	75.	21.	83.	11.	-14.	31.	69.
	10	66.	14.	73.	16.	-5.	6.	68.	22.
	11	106.	-33.	117.	-37.	-26.	35.	91.	-2.
5	1	106.	-33.	117.	-37.	-26.	35.	91.	-2.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 7

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	74.	12.	82.	13.	-5.	6.	77.	19.
	3	28.	67.	31.	74.	10.	-14.	41.	60.
	4	2.	92.	2.	101.	17.	-23.	20.	78.
	5	-12.	113.	-13.	124.	21.	-28.	8.	96.
	6	-17.	120.	-18.	132.	22.	-30.	4.	103.
	7	-12.	115.	-13.	127.	21.	-28.	8.	99.
	8	0.	100.	0.	109.	17.	-22.	17.	87.
	9	21.	73.	23.	80.	10.	-13.	33.	67.
	10	68.	12.	75.	13.	-6.	8.	69.	20.
	11	109.	-36.	119.	-40.	-27.	36.	92.	-4.
6	1	109.	-36.	119.	-40.	-27.	36.	92.	-4.
	2	75.	10.	83.	11.	-5.	7.	78.	18.
	3	27.	67.	30.	74.	11.	-14.	41.	60.
	4	1.	93.	1.	103.	18.	-23.	19.	79.
	5	-14.	115.	-15.	126.	22.	-29.	7.	97.
	6	-19.	124.	-21.	136.	24.	-32.	3.	104.
	7	-16.	121.	-18.	133.	23.	-30.	5.	102.
	8	-5.	106.	-5.	117.	19.	-25.	14.	92.
	9	15.	80.	17.	89.	13.	-17.	29.	72.
	10	61.	20.	67.	22.	-2.	3.	65.	25.
	11	101.	-26.	111.	-29.	-23.	31.	88.	2.
7	1	101.	-26.	111.	-29.	-23.	31.	88.	2.
	2	66.	22.	73.	25.	-3.	4.	70.	29.
	3	16.	69.	17.	76.	11.	-15.	28.	61.
	4	-2.	68.	-2.	75.	16.	-21.	14.	53.
	5	-15.	87.	-17.	96.	19.	-26.	3.	70.
	6	-23.	98.	-25.	108.	21.	-28.	-4.	80.
	7	-24.	100.	-27.	110.	20.	-27.	-6.	84.
	8	-19.	94.	-21.	104.	18.	-24.	-3.	80.
	9	-8.	81.	-9.	89.	14.	-18.	5.	70.
	10	9.	59.	10.	64.	8.	-10.	17.	54.
	11	29.	32.	32.	35.	0.	0.	32.	35.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	50.	51.	50.	51.	50.	51.	50.	51.	50.	51.
	2	29.	80.	42.	62.	26.	84.	34.	73.	27.	82.
	3	13.	99.	37.	68.	7.	107.	23.	86.	11.	102.
	4	10.	102.	41.	61.	1.	113.	23.	85.	7.	106.
	5	12.	98.	46.	53.	0.	114.	26.	80.	8.	105.
	6	16.	92.	50.	47.	1.	112.	30.	74.	10.	100.
	7	23.	82.	54.	41.	5.	106.	36.	66.	16.	91.
	8	33.	67.	58.	35.	12.	95.	43.	54.	25.	78.
	9	46.	49.	61.	30.	22.	81.	52.	42.	37.	62.
	10	62.	28.	70.	18.	34.	65.	65.	24.	51.	43.
	11	64.	29.	72.	19.	18.	90.	67.	25.	45.	53.
2	1	64.	29.	72.	19.	18.	90.	67.	25.	45.	53.
	2	65.	29.	69.	25.	48.	53.	67.	28.	58.	39.
	3AI	42.	64.	63.	36.	29.	82.	51.	53.	37.	71.
	3AD	42.	44.	63.	17.	28.	63.	50.	33.	36.	52.
	4	25.	67.	55.	27.	12.	84.	37.	51.	20.	74.
	5	16.	81.	52.	33.	3.	98.	31.	62.	11.	88.
	6	12.	87.	51.	36.	-1.	105.	28.	67.	7.	94.
	7	14.	86.	52.	36.	0.	105.	29.	66.	8.	93.
	8	21.	78.	54.	34.	4.	100.	34.	60.	14.	86.
	9	33.	63.	57.	31.	13.	89.	42.	50.	25.	73.
	10	60.	28.	67.	19.	36.	60.	63.	24.	50.	40.
	11	71.	19.	79.	9.	20.	87.	74.	15.	51.	46.
3	1	71.	19.	79.	9.	20.	87.	74.	15.	51.	46.
	2	69.	25.	74.	18.	46.	56.	71.	22.	59.	37.
	3AI	42.	64.	65.	34.	23.	89.	51.	52.	34.	74.
	3AD	41.	45.	64.	15.	22.	70.	50.	33.	34.	55.
	4	24.	68.	56.	26.	7.	90.	37.	51.	18.	77.
	5	16.	82.	53.	33.	-1.	103.	30.	62.	9.	90.
	6	12.	88.	51.	36.	-4.	108.	28.	67.	6.	96.
	7	14.	86.	52.	36.	-2.	107.	29.	66.	8.	94.
	8	21.	78.	54.	34.	4.	100.	34.	60.	14.	87.
	9	33.	63.	57.	31.	13.	89.	42.	50.	25.	73.
	10	60.	28.	67.	18.	36.	59.	63.	24.	50.	40.
	11	72.	19.	79.	9.	20.	87.	75.	15.	51.	46.
4	1	72.	19.	79.	9.	20.	87.	75.	15.	51.	46.
	2	69.	25.	76.	16.	45.	57.	72.	21.	59.	38.
	3AI	42.	64.	66.	32.	23.	90.	52.	51.	34.	74.
	3AD	41.	45.	65.	13.	22.	70.	51.	32.	34.	55.
	4	24.	68.	57.	24.	7.	90.	37.	50.	17.	77.
	5	15.	82.	53.	32.	-1.	103.	31.	62.	9.	90.
	6	12.	88.	51.	36.	-4.	108.	28.	67.	6.	96.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	14.	86.	52.	36.	-2.	108.	29.	66.	7.	95.
	8	21.	78.	53.	35.	3.	101.	34.	61.	14.	87.
	9	32.	63.	57.	31.	13.	89.	42.	50.	25.	73.
	10	60.	28.	67.	19.	36.	59.	63.	24.	50.	40.
	11	71.	19.	79.	9.	19.	88.	74.	15.	50.	46.
5	1	71.	19.	79.	9.	19.	88.	74.	15.	50.	46.
	2	69.	25.	76.	16.	44.	57.	72.	21.	59.	38.
	3AI	42.	64.	66.	32.	22.	90.	52.	51.	34.	75.
	3AD	41.	45.	66.	13.	22.	71.	51.	32.	33.	55.
	4	24.	68.	57.	24.	7.	90.	38.	50.	18.	77.
	5	15.	82.	53.	32.	-1.	103.	31.	62.	9.	90.
	6	12.	87.	52.	35.	-4.	108.	28.	66.	6.	96.
	7	15.	85.	52.	36.	-1.	106.	30.	65.	8.	93.
	8	22.	76.	54.	34.	5.	99.	35.	60.	15.	85.
	9	34.	62.	57.	31.	15.	87.	43.	50.	26.	72.
	10	61.	27.	66.	19.	38.	57.	63.	24.	51.	39.
	11	72.	18.	80.	7.	20.	86.	75.	14.	51.	45.
6	1	72.	18.	80.	7.	20.	86.	75.	14.	51.	45.
	2	69.	25.	76.	16.	45.	57.	72.	21.	59.	38.
	3AI	42.	64.	66.	32.	22.	90.	52.	52.	34.	75.
	3AD	41.	45.	65.	13.	21.	71.	51.	32.	33.	55.
	4	24.	68.	57.	25.	7.	90.	37.	51.	17.	77.
	5	15.	83.	53.	33.	0.	102.	30.	63.	9.	90.
	6	11.	89.	50.	37.	-2.	106.	27.	68.	6.	96.
	7	13.	88.	49.	39.	0.	105.	27.	68.	8.	94.
	8	19.	80.	50.	40.	6.	97.	31.	64.	14.	87.
	9	31.	65.	52.	38.	17.	84.	39.	54.	25.	73.
	10	58.	31.	61.	26.	40.	54.	59.	29.	51.	40.
	11	69.	22.	77.	12.	23.	83.	72.	18.	50.	46.
7	1	69.	22.	77.	12.	23.	83.	72.	18.	50.	46.
	2	62.	34.	71.	22.	37.	67.	66.	29.	52.	47.
	3AI	31.	78.	57.	45.	11.	105.	41.	65.	23.	89.
	3AD	28.	32.	54.	-2.	8.	59.	38.	18.	20.	43.
	4	20.	44.	50.	3.	1.	67.	32.	27.	12.	53.
	5	10.	57.	44.	12.	-5.	77.	24.	39.	4.	65.
	6	4.	66.	39.	20.	-9.	83.	18.	48.	-1.	73.
	7	3.	69.	35.	26.	-7.	82.	16.	51.	-1.	74.
	8	5.	66.	33.	29.	-3.	76.	16.	51.	2.	70.
	9	11.	59.	32.	31.	6.	66.	19.	48.	9.	62.
	10	20.	47.	32.	31.	18.	51.	25.	41.	19.	48.
	11	31.	34.	31.	34.	31.	34.	31.	34.	31.	34.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	45.	46.	45.	46.	45.	46.	45.	46.	45.	46.
	2	28.	69.	42.	52.	25.	73.	33.	62.	27.	71.
	3	16.	84.	40.	53.	10.	92.	25.	72.	14.	87.
	4	15.	85.	45.	44.	6.	97.	27.	69.	11.	90.
	5	17.	81.	51.	36.	5.	96.	31.	63.	13.	87.
	6	21.	74.	56.	29.	6.	94.	35.	56.	15.	82.
	7	28.	64.	59.	24.	10.	88.	41.	48.	21.	74.
	8	37.	51.	61.	19.	16.	79.	47.	39.	29.	63.
	9	48.	36.	63.	17.	24.	67.	54.	28.	39.	48.
	10	62.	17.	69.	8.	34.	55.	65.	13.	51.	32.
	11	62.	20.	70.	10.	16.	81.	65.	16.	44.	44.
2	1	62.	20.	70.	10.	16.	81.	65.	16.	44.	44.
	2	66.	17.	69.	13.	48.	41.	67.	16.	59.	27.
	3AI	46.	46.	67.	19.	33.	65.	55.	35.	41.	54.
	3AD	46.	29.	67.	1.	32.	47.	54.	18.	40.	36.
	4	31.	49.	62.	9.	18.	66.	43.	33.	26.	56.
	5	23.	62.	60.	13.	10.	79.	38.	42.	18.	68.
	6	20.	68.	59.	16.	6.	85.	35.	47.	14.	74.
	7	20.	67.	58.	17.	6.	86.	36.	47.	15.	75.
	8	25.	61.	58.	18.	9.	83.	39.	44.	19.	70.
	9	35.	50.	59.	18.	15.	76.	44.	37.	27.	60.
	10	56.	22.	63.	13.	32.	54.	59.	19.	46.	35.
	11	63.	19.	70.	9.	11.	88.	66.	15.	42.	47.
3	1	63.	19.	70.	9.	11.	88.	66.	15.	42.	47.
	2	63.	21.	69.	13.	40.	51.	66.	18.	54.	33.
	3AI	42.	53.	65.	23.	23.	78.	51.	41.	34.	63.
	3AD	41.	35.	64.	5.	22.	60.	50.	23.	34.	45.
	4	27.	55.	59.	12.	10.	77.	40.	38.	20.	64.
	5	20.	66.	57.	17.	3.	88.	35.	47.	13.	75.
	6	17.	71.	56.	19.	1.	92.	33.	50.	11.	79.
	7	19.	70.	57.	19.	3.	91.	34.	50.	12.	78.
	8	24.	63.	57.	19.	7.	85.	37.	45.	18.	72.
	9	34.	51.	58.	18.	15.	76.	44.	38.	26.	61.
	10	57.	21.	64.	12.	33.	53.	60.	17.	47.	34.
	11	64.	17.	72.	7.	12.	86.	67.	13.	44.	44.
4	1	64.	17.	72.	7.	12.	86.	67.	13.	44.	44.
	2	65.	19.	72.	10.	41.	50.	68.	15.	55.	31.
	3AI	43.	51.	67.	19.	23.	77.	52.	39.	35.	61.
	3AD	42.	34.	66.	2.	23.	59.	52.	21.	35.	44.
	4	28.	53.	61.	10.	11.	76.	41.	36.	21.	62.
	5	21.	65.	58.	15.	4.	87.	36.	45.	14.	74.
	6	18.	70.	57.	18.	2.	91.	33.	49.	11.	79.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	19.	69.	57.	19.	3.	91.	34.	49.	12.	78.
	8	25.	63.	57.	19.	7.	85.	38.	45.	18.	72.
	9	34.	51.	58.	19.	15.	76.	44.	38.	26.	61.
	10	57.	22.	64.	12.	33.	53.	59.	18.	47.	34.
	11	64.	18.	71.	8.	12.	86.	67.	14.	43.	45.
5	1	64.	18.	71.	8.	12.	86.	67.	14.	43.	45.
	2	64.	19.	72.	10.	40.	51.	67.	16.	55.	32.
	3AI	42.	52.	67.	20.	23.	78.	52.	39.	35.	62.
	3AD	42.	34.	66.	2.	22.	60.	52.	21.	34.	45.
	4	28.	54.	61.	10.	11.	76.	41.	36.	21.	63.
	5	20.	66.	58.	16.	4.	87.	35.	46.	14.	74.
	6	17.	70.	57.	18.	2.	91.	33.	50.	11.	79.
	7	20.	68.	57.	19.	3.	90.	34.	49.	13.	77.
	8	25.	62.	57.	20.	8.	84.	38.	45.	18.	71.
	9	35.	50.	58.	19.	16.	75.	44.	38.	27.	60.
	10	57.	21.	63.	14.	34.	52.	59.	18.	48.	34.
	11	64.	17.	72.	7.	12.	86.	67.	13.	43.	45.
6	1	64.	17.	72.	7.	12.	86.	67.	13.	43.	45.
	2	65.	19.	71.	10.	40.	51.	67.	16.	55.	32.
	3AI	42.	52.	67.	20.	23.	78.	52.	39.	35.	62.
	3AD	42.	34.	66.	2.	22.	60.	52.	21.	34.	45.
	4	28.	54.	60.	10.	11.	76.	41.	36.	21.	62.
	5	20.	66.	58.	16.	6.	85.	35.	46.	14.	73.
	6	17.	71.	56.	19.	4.	88.	33.	50.	12.	78.
	7	19.	70.	55.	21.	6.	87.	33.	50.	13.	76.
	8	24.	63.	55.	23.	11.	80.	36.	47.	19.	70.
	9	34.	51.	55.	24.	20.	69.	42.	40.	28.	58.
	10	56.	22.	59.	18.	39.	45.	57.	21.	49.	32.
	11	63.	18.	71.	8.	17.	79.	66.	14.	45.	43.
7	1	63.	18.	71.	8.	17.	79.	66.	14.	45.	43.
	2	59.	26.	68.	14.	34.	60.	63.	21.	49.	39.
	3AI	33.	64.	58.	31.	12.	91.	43.	51.	25.	75.
	3AD	30.	22.	56.	-11.	10.	50.	40.	9.	22.	33.
	4	23.	33.	53.	-8.	5.	56.	35.	16.	15.	42.
	5	14.	45.	48.	0.	-1.	65.	28.	27.	8.	53.
	6	9.	53.	43.	7.	-4.	70.	23.	35.	4.	60.
	7	7.	56.	40.	13.	-3.	70.	20.	39.	3.	61.
	8	8.	55.	37.	18.	1.	65.	20.	40.	5.	59.
	9	13.	50.	34.	22.	7.	56.	21.	38.	11.	52.
	10	20.	40.	32.	25.	17.	44.	25.	34.	19.	42.
	11	28.	30.	28.	30.	28.	30.	28.	30.	28.	30.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	41.	42.	41.	42.	41.	42.	41.	42.	41.	42.
	2	26.	63.	39.	45.	23.	66.	31.	55.	25.	64.
	3	15.	76.	39.	45.	9.	84.	24.	63.	12.	79.
	4	13.	77.	44.	37.	4.	89.	26.	61.	10.	82.
	5	15.	74.	49.	29.	3.	90.	29.	56.	10.	80.
	6	18.	70.	52.	24.	3.	89.	32.	51.	12.	77.
	7	23.	62.	53.	22.	5.	86.	35.	46.	15.	72.
	8	29.	53.	53.	21.	8.	81.	39.	40.	21.	64.
	9	37.	41.	52.	22.	13.	73.	43.	34.	28.	54.
	10	47.	28.	54.	18.	19.	65.	50.	24.	36.	43.
	11	45.	34.	53.	23.	-1.	94.	48.	30.	26.	58.
2	1	45.	34.	53.	23.	-1.	94.	48.	30.	26.	58.
	2	52.	27.	55.	22.	34.	50.	53.	25.	45.	36.
	3AI	37.	49.	58.	22.	23.	67.	45.	38.	31.	56.
	3AD	36.	33.	57.	6.	23.	52.	45.	22.	31.	41.
	4	24.	50.	55.	9.	11.	67.	37.	34.	19.	56.
	5	18.	60.	55.	11.	5.	77.	33.	40.	13.	66.
	6	16.	64.	55.	13.	2.	82.	31.	44.	10.	71.
	7	17.	63.	55.	13.	2.	83.	32.	43.	11.	71.
	8	21.	58.	54.	15.	5.	80.	34.	41.	15.	67.
	9	29.	48.	53.	16.	9.	74.	39.	36.	21.	59.
	10	47.	25.	54.	16.	23.	57.	50.	21.	38.	38.
	11	51.	25.	59.	15.	-1.	94.	54.	21.	30.	53.
3	1	51.	25.	59.	15.	-1.	94.	54.	21.	30.	53.
	2	54.	23.	60.	15.	31.	54.	57.	20.	45.	35.
	3AI	36.	50.	59.	19.	18.	74.	46.	37.	29.	60.
	3AD	36.	34.	59.	3.	17.	59.	45.	22.	28.	44.
	4	24.	50.	56.	8.	7.	73.	37.	33.	17.	59.
	5	18.	60.	55.	11.	2.	82.	33.	40.	11.	69.
	6	15.	64.	55.	12.	0.	85.	31.	44.	9.	73.
	7	17.	64.	55.	13.	1.	85.	32.	43.	10.	72.
	8	21.	58.	54.	15.	4.	81.	34.	41.	14.	67.
	9	29.	49.	53.	16.	9.	74.	39.	36.	21.	59.
	10	47.	25.	55.	15.	23.	57.	50.	21.	38.	38.
	11	51.	25.	59.	15.	-1.	94.	54.	21.	30.	53.
4	1	51.	25.	59.	15.	-1.	94.	54.	21.	30.	53.
	2	54.	23.	61.	14.	31.	54.	57.	19.	45.	36.
	3AI	37.	50.	61.	18.	17.	75.	46.	37.	29.	60.
	3AD	36.	34.	60.	2.	17.	59.	46.	21.	28.	44.
	4	24.	50.	57.	7.	7.	73.	37.	33.	17.	59.
	5	18.	60.	56.	10.	1.	82.	33.	40.	11.	69.
	6	15.	64.	55.	13.	0.	85.	31.	44.	9.	73.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	17.	64.	54.	14.	0.	85.	32.	44.	10.	72.
	8	21.	58.	54.	15.	4.	81.	34.	41.	14.	68.
	9	29.	49.	53.	17.	9.	74.	38.	36.	21.	59.
	10	47.	25.	54.	16.	23.	57.	50.	21.	38.	38.
	11	51.	25.	58.	15.	-1.	94.	54.	21.	30.	53.
5	1	51.	25.	58.	15.	-1.	94.	54.	21.	30.	53.
	2	54.	23.	62.	13.	30.	55.	57.	19.	45.	36.
	3AI	37.	50.	61.	18.	17.	76.	46.	37.	29.	60.
	3AD	36.	34.	60.	2.	16.	60.	46.	21.	28.	44.
	4	24.	50.	57.	6.	7.	73.	37.	33.	17.	59.
	5	18.	60.	56.	10.	2.	81.	33.	40.	11.	69.
	6	16.	64.	55.	12.	0.	85.	31.	43.	9.	73.
	7	17.	63.	54.	14.	1.	84.	32.	43.	11.	71.
	8	22.	57.	54.	15.	5.	80.	35.	40.	15.	66.
	9	30.	48.	53.	17.	11.	72.	39.	36.	22.	58.
	10	48.	25.	53.	17.	25.	55.	50.	21.	38.	37.
	11	51.	25.	59.	14.	0.	93.	54.	21.	31.	52.
6	1	51.	25.	59.	14.	0.	93.	54.	21.	31.	52.
	2	55.	23.	61.	14.	30.	55.	57.	19.	45.	36.
	3AI	36.	50.	61.	18.	17.	76.	46.	37.	29.	60.
	3AD	36.	34.	60.	2.	16.	60.	46.	21.	28.	44.
	4	24.	50.	57.	7.	7.	72.	37.	33.	17.	59.
	5	17.	61.	55.	11.	3.	80.	33.	41.	12.	68.
	6	15.	65.	54.	14.	2.	83.	30.	45.	10.	72.
	7	16.	65.	52.	16.	3.	82.	30.	45.	11.	71.
	8	20.	60.	51.	19.	7.	77.	32.	43.	15.	66.
	9	28.	50.	49.	22.	14.	68.	36.	39.	22.	57.
	10	46.	27.	49.	22.	29.	50.	47.	25.	39.	36.
	11	49.	27.	57.	17.	4.	88.	53.	23.	31.	51.
7	1	49.	27.	57.	17.	4.	88.	53.	23.	31.	51.
	2	49.	30.	58.	18.	24.	63.	53.	25.	39.	43.
	3AI	28.	61.	53.	27.	7.	88.	38.	47.	20.	72.
	3AD	26.	23.	51.	-11.	5.	50.	36.	9.	17.	34.
	4	20.	31.	51.	-10.	2.	54.	32.	14.	13.	40.
	5	13.	40.	47.	-4.	-2.	61.	27.	22.	7.	48.
	6	9.	47.	43.	1.	-4.	64.	23.	29.	4.	54.
	7	8.	49.	40.	6.	-3.	63.	21.	32.	3.	55.
	8	9.	48.	37.	11.	1.	58.	20.	33.	6.	52.
	9	13.	44.	34.	16.	7.	50.	21.	32.	10.	46.
	10	19.	36.	30.	20.	16.	39.	23.	30.	18.	37.
	11	25.	28.	25.	28.	25.	28.	25.	28.	25.	28.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	37.	38.	37.	38.	37.	38.	37.	38.	37.	38.
	2	25.	54.	39.	36.	22.	58.	30.	47.	24.	56.
	3	17.	64.	40.	33.	11.	72.	26.	52.	14.	67.
	4	16.	63.	47.	23.	7.	75.	29.	47.	13.	68.
	5	19.	60.	53.	15.	7.	76.	32.	42.	14.	66.
	6	22.	55.	56.	10.	7.	75.	35.	37.	16.	63.
	7	26.	49.	57.	8.	8.	73.	38.	33.	19.	58.
	8	32.	41.	56.	9.	11.	68.	41.	28.	23.	52.
	9	38.	31.	53.	12.	14.	63.	44.	23.	29.	44.
	10	46.	20.	53.	11.	18.	58.	49.	16.	35.	35.
	11	42.	28.	50.	17.	-3.	88.	46.	24.	24.	52.
2	1	42.	28.	50.	17.	-3.	88.	46.	24.	24.	52.
	2	51.	18.	55.	13.	34.	41.	53.	16.	44.	27.
	3AI	39.	36.	60.	9.	26.	54.	48.	25.	34.	44.
	3AD	39.	22.	60.	-6.	25.	40.	47.	11.	33.	29.
	4	28.	36.	59.	-4.	16.	53.	41.	20.	23.	43.
	5	23.	45.	60.	-3.	10.	62.	38.	26.	18.	52.
	6	20.	49.	59.	-2.	7.	67.	36.	29.	15.	56.
	7	21.	50.	59.	0.	6.	69.	36.	30.	15.	57.
	8	24.	46.	57.	3.	7.	68.	37.	29.	17.	55.
	9	29.	39.	54.	7.	10.	65.	39.	27.	22.	50.
	10	43.	22.	50.	13.	19.	54.	46.	18.	33.	35.
	11	43.	27.	50.	17.	-9.	96.	46.	23.	22.	55.
3	1	43.	27.	50.	17.	-9.	96.	46.	23.	22.	55.
	2	49.	21.	55.	13.	26.	51.	51.	18.	40.	33.
	3AI	35.	42.	58.	11.	16.	67.	44.	30.	28.	52.
	3AD	35.	28.	58.	-3.	16.	52.	44.	15.	27.	37.
	4	25.	41.	57.	-1.	8.	63.	38.	24.	18.	50.
	5	20.	49.	57.	0.	4.	70.	35.	29.	14.	57.
	6	18.	52.	58.	0.	2.	73.	34.	31.	12.	61.
	7	19.	52.	57.	1.	3.	73.	34.	32.	13.	60.
	8	23.	48.	56.	4.	6.	70.	36.	30.	16.	57.
	9	29.	40.	53.	8.	9.	66.	39.	27.	21.	50.
	10	44.	21.	51.	12.	19.	53.	47.	17.	34.	34.
	11	44.	25.	52.	15.	-8.	94.	47.	21.	23.	53.
4	1	44.	25.	52.	15.	-8.	94.	47.	21.	23.	53.
	2	50.	19.	57.	10.	26.	51.	53.	15.	41.	32.
	3AI	36.	40.	60.	9.	17.	66.	46.	28.	28.	51.
	3AD	36.	26.	60.	-6.	16.	52.	45.	13.	28.	36.
	4	26.	40.	59.	-4.	9.	62.	39.	22.	19.	49.
	5	21.	48.	59.	-2.	5.	69.	36.	28.	14.	56.
	6	19.	52.	58.	0.	3.	72.	34.	31.	12.	60.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	20.	51.	58.	1.	3.	73.	35.	31.	13.	60.
	8	23.	47.	56.	4.	6.	70.	36.	30.	16.	56.
	9	29.	40.	53.	8.	10.	65.	39.	27.	21.	50.
	10	43.	21.	50.	12.	20.	53.	46.	18.	34.	34.
	11	44.	26.	51.	16.	-8.	94.	47.	22.	23.	53.
5	1	44.	26.	51.	16.	-8.	94.	47.	22.	23.	53.
	2	50.	20.	57.	10.	26.	52.	53.	16.	40.	33.
	3AI	36.	41.	60.	9.	16.	67.	46.	28.	28.	51.
	3AD	35.	27.	60.	-6.	16.	52.	45.	14.	28.	37.
	4	26.	40.	59.	-4.	9.	62.	39.	22.	19.	49.
	5	20.	48.	58.	-2.	4.	70.	36.	28.	14.	57.
	6	19.	52.	58.	0.	3.	73.	34.	31.	12.	60.
	7	20.	51.	57.	2.	4.	72.	35.	31.	14.	59.
	8	24.	47.	55.	5.	6.	69.	36.	30.	17.	56.
	9	29.	39.	53.	9.	11.	64.	39.	27.	22.	49.
	10	44.	21.	49.	14.	20.	52.	46.	18.	34.	34.
	11	44.	26.	52.	15.	-8.	94.	47.	21.	23.	53.
6	1	44.	26.	52.	15.	-8.	94.	47.	21.	23.	53.
	2	50.	20.	57.	11.	26.	52.	53.	16.	40.	32.
	3AI	36.	41.	60.	9.	16.	67.	46.	28.	28.	51.
	3AD	35.	27.	60.	-6.	16.	53.	45.	14.	28.	37.
	4	26.	40.	58.	-3.	9.	62.	39.	23.	19.	49.
	5	21.	48.	58.	-2.	6.	67.	36.	28.	15.	56.
	6	18.	52.	58.	0.	5.	69.	34.	31.	13.	59.
	7	19.	52.	56.	3.	7.	68.	34.	32.	14.	58.
	8	23.	48.	53.	7.	10.	65.	35.	31.	18.	54.
	9	29.	40.	50.	12.	15.	58.	37.	29.	23.	47.
	10	43.	22.	47.	17.	26.	45.	45.	20.	36.	31.
	11	43.	26.	51.	16.	-2.	87.	47.	22.	25.	50.
7	1	43.	26.	51.	16.	-2.	87.	47.	22.	25.	50.
	2	46.	25.	55.	13.	21.	58.	49.	20.	36.	38.
	3AI	28.	51.	54.	17.	8.	78.	39.	37.	20.	62.
	3AD	26.	16.	51.	-17.	6.	44.	36.	3.	18.	27.
	4	21.	23.	52.	-18.	3.	47.	34.	7.	14.	32.
	5	16.	31.	50.	-13.	0.	52.	29.	13.	9.	39.
	6	12.	37.	46.	-8.	-1.	54.	26.	19.	7.	44.
	7	10.	40.	43.	-3.	0.	53.	23.	22.	6.	45.
	8	11.	39.	39.	2.	3.	49.	22.	24.	8.	43.
	9	14.	36.	35.	8.	8.	43.	22.	25.	12.	39.
	10	18.	31.	30.	15.	16.	34.	23.	24.	17.	32.
	11	23.	25.	23.	25.	23.	25.	23.	25.	23.	25.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

F. REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
0	1	0	0	860	-8.8	1297	-13.0
2	2	1.01	-1.33	857	-8.7	1292	-12.9
4	3	2.01	-2.66	854	-8.7	1287	-12.9
6	4	3.02	-3.98	850	-8.7	1283	-12.8
8	5	4.02	-5.31	847	-8.6	1278	-12.8
10	6	5.03	-6.64	844	-8.6	1273	-12.7
12	7	6.03	-7.97	841	-8.6	1268	-12.7
14	8	7.04	-9.3	838	-8.5	1263	-12.6
16	9	8.05	-10.63	835	-8.5	1259	-12.6
18	10	9.05	-11.95	831	-8.5	1254	-12.5
20	11	10.06	-13.28	828	-8.4	1249	-12.5
20	11	10.06	-13.28	828	-8.4	1249	-12.5
22.5	2	9.75	-12.88	824	-8.4	1243	-12.4
25	3	9.45	-12.48	820	-8.4	1237	-12.4
25	3	9.45	-12.48	820	-8.4	1237	-12.4
27.5	4	9.24	-12.21	816	-8.3	1231	-12.3
30	5	9.04	-11.94	812	-8.3	1225	-12.2
32.5	6	8.83	-11.67	808	-8.2	1219	-12.2
35	7	8.63	-11.4	804	-8.2	1213	-12.1
37.5	8	8.43	-11.13	800	-8.2	1207	-12.1
40	9	8.22	-10.86	796	-8.1	1201	-12.0
42.5	20	7.92	-10.46	792	-8.1	1195	-11.9
45	21	7.61	-10.05	788	-8.0	1189	-11.9
45	21	7.61	-10.05	788	-8.0	1189	-11.9
47.5	2	7.69	-10.15	784	-8.0	1183	-11.8
50	3	7.77	-10.26	780	-8.0	1177	-11.8
50	3	7.77	-10.26	780	-8.0	1177	-11.8
52.5	4	7.82	-10.32	776	-7.9	1171	-11.7
55	5	7.87	-10.39	772	-7.9	1165	-11.6
57.5	6	7.92	-10.46	768	-7.8	1159	-11.6
60	7	7.97	-10.52	764	-7.8	1153	-11.5
62.5	8	8.02	-10.59	760	-7.8	1147	-11.5
65	9	8.07	-10.66	756	-7.7	1141	-11.4
67.5	30	8.15	-10.76	753	-7.7	1135	-11.3
70	31	8.22	-10.86	749	-7.6	1129	-11.3
70	31	8.22	-10.86	749	-7.6	1129	-11.3
72.5	2	8.22	-10.86	745	-7.6	1123	-11.2
75	3	8.22	-10.86	741	-7.6	1117	-11.2
75	3	8.22	-10.86	741	-7.6	1117	-11.2
77.5	4	8.22	-10.86	737	-7.5	1111	-11.1
80	5	8.22	-10.86	733	-7.5	1105	-11.0
82.5	6	8.22	-10.86	729	-7.4	1099	-11.0
85	7	8.22	-10.86	725	-7.4	1093	-10.9
87.5	8	8.22	-10.86	721	-7.4	1087	-10.9
90	9	8.22	-10.86	717	-7.3	1081	-10.8
92.5	40	8.22	-10.86	713	-7.3	1075	-10.7
95	41	8.22	-10.86	709	-7.2	1069	-10.7
95	41	8.22	-10.86	709	-7.2	1069	-10.7
97.5	2	8.22	-10.86	705	-7.2	1063	-10.6
100	3	8.22	-10.86	701	-7.1	1057	-10.6
100	3	8.22	-10.86	701	-7.1	1057	-10.6
102.5	4	8.22	-10.86	697	-7.1	1051	-10.5
105	5	8.22	-10.86	693	-7.1	1045	-10.4
107.5	6	8.22	-10.86	689	-7.0	1039	-10.4
110	7	8.22	-10.86	685	-7.0	1033	-10.3
112.5	8	8.22	-10.86	681	-6.9	1027	-10.3
115	9	8.22	-10.86	677	-6.9	1021	-10.2
117.5	50	8.22	-10.86	673	-6.9	1015	-10.1
120	51	8.22	-10.86	669	-6.8	1009	-10.1
120	51	8.22	-10.86	669	-6.8	1009	-10.1
122.5	2	8.22	-10.86	665	-6.8	1003	-10.0
125	3	8.22	-10.86	661	-6.7	997	-10.0
125	3	8.22	-10.86	661	-6.7	997	-10.0
127.5	4	8.22	-10.86	657	-6.7	991	-9.9
130	5	8.22	-10.86	653	-6.7	985	-9.8
132.5	6	8.22	-10.86	649	-6.6	979	-9.8
135	7	8.22	-10.86	645	-6.6	973	-9.7
137.5	8	8.22	-10.86	641	-6.5	967	-9.7
140	9	8.22	-10.86	637	-6.5	961	-9.6
142.5	60	8.22	-10.86	633	-6.5	955	-9.5
145	61	8.22	-10.86	629	-6.4	949	-9.5
145	61	8.22	-10.86	629	-6.4	949	-9.5
147.5	2	8.22	-10.86	625	-6.4	943	-9.4
150	3	8.22	-10.86	621	-6.3	937	-9.4
150	3	8.22	-10.86	621	-6.3	937	-9.4
152.5	4	8.22	-10.86	617	-6.3	931	-9.3
155	5	8.22	-10.86	613	-6.3	925	-9.2

F. REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
157.5	6	8.22	-10.86	609	-6.2	919	-9.2
160	7	8.22	-10.86	605	-6.2	913	-9.1
162.5	8	8.22	-10.86	601	-6.1	907	-9.1
165	9	8.22	-10.86	597	-6.1	901	-9.0
167.5	70	8.22	-10.86	593	-6.1	895	-8.9
170	71	8.22	-10.86	589	-6.0	889	-8.9
170	71	8.22	-10.86	589	-6.0	889	-8.9
172.5	2	8.22	-10.86	585	-6.0	883	-8.8
175	3	8.22	-10.86	581	-5.9	877	-8.8
175	3	8.22	-10.86	581	-5.9	877	-8.8
177.5	4	8.22	-10.86	577	-5.9	871	-8.7
180	5	8.22	-10.86	573	-5.8	865	-8.6
182.5	6	8.22	-10.86	569	-5.8	859	-8.6
185	7	8.22	-10.86	565	-5.8	853	-8.5
187.5	8	8.22	-10.86	561	-5.7	847	-8.5
190	9	8.22	-10.86	557	-5.7	841	-8.4
192.5	80	8.22	-10.86	553	-5.6	835	-8.3
195	81	8.22	-10.86	549	-5.6	829	-8.3
195	81	8.22	-10.86	549	-5.6	829	-8.3
197.5	2	8.22	-10.86	545	-5.6	823	-8.2
200	3	8.22	-10.86	541	-5.5	817	-8.2
200	3	8.22	-10.86	541	-5.5	817	-8.2
202.5	4	8.22	-10.86	538	-5.5	811	-8.1
205	5	8.22	-10.86	534	-5.4	805	-8.0
207.5	6	8.22	-10.86	530	-5.4	799	-8.0
210	7	8.22	-10.86	526	-5.4	793	-7.9
212.5	8	8.22	-10.86	522	-5.3	787	-7.9
215	9	8.22	-10.86	518	-5.3	781	-7.8
217.5	90	8.22	-10.86	514	-5.2	775	-7.7
220	91	8.22	-10.86	510	-5.2	769	-7.7
220	91	8.22	-10.86	510	-5.2	769	-7.7
222.5	2	8.22	-10.86	506	-5.2	763	-7.6
225	3	8.22	-10.86	502	-5.1	757	-7.6
225	3	8.22	-10.86	502	-5.1	757	-7.6
227.5	4	8.22	-10.86	498	-5.1	751	-7.5
230	5	8.22	-10.86	494	-5.0	745	-7.4
232.5	6	8.22	-10.86	490	-5.0	739	-7.4
235	7	8.22	-10.86	486	-5.0	733	-7.3
237.5	8	8.22	-10.86	482	-4.9	727	-7.3
240	9	8.22	-10.86	478	-4.9	721	-7.2
242.5	100	8.22	-10.86	474	-4.8	715	-7.1
245	101	8.22	-10.86	470	-4.8	709	-7.1
245	101	8.22	-10.86	470	-4.8	709	-7.1
247.5	2	8.22	-10.86	466	-4.8	703	-7.0
250	3	8.22	-10.86	462	-4.7	697	-7.0
250	3	8.22	-10.86	462	-4.7	697	-7.0
252.5	4	8.22	-10.86	458	-4.7	691	-6.9
255	5	8.22	-10.86	454	-4.6	685	-6.8
257.5	6	8.22	-10.86	450	-4.6	679	-6.8
260	7	8.22	-10.86	446	-4.5	673	-6.7
262.5	8	8.22	-10.86	442	-4.5	667	-6.7
265	9	8.22	-10.86	438	-4.5	661	-6.6
267.5	110	8.22	-10.86	434	-4.4	655	-6.5
270	111	8.22	-10.86	430	-4.4	649	-6.5
270	111	8.22	-10.86	430	-4.4	649	-6.5
272.5	2	8.22	-10.86	426	-4.3	642	-6.4
275	3	8.22	-10.86	422	-4.3	636	-6.4
275	3	8.22	-10.86	422	-4.3	636	-6.4
277.5	4	8.22	-10.86	418	-4.3	630	-6.3
280	5	8.22	-10.86	414	-4.2	624	-6.2
282.5	6	8.22	-10.86	410	-4.2	618	-6.2
285	7	8.22	-10.86	406	-4.1	612	-6.1
287.5	8	8.22	-10.86	402	-4.1	606	-6.1
290	9	8.22	-10.86	398	-4.1	600	-6.0
292.5	120	8.22	-10.86	394	-4.0	594	-5.9
295	121	8.22	-10.86	390	-4.0	588	-5.9
295	121	8.22	-10.86	390	-4.0	588	-5.9
297.5	2	8.22	-10.86	386	-3.9	582	-5.8
300	3	8.22	-10.86	382	-3.9	576	-5.8
300	3	8.22	-10.86	382	-3.9	576	-5.8
302.5	4	8.22	-10.86	378	-3.9	570	-5.7
305	5	8.22	-10.86	374	-3.8	564	-5.6
307.5	6	8.22	-10.86	370	-3.8	558	-5.6
310	7	8.22	-10.86	366	-3.7	552	-5.5
312.5	8	8.22	-10.86	362	-3.7	546	-5.5
315	9	8.22	-10.86	358	-3.7	540	-5.4
317.5	130	8.22	-10.86	354	-3.6	534	-5.3

F. REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
320	131	8.22	-10.86	350	-3.6	528	-5.3
320	131	8.22	-10.86	350	-3.6	528	-5.3
322.5	2	8.22	-10.86	346	-3.5	522	-5.2
325	3	8.22	-10.86	342	-3.5	516	-5.2
325	3	8.22	-10.86	342	-3.5	516	-5.2
327.5	4	8.22	-10.86	338	-3.5	510	-5.1
330	5	8.22	-10.86	334	-3.4	504	-5.0
332.5	6	8.22	-10.86	330	-3.4	498	-5.0
335	7	8.22	-10.86	326	-3.3	492	-4.9
337.5	8	8.22	-10.86	323	-3.3	486	-4.9
340	9	8.22	-10.86	319	-3.2	480	-4.8
342.5	140	8.22	-10.86	315	-3.2	474	-4.7
345	141	8.22	-10.86	311	-3.2	468	-4.7
345	141	8.22	-10.86	311	-3.2	468	-4.7
347.5	2	8.22	-10.86	307	-3.1	462	-4.6
350	3	8.22	-10.86	303	-3.1	456	-4.6
350	3	8.22	-10.86	303	-3.1	456	-4.6
352.5	4	8.22	-10.86	299	-3.0	450	-4.5
355	5	8.22	-10.86	295	-3.0	444	-4.4
357.5	6	8.22	-10.86	291	-3.0	438	-4.4
360	7	8.22	-10.86	287	-2.9	432	-4.3
362.5	8	8.22	-10.86	283	-2.9	426	-4.3
365	9	8.22	-10.86	279	-2.8	420	-4.2
367.5	150	8.22	-10.86	275	-2.8	414	-4.1
370	151	8.22	-10.86	271	-2.8	408	-4.1
370	151	8.22	-10.86	271	-2.8	408	-4.1
372.5	2	8.22	-10.86	267	-2.7	402	-4.0
375	3	8.22	-10.86	263	-2.7	396	-4.0
375	3	8.22	-10.86	263	-2.7	396	-4.0
377.5	4	8.22	-10.86	259	-2.6	390	-3.9
380	5	8.22	-10.86	255	-2.6	384	-3.8
382.5	6	8.22	-10.86	251	-2.6	378	-3.8
385	7	8.22	-10.86	247	-2.5	372	-3.7
387.5	8	8.22	-10.86	243	-2.5	366	-3.7
390	9	8.22	-10.86	239	-2.4	360	-3.6
392.5	160	8.22	-10.86	235	-2.4	354	-3.5
395	161	8.22	-10.86	231	-2.4	348	-3.5
395	161	8.22	-10.86	231	-2.4	348	-3.5
397.5	2	8.22	-10.86	227	-2.3	342	-3.4
400	3	8.22	-10.86	223	-2.3	336	-3.4
400	3	8.22	-10.86	223	-2.3	336	-3.4
402.5	4	8.22	-10.86	219	-2.2	330	-3.3
405	5	8.22	-10.86	215	-2.2	324	-3.2
407.5	6	8.22	-10.86	211	-2.2	318	-3.2
410	7	8.22	-10.86	207	-2.1	312	-3.1
412.5	8	8.22	-10.86	203	-2.1	306	-3.1
415	9	8.22	-10.86	199	-2.0	300	-3.0
417.5	170	8.22	-10.86	195	-2.0	294	-2.9
420	171	8.22	-10.86	191	-1.9	288	-2.9
420	171	8.22	-10.86	191	-1.9	288	-2.9
422.5	2	8.22	-10.86	187	-1.9	282	-2.8
425	3	8.22	-10.86	183	-1.9	276	-2.8
425	3	8.22	-10.86	183	-1.9	276	-2.8
427.5	4	8.22	-10.86	179	-1.8	270	-2.7
430	5	8.22	-10.86	175	-1.8	264	-2.6
432.5	6	8.22	-10.86	171	-1.7	258	-2.6
435	7	8.22	-10.86	167	-1.7	252	-2.5
437.5	8	8.22	-10.86	163	-1.7	246	-2.5
440	9	8.22	-10.86	159	-1.6	240	-2.4
442.5	180	8.22	-10.86	155	-1.6	234	-2.3
445	181	8.22	-10.86	151	-1.5	228	-2.3
445	181	8.22	-10.86	151	-1.5	228	-2.3
447.5	2	8.22	-10.86	147	-1.5	222	-2.2
450	3	8.22	-10.86	143	-1.5	216	-2.2
450	3	8.22	-10.86	143	-1.5	216	-2.2
452.5	4	8.22	-10.86	139	-1.4	210	-2.1
455	5	8.22	-10.86	135	-1.4	204	-2.0
457.5	6	8.22	-10.86	131	-1.3	198	-2.0
460	7	8.22	-10.86	127	-1.3	192	-1.9
462.5	8	8.22	-10.86	123	-1.3	186	-1.9
465	9	8.22	-10.86	119	-1.2	180	-1.8
467.5	190	8.22	-10.86	115	-1.2	174	-1.7
470	191	8.22	-10.86	111	-1.1	168	-1.7
470	191	8.22	-10.86	111	-1.1	168	-1.7
472.5	2	8.15	-10.76	108	-1.1	162	-1.6
475	3	8.07	-10.66	104	-1.1	156	-1.6
475	3	8.07	-10.66	104	-1.1	156	-1.6

F. REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
477.5	4	8.02	-10.59	100	-1.0	150	-1.5
480	5	7.97	-10.52	96	-1.0	144	-1.4
482.5	6	7.92	-10.46	92	-0.9	138	-1.4
485	7	7.87	-10.39	88	-0.9	132	-1.3
487.5	8	7.82	-10.32	84	-0.9	126	-1.3
490	9	7.76	-10.25	80	-0.8	120	-1.2
492.5	200	7.69	-10.15	76	-0.8	114	-1.1
495	201	7.61	-10.05	72	-0.7	108	-1.1
495	201	7.61	-10.05	72	-0.7	108	-1.1
497.5	2	7.92	-10.46	68	-0.7	102	-1.0
500	3	8.22	-10.86	64	-0.6	96	-1.0
500	3	8.22	-10.86	64	-0.6	96	-1.0
502.5	4	8.43	-11.13	60	-0.6	90	-0.9
505	5	8.63	-11.4	56	-0.6	84	-0.8
507.5	6	8.84	-11.67	52	-0.5	78	-0.8
510	7	9.04	-11.94	48	-0.5	72	-0.7
512.5	8	9.25	-12.21	44	-0.4	66	-0.7
515	9	9.45	-12.48	40	-0.4	60	-0.6
517.5	210	9.76	-12.89	36	-0.4	54	-0.5
520	211	10.06	-13.29	32	-0.3	48	-0.5
520	211	10.06	-13.29	32	-0.3	48	-0.5
522	2	8.49	-11.21	29	-0.3	43	-0.4
524	3	6.92	-9.14	25	-0.3	38	-0.4
524	3	6.92	-9.14	25	-0.3	38	-0.4
526	4	6.05	-8	22	-0.2	34	-0.3
528	5	5.19	-6.85	19	-0.2	29	-0.3
530	6	4.32	-5.71	16	-0.2	24	-0.2
532	7	3.46	-4.57	13	-0.1	19	-0.2
534	8	2.59	-3.43	10	-0.1	14	-0.1
536	9	1.73	-2.28	6	-0.1	10	-0.1
538	220	0.86	-1.14	3	-0.0	5	-0.0
540	221	0	0	0	0.0	0	0.0

TESADO Y ANCLADO AL 95 %

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		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
0	1	37.4	37.4	0.0	0.0	37.4	37.4	0.0	0.0	28.4	29.4	0.0	0.0	28.4	29.4	0.0	0.0
2	2	34.4	42.1	0.0	0.0	16.4	65.4	0.0	0.0	31.4	27.1	0.0	0.0	13.4	50.4	0.0	0.0
4	3	33.5	42.8	0.0	0.0	1.4	84.4	0.0	0.0	33.5	21.8	0.0	0.0	2.4	64.4	0.0	0.0
6	4	39.5	32.5	0.0	0.0	-2.5	89.5	-0.6	0.0	41.5	11.5	0.0	0.0	-1.5	67.5	-0.3	0.0
8	5	46.5	23.2	0.0	0.0	-3.5	88.5	-1.1	0.0	48.5	2.2	0.0	0.0	-1.5	67.5	-0.3	0.0
10	6	52.6	14.9	0.0	0.0	-2.5	86.5	-0.6	0.0	52.6	-4.1	0.0	-2.4	-1.5	67.5	-0.3	0.0
12	7	56.6	7.6	0.0	0.0	1.6	80.6	0.0	0.0	54.6	-7.4	0.0	-7.3	-0.4	64.6	-0.0	0.0
14	8	60.6	2.3	0.0	0.0	7.6	71.6	0.0	0.0	54.8	-8.7	0.0	-9.9	2.6	60.6	0.0	0.0
16	9	62.7	-2.0	0.0	-0.5	16.6	58.6	0.0	0.0	52.7	-7.0	0.0	-6.8	6.6	54.6	0.0	0.0
18	10	70.7	-13.3	0.0	-17.3	25.7	46.7	0.0	0.0	54.7	-10.3	0.0	-13.4	9.7	49.7	0.0	0.0
20	11	72.8	-12.6	0.0	-15.3	8.7	71.7	0.0	0.0	52.8	-4.6	0.0	-3.0	-11.3	79.7	-11.6	0.0
20	11	72.8	-12.6	0.0	-15.3	8.7	71.7	0.0	0.0	52.8	-4.6	0.0	-3.0	-11.3	79.7	-11.6	0.0
22.5	2	71.5	-8.1	0.0	-8.9	40.7	31.7	0.0	0.0	56.5	-8.1	0.0	-8.5	25.7	32.7	0.0	0.0
25	3	69.2	-1.7	0.0	-0.3	24.8	56.8	0.0	0.0	62.2	-11.7	0.0	-15.3	17.8	46.8	0.0	0.0
25	3	68.2	-18.7	0.0	-33.2	23.8	39.8	0.0	0.0	61.2	-25.7	0.0	-62.7	16.8	32.8	0.0	0.0
27.5	4	63.1	-11.4	0.0	-14.4	9.8	58.8	0.0	0.0	60.1	-24.4	0.0	-58.1	7.8	45.8	0.0	0.0
30	5	60.9	-6.1	0.0	-4.6	1.9	70.9	0.0	0.0	60.9	-23.1	0.0	-52.3	1.9	54.9	0.0	0.0
32.5	6	59.7	-2.8	0.0	-1.0	-2.1	77.9	-0.5	0.0	59.7	-21.8	0.0	-48.0	-1.1	58.9	-0.2	0.0
35	7	58.6	-1.5	0.0	-0.3	-2.1	78.9	-0.4	0.0	58.6	-19.5	0.0	-38.5	-2.1	60.9	-0.6	0.0
37.5	8	58.4	-0.2	0.0	-0.0	1.0	76.0	0.0	0.0	57.4	-16.2	0.0	-29.3	-1.0	61.0	-0.1	0.0
40	9	59.2	-0.8	0.0	-0.1	7.0	69.0	0.0	0.0	54.2	-10.8	0.0	-14.9	2.0	58.0	0.0	0.0
42.5	20	64.0	-5.4	0.0	-3.5	24.1	46.1	0.0	0.0	50.0	-5.4	0.0	-4.3	11.1	46.1	0.0	0.0
45	21	70.7	-9.0	0.0	-8.3	4.1	79.1	0.0	0.0	50.7	-1.0	0.0	-0.1	-16.9	87.1	-22.7	0.0
45	21	70.7	-9.0	0.0	-8.3	4.1	79.1	0.0	0.0	50.7	-1.0	0.0	-0.1	-16.9	87.1	-22.7	0.0
47.5	2	69.8	-5.0	0.0	-2.8	33.1	43.1	0.0	0.0	54.8	-5.0	0.0	-3.5	18.1	43.1	0.0	0.0
50	3	64.9	4.9	0.0	0.0	15.2	70.2	0.0	0.0	57.9	-6.1	0.0	-4.8	9.2	59.2	0.0	0.0
50	3	63.9	-13.1	0.0	-18.3	15.2	53.2	0.0	0.0	57.9	-21.1	0.0	-46.4	8.2	45.2	0.0	0.0
52.5	4	59.0	-5.1	0.0	-3.3	2.2	70.2	0.0	0.0	57.0	-19.1	0.0	-39.5	0.2	56.2	0.0	0.0
55	5	57.1	-0.1	0.0	-0.0	-4.7	80.3	-2.2	0.0	57.1	-18.1	0.0	-36.0	-3.7	63.3	-1.7	0.0
57.5	6	56.2	1.8	0.0	0.0	-6.7	85.3	-4.0	0.0	58.2	-17.2	0.0	-32.2	-5.7	66.3	-3.7	0.0
60	7	57.3	1.8	0.0	0.0	-4.7	84.3	-2.0	0.0	57.3	-18.2	0.0	-29.4	-4.7	65.3	-2.6	0.0
62.5	8	57.4	1.8	0.0	0.0	-0.6	78.4	-0.0	0.0	56.4	-13.2	0.0	-20.7	-1.8	63.4	-0.3	0.0
65	9	59.5	0.8	0.0	0.0	7.4	69.4	0.0	0.0	54.5	-10.2	0.0	-13.4	2.4	58.4	0.0	0.0
67.5	30	65.6	-6.3	0.0	-4.6	25.5	45.5	0.0	0.0	51.6	-6.3	0.0	-5.7	12.5	45.5	0.0	0.0
70	31	73.7	-11.4	0.0	-12.5	5.5	77.5	0.0	0.0	52.7	-3.4	0.0	-1.7	-14.5	86.5	-17.2	0.0
70	31	73.7	-11.4	0.0	-12.5	5.5	77.5	0.0	0.0	52.7	-3.4	0.0	-1.7	-14.5	86.5	-17.2	0.0
72.5	2	73.8	-8.3	0.0	-7.0	34.5	42.5	0.0	0.0	58.8	-8.3	0.0	-8.5	19.5	43.5	0.0	0.0
75	3	67.8	1.7	0.0	0.0	16.6	69.6	0.0	0.0	61.8	-9.3	0.0	-10.0	9.6	58.6	0.0	0.0
75	3	67.8	-16.3	0.0	-26.0	15.6	52.6	0.0	0.0	60.8	-23.3	0.0	-53.2	9.6	44.6	0.0	0.0
77.5	4	61.8	-7.2	0.0	-6.3	3.6	69.6	0.0	0.0	59.8	-21.2	0.0	-45.9	1.6	55.6	0.0	0.0
80	5	58.9	-2.2	0.0	-0.7	-3.3	79.7	-1.1	0.0	59.9	-20.2	0.0	-42.0	-2.3	62.7	-0.7	0.0
82.5	6	57.9	0.8	0.0	0.0	-5.3	84.7	-2.6	0.0	58.9	-18.2	0.0	-35.3	-4.3	65.7	-2.2	0.0
85	7	58.0	1.9	0.0	0.0	-4.3	84.7	-1.7	0.0	58.0	-16.1	0.0	-28.9	-4.3	65.7	-2.1	0.0
87.5	8	58.0	1.9	0.0	0.0	-0.2	78.8	-0.0	0.0	57.0	-13.1	0.0	-20.2	-1.2	63.8	-0.2	0.0
90	9	59.0	1.0	0.0	0.0	7.8	69.8	0.0	0.0	54.0	-10.0	0.0	-13.0	2.8	58.8	0.0	0.0
92.5	40	65.1	-6.0	0.0	-4.2	25.9	45.9	0.0	0.0	52.1	-6.0	0.0	-5.1	12.9	45.9	0.0	0.0
95	41	73.1	-11.0	0.0	-11.8	5.9	78.9	0.0	0.0	53.1	-3.0	0.0	-1.3	-15.1	86.9	-18.5	0.0
95	41	73.1	-11.0	0.0	-11.8	5.9	78.9	0.0	0.0	53.1	-3.0	0.0	-1.3	-15.1	86.9	-18.5	0.0
97.5	2	74.2	-7.9	0.0	-6.3	34.9	42.9	0.0	0.0	59.2	-7.9	0.0	-7.7	19.9	43.9	0.0	0.0
100	3	68.2	2.1	0.0	0.0	17.0	70.0	0.0	0.0	62.2	-8.9	0.0	-9.2	10.0	59.0	0.0	0.0
100	3	68.2	-15.9	0.0	-24.8	16.0	53.0	0.0	0.0	61.2	-22.9	0.0	-51.4	10.0	45.0	0.0	0.0
102.5	4	62.2	-6.8	0.0	-5.6	4.0	70.0	0.0	0.0	60.2	-20.8	0.0	-44.2	2.0	56.0	0.0	0.0
105	5	59.3	-1.8	0.0	-0.4	-2.9	80.1	-0.9	0.0	60.3	-19.8	0.0	-40.4	-1.9	63.1	-0.5	0.0
107.5	6	58.3	1.2	0.0	0.0	-4.9	85.1	-2.2	0.0	59.3	-17.8	0.0	-33.8	-3.9	66.1	-1.8	0.0
110	7	58.4	2.3	0.0	0.0	-3.9	85.1	-1.4	0.0	58.4	-15.7	0.0	-27.5	-3.9	66.1	-1.8	0.0
112.5	8	58.4	2.3	0.0	0.0	0.2	79.2	0.0	0.0	57.4	-12.7	0.0	-18.9	-0.8	64.2	-0.1	0.0
115	9	59.4	1.4	0.0	0.0	8.2	70.2	0.0	0.0	54.4	-9.6	0.0	-12.0	3.2	59.2	0.0	0.0
117.5	50	65.5	-5.6	0.0	-3.6	26.3	46.3	0.0	0.0	52.5	-5.6	0.0	-4.5	13.3	46.3	0.0	0.0
120	51	73.5	-10.6	0.0	-11.0	6.3	79.3	0.0	0.0	53.5	-2.6	0.0	-1.0	-14.7	87.3	-17.5	0.0
120	51	73.5	-10.6	0.0	-11.0	6.3	79.3	0.0	0.0	53.5	-2.6	0.0	-1.0	-14.7	87.3	-17.5	0.0
122.5	2	74.6	-7.5	0.0	-5.7	35.3	43.3	0.0	0.0	59.6	-7.5	0.0	-7.0	20.3	44.3	0.0	0.0
125	3	68.6	2.5	0.0	0.0	17.4	70.4	0.0	0.0	62.6	-8.5	0.0	-8.4	10.4	59.4	0.0	0.0
125	3	68.6	-15.5	0.0	-23.5	16.4	53.4	0.0	0.0	61.6	-22.5	0.0	-49.6	10.4	45.4	0.0	0.0
127.5	4	62.6	-6.4	0.0	-5.0	4.4	70.4	0.0	0.0	60.6	-20.4	0.0	-42.5	2.4	56.4	0.0	0.0
130	5	59.7	-1.4	0.0	-0.3	-2.5	80.5	-0.6	0.0	60.7	-19.4	0.0	-38.8	-1.5	63.5	-0.3	0.0
132.5	6	58.7	1.6	0.0	0.0	-4.5	85.5	-1.9	0.0	59.7	-17.4	0.0	-32.3	-3.5	66.5	-1.4	0.0
135	7	58.8	2.7	0.0	0.0	-3.5	85.5	-1.1	0.0	58.8	-15.3	0.0	-26.2	-3.5	66.5	-1.4	0.0
137.5	8	58.8	2.7	0.0	0.0	0.6	79.6	0.0	0.0	57.8	-12.3	0.0	-17.8	-0.4	64.6	-0.0	0.0
140	9	59.8	1.8	0.0	0.0	8.6	70.6	0.0	0.0	54.8	-9.2	0.0	-11.0	3.6	59.6	0.0	0.0
142.5	60	65.9	-5.2	0.0	-3.1	26.7	46.7	0.0	0.0	52.9	-5.2	0.0	-3.8	13.7	46.7	0.0	0.0
145	61	73.9	-10.2	0.0	-10.1	6.7	79.7	0.0	0.0	53.9	-2.2	0.0	-0.7	-14.3	87.7	-16.6	0.0
145	61	73.9	-10.2	0.0	-10.1	6.7	79.7	0.0	0.0	53.9	-2.2	0.0	-0.7	-14.3	87.7	-16.6	0.0
147.5	2	75.0	-7.1	0.0	-5.1	35.7	43.7	0.0	0.0	60.0	-7.1	0.0	-6.2	20.7	44.7	0.0	0.0
150	3	69.0	2.9	0.0	0.0	17.8	70.8	0.0	0.0	63.0	-8.1	0.0	-7.6	10.8	59.8	0.0	0.0
150	3	69.0	-15.1	0.0	-22.3	16.8	53.8	0.0	0.0	62.0	-22.1	0.0	-47.9	10.8	45.8	0.0	0.0
152.5	4	63.0	-6.0	0.0	-4.4	4.8	70.8	0.0	0.0	61.0	-20.0	0.0	-40.9	2.8	56.8	0.0	0.0
155	5	60.1	-1.0	0.0	-0.1	-2.1	80.9	-0.5	0.0	61.1	-19.0	0.0	-37.2	-1.1	63.9	-0.2	0.0
157.5	6	59.1	2.0	0.0	0.0	-4.1	85.9	-1.5	0.0	60.1	-17.0	0.0	-30.8	-3.1	66.9	-1.1	0.0
160	7	59.2	3.1	0.0	0.0	-3.1	85.9	-0.9	0.0	59.2	-14.9	0.0	-24.8	-3.1	66.9	-1.1	0.0
162.5	8	59.2	3.1	0.0	0.0	1.0	80.0	0.0	0.0	58.2	-11.9	0.0	-16.6	-0.0	65.0	-0.0	0.0
165	9	60.2	2.2	0.0	0.0	9.0	71.0	0.0	0.0	55.2	-8.8	0.0	-10.1	4.0	60.0	0.0	0.0
167.5	70	66.3	-4.8	0.0	-2.7	27.1	47.1	0.0	0.0	53.3	-4.8	0.0	-3.3	14.1	47.1	0.0	0.0
170	71	74.3	-9.8	0.0	-9.4	7.1	80.1	0.0	0.0	54.3	-1.8	0.0	-0.5	-13.9	88.1	-15.6	0.0
170	71	74.3	-9.8	0.0	-9.4	7.1	80.1	0.0	0.0	54.3	-1.8	0.0	-0.5	-13.9	88.1	-15.6	0.0
172.5	2	75.4	-6.7	0.0	-4.5	36.1	44.1	0.0	0.0	60.4	-6.7	0.0	-5.6	21.1	45.1	0.0	0.0
175	3	69.4	3.3	0.0	0.0	18.2	71.2	0.0	0.0	63.4	-7.7	0.0	-6.9	11.2	60.2	0.0	0.0
175	3	69.4	-14.7	0.0	-21.2	17.2	54.2	0.0	0.0	62.4	-21.7	0.0	-46.1	11.2	46.2	0.0	0.0
177.5	4	63.4	-5.6	0.0	-3.8	5.2	71.2	0.0	0.0	61.4	-19.6	0.0	-39.3	3.2	57.2	0.0	0.0
180	5	60.5	-0.6	0.0	-0.0	-1.7	81.3	-0.3	0.0	61.5	-18.6	0.0	-35.7	-0.7	64.3	-0.1	0.0
182.5	6	59.5	2.4	0.0	0.0	-3.7	86.3	-1.3	0.0	60.5	-16.6	0.0	-29.4	-2.7	67.3	-0.9	0.0
185	7	59.6	3.5	0.0	0.0	-2.7	86.3	-0.7	0.0	59.6	-14.5	0.0	-23.5	-2.7	67.3	-0.8	0.0
187.5	8	59.6	3.5	0.0	0.0	1.4	80.4	0.0	0.0	58.6	-11.5	0.0	-15.5	0.4	65.4	0.0	0.0
190	9	60.6	2.6	0.0	0.0	9.4	71.4	0.0	0.0	55.6	-8.4	0.0	-9.2	4.4	60.4	0.0	0.0
192.5	80	66.7	-4.4	0.0	-2.3	27.5	47.5	0.0	0.0	53.7	-4.4	0.0	-2.8	14.5	47.5	0.0	0.0
195	81	74.7	-9.4	0.0	-8.6	7.5	80.5	0.0	0.0	54.7	-1.4	0.0	-0.3	-13.5	88.5	-14.8	0.0

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		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
195	81	74.7	-9.4	0.0	-8.6	7.5	80.5	0.0	0.0	54.7	-1.4	0.0	-0.3	-13.5	88.5	-14.8	0.0
197.5	2	75.8	-6.3	0.0	-4.0	36.5	44.5	0.0	0.0	60.8	-6.3	0.0	-4.9	21.5	45.5	0.0	0.0
200	3	69.8	3.7	0.0	0.0	18.6	71.6	0.0	0.0	63.8	-7.3	0.0	-6.2	11.6	60.6	0.0	0.0
200	3	69.8	-14.3	0.0	-20.0	17.6	54.6	0.0	0.0	62.8	-21.3	0.0	-44.5	11.6	46.6	0.0	0.0
202.5	4	63.8	-5.2	0.0	-3.3	5.6	71.6	0.0	0.0	61.8	-19.2	0.0	-37.7	3.6	57.6	0.0	0.0
205	5	60.9	-0.2	0.0	-0.0	-1.3	81.7	-0.2	0.0	61.9	-18.2	0.0	-34.2	-0.3	64.7	-0.0	0.0
207.5	6	59.9	2.8	0.0	0.0	-3.3	86.7	-1.0	0.0	60.9	-16.2	0.0	-28.0	-2.3	67.7	-0.6	0.0
210	7	60.0	3.9	0.0	0.0	-2.3	86.7	-0.5	0.0	60.0	-14.1	0.0	-22.2	-2.3	67.7	-0.6	0.0
212.5	8	60.0	3.9	0.0	0.0	1.8	80.8	0.0	0.0	59.0	-11.1	0.0	-14.5	0.8	65.8	0.0	0.0
215	9	61.0	3.0	0.0	0.0	9.8	71.8	0.0	0.0	56.0	-8.0	0.0	-8.3	4.8	60.8	0.0	0.0
217.5	90	67.1	-4.0	0.0	-1.9	27.9	47.9	0.0	0.0	54.1	-4.0	0.0	-2.3	14.9	47.9	0.0	0.0
220	91	75.1	-9.0	0.0	-7.9	7.9	80.9	0.0	0.0	55.1	-1.0	0.0	-0.1	-13.1	88.9	-13.9	0.0
220	91	75.1	-9.0	0.0	-7.9	7.9	80.9	0.0	0.0	55.1	-1.0	0.0	-0.1	-13.1	88.9	-13.9	0.0
222.5	2	76.2	-5.9	0.0	-3.5	36.9	44.9	0.0	0.0	61.2	-5.9	0.0	-4.3	21.9	45.9	0.0	0.0
225	3	70.2	4.1	0.0	0.0	19.0	72.0	0.0	0.0	64.2	-6.9	0.0	-5.5	12.0	61.0	0.0	0.0
225	3	70.2	-13.9	0.0	-18.9	18.0	55.0	0.0	0.0	63.2	-20.9	0.0	-42.8	12.0	47.0	0.0	0.0
227.5	4	64.2	-4.8	0.0	-2.8	6.0	72.0	0.0	0.0	62.2	-18.8	0.0	-36.1	4.0	58.0	0.0	0.0
230	5	61.3	0.2	0.0	0.0	-0.9	82.1	-0.1	0.0	62.3	-17.8	0.0	-32.7	0.1	65.1	0.0	0.0
232.5	6	60.3	3.2	0.0	0.0	-2.9	87.1	-0.8	0.0	61.3	-15.8	0.0	-26.6	-1.9	68.1	-0.4	0.0
235	7	60.4	4.3	0.0	0.0	-1.9	87.1	-0.3	0.0	60.4	-13.7	0.0	-21.0	-1.9	68.1	-0.4	0.0
237.5	8	60.4	4.3	0.0	0.0	2.2	81.2	0.0	0.0	59.4	-10.7	0.0	-13.4	1.2	66.2	0.0	0.0
240	9	61.4	3.4	0.0	0.0	10.2	72.2	0.0	0.0	56.4	-7.6	0.0	-7.5	5.2	61.2	0.0	0.0
242.5	100	67.5	-3.6	0.0	-1.5	28.3	48.3	0.0	0.0	54.5	-3.6	0.0	-1.9	15.3	48.3	0.0	0.0
245	101	75.5	-8.6	0.0	-7.2	8.3	81.3	0.0	0.0	55.5	-0.6	0.0	-0.0	-12.7	89.3	-13.1	0.0
245	101	75.5	-8.6	0.0	-7.2	8.3	81.3	0.0	0.0	55.5	-0.6	0.0	-0.0	-12.7	89.3	-13.1	0.0
247.5	2	76.6	-5.5	0.0	-3.1	37.3	45.3	0.0	0.0	61.6	-5.5	0.0	-3.8	22.3	46.3	0.0	0.0
250	3	70.6	4.5	0.0	0.0	19.4	72.4	0.0	0.0	64.6	-6.5	0.0	-4.9	12.4	61.4	0.0	0.0
250	3	70.6	-13.5	0.0	-17.9	18.4	55.4	0.0	0.0	63.6	-20.5	0.0	-41.2	12.4	47.4	0.0	0.0
252.5	4	64.6	-4.4	0.0	-2.4	6.4	72.4	0.0	0.0	62.6	-18.4	0.0	-34.6	4.4	58.4	0.0	0.0
255	5	61.7	0.6	0.0	0.0	-0.5	82.5	-0.0	0.0	62.7	-17.4	0.0	-31.2	0.5	65.5	0.0	0.0
257.5	6	60.7	3.6	0.0	0.0	-2.5	87.5	-0.6	0.0	61.7	-15.4	0.0	-25.3	-1.5	68.5	-0.3	0.0
260	7	60.8	4.7	0.0	0.0	-1.5	87.5	-0.2	0.0	60.8	-13.3	0.0	-19.8	-1.5	68.5	-0.3	0.0
262.5	8	60.8	4.7	0.0	0.0	2.6	81.6	0.0	0.0	59.8	-10.3	0.0	-12.5	1.6	66.6	0.0	0.0
265	9	61.8	3.8	0.0	0.0	10.6	72.6	0.0	0.0	56.8	-7.2	0.0	-6.8	5.6	61.6	0.0	0.0
267.5	110	67.9	-3.2	0.0	-1.2	28.7	48.7	0.0	0.0	54.9	-3.2	0.0	-1.5	15.7	48.7	0.0	0.0
270	111	75.9	-8.2	0.0	-6.5	8.7	81.7	0.0	0.0	55.9	-0.2	0.0	-0.0	-12.3	89.7	-12.3	0.0
270	111	75.9	-8.2	0.0	-6.5	8.7	81.7	0.0	0.0	55.9	-0.2	0.0	-0.0	-12.3	89.7	-12.3	0.0
272.5	2	76.9	-5.1	0.0	-2.6	37.7	45.7	0.0	0.0	61.9	-5.1	0.0	-3.2	22.7	46.7	0.0	0.0
275	3	71.0	4.9	0.0	0.0	19.8	72.8	0.0	0.0	65.0	-6.1	0.0	-4.3	12.8	61.8	0.0	0.0
275	3	71.0	-13.1	0.0	-16.8	18.8	55.8	0.0	0.0	64.0	-20.1	0.0	-39.6	12.8	47.8	0.0	0.0
277.5	4	65.0	-4.1	0.0	-2.0	6.8	72.8	0.0	0.0	63.0	-18.1	0.0	-33.2	4.8	58.8	0.0	0.0
280	5	62.1	1.0	0.0	0.0	-0.2	82.8	-0.0	0.0	63.1	-17.0	0.0	-29.8	0.8	65.8	0.0	0.0
282.5	6	61.1	4.0	0.0	0.0	-2.1	87.9	-0.4	0.0	62.1	-15.0	0.0	-24.0	-1.1	68.9	-0.1	0.0
285	7	61.1	5.1	0.0	0.0	-1.1	87.9	-0.1	0.0	61.1	-12.9	0.0	-18.6	-1.1	68.9	-0.1	0.0
287.5	8	61.2	5.1	0.0	0.0	3.0	82.0	0.0	0.0	60.2	-9.9	0.0	-11.5	2.0	67.0	0.0	0.0
290	9	62.2	4.1	0.0	0.0	11.0	73.0	0.0	0.0	57.2	-6.9	0.0	-6.0	6.0	62.0	0.0	0.0
292.5	120	68.3	-2.8	0.0	-0.9	29.0	49.0	0.0	0.0	55.3	-2.8	0.0	-1.1	16.0	49.0	0.0	0.0
295	121	76.3	-7.8	0.0	-5.9	9.1	82.1	0.0	0.0	56.3	0.2	0.0	0.0	-11.9	90.1	-11.5	0.0
295	121	76.3	-7.8	0.0	-5.9	9.1	82.1	0.0	0.0	56.3	0.2	0.0	0.0	-11.9	90.1	-11.5	0.0
297.5	2	77.3	-4.7	0.0	-2.2	38.1	46.1	0.0	0.0	62.3	-4.7	0.0	-2.8	23.1	47.1	0.0	0.0
300	3	71.4	5.3	0.0	0.0	20.2	73.2	0.0	0.0	65.4	-5.7	0.0	-3.8	13.2	62.2	0.0	0.0
300	3	71.4	-12.7	0.0	-15.8	19.2	56.2	0.0	0.0	64.4	-19.7	0.0	-38.0	13.2	48.2	0.0	0.0
302.5	4	65.4	-3.7	0.0	-1.6	7.2	73.2	0.0	0.0	63.4	-17.7	0.0	-31.7	5.2	59.2	0.0	0.0
305	5	62.5	1.4	0.0	0.0	0.2	83.2	0.0	0.0	63.5	-16.6	0.0	-26.4	1.2	66.2	0.0	0.0
307.5	6	61.5	4.4	0.0	0.0	-1.7	88.3	-0.3	0.0	62.5	-14.6	0.0	-22.7	-0.7	69.3	-0.1	0.0
310	7	61.5	5.5	0.0	0.0	-0.7	88.3	-0.0	0.0	61.5	-12.5	0.0	-17.5	-0.7	69.3	-0.1	0.0
312.5	8	61.6	5.5	0.0	0.0	3.4	82.4	0.0	0.0	60.6	-9.5	0.0	-10.6	2.4	67.4	0.0	0.0
315	9	62.6	4.5	0.0	0.0	11.4	73.4	0.0	0.0	57.6	-6.5	0.0	-5.4	6.4	62.4	0.0	0.0
317.5	130	68.7	-2.4	0.0	-0.7	29.4	49.4	0.0	0.0	55.7	-2.4	0.0	-0.8	16.4	49.4	0.0	0.0
320	131	76.7	-7.4	0.0	-5.3	9.5	82.5	0.0	0.0	56.7	0.6	0.0	0.0	-11.5	90.5	-10.7	0.0
320	131	76.7	-7.4	0.0	-5.3	9.5	82.5	0.0	0.0	56.7	0.6	0.0	0.0	-11.5	90.5	-10.7	0.0
322.5	2	77.7	-4.3	0.0	-1.9	38.5	46.5	0.0	0.0	62.7	-4.3	0.0	-2.3	23.5	47.5	0.0	0.0
325	3	71.8	5.7	0.0	0.0	20.6	73.6	0.0	0.0	65.8	-5.3	0.0	-3.3	13.6	62.6	0.0	0.0
325	3	71.8	-12.3	0.0	-14.8	19.6	56.6	0.0	0.0	64.8	-19.3	0.0	-36.5	13.6	48.6	0.0	0.0
327.5	4	65.8	-3.3	0.0	-1.3	7.6	73.6	0.0	0.0	63.8	-17.3	0.0	-30.3	5.6	59.6	0.0	0.0
330	5	62.9	1.8	0.0	0.0	0.6	83.6	0.0	0.0	63.9	-16.2	0.0	-27.1	1.6	66.6	0.0	0.0
332.5	6	61.9	4.8	0.0	0.0	-1.3	88.7	-0.2	0.0	62.9	-14.2	0.0	-21.5	-0.3	69.7	-0.0	0.0
335	7	61.9	5.9	0.0	0.0	-0.3	88.7	-0.0	0.0	61.9	-12.1	0.0	-16.4	-0.3	69.7	-0.0	0.0
337.5	8	62.0	5.9	0.0	0.0	3.8	82.8	0.0	0.0	61.0	-9.1	0.0	-9.7	2.8	67.8	0.0	0.0
340	9	63.0	4.9	0.0	0.0	11.8	73.8	0.0	0.0	58.0	-6.1	0.0	-4.7	6.8	62.8	0.0	0.0
342.5	140	69.1	-2.0	0.0	-0.5	29.8	49.8	0.0	0.0	56.1	-2.0	0.0	-0.6	16.8	49.8	0.0	0.0
345	141	77.1	-7.0	0.0	-4.8	9.9	82.9	0.0	0.0	57.1	1.0	0.0	0.0	-11.1	90.9	-10.0	0.0
345	141	77.1	-7.0	0.0	-4.8	9.9	82.9	0.0	0.0	57.1	1.0	0.0	0.0	-11.1	90.9	-10.0	0.0
347.5	2	78.1	-3.9	0.0	-1.6	38.9	46.9	0.0	0.0	63.1	-3.9	0.0	-1.9	23.9	47.9	0.0	0.0
350	3	72.2	6.1	0.0	0.0	21.0	74.0	0.0	0.0	66.2	-4.9	0.0	-2.8	14.0	63.0	0.0	0.0
350	3	72.2	-11.9	0.0	-13.9	20.0	57.0	0.0	0.0	65.2	-18.9	0.0	-35.0	14.0	49.0	0.0	0.0
352.5	4	66.2	-2.9	0.0	-1.0	8.0	74.0	0.0	0.0	64.2	-16.9	0.0	-28.9	6.0	60.0	0.0	0.0
355	5	63.3	2.2	0.0	0.0	1.0	84.0	0.0	0.0	64.3	-15.8	0.0	-25.8	2.0	67.0	0.0	0.0
357.5	6	62.3	5.2	0.0	0.0	-0.9	89.1	-0.1	0.0	63.3	-13.8	0.0	-20.3	0.1	70.1	0.0	0.0
360	7	62.3	6.3	0.0	0.0	0.1	89.1	0.0	0.0	62.3	-11.7	0.0	-15.3	0.1	70.1	0.0	0.0
362.5	8	62.4	6.3	0.0	0.0	4.2	83.2	0.0	0.0	61.4	-8.7	0.0	-8.9	3.2	68.2	0.0	0.0
365	9	63.4	5.3	0.0	0.0	12.2	74.2	0.0	0.0	58.4	-5.7	0.0	-4.1	7.2	63.2	0.0	0.0
367.5	150	69.5	-1.6	0.0	-0.3	30.2	50.2	0.0	0.0	56.5	-1.6	0.0	-0.4	17.2	50.2	0.0	0.0
370	151	77.5	-6.6	0.0	-4.2	10.3	83.3	0.0	0.0	57.5	1.4	0.0	0.0	-10.7	91.3	-9.3	0.0
370	151	77.5	-6.6	0.0	-4.2	10.3	83.3	0.0	0.0	57.5	1.4	0.0	0.0	-10.7	91.3	-9.3	0.0
372.5	2	78.5	-3.5	0.0	-1.3	39.3	47.3	0.0	0.0	63.5	-3.5	0.0	-1.5	24.3	48.3	0.0	0.0
375	3	72.6	6.5	0.0	0.0	21.4	74.4	0.0	0.0	66.6	-4.5	0.0	-2.3	14.4	63.4	0.0	0.0
375	3	72.6	-11.5	0.0	-13.0	20.4	57.4	0.0	0.0	65.6	-18.5	0.0	-33.6	14.4	49.4	0.0	0.0
377.5	4	66.6	-2.5	0.0	-0.7	8.4	74.4	0.0	0.0	64.6	-16.5	0.0	-27.5	6.4	60.4	0.0	0.0
380	5	63.7	2.6	0.0	0.0	1.4	84.4	0.0	0.0	64.7	-15.4	0.0	-24.5	2.4	67.4	0.0	0.0
382.5	6	62.7	5.6	0.0	0.0	-0.5	89.5	-0.0	0.0	63.7	-13.4	0.0	-19.1	0.5	70.5	0.0	0.0
385	7	62.7	6.7	0.0	0.0	0.5	89.5	0.0	0.0	62.7	-11.3	0.0	-14.3	0.5	70.5	0.0	0.0
387.5	8	62.8	6.7	0.0	0.0	4.6	83.6	0.0	0.0	61.8	-8.3	0.0	-8.1	3.6	68.6	0.0	0.0
390	9	63.8	5.7	0.0	0.0	12.6	74.6	0.0	0.0	58.8	-5.3	0.0	-3.6	7.6	63.6	0.0	0.0
392.5	160	69.9	-1.2	0.0	-0.2	30.6	50.6	0.0	0.0	56.9	-1.2	0.0	-0.2	17.6	50.6	0.0	0.0

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TESADO Y ANCLADO 75%

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
395	161	77.9	-6.2	0.0	-3.7	10.7	83.7	0.0	0.0	57.9	1.8	0.0	0.0	-10.3	91.7	-8.6	0.0
395	161	77.9	-6.2	0.0	-3.7	10.7	83.7	0.0	0.0	57.9	1.8	0.0	0.0	-10.3	91.7	-8.6	0.0
397.5	2	78.9	-3.1	0.0	-1.0	39.7	47.7	0.0	0.0	53.9	-3.1	0.0	-1.2	24.7	48.7	0.0	0.0
400	3	73.0	6.9	0.0	0.0	21.8	74.8	0.0	0.0	57.0	-4.1	0.0	-1.9	14.8	63.8	0.0	0.0
400	3	73.0	-11.1	0.0	-12.1	20.8	57.8	0.0	0.0	56.0	-18.1	0.0	-32.1	14.8	49.8	0.0	0.0
402.5	4	67.0	-2.1	0.0	-0.5	8.8	74.8	0.0	0.0	55.0	-16.1	0.0	-26.2	6.8	60.8	0.0	0.0
405	5	64.1	3.0	0.0	0.0	1.8	84.8	0.0	0.0	55.1	-15.0	0.0	-23.2	2.8	67.8	0.0	0.0
407.5	6	63.1	6.0	0.0	0.0	-0.1	89.9	-0.0	0.0	54.1	-13.0	0.0	-16.0	0.9	70.9	0.0	0.0
410	7	63.1	7.1	0.0	0.0	0.9	89.9	0.0	0.0	53.1	-10.9	0.0	-13.3	0.9	70.9	0.0	0.0
412.5	8	63.2	7.1	0.0	0.0	5.0	84.0	0.0	0.0	52.2	-7.9	0.0	-7.3	4.0	69.0	0.0	0.0
415	9	64.2	6.1	0.0	0.0	13.0	75.0	0.0	0.0	59.2	-4.9	0.0	-3.0	8.0	64.0	0.0	0.0
417.5	170	70.3	-0.8	0.0	-0.1	31.0	51.0	0.0	0.0	57.3	-0.8	0.0	-0.1	18.0	51.0	0.0	0.0
420	171	78.3	-5.8	0.0	-3.3	11.1	84.1	0.0	0.0	58.3	2.2	0.0	0.0	-9.9	92.1	-8.0	0.0
420	171	78.3	-5.8	0.0	-3.3	11.1	84.1	0.0	0.0	58.3	2.2	0.0	0.0	-9.9	92.1	-8.0	0.0
422.5	2	79.3	-2.7	0.0	-0.8	40.1	48.1	0.0	0.0	54.3	-2.7	0.0	-0.9	25.1	49.1	0.0	0.0
425	3	73.4	7.3	0.0	0.0	22.2	75.2	0.0	0.0	57.4	-3.7	0.0	-1.6	15.2	64.2	0.0	0.0
425	3	73.4	-10.7	0.0	-11.2	21.2	58.2	0.0	0.0	56.4	-17.7	0.0	-30.7	15.2	50.2	0.0	0.0
427.5	4	67.4	-1.7	0.0	-0.3	9.2	75.2	0.0	0.0	55.4	-15.7	0.0	-24.9	7.2	61.2	0.0	0.0
430	5	64.5	3.4	0.0	0.0	2.2	85.2	0.0	0.0	55.5	-14.6	0.0	-22.0	3.2	68.2	0.0	0.0
432.5	6	63.5	6.4	0.0	0.0	0.3	90.3	0.0	0.0	54.5	-12.6	0.0	-16.9	1.3	71.3	0.0	0.0
435	7	63.5	7.5	0.0	0.0	1.3	90.3	0.0	0.0	53.5	-10.5	0.0	-12.4	1.3	71.3	0.0	0.0
437.5	8	63.6	7.5	0.0	0.0	5.4	84.4	0.0	0.0	52.6	-7.5	0.0	-6.6	4.4	69.4	0.0	0.0
440	9	64.6	6.5	0.0	0.0	13.4	75.4	0.0	0.0	59.6	-4.5	0.0	-2.6	8.4	64.4	0.0	0.0
442.5	180	70.7	-0.4	0.0	-0.0	31.4	51.4	0.0	0.0	57.7	-0.4	0.0	-0.0	18.4	51.4	0.0	0.0
445	181	78.7	-5.4	0.0	-2.8	11.5	84.5	0.0	0.0	58.7	2.6	0.0	0.0	-9.5	92.5	-7.3	0.0
445	181	78.7	-5.4	0.0	-2.8	11.5	84.5	0.0	0.0	58.7	2.6	0.0	0.0	-9.5	92.5	-7.3	0.0
447.5	2	79.7	-2.3	0.0	-0.5	40.5	48.5	0.0	0.0	54.7	-2.3	0.0	-0.7	25.5	49.5	0.0	0.0
450	3	73.8	7.7	0.0	0.0	22.6	75.6	0.0	0.0	57.8	-3.3	0.0	-1.3	15.6	64.6	0.0	0.0
450	3	73.8	-10.3	0.0	-10.4	21.8	58.6	0.0	0.0	56.8	-17.3	0.0	-29.4	15.6	50.6	0.0	0.0
452.5	4	67.8	-1.3	0.0	-0.2	9.8	75.6	0.0	0.0	55.8	-15.3	0.0	-23.7	7.6	61.6	0.0	0.0
455	5	64.9	3.8	0.0	0.0	2.6	85.6	0.0	0.0	55.9	-14.2	0.0	-20.8	3.6	68.6	0.0	0.0
457.5	6	63.9	6.8	0.0	0.0	0.7	90.7	0.0	0.0	54.9	-12.2	0.0	-15.9	1.7	71.7	0.0	0.0
460	7	63.9	7.9	0.0	0.0	1.7	90.7	0.0	0.0	53.9	-10.1	0.0	-11.4	1.7	71.7	0.0	0.0
462.5	8	64.0	7.9	0.0	0.0	5.8	84.8	0.0	0.0	53.0	-7.1	0.0	-5.9	4.8	69.8	0.0	0.0
465	9	65.0	6.9	0.0	0.0	13.8	75.8	0.0	0.0	60.0	-4.1	0.0	-2.1	8.8	64.8	0.0	0.0
467.5	190	71.1	-0.0	0.0	-0.0	31.8	51.8	0.0	0.0	58.1	-0.0	0.0	-0.0	18.8	51.8	0.0	0.0
470	191	79.1	-5.0	0.0	-2.4	11.9	84.9	0.0	0.0	59.1	3.0	0.0	0.0	-9.1	92.9	-6.7	0.0
470	191	79.1	-5.0	0.0	-2.4	11.9	84.9	0.0	0.0	59.1	3.0	0.0	0.0	-9.1	92.9	-6.7	0.0
472.5	2	79.1	-1.8	0.0	-0.3	39.9	49.9	0.0	0.0	55.1	-1.8	0.0	-0.4	24.9	50.9	0.0	0.0
475	3	74.0	8.3	0.0	0.0	22.0	77.0	0.0	0.0	57.0	-2.7	0.0	-0.9	16.0	66.0	0.0	0.0
475	3	74.0	-8.7	0.0	-7.5	22.0	60.0	0.0	0.0	57.0	-16.7	0.0	-27.5	15.0	52.0	0.0	0.0
477.5	4	68.0	-0.6	0.0	-0.0	10.0	76.0	0.0	0.0	56.0	-14.6	0.0	-21.8	8.0	62.0	0.0	0.0
480	5	65.0	4.5	0.0	0.0	3.0	87.0	0.0	0.0	56.0	-12.5	0.0	-16.6	3.0	69.0	0.0	0.0
482.5	6	64.0	7.6	0.0	0.0	1.1	91.1	0.0	0.0	55.0	-11.4	0.0	-14.0	2.1	72.1	0.0	0.0
485	7	64.0	8.7	0.0	0.0	2.1	90.1	0.0	0.0	54.0	-9.3	0.0	-9.7	3.1	72.1	0.0	0.0
487.5	8	64.0	8.8	0.0	0.0	7.2	84.2	0.0	0.0	52.0	-6.2	0.0	-4.6	6.2	69.2	0.0	0.0
490	9	65.0	9.0	0.0	0.0	15.2	74.2	0.0	0.0	50.0	-2.0	0.0	-0.6	10.2	63.2	0.0	0.0
492.5	200	69.9	3.1	0.0	0.0	33.2	51.2	0.0	0.0	56.9	3.1	0.0	0.0	20.2	51.2	0.0	0.0
495	201	79.9	-3.8	0.0	-1.4	12.3	84.3	0.0	0.0	58.9	4.2	0.0	0.0	-7.7	93.3	-4.9	0.0
495	201	79.9	-3.8	0.0	-1.4	12.3	84.3	0.0	0.0	58.9	4.2	0.0	0.0	-7.7	93.3	-4.9	0.0
497.5	2	79.2	-1.1	0.0	-0.1	40.3	50.3	0.0	0.0	54.2	-0.1	0.0	-0.0	25.3	51.3	0.0	0.0
500	3	74.8	8.5	0.0	0.0	22.4	77.4	0.0	0.0	58.8	-2.5	0.0	-0.7	16.4	66.4	0.0	0.0
500	3	74.8	-8.5	0.0	-7.2	22.4	60.4	0.0	0.0	57.8	-16.5	0.0	-26.7	15.4	52.4	0.0	0.0
502.5	4	68.8	-0.7	0.0	-0.1	10.4	75.4	0.0	0.0	56.8	-14.7	0.0	-21.9	8.4	61.4	0.0	0.0
505	5	66.1	4.0	0.0	0.0	5.4	85.4	0.0	0.0	56.1	-13.0	0.0	-17.5	5.4	67.4	0.0	0.0
507.5	6	64.3	7.8	0.0	0.0	3.5	86.5	0.0	0.0	55.3	-11.2	0.0	-13.5	4.5	69.5	0.0	0.0
510	7	63.6	9.6	0.0	0.0	5.5	86.5	0.0	0.0	54.6	-9.4	0.0	-8.0	6.5	68.5	0.0	0.0
512.5	8	63.8	11.4	0.0	0.0	10.6	80.6	0.0	0.0	51.8	-4.6	0.0	-2.7	9.6	64.6	0.0	0.0
515	9	64.1	11.1	0.0	0.0	19.6	69.6	0.0	0.0	59.1	0.1	0.0	0.0	14.6	58.6	0.0	0.0
517.5	210	69.4	4.8	0.0	0.0	38.6	44.6	0.0	0.0	56.4	3.8	0.0	0.0	25.6	44.6	0.0	0.0
520	211	81.7	-5.6	0.0	-3.0	17.7	78.7	0.0	0.0	61.7	1.4	0.0	0.0	-2.3	85.7	-0.5	0.0
520	211	81.7	-5.6	0.0	-3.0	17.7	78.7	0.0	0.0	61.7	1.4	0.0	0.0	-2.3	85.7	-0.5	0.0
522	2	77.2	2.5	0.0	0.0	34.7	59.7	0.0	0.0	63.2	1.5	0.0	0.0	20.7	57.7	0.0	0.0
524	3	64.7	21.6	0.0	0.0	12.7	91.7	0.0	0.0	60.7	8.8	0.0	0.0	7.7	77.7	0.0	0.0
524	3	62.7	-20.4	0.0	-41.3	9.7	49.7	0.0	0.0	58.7	-26.4	0.0	-67.6	5.7	43.7	0.0	0.0
526	4	59.8	-16.2	0.0	-26.6	4.8	56.8	0.0	0.0	57.8	-26.2	0.0	-67.5	2.8	46.8	0.0	0.0
528	5	53.0	-8.0	0.0	-5.1	-1.2	65.8	-0.2	0.0	54.0	-20.0	0.0	-44.8	-0.2	51.8	-0.0	0.0
530	6	47.2	2.1	0.0	0.0	-4.2	70.8	-1.9	0.0	50.2	-13.9	0.0	-24.8	-1.2	54.8	-0.2	0.0
532	7	42.3	9.3	0.0	0.0	-3.1	69.9	-1.1	0.0	46.3	-7.7	0.0	-9.0	-0.1	53.9	-0.0	0.0
534	8	38.5	14.5	0.0	0.0	0.9	65.9	0.0	0.0	41.5	-0.5	0.0	-0.1	2.9	49.9	0.0	0.0
536	9	35.7	19.7	0.0	0.0	6.9	56.9	0.0	0.0	36.7	6.7	0.0	0.0	7.9	43.9	0.0	0.0
538	220	32.8	23.8	0.0	0.0	17.0	44.0	0.0	0.0	30.8	13.8	0.0	0.0	16.0	34.0	0.0	0.0
540	221	28.0	31.0	0.0	0.0	28.0	31.0	0.0	0.0	23.0	25.0	0.0	0.0	23.0	25.0	0.0	0.0

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Al cm2
0	1	0.0	0.0	56.2	16.89	16.89
2	2	0.0	0.0	57.9	16.82	16.82
4	3	0.0	0.0	57.7	16.75	16.75
6	4	-0.6	0.0	57.5	16.66	16.66
8	5	-1.1	0.0	57.3	16.96	16.61
10	6	-0.6	-2.4	57.1	16.72	19.33
12	7	-0.0	-7.3	56.9	16.47	20.63
14	8	0.0	-9.9	56.7	16.40	21.59
16	9	0.0	-6.8	56.4	16.33	20.52
18	10	0.0	-17.3	56.2	16.26	23.88
20	11	-11.6	-15.3	56.0	21.95	23.15
20	11	-11.6	-15.3	56.0	21.95	23.15
22.5	2	0.0	-8.5	55.7	16.10	20.85
25	3	0.0	-15.3	55.5	16.01	22.97
25	3	0.0	-62.7	55.5	16.01	38.37
27.5	4	0.0	-58.1	55.2	17.92	36.79
30	5	0.0	-52.3	54.9	17.84	34.63
32.5	6	-0.5	-46.0	54.7	17.90	33.33
35	7	-0.6	-39.5	54.4	17.84	30.50
37.5	8	-0.1	-29.3	54.1	17.62	27.07
40	9	0.0	-14.9	53.9	17.49	22.32
42.5	20	0.0	-4.3	53.6	17.40	16.81
45	21	-22.7	-8.3	53.3	24.67	20.01
45	21	-22.7	-8.3	53.3	24.67	20.01
47.5	2	0.0	-3.5	53.0	17.22	18.35
50	3	0.0	-4.8	52.8	17.14	16.68
50	3	0.0	-46.4	52.8	17.14	32.20
52.5	4	0.0	-39.5	52.5	17.05	29.89
55	5	-2.2	-36.0	52.2	17.67	28.66
57.5	6	-4.0	-32.2	52.0	18.18	27.34
60	7	-2.6	-29.4	51.7	17.62	26.33
62.5	8	-0.3	-20.7	51.4	16.81	23.42
65	9	0.0	-13.4	51.2	16.61	20.95
67.5	30	0.0	-5.7	50.9	16.52	18.36
70	31	-17.2	-12.5	50.6	22.02	20.50
70	31	-17.2	-12.5	50.6	22.02	20.50
72.5	2	0.0	-8.5	50.4	16.35	19.12
75	3	0.0	-10.0	50.1	16.26	19.51
75	3	0.0	-53.2	50.1	16.26	33.53
77.5	4	0.0	-45.9	49.8	16.17	31.06
80	5	-1.1	-42.0	49.5	16.45	29.74
82.5	6	-2.6	-35.3	49.3	16.84	27.47
85	7	-2.1	-28.9	49.0	16.61	25.31
87.5	8	-0.2	-20.2	48.7	15.89	22.37
90	9	0.0	-13.0	48.5	15.74	19.95
92.5	40	0.0	-5.1	48.2	15.65	17.31
95	41	-18.5	-11.8	47.9	21.55	19.39
95	41	-18.5	-11.8	47.9	21.55	19.39
97.5	2	0.0	-7.7	47.7	15.48	17.98
100	3	0.0	-9.2	47.4	15.39	18.36
100	3	0.0	-51.4	47.4	15.39	32.07
102.5	4	0.0	-44.2	47.1	15.30	29.65
105	5	-0.9	-40.4	46.9	15.49	28.33
107.5	6	-2.2	-33.8	46.6	15.84	26.09
110	7	-1.8	-27.5	46.3	15.61	23.98
112.5	8	-0.1	-18.9	46.0	14.98	21.10
115	9	0.0	-12.0	45.8	14.86	18.75
117.5	50	0.0	-4.5	45.5	14.78	16.22
120	51	-17.5	-11.0	45.2	20.37	18.24
120	51	-17.5	-11.0	45.2	20.37	18.24
122.5	2	0.0	-7.0	45.0	14.80	16.86
125	3	0.0	-8.4	44.7	14.51	17.23
125	3	0.0	-49.8	44.7	14.51	30.62
127.5	4	0.0	-42.5	44.4	14.43	28.24
130	5	-0.6	-36.8	44.2	14.55	26.93
132.5	6	-1.9	-32.3	43.9	14.86	24.73
135	7	-1.4	-26.2	43.6	14.62	22.66
137.5	8	-0.0	-17.8	43.4	14.06	19.85
140	9	0.0	-11.0	43.1	13.99	17.56
142.5	60	0.0	-3.8	42.8	13.90	15.15
145	61	-16.6	-10.1	42.5	19.19	17.11
145	61	-16.6	-10.1	42.5	19.19	17.11
147.5	2	0.0	-6.2	42.3	13.73	15.75
150	3	0.0	-7.6	42.0	13.64	16.10
150	3	0.0	-47.9	42.0	13.64	29.18
152.5	4	0.0	-40.9	41.7	13.55	26.83
155	5	-0.5	-37.2	41.5	13.61	25.55
157.5	6	-1.5	-30.8	41.2	13.88	23.36
160	7	-1.1	-24.8	40.9	13.65	21.35
162.5	8	-0.0	-16.6	40.7	13.20	18.60
165	9	0.0	-10.1	40.4	13.11	16.39
167.5	70	0.0	-3.3	40.1	13.03	14.09
170	71	-15.6	-9.4	39.9	18.02	15.98
170	71	-15.6	-9.4	39.9	18.02	15.98
172.5	2	0.0	-5.6	39.6	12.85	14.66
175	3	0.0	-6.9	39.3	12.77	14.99
175	3	0.0	-46.1	39.3	12.77	27.75
177.5	4	0.0	-39.3	39.0	12.68	25.43
180	5	-0.3	-35.7	38.8	12.59	24.17
182.5	6	-1.3	-29.4	38.5	12.91	22.04
185	7	-0.8	-23.5	38.2	12.69	20.05
187.5	8	0.0	-15.5	38.0	12.33	17.37
190	9	0.0	-9.2	37.7	12.24	15.22
192.5	80	0.0	-2.8	37.4	12.15	13.05
195	81	-14.8	-8.6	37.2	16.86	14.86

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
195	81	-14.8	-8.6	37.2	16.86	14.86
197.5	2	0.0	-4.9	36.9	11.98	13.56
200	3	0.0	-6.2	36.8	11.80	13.69
200	3	0.0	-44.5	36.6	11.89	26.33
202.5	4	0.0	-37.7	36.4	11.80	24.04
205	5	-0.2	-34.2	36.1	11.77	22.61
207.5	6	-1.0	-28.0	35.8	11.95	20.71
210	7	-0.6	-22.2	35.5	11.74	18.76
212.5	8	0.0	-14.5	35.3	11.45	16.15
215	9	0.0	-8.3	35.0	11.37	14.07
217.5	90	0.0	-2.3	34.7	11.28	12.02
220	91	-13.9	-7.9	34.5	15.70	13.75
220	91	-13.9	-7.9	34.5	15.70	13.75
222.5	2	0.0	-4.3	34.2	11.10	12.51
225	3	0.0	-5.5	33.9	11.02	12.80
225	3	0.0	-42.8	33.9	11.02	24.92
227.5	4	0.0	-36.1	33.7	10.93	22.67
230	5	-0.1	-32.7	33.4	10.87	21.45
232.5	6	-0.6	-26.6	33.1	11.01	19.40
235	7	-0.4	-21.0	32.9	10.80	17.48
237.5	8	0.0	-13.4	32.6	10.56	14.95
240	9	0.0	-7.5	32.3	10.49	12.94
242.5	100	0.0	-1.9	32.0	10.40	11.01
245	101	-13.1	-7.2	31.8	14.56	12.66
245	101	-13.1	-7.2	31.8	14.56	12.66
247.5	2	0.0	-3.8	31.5	10.23	11.45
250	3	0.0	-4.9	31.2	10.14	11.73
250	3	0.0	-41.2	31.2	10.14	23.52
252.5	4	0.0	-34.6	31.0	10.05	21.30
255	5	-0.0	-31.2	30.7	9.98	20.11
257.5	6	-0.6	-25.3	30.4	10.07	18.09
260	7	-0.3	-19.8	30.2	9.88	16.22
262.5	8	0.0	-12.5	29.9	9.70	13.75
265	9	0.0	-6.8	29.6	9.62	11.81
267.5	110	0.0	-1.5	29.3	9.53	10.01
270	111	-12.3	-6.5	29.1	13.42	11.57
270	111	-12.3	-6.5	29.1	13.42	11.57
272.5	2	0.0	-3.2	28.8	9.36	10.41
275	3	0.0	-4.3	28.5	9.27	10.67
275	3	0.0	-39.6	28.5	9.27	22.13
277.5	4	0.0	-33.2	28.3	9.18	19.94
280	5	-0.0	-29.8	28.0	9.09	18.77
282.5	6	-0.4	-24.0	27.7	9.14	16.79
285	7	-0.1	-18.6	27.5	8.96	14.96
287.5	8	0.0	-11.5	27.2	8.83	12.57
290	9	0.0	-6.0	26.9	8.74	10.71
292.5	120	0.0	-1.1	26.7	8.66	9.02
295	121	-11.5	-5.9	26.4	12.29	10.49
295	121	-11.5	-5.9	26.4	12.29	10.49
297.5	2	0.0	-2.6	26.1	8.48	9.37
300	3	0.0	-3.8	25.8	8.39	9.61
300	3	0.0	-36.0	25.8	8.39	20.75
302.5	4	0.0	-31.7	25.6	8.31	18.60
305	5	0.0	-28.4	25.3	8.22	17.45
307.5	6	-0.3	-22.7	25.0	8.22	15.51
310	7	-0.1	-17.5	24.8	8.06	13.72
312.5	8	0.0	-10.6	24.5	7.96	11.40
315	9	0.0	-5.4	24.2	7.87	9.61
317.5	130	0.0	-0.8	24.0	7.78	8.05
320	131	-10.7	-5.3	23.7	11.17	9.43
320	131	-10.7	-5.3	23.7	11.17	9.43
322.5	2	0.0	-2.3	23.4	7.61	8.36
325	3	0.0	-3.3	23.2	7.52	8.57
325	3	0.0	-36.5	23.2	7.52	19.36
327.5	4	0.0	-30.3	22.9	7.43	17.27
330	5	0.0	-27.1	22.6	7.34	16.14
332.5	6	-0.2	-21.5	22.3	7.31	14.24
335	7	-0.0	-16.4	22.1	7.17	12.49
337.5	8	0.0	-9.7	21.8	7.08	10.24
340	9	0.0	-4.7	21.5	6.99	8.53
342.5	140	0.0	-0.6	21.3	6.91	7.09
345	141	-10.0	-4.8	21.0	10.06	8.37
345	141	-10.0	-4.8	21.0	10.06	8.37
347.5	2	0.0	-1.9	20.7	6.73	7.35
350	3	0.0	-2.8	20.5	6.64	7.55
350	3	0.0	-35.0	20.5	6.64	18.02
352.5	4	0.0	-28.9	20.2	6.56	15.94
355	5	0.0	-25.6	19.9	6.47	14.83
357.5	6	-0.1	-20.3	19.7	6.41	12.98
360	7	0.0	-15.3	19.4	6.30	11.27
362.5	8	0.0	-8.9	19.1	6.21	9.10
365	9	0.0	-4.1	18.8	6.12	7.46
367.5	150	0.0	-0.4	18.6	6.03	6.15
370	151	-9.3	-4.2	18.3	8.96	7.32
370	151	-9.3	-4.2	18.3	8.96	7.32
372.5	2	0.0	-1.5	18.0	5.86	6.36
375	3	0.0	-2.3	17.8	5.77	6.53
375	3	0.0	-33.6	17.8	5.77	16.67
377.5	4	0.0	-27.5	17.5	5.68	14.63
380	5	0.0	-24.5	17.2	5.60	13.54
382.5	6	-0.0	-19.1	17.0	5.52	11.72
385	7	0.0	-14.3	16.7	5.42	10.07
387.5	8	0.0	-8.1	16.4	5.33	7.96
390	9	0.0	-3.6	16.2	5.25	6.40
392.5	160	0.0	-0.2	15.9	5.16	5.23

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
395	161	-8.6	-3.7	15.6	7.87	6.29
395	161	-8.6	-3.7	15.6	7.87	6.29
397.5	2	0.0	-1.2	15.3	4.98	5.38
400	3	0.0	-1.9	15.1	4.90	5.53
400	3	0.0	-32.1	15.1	4.90	15.33
402.5	4	0.0	-26.2	14.8	4.81	13.32
405	5	0.0	-23.2	14.5	4.72	12.26
407.5	6	-0.0	-18.0	14.3	4.63	10.48
410	7	0.0	-13.3	14.0	4.55	8.87
412.5	8	0.0	-7.3	13.7	4.46	6.84
415	9	0.0	-3.0	13.5	4.37	5.36
417.5	170	0.0	-0.1	13.2	4.28	4.31
420	171	-8.0	-3.3	12.9	6.78	5.26
420	171	-8.0	-3.3	12.9	6.78	5.26
422.5	2	0.0	-0.9	12.7	4.11	4.41
425	3	0.0	-1.6	12.4	4.02	4.54
425	3	0.0	-30.7	12.4	4.02	14.00
427.5	4	0.0	-24.9	12.1	3.93	12.03
430	5	0.0	-22.0	11.8	3.85	10.99
432.5	6	0.0	-16.9	11.6	3.76	9.26
435	7	0.0	-12.4	11.3	3.67	7.69
437.5	8	0.0	-6.6	11.0	3.58	5.73
440	9	0.0	-2.6	10.8	3.50	4.33
442.5	180	0.0	-0.0	10.5	3.41	3.42
445	181	-7.3	-2.8	10.2	5.70	4.24
445	181	-7.3	-2.8	10.2	5.70	4.24
447.5	2	0.0	-0.7	10.0	3.23	3.45
450	3	0.0	-1.3	9.7	3.15	3.56
450	3	0.0	-29.4	9.7	3.15	12.66
452.5	4	0.0	-23.7	9.4	3.06	10.75
455	5	0.0	-20.8	9.2	2.97	9.73
457.5	6	0.0	-15.9	8.9	2.89	8.04
460	7	0.0	-11.4	8.6	2.80	6.51
462.5	8	0.0	-5.9	8.3	2.71	4.64
465	9	0.0	-2.1	8.1	2.62	3.31
467.5	190	0.0	-0.0	7.8	2.54	2.54
470	191	-6.7	-2.4	7.5	4.63	3.24
470	191	-6.7	-2.4	7.5	4.63	3.24
472.5	2	0.0	-0.4	7.3	2.36	2.50
475	3	0.0	-0.9	7.0	2.27	2.55
475	3	0.0	-27.5	7.0	2.27	11.19
477.5	4	0.0	-21.8	6.7	2.19	9.26
480	5	0.0	-16.6	6.5	2.10	7.48
482.5	6	0.0	-14.0	6.2	2.01	6.55
485	7	0.0	-9.7	5.9	1.92	5.06
487.5	8	0.0	-4.6	5.7	1.84	3.33
490	9	0.0	-0.6	5.4	1.75	1.93
492.5	200	0.0	0.0	5.1	1.66	1.66
495	201	-4.9	-1.4	4.8	3.15	2.03
495	201	-4.9	-1.4	4.8	3.15	2.03
497.5	2	0.0	-0.1	4.6	1.49	1.53
500	3	0.0	-0.7	4.3	1.40	1.63
500	3	0.0	-26.7	4.3	1.40	10.07
502.5	4	0.0	-21.9	4.0	1.31	8.44
505	5	0.0	-17.5	3.8	1.22	6.92
507.5	6	0.0	-13.5	3.5	1.14	5.52
510	7	0.0	-8.0	3.2	1.05	3.65
512.5	8	0.0	-2.7	3.0	0.96	1.83
515	9	0.0	0.0	2.7	0.87	0.87
517.5	210	0.0	0.0	2.4	0.79	0.79
520	211	-0.5	-3.0	2.2	0.86	1.66
520	211	-0.5	-3.0	2.2	0.86	1.66
522	2	0.0	0.0	1.9	0.63	0.63
524	3	0.0	0.0	1.7	0.56	0.56
524	3	0.0	-67.6	1.7	0.56	22.50
526	4	0.0	-67.5	1.5	0.49	22.41
528	5	-0.2	-44.8	1.3	0.48	14.95
530	6	-1.9	-24.8	1.1	0.97	8.40
532	7	-1.1	-9.0	0.9	0.64	3.22
534	8	0.0	-0.1	0.6	0.21	0.23
536	9	0.0	0.0	0.4	0.14	0.14
538	220	0.0	0.0	0.2	0.07	0.07
540	221	0.0	0.0	0.0	0.00	0.00

TESADO 80% ANCLADO AL 75 %

1/3

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
0	1	40.4	40.4	0.0	0.0	40.4	40.4	0.0	0.0	31.4	31.4	0.0	0.0	31.4	31.4	0.0	0.0
2	2	35.4	48.1	0.0	0.0	17.4	71.4	0.0	0.0	32.4	31.1	0.0	0.0	14.4	54.4	0.0	0.0
4	3	32.5	49.8	0.0	0.0	1.4	91.4	0.0	0.0	33.5	27.8	0.0	0.0	1.4	70.4	0.0	0.0
6	4	38.5	40.5	0.0	0.0	-3.5	96.5	-1.0	0.0	40.5	17.5	0.0	0.0	-1.5	73.5	-0.3	0.0
8	5	46.5	30.2	0.0	0.0	-3.5	96.5	-1.0	0.0	47.5	8.2	0.0	0.0	-2.5	73.5	-0.7	0.0
10	6	52.6	21.9	0.0	0.0	-2.5	93.5	-0.5	0.0	52.6	0.9	0.0	0.0	-1.5	72.5	-0.2	0.0
12	7	57.6	13.6	0.0	0.0	2.6	85.6	0.0	0.0	55.6	-3.4	0.0	-1.6	0.6	69.6	0.0	0.0
14	8	62.6	6.3	0.0	0.0	9.6	74.6	0.0	0.0	56.6	-5.7	0.0	-4.3	3.6	63.6	0.0	0.0
16	9	66.7	0.0	0.0	0.0	20.6	60.6	0.0	0.0	55.7	-5.0	0.0	-3.4	9.6	55.6	0.0	0.0
18	10	76.7	-14.3	0.0	-18.5	31.7	45.7	0.0	0.0	59.7	-10.3	0.0	-12.5	14.7	48.7	0.0	0.0
20	11	79.6	-14.6	0.0	-18.6	15.7	69.7	0.0	0.0	58.8	-6.6	0.0	-5.5	-5.3	77.7	-2.8	0.0
20	11	79.6	-14.6	0.0	-18.6	15.7	69.7	0.0	0.0	58.8	-6.6	0.0	-5.5	-5.3	77.7	-2.8	0.0
22.5	2	76.5	-8.1	0.0	-6.5	45.7	31.7	0.0	0.0	60.5	-8.1	0.0	-8.0	30.7	32.7	0.0	0.0
25	3	71.2	2.3	0.0	0.0	27.8	60.8	0.0	0.0	64.2	-8.7	0.0	-8.6	19.8	49.8	0.0	0.0
25	3	71.2	-16.7	0.0	-26.2	26.8	41.8	0.0	0.0	63.2	-23.7	0.0	-53.3	18.8	34.8	0.0	0.0
27.5	4	64.1	-6.4	0.0	-4.8	10.8	62.8	0.0	0.0	61.1	-20.4	0.0	-42.1	8.8	46.8	0.0	0.0
30	5	60.9	-0.1	0.0	-0.0	1.9	76.9	0.0	0.0	60.9	-18.1	0.0	-34.1	1.9	56.9	0.0	0.0
32.5	6	58.7	3.2	0.0	0.0	-2.1	83.9	-0.4	0.0	59.7	-15.8	0.0	-27.2	-1.1	64.9	-0.2	0.0
35	7	58.6	4.5	0.0	0.0	-2.1	84.9	-0.4	0.0	59.6	-14.5	0.0	-23.3	-2.1	65.9	-0.5	0.0
37.5	8	59.4	4.8	0.0	0.0	1.0	81.0	0.0	0.0	57.4	-11.2	0.0	-15.0	-0.0	65.0	-0.0	0.0
40	9	61.2	3.2	0.0	0.0	9.0	72.0	0.0	0.0	55.2	-7.8	0.0	-8.0	3.0	61.0	0.0	0.0
42.5	20	68.0	-5.4	0.0	-3.3	29.1	46.1	0.0	0.0	54.0	-5.4	0.0	-4.1	15.1	46.1	0.0	0.0
45	21	77.7	-12.0	0.0	-13.1	11.1	77.1	0.0	0.0	56.7	-4.0	0.0	-2.1	-10.9	85.1	-10.2	0.0
45	21	77.7	-12.0	0.0	-13.1	11.1	77.1	0.0	0.0	56.7	-4.0	0.0	-2.1	-10.9	85.1	-10.2	0.0
47.5	2	74.8	-5.0	0.0	-2.6	38.1	43.1	0.0	0.0	58.8	-5.0	0.0	-3.2	23.1	43.1	0.0	0.0
50	3	66.9	8.9	0.0	0.0	17.2	74.2	0.0	0.0	59.9	-3.1	0.0	-1.2	11.2	62.2	0.0	0.0
50	3	66.9	-10.1	0.0	-10.9	17.2	55.2	0.0	0.0	59.9	-18.1	0.0	-34.6	10.2	47.2	0.0	0.0
52.5	4	60.0	-0.1	0.0	-0.0	3.2	75.2	0.0	0.0	58.0	-15.1	0.0	-25.7	1.2	60.2	0.0	0.0
55	5	57.1	5.9	0.0	0.0	-4.7	87.3	-2.0	0.0	57.1	-13.1	0.0	-20.2	-3.7	68.3	-1.6	0.0
57.5	6	56.2	8.8	0.0	0.0	-6.7	91.3	-3.8	0.0	57.2	-12.2	0.0	-17.6	-5.7	71.3	-3.5	0.0
60	7	56.3	8.8	0.0	0.0	-5.7	90.3	-2.8	0.0	57.3	-11.2	0.0	-15.1	-4.7	71.3	-2.4	0.0
62.5	8	58.4	7.8	0.0	0.0	0.4	84.4	0.0	0.0	56.4	-9.2	0.0	-10.7	-1.6	67.4	-0.3	0.0
65	9	60.5	4.8	0.0	0.0	9.4	73.4	0.0	0.0	55.5	-7.2	0.0	-6.9	3.4	61.4	0.0	0.0
67.5	30	70.6	-6.3	0.0	-4.3	30.5	45.5	0.0	0.0	55.6	-6.3	0.0	-5.3	16.5	45.5	0.0	0.0
70	31	80.7	-14.4	0.0	-17.9	13.5	74.5	0.0	0.0	58.7	-6.4	0.0	-5.1	-8.5	83.5	-6.5	0.0
70	31	80.7	-14.4	0.0	-17.9	13.5	74.5	0.0	0.0	58.7	-6.4	0.0	-5.1	-8.5	83.5	-6.5	0.0
72.5	2	78.8	-9.3	0.0	-8.1	39.5	42.5	0.0	0.0	62.8	-8.3	0.0	-8.0	23.5	43.5	0.0	0.0
75	3	70.8	5.7	0.0	0.0	18.6	73.6	0.0	0.0	62.8	-6.3	0.0	-4.7	11.6	61.6	0.0	0.0
75	3	69.8	-13.3	0.0	-17.5	18.6	55.6	0.0	0.0	62.8	-21.3	0.0	-44.4	11.6	46.6	0.0	0.0
77.5	4	62.8	-3.2	0.0	-1.3	4.6	73.6	0.0	0.0	59.8	-17.2	0.0	-31.8	1.6	59.6	0.0	0.0
80	5	58.9	3.8	0.0	0.0	-3.3	86.7	-1.0	0.0	59.9	-15.2	0.0	-25.4	-3.3	67.7	-1.3	0.0
82.5	6	56.9	7.8	0.0	0.0	-6.3	90.7	-3.4	0.0	58.9	-12.2	0.0	-17.2	-4.3	70.7	-2.0	0.0
85	7	58.0	7.9	0.0	0.0	-5.3	90.7	-2.4	0.0	58.0	-11.1	0.0	-14.8	-4.3	71.7	-2.0	0.0
87.5	8	59.0	6.9	0.0	0.0	0.8	83.8	0.0	0.0	57.0	-9.1	0.0	-10.3	-1.2	67.8	-0.2	0.0
90	9	61.0	5.0	0.0	0.0	9.8	72.8	0.0	0.0	56.0	-7.0	0.0	-6.5	3.8	61.8	0.0	0.0
92.5	40	70.1	-6.0	0.0	-3.9	30.9	45.9	0.0	0.0	56.1	-6.0	0.0	-4.8	16.9	45.9	0.0	0.0
95	41	80.1	-14.0	0.0	-17.1	12.9	75.9	0.0	0.0	59.1	-5.0	0.0	-3.2	-9.1	84.9	-7.3	0.0
95	41	80.1	-14.0	0.0	-17.1	12.9	75.9	0.0	0.0	59.1	-5.0	0.0	-3.2	-9.1	84.9	-7.3	0.0
97.5	2	79.2	-8.9	0.0	-7.5	39.9	42.9	0.0	0.0	63.2	-7.9	0.0	-7.3	23.9	43.9	0.0	0.0
100	3	71.2	6.1	0.0	0.0	19.0	74.0	0.0	0.0	63.2	-5.9	0.0	-4.1	12.0	62.0	0.0	0.0
100	3	70.2	-12.9	0.0	-16.5	19.0	56.0	0.0	0.0	63.2	-20.9	0.0	-42.8	12.0	47.0	0.0	0.0
102.5	4	63.2	-2.8	0.0	-1.0	5.0	74.0	0.0	0.0	60.2	-16.8	0.0	-30.4	2.0	60.0	0.0	0.0
105	5	59.3	4.2	0.0	0.0	-2.9	87.1	-0.8	0.0	60.3	-14.8	0.0	-24.1	-2.9	68.1	-1.0	0.0
107.5	6	57.3	8.2	0.0	0.0	-5.9	91.1	-3.0	0.0	59.3	-11.8	0.0	-16.1	-3.9	71.1	-1.7	0.0
110	7	58.4	8.3	0.0	0.0	-4.9	91.1	-2.0	0.0	58.4	-10.7	0.0	-13.7	-3.9	72.1	-1.6	0.0
112.5	8	59.4	7.3	0.0	0.0	1.2	84.2	0.0	0.0	57.4	-8.7	0.0	-9.4	-0.8	68.2	-0.1	0.0
115	9	61.4	5.4	0.0	0.0	10.2	73.2	0.0	0.0	56.4	-6.6	0.0	-5.8	4.2	62.2	0.0	0.0
117.5	50	70.5	-5.6	0.0	-3.4	31.3	46.3	0.0	0.0	56.5	-5.6	0.0	-4.2	17.3	46.3	0.0	0.0
120	51	80.5	-13.6	0.0	-16.1	13.3	76.3	0.0	0.0	59.5	-4.6	0.0	-2.7	-8.7	85.3	-6.6	0.0
120	51	80.5	-13.6	0.0	-16.1	13.3	76.3	0.0	0.0	59.5	-4.6	0.0	-2.7	-8.7	85.3	-6.6	0.0
122.5	2	79.6	-8.5	0.0	-6.8	40.3	43.3	0.0	0.0	63.6	-7.5	0.0	-6.6	24.3	44.3	0.0	0.0
125	3	71.6	6.5	0.0	0.0	19.4	74.4	0.0	0.0	63.6	-5.5	0.0	-3.6	12.4	62.4	0.0	0.0
125	3	70.6	-12.5	0.0	-15.5	19.4	56.4	0.0	0.0	63.6	-20.5	0.0	-41.2	12.4	47.4	0.0	0.0
127.5	4	63.6	-2.4	0.0	-0.7	5.4	74.4	0.0	0.0	60.6	-16.4	0.0	-28.9	2.4	60.4	0.0	0.0
130	5	59.7	4.6	0.0	0.0	-2.5	87.5	-0.6	0.0	60.7	-14.4	0.0	-22.8	-2.5	68.5	-0.8	0.0
132.5	6	57.7	8.6	0.0	0.0	-5.5	91.5	-2.6	0.0	59.7	-11.4	0.0	-15.0	-3.5	71.5	-1.4	0.0
135	7	58.8	8.7	0.0	0.0	-4.5	91.5	-1.7	0.0	58.8	-10.3	0.0	-12.7	-3.5	72.5	-1.3	0.0
137.5	8	59.8	7.7	0.0	0.0	1.6	84.6	0.0	0.0	57.8	-8.3	0.0	-8.6	-0.4	68.6	-0.0	0.0
140	9	61.8	5.8	0.0	0.0	10.6	73.6	0.0	0.0	56.8	-6.2	0.0	-5.1	4.6	62.6	0.0	0.0
142.5	60	70.9	-5.2	0.0	-2.9	31.7	46.7	0.0	0.0	56.9	-5.2	0.0	-3.6	17.7	46.7	0.0	0.0
145	61	80.9	-13.2	0.0	-15.2	13.7	76.7	0.0	0.0	59.9	-4.2	0.0	-2.2	-8.3	85.7	-6.1	0.0
145	61	80.9	-13.2	0.0	-15.2	13.7	76.7	0.0	0.0	59.9	-4.2	0.0	-2.2	-8.3	85.7	-6.1	0.0
147.5	2	80.0	-8.1	0.0	-6.2	40.7	43.7	0.0	0.0	64.0	-7.1	0.0	-5.9	24.7	44.7	0.0	0.0
150	3	72.0	6.9	0.0	0.0	19.8	74.8	0.0	0.0	64.0	-5.1	0.0	-3.1	12.8	62.8	0.0	0.0
150	3	71.0	-12.1	0.0	-14.5	19.8	56.8	0.0	0.0	64.0	-20.1	0.0	-39.6	12.8	47.8	0.0	0.0
152.5	4	64.0	-2.0	0.0	-0.5	5.8	74.8	0.0	0.0	61.0	-16.0	0.0	-27.6	2.8	60.8	0.0	0.0
155	5	60.1	5.0	0.0	0.0	-2.1	87.9	-0.4	0.0	61.1	-14.0	0.0	-21.6	-2.1	68.9	-0.5	0.0
157.5	6	58.1	9.0	0.0	0.0	-5.1	91.9	-2.2	0.0	60.1	-11.0	0.0	-14.0	-3.1	71.9	-1.1	0.0
160	7	59.2	9.1	0.0	0.0	-4.1	91.9	-1.4	0.0	59.2	-9.9	0.0	-11.8	-3.1	72.9	-1.0	0.0
162.5	8	60.2	8.1	0.0	0.0	2.0	85.0	0.0	0.0	58.2	-7.9	0.0	-7.8	-0.0	69.0	-0.0	0.0
165	9	62.2	6.2	0.0	0.0	11.0	74.0	0.0	0.0	57.2	-5.8	0.0	-4.5	5.0	63.0	0.0	0.0
167.5	70	71.3	-4.8	0.0	-2.5	32.1	47.1	0.0	0.0	57.3	-4.8	0.0	-3.1	18.1	47.1	0.0	0.0
170	71	81.3	-12.8	0.0	-14.3	14.1	77.1	0.0	0.0	60.3	-3.8	0.0	-1.8	-7.9	86.1	-5.5	0.0
170	71	81.3	-12.8	0.0	-14.3	14.1	77.1	0.0	0.0	60.3	-3.8	0.0	-1.8	-7.9	86.1	-5.5	0.0
172.5	2	80.4	-7.7	0.0	-5.6	41.1	44.1	0.0	0.0	64.4	-6.7	0.0	-5.3	25.1	45.1	0.0	0.0
175	3	72.4	7.3	0.0	0.0	20.2	75.2	0.0	0.0	64.4	-4.7	0.0	-2.6	13.2	63.2	0.0	0.0
175	3	71.4	-11.7	0.0	-13.6	20.2	57.2	0.0	0.0	64.4	-19.7	0.0	-38.0	13.2	48.2	0.0	0.0
177.5	4	64.4	-1.6	0.0	-0.3	6.2	75.2	0.0	0.0	61.4	-15.6	0.0	-26.2	3.2	61.2	0.0	0.0
180	5	60.5	5.4	0.0	0.0	-1.7	88.3	-0.3	0.0	61.5	-13.6	0.0	-20.3	-1.7	69.3	-0.4	0.0
182.5	6	58.5	9.4	0.0	0.0	-4.7	92.3	-1.9	0.0	60.5	-10.6	0.0	-13.0	-2.7	72.3	-0.8	0.0
185	7	59.6	9.5	0.0	0.0	-3.7	92.3	-1.2	0.0	59.6	-9.5	0.0	-10.8	-2.7	73.3	-0.8	0.0
187.5	8	60.6	8.5	0.0	0.0	2.4	85.4	0.0	0.0	58.6	-7.5	0.0	-7.0	0.4	69.4	0.0	0.0
190	9	62.6	6.6	0.0	0.0	11.4	74.4	0.0	0.0	57.6	-5.4	0.0	-3.9	5.4	63.4	0.0	0.0
192.5	80	71.7	-4.4	0.0	-2.1	32.5	47.5	0.0	0.0	57.7	-4.4	0.0	-2.6	18.5	47.5	0.0	0.0
195	81	81.7	-12.4	0.0	-13.4	14.5	77.5	0.0	0.0	60.7	-3.4	0.0	-1.5	-7.5	86.5	-4.9	0.0

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		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
195	81	81.7	-12.4	0.0	-13.4	14.5	77.5	0.0	0.0	60.7	-3.4	0.0	-1.5	-7.5	86.5	-4.9	0.0
197.5	2	80.8	-7.3	0.0	-5.0	41.5	44.5	0.0	0.0	64.8	-6.3	0.0	-4.6	25.5	45.5	0.0	0.0
200	3	72.8	7.7	0.0	0.0	20.6	75.6	0.0	0.0	64.8	-4.3	0.0	-2.2	13.6	63.6	0.0	0.0
200	3	71.8	-11.3	0.0	-12.7	20.6	57.6	0.0	0.0	64.8	-19.3	0.0	-36.5	13.6	48.6	0.0	0.0
202.5	4	64.8	-1.2	0.0	-0.2	6.6	75.6	0.0	0.0	61.8	-15.2	0.0	-24.9	3.6	61.6	0.0	0.0
205	5	60.9	5.8	0.0	0.0	-1.3	88.7	-0.2	0.0	61.9	-13.2	0.0	-19.2	-1.3	69.7	-0.2	0.0
207.5	6	58.9	9.8	0.0	0.0	-4.3	92.7	-1.6	0.0	60.9	-10.2	0.0	-12.0	-2.3	72.7	-0.6	0.0
210	7	60.0	9.9	0.0	0.0	-3.3	92.7	-0.9	0.0	60.0	-9.1	0.0	-9.9	-2.3	73.7	-0.6	0.0
212.5	8	61.0	8.9	0.0	0.0	2.8	85.8	0.0	0.0	59.0	-7.1	0.0	-6.3	0.8	69.8	0.0	0.0
215	9	63.0	7.0	0.0	0.0	11.8	74.8	0.0	0.0	58.0	-5.0	0.0	-3.3	5.8	63.8	0.0	0.0
217.5	90	72.1	-4.0	0.0	-1.7	32.9	47.9	0.0	0.0	58.1	-4.0	0.0	-2.1	18.9	47.9	0.0	0.0
220	91	82.1	-12.0	0.0	-12.6	14.9	77.9	0.0	0.0	61.1	-3.0	0.0	-1.1	-7.1	86.9	-4.4	0.0
220	91	82.1	-12.0	0.0	-12.6	14.9	77.9	0.0	0.0	61.1	-3.0	0.0	-1.1	-7.1	86.9	-4.4	0.0
222.5	2	81.2	-6.9	0.0	-4.5	41.9	44.9	0.0	0.0	65.2	-5.9	0.0	-4.1	25.9	45.9	0.0	0.0
225	3	73.2	8.1	0.0	0.0	21.0	76.0	0.0	0.0	65.2	-3.9	0.0	-1.8	14.0	64.0	0.0	0.0
225	3	72.2	-10.9	0.0	-11.8	21.0	58.0	0.0	0.0	65.2	-18.9	0.0	-35.0	14.0	49.0	0.0	0.0
227.5	4	65.2	-0.8	0.0	-0.1	7.0	76.0	0.0	0.0	62.2	-14.8	0.0	-23.8	4.0	62.0	0.0	0.0
230	5	61.3	6.2	0.0	0.0	-0.9	89.1	-0.1	0.0	62.3	-12.8	0.0	-18.0	-0.9	70.1	-0.1	0.0
232.5	6	59.3	10.2	0.0	0.0	-3.9	93.1	-1.3	0.0	61.3	-9.8	0.0	-11.1	-1.9	73.1	-0.4	0.0
235	7	60.4	10.3	0.0	0.0	-2.9	93.1	-0.7	0.0	60.4	-8.7	0.0	-9.1	-1.9	74.1	-0.4	0.0
237.5	8	61.4	9.3	0.0	0.0	3.2	86.2	0.0	0.0	59.4	-6.7	0.0	-5.6	1.2	70.2	0.0	0.0
240	9	63.4	7.4	0.0	0.0	12.2	75.2	0.0	0.0	58.4	-4.6	0.0	-2.8	6.2	64.2	0.0	0.0
242.5	100	72.5	-3.6	0.0	-1.4	33.3	48.3	0.0	0.0	58.5	-3.6	0.0	-1.7	19.3	48.3	0.0	0.0
245	101	82.5	-11.6	0.0	-11.7	15.3	78.3	0.0	0.0	61.5	-2.6	0.0	-0.8	-6.7	87.3	-4.0	0.0
245	101	82.5	-11.6	0.0	-11.7	15.3	78.3	0.0	0.0	61.5	-2.6	0.0	-0.8	-6.7	87.3	-4.0	0.0
247.5	2	81.6	-6.5	0.0	-4.0	42.3	45.3	0.0	0.0	65.6	-5.5	0.0	-3.5	26.3	46.3	0.0	0.0
250	3	73.6	8.5	0.0	0.0	21.4	76.4	0.0	0.0	65.6	-3.5	0.0	-1.5	14.4	64.4	0.0	0.0
250	3	72.6	-10.5	0.0	-10.9	21.4	58.4	0.0	0.0	65.6	-18.5	0.0	-33.5	14.4	49.4	0.0	0.0
252.5	4	65.6	-0.4	0.0	-0.0	7.4	76.4	0.0	0.0	62.6	-14.4	0.0	-22.3	4.4	62.4	0.0	0.0
255	5	61.7	6.6	0.0	0.0	-0.5	89.5	-0.0	0.0	62.7	-12.4	0.0	-16.9	-0.5	70.5	-0.0	0.0
257.5	6	59.7	10.6	0.0	0.0	-3.5	93.5	-1.0	0.0	61.7	-9.4	0.0	-10.2	-1.5	73.5	-0.3	0.0
260	7	60.8	10.7	0.0	0.0	-2.5	93.5	-0.5	0.0	60.8	-8.3	0.0	-8.3	-1.5	74.5	-0.2	0.0
262.5	8	61.8	9.7	0.0	0.0	3.6	86.6	0.0	0.0	59.8	-6.3	0.0	-4.9	1.6	70.6	0.0	0.0
265	9	63.8	7.8	0.0	0.0	12.6	75.6	0.0	0.0	58.8	-4.2	0.0	-2.4	6.6	64.6	0.0	0.0
267.5	110	72.9	-3.2	0.0	-1.1	33.7	48.7	0.0	0.0	58.9	-3.2	0.0	-1.4	19.7	48.7	0.0	0.0
270	111	82.9	-11.2	0.0	-10.9	15.7	78.7	0.0	0.0	61.9	-2.2	0.0	-0.6	-6.3	87.7	-3.5	0.0
270	111	82.9	-11.2	0.0	-10.9	15.7	78.7	0.0	0.0	61.9	-2.2	0.0	-0.6	-6.3	87.7	-3.5	0.0
272.5	2	81.9	-6.1	0.0	-3.5	42.7	45.7	0.0	0.0	65.9	-5.1	0.0	-3.1	26.7	46.7	0.0	0.0
275	3	74.0	8.9	0.0	0.0	21.8	76.8	0.0	0.0	66.0	-3.1	0.0	-1.1	14.8	64.8	0.0	0.0
275	3	73.0	-10.1	0.0	-10.1	21.8	58.8	0.0	0.0	66.0	-18.1	0.0	-32.1	14.8	49.8	0.0	0.0
277.5	4	66.0	-0.1	0.0	-0.0	7.8	76.8	0.0	0.0	63.0	-14.1	0.0	-21.1	4.8	62.8	0.0	0.0
280	5	62.1	7.0	0.0	0.0	-0.2	89.8	-0.0	0.0	63.1	-12.0	0.0	-15.9	-0.2	70.8	-0.0	0.0
282.5	6	60.1	11.0	0.0	0.0	-3.1	93.9	-0.8	0.0	62.1	-9.0	0.0	-9.3	-1.1	73.9	-0.1	0.0
285	7	61.1	11.1	0.0	0.0	-2.1	93.9	-0.4	0.0	61.1	-7.9	0.0	-7.5	-1.1	74.9	-0.1	0.0
287.5	8	62.2	10.1	0.0	0.0	4.0	87.0	0.0	0.0	60.2	-5.9	0.0	-4.3	2.0	71.0	-0.0	0.0
290	9	64.2	8.1	0.0	0.0	13.0	76.0	0.0	0.0	59.2	-3.9	0.0	-1.9	7.0	65.0	0.0	0.0
292.5	120	73.3	-2.8	0.0	-0.9	34.0	49.0	0.0	0.0	59.3	-2.8	0.0	-1.0	20.0	49.0	0.0	0.0
295	121	83.3	-10.8	0.0	-10.2	16.1	79.1	0.0	0.0	62.3	-1.8	0.0	-0.4	-5.9	88.1	-3.1	0.0
295	121	83.3	-10.8	0.0	-10.2	16.1	79.1	0.0	0.0	62.3	-1.8	0.0	-0.4	-5.9	88.1	-3.1	0.0
297.5	2	82.3	-5.7	0.0	-3.1	43.1	46.1	0.0	0.0	66.3	-4.7	0.0	-2.6	27.1	47.1	0.0	0.0
300	3	74.4	9.3	0.0	0.0	22.2	77.2	0.0	0.0	66.4	-2.7	0.0	-0.9	15.2	65.2	0.0	0.0
300	3	73.4	-9.7	0.0	-9.3	22.2	59.2	0.0	0.0	66.4	-17.7	0.0	-30.7	15.2	50.2	0.0	0.0
302.5	4	66.4	0.3	0.0	0.0	8.2	77.2	0.0	0.0	63.4	-13.7	0.0	-19.9	5.2	63.2	0.0	0.0
305	5	62.5	7.4	0.0	0.0	0.2	90.2	0.0	0.0	63.5	-11.6	0.0	-14.8	0.2	71.2	0.0	0.0
307.5	6	60.5	11.4	0.0	0.0	-2.7	94.3	-0.6	0.0	62.5	-8.6	0.0	-8.5	-0.7	74.3	-0.1	0.0
310	7	61.5	11.5	0.0	0.0	-1.7	94.3	-0.2	0.0	61.5	-7.5	0.0	-6.8	-0.7	75.3	-0.0	0.0
312.5	8	62.6	10.5	0.0	0.0	4.4	87.4	0.0	0.0	60.6	-5.5	0.0	-3.8	2.4	71.4	0.0	0.0
315	9	64.6	8.5	0.0	0.0	13.4	76.4	0.0	0.0	59.6	-3.5	0.0	-1.6	7.4	65.4	0.0	0.0
317.5	130	73.7	-2.4	0.0	-0.8	34.4	49.4	0.0	0.0	59.7	-2.4	0.0	-0.8	20.4	49.4	0.0	0.0
320	131	83.7	-10.4	0.0	-9.4	16.5	79.5	0.0	0.0	62.7	-1.4	0.0	-0.2	-5.5	88.5	-2.7	0.0
320	131	83.7	-10.4	0.0	-9.4	16.5	79.5	0.0	0.0	62.7	-1.4	0.0	-0.2	-5.5	88.5	-2.7	0.0
322.5	2	82.7	-5.3	0.0	-2.7	43.5	46.5	0.0	0.0	66.7	-4.3	0.0	-2.2	27.5	47.5	0.0	0.0
325	3	74.8	9.7	0.0	0.0	22.6	77.6	0.0	0.0	66.8	-2.3	0.0	-0.6	15.6	65.6	0.0	0.0
325	3	73.8	-9.3	0.0	-8.6	22.6	59.6	0.0	0.0	66.8	-17.3	0.0	-29.3	15.6	50.6	0.0	0.0
327.5	4	66.8	0.7	0.0	0.0	8.6	77.6	0.0	0.0	63.8	-13.3	0.0	-18.8	5.6	63.6	0.0	0.0
330	5	62.9	7.8	0.0	0.0	0.6	90.6	0.0	0.0	63.9	-11.2	0.0	-13.8	0.6	71.6	0.0	0.0
332.5	6	60.9	11.8	0.0	0.0	-2.3	94.7	-0.5	0.0	62.9	-8.2	0.0	-7.8	-0.3	74.7	-0.0	0.0
335	7	61.9	11.9	0.0	0.0	-1.3	94.7	-0.1	0.0	61.9	-7.1	0.0	-6.1	-0.3	75.7	-0.0	0.0
337.5	8	63.0	10.9	0.0	0.0	4.8	87.8	0.0	0.0	61.0	-5.1	0.0	-3.2	2.8	71.8	0.0	0.0
340	9	65.0	8.9	0.0	0.0	13.8	76.8	0.0	0.0	60.0	-3.1	0.0	-1.2	7.8	65.8	0.0	0.0
342.5	140	74.1	-2.0	0.0	-0.4	34.8	49.8	0.0	0.0	60.1	-2.0	0.0	-0.5	20.8	49.8	0.0	0.0
345	141	84.1	-10.0	0.0	-8.7	16.9	79.9	0.0	0.0	63.1	-1.0	0.0	-0.1	-5.1	88.9	-2.3	0.0
345	141	84.1	-10.0	0.0	-8.7	16.9	79.9	0.0	0.0	63.1	-1.0	0.0	-0.1	-5.1	88.9	-2.3	0.0
347.5	2	83.1	-4.9	0.0	-2.3	43.9	46.9	0.0	0.0	67.1	-3.9	0.0	-1.8	27.9	47.9	0.0	0.0
350	3	75.2	10.1	0.0	0.0	23.0	78.0	0.0	0.0	67.2	-1.9	0.0	-0.4	16.0	66.0	0.0	0.0
350	3	74.2	-8.9	0.0	-7.9	23.0	60.0	0.0	0.0	67.2	-16.9	0.0	-28.0	16.0	51.0	0.0	0.0
352.5	4	67.2	1.1	0.0	0.0	9.0	78.0	0.0	0.0	64.2	-12.9	0.0	-17.7	6.0	64.0	0.0	0.0
355	5	63.3	8.2	0.0	0.0	1.0	91.0	0.0	0.0	64.3	-10.8	0.0	-12.8	1.0	72.0	0.0	0.0
357.5	6	61.3	12.2	0.0	0.0	-1.9	95.1	-0.3	0.0	63.3	-7.8	0.0	-7.0	0.1	75.1	0.0	0.0
360	7	62.3	12.3	0.0	0.0	-0.9	95.1	-0.1	0.0	62.3	-6.7	0.0	-5.4	0.1	76.1	0.0	0.0
362.5	8	63.4	11.3	0.0	0.0	5.2	88.2	0.0	0.0	61.4	-4.7	0.0	-2.8	3.2	72.2	0.0	0.0
365	9	65.4	9.3	0.0	0.0	14.2	77.2	0.0	0.0	60.4	-2.7	0.0	-0.9	8.2	66.2	0.0	0.0
367.5	150	74.5	-1.6	0.0	-0.3	35.2	50.2	0.0	0.0	60.5	-1.6	0.0	-0.3	21.2	50.2	0.0	0.0
370	151	84.5	-9.6	0.0	-8.0	17.3	80.3	0.0	0.0	63.5	-0.6	0.0	-0.0	-4.7	89.3	-2.0	0.0
370	151	84.5	-9.6	0.0	-8.0	17.3	80.3	0.0	0.0	63.5	-0.6	0.0	-0.0	-4.7	89.3	-2.0	0.0
372.5	2	83.5	-4.5	0.0	-1.9	44.3	47.3	0.0	0.0	67.5	-3.5	0.0	-1.4	28.3	48.3	0.0	0.0
375	3	75.6	10.5	0.0	0.0	23.4	78.4	0.0	0.0	67.6	-1.5	0.0	-0.3	16.4	66.4	0.0	0.0
375	3	74.6	-8.5	0.0	-7.2	23.4	60.4	0.0	0.0	67.6	-16.5	0.0	-26.7	16.4	51.4	0.0	0.0
377.5	4	67.6	1.5	0.0	0.0	9.4	78.4	0.0	0.0	64.6	-12.5	0.0	-16.6	6.4	64.4	0.0	0.0
380	5	63.7	8.6	0.0	0.0	1.4	91.4	0.0	0.0	64.7	-10.4	0.0	-11.9	1.4	72.4	0.0	0.0
382.5	6	61.7	12.6	0.0	0.0	-1.5	95.5	-0.2	0.0	63.7	-7.4	0.0	-6.3	0.5	75.5	0.0	0.0
385	7	62.7	12.7	0.0	0.0	-0.5	95.5	-0.0	0.0	62.7	-6.3	0.0	-4.8	0.5	76.5	0.0	0.0
387.5	8	63.8	11.7	0.0	0.0	5.6	88.6	0.0	0.0	61.8	-4.3	0.0	-2.3	3.6	72.6	0.0	0.0
390	9	65.8	9.7	0.0	0.0	14.6	77.6	0.0	0.0	60.8	-2.3	0.0	-0.7	8.6	66.6	0.0	0.0
392.5	160	74.9	-1.2	0.0	-0.2	35.6	50.6	0.0	0.0	60.9	-1.2	0.0	-0.2	21.6	50.6	0.0	0.0

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TESADO 80% ANCLADO 75%

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
395	161	84.9	-9.2	0.0	-7.4	17.7	80.7	0.0	0.0	63.9	-0.2	0.0	-0.0	-4.3	89.7	-1.6	0.0
395	161	84.9	-9.2	0.0	-7.4	17.7	80.7	0.0	0.0	63.9	-0.2	0.0	-0.0	-4.3	89.7	-1.6	0.0
397.5	2	83.9	-4.1	0.0	-1.6	44.7	47.7	0.0	0.0	57.9	-3.1	0.0	-1.1	26.7	48.7	0.0	0.0
400	3	76.0	10.9	0.0	0.0	23.8	78.8	0.0	0.0	66.0	-1.1	0.0	-0.1	16.8	66.8	0.0	0.0
400	3	75.0	-6.1	0.0	-6.5	23.8	60.8	0.0	0.0	66.0	-16.1	0.0	-25.4	16.8	51.8	0.0	0.0
402.5	4	68.0	1.9	0.0	0.0	9.8	78.8	0.0	0.0	65.0	-12.1	0.0	-15.6	6.8	64.8	0.0	0.0
405	5	64.1	9.0	0.0	0.0	1.8	91.8	0.0	0.0	65.1	-10.0	0.0	-11.0	1.8	72.8	0.0	0.0
407.5	6	62.1	13.0	0.0	0.0	-1.1	95.9	-0.1	0.0	64.1	-7.0	0.0	-5.6	0.9	75.9	0.0	0.0
410	7	63.1	13.1	0.0	0.0	-0.1	95.9	-0.0	0.0	63.1	-5.9	0.0	-4.2	0.9	76.9	0.0	0.0
412.5	8	64.2	12.1	0.0	0.0	6.0	89.0	0.0	0.0	62.2	-3.9	0.0	-1.9	4.0	73.0	0.0	0.0
415	9	66.2	10.1	0.0	0.0	15.0	78.0	0.0	0.0	61.2	-1.9	0.0	-0.5	9.0	67.0	0.0	0.0
417.5	170	75.3	-0.8	0.0	-0.1	36.0	51.0	0.0	0.0	61.3	-0.8	0.0	-0.1	22.0	51.0	0.0	0.0
420	171	85.3	-6.8	0.0	-6.8	18.1	81.1	0.0	0.0	64.3	0.2	0.0	0.0	-3.9	90.1	-1.3	0.0
420	171	85.3	-6.8	0.0	-6.8	18.1	81.1	0.0	0.0	64.3	0.2	0.0	0.0	-3.9	90.1	-1.3	0.0
422.5	2	84.3	-3.7	0.0	-1.3	45.1	48.1	0.0	0.0	58.3	-2.7	0.0	-0.9	29.1	49.1	0.0	0.0
425	3	76.4	11.3	0.0	0.0	24.2	79.2	0.0	0.0	68.4	-0.7	0.0	-0.1	17.2	67.2	0.0	0.0
425	3	75.4	-7.7	0.0	-5.9	24.2	61.2	0.0	0.0	68.4	-15.7	0.0	-24.2	17.2	52.2	0.0	0.0
427.5	4	68.4	2.3	0.0	0.0	10.2	79.2	0.0	0.0	65.4	-11.7	0.0	-14.5	7.2	65.2	0.0	0.0
430	5	64.5	9.4	0.0	0.0	2.2	92.2	0.0	0.0	65.5	-9.6	0.0	-10.2	2.2	73.2	0.0	0.0
432.5	6	62.5	13.4	0.0	0.0	-0.7	96.3	-0.0	0.0	64.5	-6.6	0.0	-5.0	1.3	76.3	0.0	0.0
435	7	63.5	13.5	0.0	0.0	0.3	96.3	0.0	0.0	63.5	-5.5	0.0	-3.7	1.3	77.3	0.0	0.0
437.5	8	64.6	12.5	0.0	0.0	6.4	89.4	0.0	0.0	62.6	-3.5	0.0	-1.5	4.4	73.4	0.0	0.0
440	9	66.6	10.5	0.0	0.0	15.4	78.4	0.0	0.0	61.6	-1.5	0.0	-0.3	9.4	67.4	0.0	0.0
442.5	180	75.7	-0.4	0.0	-0.0	36.4	51.4	0.0	0.0	61.7	-0.4	0.0	-0.0	22.4	51.4	0.0	0.0
445	181	85.7	-6.4	0.0	-6.2	18.5	81.5	0.0	0.0	64.7	0.6	0.0	0.0	-3.5	90.5	-1.1	0.0
445	181	85.7	-6.4	0.0	-6.2	18.5	81.5	0.0	0.0	64.7	0.6	0.0	0.0	-3.5	90.5	-1.1	0.0
447.5	2	84.7	-3.3	0.0	-1.0	45.5	48.5	0.0	0.0	58.7	-2.3	0.0	-0.6	29.5	49.5	0.0	0.0
450	3	76.8	11.7	0.0	0.0	24.6	79.6	0.0	0.0	68.8	-0.3	0.0	-0.0	17.6	67.6	0.0	0.0
450	3	75.8	-7.3	0.0	-5.3	24.6	61.6	0.0	0.0	68.8	-15.3	0.0	-23.0	17.6	52.6	0.0	0.0
452.5	4	68.8	2.7	0.0	0.0	10.6	79.6	0.0	0.0	65.8	-11.3	0.0	-13.6	7.6	65.6	0.0	0.0
455	5	64.9	9.8	0.0	0.0	2.6	92.6	0.0	0.0	65.9	-9.2	0.0	-9.3	2.6	73.6	0.0	0.0
457.5	6	62.9	13.8	0.0	0.0	-0.3	96.7	-0.0	0.0	64.9	-6.2	0.0	-4.4	1.7	76.7	0.0	0.0
460	7	63.9	13.9	0.0	0.0	0.7	96.7	0.0	0.0	63.9	-5.1	0.0	-3.2	1.7	77.7	0.0	0.0
462.5	8	65.0	12.9	0.0	0.0	6.8	89.8	0.0	0.0	63.0	-3.1	0.0	-1.2	4.8	73.8	0.0	0.0
465	9	67.0	10.9	0.0	0.0	15.8	78.8	0.0	0.0	62.0	-1.1	0.0	-0.1	9.8	67.8	0.0	0.0
467.5	190	76.1	-0.0	0.0	-0.0	36.8	51.8	0.0	0.0	62.1	-0.0	0.0	-0.0	22.8	51.8	0.0	0.0
470	191	86.1	-6.0	0.0	-5.6	18.9	81.9	0.0	0.0	65.1	1.0	0.0	0.0	-3.1	90.9	-0.9	0.0
470	191	86.1	-6.0	0.0	-5.6	18.9	81.9	0.0	0.0	65.1	1.0	0.0	0.0	-3.1	90.9	-0.9	0.0
472.5	2	85.1	-1.8	0.0	-0.3	44.9	49.9	0.0	0.0	59.1	-1.8	0.0	-0.4	28.9	50.9	0.0	0.0
475	3	76.0	12.3	0.0	0.0	24.0	81.0	0.0	0.0	69.0	0.3	0.0	0.0	17.0	69.0	0.0	0.0
475	3	76.0	-6.7	0.0	-4.5	24.0	62.0	0.0	0.0	69.0	-14.7	0.0	-21.3	17.0	54.0	0.0	0.0
477.5	4	68.0	4.4	0.0	0.0	10.0	81.0	0.0	0.0	66.0	-10.6	0.0	-12.1	8.0	66.0	0.0	0.0
480	5	65.0	10.5	0.0	0.0	3.0	93.0	0.0	0.0	65.0	-7.5	0.0	-6.4	3.0	74.0	0.0	0.0
482.5	6	63.0	14.6	0.0	0.0	0.1	98.1	0.0	0.0	65.0	-5.4	0.0	-3.4	1.1	78.1	0.0	0.0
485	7	63.0	15.7	0.0	0.0	2.1	96.1	0.0	0.0	64.0	-4.3	0.0	-2.2	3.1	77.1	0.0	0.0
487.5	8	65.0	14.8	0.0	0.0	8.2	89.2	0.0	0.0	63.0	-2.2	0.0	-0.6	6.2	73.2	0.0	0.0
490	9	67.0	13.0	0.0	0.0	17.2	78.2	0.0	0.0	61.0	1.0	0.0	0.0	11.2	67.2	0.0	0.0
492.5	200	74.9	3.1	0.0	0.0	36.2	51.2	0.0	0.0	60.9	3.1	0.0	0.0	24.2	51.2	0.0	0.0
495	201	86.9	-6.8	0.0	-4.0	19.3	81.3	0.0	0.0	64.9	2.2	0.0	0.0	-1.7	90.3	-0.3	0.0
495	201	86.9	-6.8	0.0	-4.0	19.3	81.3	0.0	0.0	64.9	2.2	0.0	0.0	-1.7	90.3	-0.3	0.0
497.5	2	84.2	-1.1	0.0	-0.1	45.3	50.3	0.0	0.0	58.2	-0.1	0.0	-0.0	29.3	51.3	0.0	0.0
500	3	76.6	12.5	0.0	0.0	24.4	81.4	0.0	0.0	69.6	0.5	0.0	0.0	17.4	69.4	0.0	0.0
500	3	76.6	-6.5	0.0	-4.2	24.4	62.4	0.0	0.0	69.6	-14.5	0.0	-20.6	17.4	54.4	0.0	0.0
502.5	4	68.6	4.3	0.0	0.0	11.4	80.4	0.0	0.0	66.6	-10.7	0.0	-12.2	9.4	65.4	0.0	0.0
505	5	66.1	11.0	0.0	0.0	4.4	91.4	0.0	0.0	66.1	-8.0	0.0	-7.1	5.4	72.4	0.0	0.0
507.5	6	64.3	14.8	0.0	0.0	2.5	95.5	0.0	0.0	65.3	-5.2	0.0	-3.2	4.5	74.5	0.0	0.0
510	7	63.6	16.6	0.0	0.0	4.5	93.5	0.0	0.0	64.6	-3.4	0.0	-1.4	5.5	73.5	0.0	0.0
512.5	8	63.8	16.4	0.0	0.0	11.6	85.6	0.0	0.0	62.8	-0.6	0.0	-0.1	9.6	69.6	0.0	0.0
515	9	66.1	15.1	0.0	0.0	21.6	73.6	0.0	0.0	60.1	3.1	0.0	0.0	16.6	61.6	0.0	0.0
517.5	210	74.4	4.8	0.0	0.0	43.6	45.6	0.0	0.0	60.4	4.8	0.0	0.0	29.6	44.6	0.0	0.0
520	211	88.7	-8.6	0.0	-6.3	24.7	75.7	0.0	0.0	67.7	-0.6	0.0	-0.0	3.7	83.7	0.0	0.0
520	211	88.7	-8.6	0.0	-6.3	24.7	75.7	0.0	0.0	67.7	-0.6	0.0	-0.0	3.7	83.7	0.0	0.0
522	2	82.2	3.5	0.0	0.0	38.7	59.7	0.0	0.0	67.2	2.5	0.0	0.0	24.7	58.7	0.0	0.0
524	3	66.7	26.6	0.0	0.0	13.7	96.7	0.0	0.0	61.7	12.6	0.0	0.0	8.7	81.7	0.0	0.0
524	3	63.7	-18.4	0.0	-34.0	10.7	51.7	0.0	0.0	59.7	-24.4	0.0	-58.4	6.7	45.7	0.0	0.0
526	4	59.8	-12.2	0.0	-17.1	4.8	59.8	0.0	0.0	58.8	-23.2	0.0	-54.2	3.8	49.8	0.0	0.0
528	5	53.0	-2.0	0.0	-0.6	-2.2	69.8	-0.6	0.0	54.0	-16.0	0.0	-30.3	-0.2	55.8	-0.0	0.0
530	6	46.2	8.1	0.0	0.0	-5.2	75.8	-2.7	0.0	49.2	-8.9	0.0	-11.2	-2.2	58.8	-0.6	0.0
532	7	41.3	15.3	0.0	0.0	-5.1	75.9	-2.7	0.0	45.3	-2.7	0.0	-1.3	-1.1	58.9	-0.2	0.0
534	8	37.5	20.5	0.0	0.0	-0.1	70.9	-0.0	0.0	40.5	3.5	0.0	0.0	1.9	54.9	0.0	0.0
536	9	34.7	24.7	0.0	0.0	6.9	61.9	0.0	0.0	36.7	10.7	0.0	0.0	7.9	46.9	0.0	0.0
538	220	32.8	27.8	0.0	0.0	18.0	48.0	0.0	0.0	31.8	16.8	0.0	0.0	16.0	37.0	0.0	0.0
540	221	30.0	33.0	0.0	0.0	30.0	33.0	0.0	0.0	25.0	27.0	0.0	0.0	25.0	27.0	0.0	0.0

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
0	1	0.0	0.0	58.2	16.89	18.89
2	2	0.0	0.0	57.9	16.82	18.82
4	3	0.0	0.0	57.7	16.75	18.75
6	4	-1.0	0.0	57.5	19.01	18.68
8	5	-1.0	0.0	57.3	18.93	18.61
10	6	-0.5	0.0	57.1	18.70	18.54
12	7	0.0	-1.6	56.9	18.47	18.99
14	8	0.0	-4.3	56.7	18.40	19.79
16	9	0.0	-3.4	56.4	18.33	19.43
18	10	0.0	-18.5	56.2	18.26	24.26
20	11	-2.6	-18.6	56.0	19.09	24.22
20	11	-2.6	-18.6	56.0	19.09	24.22
22.5	2	0.0	-6.0	55.7	18.10	20.69
25	3	0.0	-6.6	55.5	18.01	20.79
25	3	0.0	-53.3	55.5	18.01	35.32
27.5	4	0.0	-42.1	55.2	17.92	31.60
30	5	0.0	-34.1	54.9	17.84	28.92
32.5	6	-0.4	-27.2	54.7	17.89	26.57
35	7	-0.5	-23.3	54.4	17.83	25.23
37.5	8	-0.0	-15.0	54.1	17.57	22.43
40	9	0.0	-8.0	53.9	17.49	20.10
42.5	20	0.0	-4.1	53.6	17.40	18.72
45	21	-10.2	-13.1	53.3	20.63	21.58
45	21	-10.2	-13.1	53.3	20.63	21.58
47.5	2	0.0	-3.2	53.0	17.22	18.28
50	3	0.0	-1.2	52.8	17.14	17.54
50	3	0.0	-34.8	52.8	17.14	28.36
52.5	4	0.0	-25.7	52.5	17.05	25.40
55	5	-2.0	-20.2	52.2	17.62	23.54
57.5	6	-3.8	-17.8	52.0	18.10	22.59
60	7	-2.8	-15.1	51.7	17.68	21.68
62.5	8	-0.3	-10.7	51.4	16.80	20.16
65	9	0.0	-6.9	51.2	16.61	18.85
67.5	30	0.0	-5.3	50.9	16.52	18.24
70	31	-6.5	-17.9	50.6	18.54	22.25
70	31	-6.5	-17.9	50.6	18.54	22.25
72.5	2	0.0	-8.1	50.4	16.35	18.99
75	3	0.0	-4.7	50.1	16.26	17.79
75	3	0.0	-44.4	50.1	16.26	30.69
77.5	4	0.0	-31.8	49.8	16.17	26.51
80	5	-1.3	-25.4	49.5	16.51	24.33
82.5	6	-3.4	-17.2	49.3	17.10	21.56
85	7	-2.4	-14.8	49.0	16.69	20.71
87.5	8	-0.2	-10.3	48.7	15.88	19.17
90	9	0.0	-6.5	48.5	15.74	17.84
92.5	40	0.0	-4.8	48.2	15.65	17.21
95	41	-7.3	-17.1	47.9	17.92	21.11
95	41	-7.3	-17.1	47.9	17.92	21.11
97.5	2	0.0	-7.5	47.7	15.48	17.90
100	3	0.0	-4.1	47.4	15.39	16.73
100	3	0.0	-42.8	47.4	15.39	29.26
102.5	4	0.0	-30.4	47.1	15.30	25.16
105	5	-1.0	-24.1	46.9	15.54	23.03
107.5	6	-3.0	-16.1	46.6	16.09	20.34
110	7	-2.0	-13.7	46.3	15.70	19.50
112.5	8	-0.1	-9.4	46.0	14.98	18.01
115	9	0.0	-5.8	45.8	14.86	16.74
117.5	50	0.0	-4.2	45.5	14.78	16.13
120	51	-6.6	-16.1	45.2	16.85	19.93
120	51	-6.6	-16.1	45.2	16.85	19.93
122.5	2	0.0	-6.8	45.0	14.60	16.81
125	3	0.0	-3.6	44.7	14.51	15.68
125	3	0.0	-41.2	44.7	14.51	27.88
127.5	4	0.0	-28.9	44.4	14.43	23.62
130	5	-0.8	-22.8	44.2	14.58	21.74
132.5	6	-2.6	-15.0	43.9	15.09	19.12
135	7	-1.7	-12.7	43.6	14.72	18.30
137.5	8	-0.0	-8.6	43.4	14.06	16.86
140	9	0.0	-5.1	43.1	13.99	15.65
142.5	60	0.0	-3.6	42.8	13.90	15.07
145	61	-6.1	-15.2	42.5	15.78	18.75
145	61	-6.1	-15.2	42.5	15.78	18.75
147.5	2	0.0	-6.2	42.3	13.73	15.73
150	3	0.0	-3.1	42.0	13.64	14.64
150	3	0.0	-39.6	42.0	13.64	26.49
152.5	4	0.0	-27.6	41.7	13.55	22.50
155	5	-0.5	-21.6	41.5	13.64	20.46
157.5	6	-2.2	-14.0	41.2	14.10	17.91
160	7	-1.4	-11.8	40.9	13.75	17.11
162.5	8	-0.0	-7.8	40.7	13.20	15.72
165	9	0.0	-4.5	40.4	13.11	14.57
167.5	70	0.0	-3.1	40.1	13.03	14.02
170	71	-5.5	-14.3	39.9	14.72	17.58
170	71	-5.5	-14.3	39.9	14.72	17.58
172.5	2	0.0	-5.6	39.6	12.85	14.67
175	3	0.0	-2.6	39.3	12.77	13.62
175	3	0.0	-36.0	39.3	12.77	25.11
177.5	4	0.0	-26.2	39.0	12.68	21.19
180	5	-0.4	-20.3	38.8	12.71	19.20
182.5	6	-1.9	-13.0	38.5	13.11	16.71
185	7	-1.2	-10.8	38.2	12.79	15.93
187.5	8	0.0	-7.0	38.0	12.33	14.60
190	9	0.0	-3.9	37.7	12.24	13.50
192.5	80	0.0	-2.6	37.4	12.15	12.99
195	81	-4.9	-13.4	37.2	13.67	16.42

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
195	81	-4.9	-13.4	37.2	13.67	16.42
197.5	2	0.0	-5.0	36.9	11.96	13.61
200	3	0.0	-2.2	36.6	11.89	12.60
200	3	0.0	-36.5	36.6	11.89	23.74
202.5	4	0.0	-24.9	36.4	11.80	19.86
205	5	-0.2	-19.2	36.1	11.78	17.94
207.5	6	-1.6	-12.0	35.8	12.14	15.52
210	7	-0.9	-9.9	35.5	11.84	14.77
212.5	8	0.0	-6.3	35.3	11.45	13.49
215	9	0.0	-3.3	35.0	11.37	12.45
217.5	90	0.0	-2.1	34.7	11.26	11.97
220	91	-4.4	-12.6	34.5	12.63	15.27
220	91	-4.4	-12.6	34.5	12.63	15.27
222.5	2	0.0	-4.5	34.2	11.10	12.56
225	3	0.0	-1.8	33.9	11.02	11.60
225	3	0.0	-35.0	33.9	11.02	22.36
227.5	4	0.0	-23.6	33.7	10.93	18.59
230	5	-0.1	-16.0	33.4	10.88	16.70
232.5	6	-1.3	-11.1	33.1	11.18	14.35
235	7	-0.7	-9.1	32.9	10.90	13.62
237.5	8	0.0	-5.6	32.6	10.58	12.39
240	9	0.0	-2.8	32.3	10.49	11.41
242.5	100	0.0	-1.7	32.0	10.40	10.97
245	101	-4.0	-11.7	31.8	11.60	14.13
245	101	-4.0	-11.7	31.8	11.60	14.13
247.5	2	0.0	-4.0	31.5	10.23	11.53
250	3	0.0	-1.5	31.2	10.14	10.61
250	3	0.0	-33.5	31.2	10.14	21.03
252.5	4	0.0	-22.3	31.0	10.05	17.31
255	5	-0.0	-16.9	30.7	9.98	15.46
257.5	6	-1.0	-10.2	30.4	10.22	13.19
260	7	-0.5	-8.3	30.2	9.96	12.48
262.5	8	0.0	-4.9	29.9	9.70	11.31
265	9	0.0	-2.4	29.6	9.62	10.38
267.5	110	0.0	-1.4	29.3	9.53	9.97
270	111	-3.5	-10.9	29.1	10.58	13.00
270	111	-3.5	-10.9	29.1	10.58	13.00
272.5	2	0.0	-3.5	28.8	9.36	10.50
275	3	0.0	-1.1	28.5	9.27	9.64
275	3	0.0	-32.1	28.5	9.27	19.69
277.5	4	0.0	-21.1	28.3	9.18	16.04
280	5	-0.0	-15.9	28.0	9.09	14.24
282.5	6	-0.8	-9.3	27.7	9.27	12.04
285	7	-0.4	-7.5	27.5	9.04	11.36
287.5	8	0.0	-4.3	27.2	8.83	10.24
290	9	0.0	-1.9	26.9	8.74	9.37
292.5	120	0.0	-1.0	26.7	8.66	9.00
295	121	-3.1	-10.2	26.4	9.56	11.87
295	121	-3.1	-10.2	26.4	9.56	11.87
297.5	2	0.0	-3.1	26.1	8.48	9.48
300	3	0.0	-0.9	25.8	8.39	8.67
300	3	0.0	-30.7	25.8	8.39	18.36
302.5	4	0.0	-19.9	25.6	8.31	14.78
305	5	0.0	-14.8	25.3	8.22	13.03
307.5	6	-0.6	-8.5	25.0	8.33	10.90
310	7	-0.2	-6.8	24.8	8.12	10.24
312.5	8	0.0	-3.8	24.5	7.96	9.18
315	9	0.0	-1.6	24.2	7.87	8.37
317.5	130	0.0	-0.8	24.0	7.78	8.03
320	131	-2.7	-9.4	23.7	8.56	10.76
320	131	-2.7	-9.4	23.7	8.56	10.76
322.5	2	0.0	-2.7	23.4	7.61	8.47
325	3	0.0	-0.6	23.2	7.52	7.72
325	3	0.0	-29.3	23.2	7.52	17.05
327.5	4	0.0	-18.8	22.9	7.43	13.54
330	5	0.0	-13.8	22.6	7.34	11.83
332.5	6	-0.5	-7.8	22.3	7.40	9.77
335	7	-0.1	-6.1	22.1	7.21	9.14
337.5	8	0.0	-3.2	21.8	7.08	8.13
340	9	0.0	-1.2	21.5	6.99	7.39
342.5	140	0.0	-0.5	21.3	6.91	7.08
345	141	-2.3	-8.7	21.0	7.56	9.65
345	141	-2.3	-8.7	21.0	7.56	9.65
347.5	2	0.0	-2.3	20.7	6.73	7.47
350	3	0.0	-0.4	20.5	6.64	6.78
350	3	0.0	-26.0	20.5	6.64	15.74
352.5	4	0.0	-17.7	20.2	6.56	12.30
355	5	0.0	-12.8	19.9	6.47	10.64
357.5	6	-0.3	-7.0	19.7	6.48	8.66
360	7	-0.1	-5.4	19.4	6.32	8.05
362.5	8	0.0	-2.8	19.1	6.21	7.10
365	9	0.0	-0.9	18.8	6.12	6.42
367.5	150	0.0	-0.3	18.6	6.03	6.15
370	151	-2.0	-8.0	18.3	6.58	8.56
370	151	-2.0	-8.0	18.3	6.58	8.56
372.5	2	0.0	-1.9	18.0	5.86	6.48
375	3	0.0	-0.3	17.8	5.77	5.86
375	3	0.0	-26.7	17.8	5.77	14.44
377.5	4	0.0	-16.6	17.5	5.68	11.07
380	5	0.0	-11.9	17.2	5.60	9.47
382.5	6	-0.2	-6.3	17.0	5.57	7.56
385	7	-0.0	-4.8	16.7	5.43	6.98
387.5	8	0.0	-2.3	16.4	5.33	6.06
390	9	0.0	-0.7	16.2	5.25	5.46
392.5	160	0.0	-0.2	15.9	5.16	5.22

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
395	161	-1.6	-7.4	15.6	5.60	7.47
395	161	-1.6	-7.4	15.6	5.60	7.47
397.5	2	0.0	-1.6	15.3	4.98	5.50
400	3	0.0	-0.1	15.1	4.90	4.94
400	3	0.0	-25.4	15.1	4.90	13.15
402.5	4	0.0	-15.6	14.8	4.81	9.86
405	5	0.0	-11.0	14.5	4.72	8.30
407.5	6	-0.1	-5.6	14.3	4.67	6.47
410	7	-0.0	-4.2	14.0	4.55	5.91
412.5	8	0.0	-1.9	13.7	4.46	5.07
415	9	0.0	-0.5	13.5	4.37	4.52
417.5	170	0.0	-0.1	13.2	4.26	4.31
420	171	-1.3	-6.8	12.9	4.63	6.39
420	171	-1.3	-6.8	12.9	4.63	6.39
422.5	2	0.0	-1.3	12.7	4.11	4.53
425	3	0.0	-0.1	12.4	4.02	4.04
425	3	0.0	-24.2	12.4	4.02	11.87
427.5	4	0.0	-14.5	12.1	3.93	8.66
430	5	0.0	-10.2	11.8	3.85	7.15
432.5	6	-0.0	-5.0	11.6	3.77	5.39
435	7	0.0	-3.7	11.3	3.67	4.86
437.5	8	0.0	-1.5	11.0	3.58	4.08
440	9	0.0	-0.3	10.8	3.50	3.59
442.5	180	0.0	-0.0	10.5	3.41	3.42
445	181	-1.1	-6.2	10.2	3.67	5.32
445	181	-1.1	-6.2	10.2	3.67	5.32
447.5	2	0.0	-1.0	10.0	3.23	3.57
450	3	0.0	-0.0	9.7	3.15	3.15
450	3	0.0	-23.0	9.7	3.15	10.60
452.5	4	0.0	-13.8	9.4	3.06	7.46
455	5	0.0	-9.3	9.2	2.97	6.00
457.5	6	-0.0	-4.4	8.9	2.89	4.32
460	7	0.0	-3.2	8.6	2.80	3.82
462.5	8	0.0	-1.2	8.3	2.71	3.10
465	9	0.0	-0.1	8.1	2.62	2.67
467.5	190	0.0	-0.0	7.8	2.54	2.54
470	191	-0.9	-5.6	7.5	2.73	4.26
470	191	-0.9	-5.6	7.5	2.73	4.26
472.5	2	0.0	-0.4	7.3	2.36	2.49
475	3	0.0	0.0	7.0	2.27	2.27
475	3	0.0	-21.3	7.0	2.27	9.18
477.5	4	0.0	-12.1	6.7	2.19	6.11
480	5	0.0	-6.4	6.5	2.10	4.16
482.5	6	0.0	-3.4	6.2	2.01	3.11
485	7	0.0	-2.2	5.9	1.92	2.64
487.5	8	0.0	-0.6	5.7	1.84	2.03
490	9	0.0	0.0	5.4	1.75	1.75
492.5	200	0.0	0.0	5.1	1.66	1.66
495	201	-0.3	-4.0	4.8	1.66	2.88
495	201	-0.3	-4.0	4.8	1.66	2.88
497.5	2	0.0	-0.1	4.6	1.49	1.53
500	3	0.0	0.0	4.3	1.40	1.40
500	3	0.0	-20.6	4.3	1.40	8.10
502.5	4	0.0	-12.2	4.0	1.31	5.29
505	5	0.0	-7.1	3.8	1.22	3.52
507.5	6	0.0	-3.2	3.5	1.14	2.16
510	7	0.0	-1.4	3.2	1.05	1.51
512.5	8	0.0	-0.1	3.0	0.96	0.96
515	9	0.0	0.0	2.7	0.87	0.87
517.5	210	0.0	0.0	2.4	0.79	0.79
520	211	0.0	-6.3	2.2	0.70	2.74
520	211	0.0	-6.3	2.2	0.70	2.74
522	2	0.0	0.0	1.9	0.63	0.63
524	3	0.0	0.0	1.7	0.56	0.56
524	3	0.0	-58.4	1.7	0.56	19.53
526	4	0.0	-54.2	1.5	0.49	18.10
528	5	-0.6	-30.3	1.3	0.60	10.26
530	6	-2.7	-11.2	1.1	1.23	3.98
532	7	-2.7	-1.3	0.9	1.15	0.69
534	8	-0.0	0.0	0.6	0.21	0.21
536	9	0.0	0.0	0.4	0.14	0.14
538	220	0.0	0.0	0.2	0.07	0.07
540	221	0.0	0.0	0.0	0.00	0.00

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO I. E-1
COMPROBACION A ROTURA

FECHA

HOJA N.º

COMPROBACION A ROTURA POR FLEXION

A continuación se adjuntan para cada sección los momentos mayorados producidos por cargas exteriores, el momento hiperestático de pretensado, la suma de ambos, ponderando el pretensado por 0,9 ó 1.1 y los momentos últimos, tanto positivos como negativos.

En el siguiente cuadro se resumen las secciones de centro de vano y sobre pilas.

SECCION	Md f. exteriores	Md F. exteriores + hiperestático ponderado	Mu último
V-1	3614	4077	4937
P-1	-5573	-4391	-5898
P-2 o P-20	-6026	-5123	-5898
V-2 a V-21	3868	5087	7273
P-21	-5592	-4499	-5491
V-22	3609	4103	6391

El momento total es inferior al momento último en todas las secciones estudiadas => El coeficiente de seguridad a rotura es superior a 1.6.

TAV1 061 25/06/97 1

Calculo de Comprobacion a Rotura - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
1	1	(H1)	0.00	0.00	0.00	3272.16	0.3	-4120.50	0.5
	1	(H2)	0.00	0.00	0.00	3272.16	0.3	-4120.50	0.5
	2	(H1)	1542.21	121.33	1675.67	4816.45	0.3	-2649.09	0.5
	2	(H2)	537.56	121.33	671.02	4816.45	0.3	-2649.09	0.5
	3	(H1)	2657.88	242.66	2924.80	5884.60	0.3	-1681.03	0.4
	3	(H2)	852.58	242.66	1119.51	5884.60	0.3	-1681.03	0.4
	4	(H1)	3347.00	363.98	3747.39	6312.74	0.3	-1300.80	0.4
	4	(H2)	945.07	363.98	1345.45	6312.74	0.3	-1300.80	0.4
	5	(H1)	3609.59	485.31	4143.42	6390.89	0.3	-1231.36	0.4
	5	(H2)	815.02	485.31	1348.86	6390.89	0.3	-1231.36	0.4
	6	(H1)	3445.64	606.63	4112.93	6243.94	0.3	-1342.45	0.4
	6	(H2)	462.44	606.63	1129.74	6243.94	0.3	-1342.45	0.4
	7	(H1)	2855.14	727.95	3655.89	5802.55	0.3	-1701.05	0.4
	7	(H2)	-112.67	727.95	542.49	5802.55	0.3	-1701.05	0.4
	8	(H1)	1838.10	849.27	2772.30	5067.26	0.3	-2340.10	0.4
	8	(H2)	-910.32	849.27	-145.97	5067.26	0.3	-2340.10	0.4
	9	(H1)	394.53	970.60	1462.18	4037.02	0.3	-3305.36	0.5
	9	(H2)	-1930.50	970.60	-1056.97	4037.02	0.3	-3305.36	0.5
	10	(H1)	-1094.17	1091.91	-111.45	2517.84	0.3	-4662.94	0.5
	10	(H2)	-3262.87	1091.91	-2280.15	2517.84	0.3	-4662.94	0.5
	11	(H1)	-2328.41	1213.24	-1236.50	1797.68	0.3	-5491.27	0.6
	11	(H2)	-5591.72	1213.24	-4499.81	1797.68	0.3	-5491.27	0.6
2	1	(H1)	-2328.41	1213.24	-1236.50	1797.68	0.3	-5491.27	0.6
	1	(H2)	-5591.72	1213.24	-4499.81	1797.68	0.3	-5491.27	0.6
	2	(H1)	-715.31	1187.06	353.04	3179.72	0.3	-4204.12	0.5
	2	(H2)	-1980.91	1187.06	-912.56	3179.72	0.3	-4204.12	0.5
	3AI	(H1)	1697.13	1160.88	2974.10	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-408.69	1160.88	636.10	5118.67	0.3	-2422.75	0.4
	3AD	(H1)	1697.13	1160.88	2974.09	5079.94	0.3	-2393.77	0.4
	3AD	(H2)	-408.69	1160.88	636.09	5079.94	0.3	-2393.77	0.4
	4	(H1)	2883.19	1143.42	4140.96	6387.77	0.3	-1342.57	0.3

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	4	(H2)	248.02	1143.42	1505.78	6387.77	0.3	-1342.57	0.3
	5	(H1)	3606.58	1125.97	4845.15	7047.77	0.3	-795.86	0.3
	5	(H2)	604.31	1125.97	1842.88	7047.77	0.3	-795.86	0.3
	6	(H1)	3867.29	1108.51	5086.65	7273.65	0.3	-659.32	0.3
	6	(H2)	699.07	1108.51	1918.43	7273.65	0.3	-659.32	0.3
	7	(H1)	3665.32	1091.06	4865.48	7077.37	0.3	-766.43	0.3
	7	(H2)	493.20	1091.06	1693.36	7077.37	0.3	-766.43	0.3
	8	(H1)	3000.67	1073.60	4181.63	6487.99	0.3	-1146.03	0.3
	8	(H2)	-2.76	1073.60	963.48	6487.99	0.3	-1146.03	0.3
	9	(H1)	1873.35	1056.14	3035.11	5506.05	0.3	-1938.64	0.4
	9	(H2)	-798.37	1056.14	152.16	5506.05	0.3	-1938.64	0.4
	10	(H1)	-562.74	1029.95	364.22	3139.92	0.3	-4034.44	0.5
	10	(H2)	-2444.69	1029.95	-1517.74	3139.92	0.3	-4034.44	0.5
	11	(H1)	-2410.91	1003.74	-1507.54	1463.11	0.3	-5897.65	0.6
	11	(H2)	-6026.55	1003.74	-5123.19	1463.11	0.3	-5897.65	0.6
3	1	(H1)	-2410.91	1003.74	-1507.54	1463.11	0.3	-5897.65	0.6
	1	(H2)	-6026.55	1003.74	-5123.19	1463.11	0.3	-5897.65	0.6
	2	(H1)	-628.08	1010.56	281.42	3044.11	0.3	-4345.19	0.5
	2	(H2)	-2378.41	1010.56	-1468.91	3044.11	0.3	-4345.19	0.5
	3AI	(H1)	1779.73	1017.38	2898.85	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-754.05	1017.38	161.59	5118.67	0.3	-2422.75	0.4
	3AD	(H1)	1779.72	1017.38	2898.84	5079.94	0.3	-2393.77	0.4
	3AD	(H2)	-754.06	1017.38	161.59	5079.94	0.3	-2393.77	0.4
	4	(H1)	2923.85	1021.93	4047.97	6387.77	0.3	-1342.57	0.3
	4	(H2)	-48.63	1021.93	871.11	6387.77	0.3	-1342.57	0.3
	5	(H1)	3605.30	1026.47	4734.42	7047.77	0.3	-795.86	0.3
	5	(H2)	362.59	1026.47	1491.71	7047.77	0.3	-795.86	0.3
	6	(H1)	3864.71	1031.02	4998.83	7273.65	0.3	-659.32	0.3
	6	(H2)	514.37	1031.02	1648.49	7273.65	0.3	-659.32	0.3
	7	(H1)	3661.88	1035.56	4801.00	7077.37	0.3	-766.43	0.3
	7	(H2)	383.91	1035.56	1523.03	7077.37	0.3	-766.43	0.3

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	8	(H1)	2996.38	1040.10	4140.48	6487.99	0.3	-1146.03	0.3
	8	(H2)	-37.28	1040.10	898.81	6487.99	0.3	-1146.03	0.3
	9	(H1)	1868.20	1044.64	3017.30	5506.05	0.3	-1938.64	0.4
	9	(H2)	-799.05	1044.64	141.12	5506.05	0.3	-1938.64	0.4
	10	(H1)	-519.78	1051.45	426.53	3139.92	0.3	-4034.44	0.5
	10	(H2)	-2431.75	1051.45	-1485.44	3139.92	0.3	-4034.44	0.5
	11	(H1)	-2402.64	1058.26	-1450.21	1463.11	0.3	-5897.65	0.6
	11	(H2)	-6017.32	1058.26	-5064.89	1463.11	0.3	-5897.65	0.6
4	1	(H1)	-2402.64	1058.26	-1450.21	1463.11	0.3	-5897.65	0.6
	1	(H2)	-6017.32	1058.26	-5064.89	1463.11	0.3	-5897.65	0.6
	2	(H1)	-535.42	1055.63	414.65	3044.11	0.3	-4345.19	0.5
	2	(H2)	-2409.19	1055.63	-1459.12	3044.11	0.3	-4345.19	0.5
	3AI	(H1)	1857.19	1053.01	3015.50	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-778.15	1053.01	169.56	5118.67	0.3	-2422.75	0.4
	3AD	(H1)	1857.19	1053.01	3015.49	5079.94	0.3	-2393.77	0.4
	3AD	(H2)	-778.15	1053.01	169.56	5079.94	0.3	-2393.77	0.4
	4	(H1)	2990.01	1051.26	4146.40	6387.77	0.3	-1342.57	0.3
	4	(H2)	-43.31	1051.26	902.83	6387.77	0.3	-1342.57	0.3
	5	(H1)	3660.16	1049.51	4814.62	7047.77	0.3	-795.86	0.3
	5	(H2)	371.18	1049.51	1525.64	7047.77	0.3	-795.86	0.3
	6	(H1)	3867.64	1047.75	5020.17	7273.65	0.3	-659.32	0.3
	6	(H2)	526.23	1047.75	1678.75	7273.65	0.3	-659.32	0.3
	7	(H1)	3660.84	1046.00	4811.44	7077.37	0.3	-766.43	0.3
	7	(H2)	371.71	1046.00	1522.31	7077.37	0.3	-766.43	0.3
	8	(H1)	2991.38	1044.25	4140.05	6487.99	0.3	-1146.03	0.3
	8	(H2)	-42.28	1044.25	897.54	6487.99	0.3	-1146.03	0.3
	9	(H1)	1859.25	1042.49	3005.99	5506.05	0.3	-1938.64	0.4
	9	(H2)	-776.52	1042.49	161.72	5506.05	0.3	-1938.64	0.4
	10	(H1)	-532.63	1039.85	403.24	3139.92	0.3	-4034.44	0.5
	10	(H2)	-2406.83	1039.85	-1470.96	3139.92	0.3	-4034.44	0.5
	11	(H1)	-2401.12	1037.21	-1467.63	1463.11	0.3	-5897.65	0.6
	11	(H2)	-6015.80	1037.21	-5082.31	1463.11	0.3	-5897.65	0.6

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
5	1	(H1)	-2401.12	1037.21	-1467.63	1463.11	0.3	-5897.65	0.6
	1	(H2)	-6015.80	1037.21	-5082.31	1463.11	0.3	-5897.65	0.6
	2	(H1)	-520.63	1040.11	415.47	3044.11	0.3	-4345.19	0.5
	2	(H2)	-2432.17	1040.11	-1496.07	3044.11	0.3	-4345.19	0.5
	3AI	(H1)	1866.95	1043.01	3014.26	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-799.87	1043.01	138.84	5118.67	0.3	-2422.75	0.4
	3AD	(H1)	1866.95	1043.01	3014.26	5079.94	0.3	-2393.77	0.4
	3AD	(H2)	-799.87	1043.01	138.84	5079.94	0.3	-2393.77	0.4
	4	(H1)	2995.08	1044.94	4144.52	6387.77	0.3	-1342.54	0.3
	4	(H2)	-38.24	1044.94	902.21	6387.77	0.3	-1342.54	0.3
	5	(H1)	3660.54	1046.87	4812.11	7064.39	0.3	-784.64	0.3
	5	(H2)	382.71	1046.87	1534.28	7064.39	0.3	-784.64	0.3
	6	(H1)	3863.33	1048.80	5017.01	7271.06	0.3	-660.62	0.3
	6	(H2)	512.98	1048.80	1666.66	7271.06	0.3	-660.62	0.3
	7	(H1)	3603.83	1050.73	4759.64	7048.29	0.3	-783.27	0.3
	7	(H2)	360.96	1050.73	1516.76	7048.29	0.3	-783.27	0.3
	8	(H1)	2922.34	1052.66	4080.27	6457.36	0.3	-1168.04	0.3
	8	(H2)	-50.50	1052.66	896.89	6457.36	0.3	-1168.04	0.3
	9	(H1)	1778.17	1054.59	2938.21	5487.35	0.3	-1954.85	0.4
	9	(H2)	-756.07	1054.59	193.06	5487.35	0.3	-1954.85	0.4
	10	(H1)	-630.03	1057.48	321.70	3139.31	0.3	-4034.96	0.5
	10	(H2)	-2380.81	1057.48	-1429.08	3139.31	0.3	-4034.96	0.5
	11	(H1)	-2415.25	1060.36	-1460.92	1463.11	0.3	-5897.65	0.6
	11	(H2)	-6030.89	1060.36	-5076.57	1463.11	0.3	-5897.65	0.6
6	1	(H1)	-2415.25	1060.36	-1460.92	1463.11	0.3	-5897.65	0.6
	1	(H2)	-6030.89	1060.36	-5076.56	1463.11	0.3	-5897.65	0.6
	2	(H1)	-565.83	1050.30	379.45	3044.11	0.3	-4345.19	0.5
	2	(H2)	-2447.32	1050.30	-1502.05	3044.11	0.3	-4345.19	0.5
	3AI	(H1)	1873.59	1040.25	3017.86	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-797.71	1040.25	138.51	5118.67	0.3	-2422.75	0.4

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	3AD	(H1)	1873.59	1040.24	3017.86	5079.94	0.3	-2393.77	0.4
	3AD	(H2)	-797.71	1040.24	138.51	5079.94	0.3	-2393.77	0.4
	4	(H1)	3003.31	1033.54	4140.20	6387.77	0.3	-1342.57	0.3
	4	(H2)	0.09	1033.54	1136.98	6387.77	0.3	-1342.57	0.3
	5	(H1)	3670.36	1026.83	4799.87	7047.77	0.3	-795.86	0.3
	5	(H2)	498.33	1026.83	1627.84	7047.77	0.3	-795.86	0.3
	6	(H1)	3874.73	1020.12	4996.86	7273.65	0.3	-659.32	0.3
	6	(H2)	706.41	1020.12	1828.54	7273.65	0.3	-659.32	0.3
	7	(H1)	3616.43	1013.41	4731.17	7077.37	0.3	-766.43	0.3
	7	(H2)	613.90	1013.41	1728.65	7077.37	0.3	-766.43	0.3
	8	(H1)	2895.44	1006.69	4002.80	6487.99	0.3	-1146.03	0.3
	8	(H2)	259.82	1006.69	1367.18	6487.99	0.3	-1146.03	0.3
	9	(H1)	1711.78	999.98	2811.76	5506.05	0.3	-1938.64	0.4
	9	(H2)	-394.59	999.98	505.39	5506.05	0.3	-1938.64	0.4
	10	(H1)	-698.23	989.90	192.69	3139.92	0.3	-4034.44	0.5
	10	(H2)	-1962.69	989.90	-1071.78	3139.92	0.3	-4034.44	0.5
	11	(H1)	-2309.24	979.82	-1427.40	1463.11	0.3	-5897.65	0.6
	11	(H2)	-5572.55	979.82	-4690.71	1463.11	0.3	-5897.65	0.6
7	1	(H1)	-2309.24	979.82	-1427.40	1463.11	0.3	-5897.65	0.6
	1	(H2)	-5572.55	979.82	-4690.71	1463.11	0.3	-5897.65	0.6
	2	(H1)	-354.99	826.73	389.06	3044.11	0.3	-4345.19	0.5
	2	(H2)	-2430.64	826.73	-1686.58	3044.11	0.3	-4345.19	0.5
	3AI	(H1)	2001.73	673.64	2742.73	5118.67	0.3	-2422.75	0.4
	3AI	(H2)	-785.27	673.64	-179.00	5118.67	0.3	-2422.75	0.4
	3AD	(H1)	2001.73	673.64	2742.73	3467.26	0.3	-1930.59	0.3
	3AD	(H2)	-785.27	673.64	-179.00	3467.26	0.3	-1930.59	0.3
	4	(H1)	2854.15	589.42	3502.52	4122.67	0.3	-1259.98	0.3
	4	(H2)	-111.81	589.42	418.67	4122.67	0.3	-1259.98	0.3
	5	(H1)	3391.47	505.21	3947.20	4668.88	0.3	-785.08	0.3
	5	(H2)	397.25	505.21	952.98	4668.88	0.3	-785.08	0.3
	6	(H1)	3613.69	420.99	4076.78	4937.44	0.3	-586.06	0.2
	6	(H2)	741.92	420.99	1205.01	4937.44	0.3	-586.06	0.2

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Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	7	(H1)	3520.80	336.78	3891.26	4907.42	0.3	-604.30	0.3
	7	(H2)	922.19	336.78	1292.65	4907.42	0.3	-604.30	0.3
	8	(H1)	3112.82	252.56	3390.63	4622.79	0.3	-807.12	0.3
	8	(H2)	938.07	252.56	1215.89	4622.79	0.3	-807.12	0.3
	9	(H1)	2389.73	168.34	2574.90	4091.84	0.3	-1272.02	0.3
	9	(H2)	789.56	168.34	974.74	4091.84	0.3	-1272.02	0.3
	10	(H1)	1351.54	84.12	1444.07	3314.55	0.3	-2084.98	0.3
	10	(H2)	476.65	84.12	569.19	3314.55	0.3	-2084.98	0.3
	11	(H1)	0.00	0.00	0.00	2340.46	0.3	-3027.89	0.3
	11	(H2)	0.00	0.00	0.00	2340.46	0.3	-3027.89	0.3

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO I E-1
COMPROBACION A CORTANTE

FECHA

HOJA N.º

COMPROBACION A CORTANTE

Para el cálculo a cortante se ha tomado un ancho bruto de 2.85m y un ancho neto de 2.15m

Se ha dividido el tablero en dos zonas de armado:

- Zona de armadura mínima → 5c ϕ12/030
- Refuerzo en zonas próximas a riostras y pilas

$$A_{wc} = -\left(\frac{140-30}{2.5} \times 1.5\right) + 140 = 74 \ m^2/m \Rightarrow 5c\ \phi 12/015$$

A continuación se adjunta un listado con la armadura necesaria en cada sección de cálculo.


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TAV1        061 25/06/97   1

Calculo de Comprobacion a Cortante - Datos generales
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Limite elastico del acero pasivo ..... =   5100.00  kg/cm2
Coeficiente del acero pasivo ......... =      1.15
Limite elastico de acero activo ...... =    170.00  kg/cm2
Coeficiente del acero activo ......... =      1.10
Resistencia caracteristica del hormigon ..... =   350.00  kg/cm2
Coeficiente del hormigon ............. =      1.50

Coef. mayoracion Cargas muertas y Peso propio . =      1.60
Coef. mayoracion Sobrecargas ......... =      1.60
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Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-324.4	0.0	-10.13	348.0	-3997.6
	1	(H2)	0.00	-877.7	0.0	-10.13	348.0	-3997.6
	2	(H1)	537.56	-213.1	0.0	-1024.84	513.3	-4013.4
	2	(H2)	1542.21	-664.5	0.0	-1024.84	513.3	-4013.4
	3	(H1)	852.58	-101.9	0.0	-1705.79	207.7	-3969.5
	3	(H2)	2657.88	-451.2	0.0	-1705.79	207.7	-3969.5
	4	(H1)	945.07	9.4	0.0	-1890.20	17.7	-3929.2
	4	(H2)	3347.00	-237.9	0.0	-1890.20	17.7	-3929.2
	5	(H1)	815.02	120.7	0.0	-1815.37	-60.7	-3906.1
	5	(H2)	3609.59	-24.7	0.0	-1815.37	-60.7	-3906.1
	6	(H1)	2119.90	279.6	0.0	-1564.10	-170.3	-3871.6
	6	(H2)	1617.48	116.4	0.0	-1564.10	-170.3	-3871.6
	7	(H1)	1772.07	492.1	0.0	-1096.10	-277.9	-3834.4
	7	(H2)	1273.36	227.7	0.0	-1096.10	-277.9	-3834.4
	8	(H1)	574.52	705.4	0.0	-418.38	-383.2	-3794.5
	8	(H2)	706.72	339.0	0.0	-418.38	-383.2	-3794.5
	9	(H1)	-1049.57	918.7	0.0	460.64	-486.5	-3756.8
	9	(H2)	-82.45	450.2	0.0	460.64	-486.5	-3756.8
	10	(H1)	-3100.20	1132.0	0.0	1538.51	-591.1	-3743.6
	10	(H2)	-1094.17	561.5	0.0	1538.51	-591.1	-3743.6
	11	(H1)	-5577.37	1345.2	0.0	2222.00	-60.7	-3865.1
	11	(H2)	-2328.41	672.8	0.0	2222.00	-60.7	-3865.1
2	1	(H1)	-2328.41	-603.1	0.0	2222.00	8.4	-3865.1
	1	(H2)	-5591.72	-1385.7	0.0	2222.00	8.4	-3865.1
	2	(H1)	-715.31	-429.3	0.0	1243.65	414.4	-3943.6
	2	(H2)	-1781.93	-1052.5	0.0	1243.65	414.4	-3943.6
	3AI	(H1)	354.49	-255.4	0.0	-242.32	486.0	-4068.9
	3AI	(H2)	986.48	-719.3	0.0	-242.32	486.0	-4068.9
	3AD	(H1)	354.49	-255.4	0.0	7.63	407.5	-3383.8
	3AD	(H2)	986.48	-719.3	0.0	7.63	407.5	-3383.8
	4	(H1)	765.82	-139.5	0.0	-851.55	378.2	-3401.8

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	4	(H2)	2253.40	-497.2	0.0	-851.55	378.2	-3401.8
	5	(H1)	935.76	-23.6	0.0	-1359.33	151.3	-3476.4
	5	(H2)	2676.88	-280.4	0.0	-1359.33	151.3	-3476.4
	6	(H1)	864.31	92.2	0.0	-1564.53	8.5	-3521.7
	6	(H2)	3047.73	-75.6	0.0	-1564.53	8.5	-3521.7
	7	(H1)	2852.80	296.8	0.0	-1473.35	-120.7	-3555.7
	7	(H2)	1053.54	56.3	0.0	-1473.35	-120.7	-3555.7
	8	(H1)	2003.13	519.0	0.0	-1105.27	-252.0	-3585.2
	8	(H2)	815.63	172.2	0.0	-1105.27	-252.0	-3585.2
	9	(H1)	690.78	741.1	0.0	-455.05	-385.0	-3610.1
	9	(H2)	336.33	288.0	0.0	-455.05	-385.0	-3610.1
	10	(H1)	-2145.79	1074.3	0.0	1055.67	-586.4	-3638.7
	10	(H2)	-835.45	461.9	0.0	1055.67	-586.4	-3638.7
	11	(H1)	-6026.55	1407.8	0.0	2276.98	8.4	-3846.8
	11	(H2)	-2551.80	635.9	0.0	2276.98	8.4	-3846.8
3	1	(H1)	-2410.91	-607.5	0.0	2276.98	-2.2	-3846.8
	1	(H2)	-5963.09	-1404.6	0.0	2276.98	-2.2	-3846.8
	2	(H1)	-784.17	-433.6	0.0	1186.54	544.8	-3946.0
	2	(H2)	-2094.54	-1071.3	0.0	1186.54	544.8	-3946.0
	3AI	(H1)	299.27	-259.8	0.0	-385.82	475.4	-4068.9
	3AI	(H2)	732.64	-738.1	0.0	-385.82	475.4	-4068.9
	3AD	(H1)	299.27	-259.8	0.0	-135.88	397.0	-3383.8
	3AD	(H2)	732.64	-738.1	0.0	-135.88	397.0	-3383.8
	4	(H1)	719.68	-143.9	0.0	-973.06	367.6	-3401.8
	4	(H2)	2038.73	-516.0	0.0	-973.06	367.6	-3401.8
	5	(H1)	898.71	-28.0	0.0	-1458.84	140.8	-3476.4
	5	(H2)	2462.06	-302.9	0.0	-1458.84	140.8	-3476.4
	6	(H1)	2833.27	91.6	0.0	-1642.04	-2.1	-3521.7
	6	(H2)	2879.78	-98.1	0.0	-1642.04	-2.1	-3521.7
	7	(H1)	2429.28	296.3	0.0	-1528.86	-131.3	-3555.7
	7	(H2)	921.49	30.7	0.0	-1528.86	-131.3	-3555.7

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	8	(H1)	2003.34	517.9	0.0	-1138.78	-262.6	-3585.2
	8	(H2)	736.90	146.6	0.0	-1138.78	-262.6	-3585.2
	9	(H1)	693.25	740.0	0.0	-466.56	-395.6	-3610.1
	9	(H2)	310.94	262.4	0.0	-466.56	-395.6	-3610.1
	10	(H1)	-2139.95	1073.2	0.0	1077.16	-597.0	-3638.7
	10	(H2)	-780.84	436.3	0.0	1077.16	-597.0	-3638.7
	11	(H1)	-6017.32	1406.7	0.0	2331.49	-2.2	-3846.8
	11	(H2)	-2417.13	610.3	0.0	2331.49	-2.2	-3846.8
4	1	(H1)	-2402.64	-608.2	0.0	2331.49	0.8	-3846.8
	1	(H2)	-5993.30	-1406.3	0.0	2331.49	0.8	-3846.8
	2	(H1)	-773.52	-434.4	0.0	1231.61	547.8	-3946.0
	2	(H2)	-2119.26	-1073.1	0.0	1231.61	547.8	-3946.0
	3AI	(H1)	312.30	-260.5	0.0	-350.21	478.4	-4068.9
	3AI	(H2)	713.42	-739.8	0.0	-350.21	478.4	-4068.9
	3AD	(H1)	312.29	-260.5	0.0	-100.26	400.0	-3383.8
	3AD	(H2)	713.42	-739.8	0.0	-100.26	400.0	-3383.8
	4	(H1)	734.29	-144.7	0.0	-943.74	370.7	-3401.8
	4	(H2)	2023.17	-517.7	0.0	-943.74	370.7	-3401.8
	5	(H1)	914.91	-28.8	0.0	-1435.82	143.8	-3476.4
	5	(H2)	2460.77	-301.9	0.0	-1435.82	143.8	-3476.4
	6	(H1)	2876.59	96.8	0.0	-1625.31	0.9	-3521.7
	6	(H2)	2876.39	-97.1	0.0	-1625.31	0.9	-3521.7
	7	(H1)	2461.63	301.6	0.0	-1518.43	-128.3	-3555.7
	7	(H2)	915.22	28.5	0.0	-1518.43	-128.3	-3555.7
	8	(H1)	2024.71	517.4	0.0	-1134.64	-259.6	-3585.2
	8	(H2)	735.09	144.4	0.0	-1134.64	-259.6	-3585.2
	9	(H1)	715.66	739.5	0.0	-468.72	-392.5	-3610.1
	9	(H2)	313.57	260.3	0.0	-468.72	-392.5	-3610.1
	10	(H1)	-2115.97	1072.7	0.0	1065.55	-594.0	-3638.7
	10	(H2)	-771.52	434.2	0.0	1065.55	-594.0	-3638.7
	11	(H1)	-5991.78	1406.2	0.0	2310.44	0.8	-3846.8
	11	(H2)	-2401.12	608.1	0.0	2310.44	0.8	-3846.8

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
5	1	(H1)	-2415.61	-610.0	0.0	2310.44	-0.9	-3846.8
	1	(H2)	-6015.80	-1406.5	0.0	2310.44	-0.9	-3846.8
	2	(H1)	-780.92	-436.2	0.0	1216.07	546.0	-3946.0
	2	(H2)	-2141.30	-1073.2	0.0	1216.07	546.0	-3946.0
	3AI	(H1)	310.47	-262.3	0.0	-360.21	476.7	-4068.9
	3AI	(H2)	691.82	-740.0	0.0	-360.21	476.7	-4068.9
	3AD	(H1)	310.47	-262.3	0.0	-110.27	398.2	-3383.7
	3AD	(H2)	691.82	-740.0	0.0	-110.27	398.2	-3383.7
	4	(H1)	736.18	-146.4	0.0	-949.98	369.6	-3401.5
	4	(H2)	2001.87	-517.9	0.0	-949.98	369.6	-3401.5
	5	(H1)	920.51	-30.5	0.0	-1448.80	146.5	-3475.1
	5	(H2)	2427.76	-296.3	0.0	-1448.80	146.5	-3475.1
	6	(H1)	2878.57	98.2	0.0	-1624.74	-14.8	-3524.6
	6	(H2)	2831.68	-91.5	0.0	-1624.74	-14.8	-3524.6
	7	(H1)	2460.76	303.0	0.0	-1494.31	-134.1	-3556.4
	7	(H2)	896.87	28.1	0.0	-1494.31	-134.1	-3556.4
	8	(H1)	2037.37	516.0	0.0	-1104.85	-259.0	-3584.9
	8	(H2)	717.58	144.0	0.0	-1104.85	-259.0	-3584.9
	9	(H1)	731.24	738.1	0.0	-443.31	-389.3	-3609.6
	9	(H2)	296.91	259.9	0.0	-443.31	-389.3	-3609.6
	10	(H1)	-2096.01	1071.3	0.0	1083.73	-594.0	-3638.6
	10	(H2)	-786.91	433.8	0.0	1083.73	-594.0	-3638.6
	11	(H1)	-5967.43	1404.8	0.0	2333.59	-0.9	-3846.8
	11	(H2)	-2415.25	607.7	0.0	2333.59	-0.9	-3846.8
6	1	(H1)	-2556.14	-636.8	0.0	2333.59	3.2	-3846.8
	1	(H2)	-6030.89	-1408.7	0.0	2333.59	3.2	-3846.8
	2	(H1)	-837.77	-463.0	0.0	1226.27	550.2	-3946.0
	2	(H2)	-2149.34	-1075.5	0.0	1226.27	550.2	-3946.0
	3AI	(H1)	337.29	-289.1	0.0	-362.97	480.8	-4068.9
	3AI	(H2)	690.84	-742.2	0.0	-362.97	480.8	-4068.9

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
3AD	(H1)	337.29	-289.1	0.0	-113.03	402.4	-3383.7
3AD	(H2)	690.84	-742.2	0.0	-113.03	402.4	-3383.7
4	(H1)	818.78	-173.2	0.0	-961.46	373.0	-3401.8
4	(H2)	2005.59	-520.1	0.0	-961.46	373.0	-3401.8
5	(H1)	1058.88	-57.3	0.0	-1458.50	146.2	-3476.4
5	(H2)	2857.66	-298.0	0.0	-1458.50	146.2	-3476.4
6	(H1)	3055.30	74.5	0.0	-1652.94	3.3	-3521.7
6	(H2)	871.54	-93.3	0.0	-1652.94	3.3	-3521.7
7	(H1)	2686.81	279.3	0.0	-1551.02	-125.9	-3555.7
7	(H2)	945.18	22.6	0.0	-1551.02	-125.9	-3555.7
8	(H1)	2265.73	496.0	0.0	-1172.18	-257.2	-3585.2
8	(H2)	777.43	138.5	0.0	-1172.18	-257.2	-3585.2
9	(H1)	1001.21	718.1	0.0	-511.22	-390.2	-3610.1
9	(H2)	368.29	254.4	0.0	-511.22	-390.2	-3610.1
10	(H1)	-1763.60	1051.4	0.0	1015.62	-591.6	-3638.7
10	(H2)	-698.23	428.2	0.0	1015.62	-591.6	-3638.7
11	(H1)	-5572.55	1384.8	0.0	2253.07	3.2	-3846.8
11	(H2)	-2309.24	602.2	0.0	2253.07	3.2	-3846.8
7 1	(H1)	-2309.24	-671.8	0.0	2253.07	49.0	-3846.8
1	(H2)	-5558.20	-1344.3	0.0	2253.07	49.0	-3846.8
2	(H1)	-481.52	-497.9	0.0	1002.72	595.9	-3946.0
2	(H2)	-1878.06	-1011.0	0.0	1002.72	595.9	-3946.0
3AI	(H1)	802.89	-324.1	0.0	-729.56	526.6	-4068.9
3AI	(H2)	760.71	-677.8	0.0	-729.56	526.6	-4068.9
3AD	(H1)	802.89	-324.1	0.0	-147.61	323.9	-2354.0
3AD	(H2)	760.71	-677.8	0.0	-147.61	323.9	-2354.0
4	(H1)	1277.80	-228.5	0.0	-707.25	324.5	-2359.1
4	(H2)	1768.28	-494.5	0.0	-707.25	324.5	-2359.1
5	(H1)	1588.32	-132.8	0.0	-1210.95	216.8	-2394.5
5	(H2)	2460.75	-311.2	0.0	-1210.95	216.8	-2394.5
6	(H1)	3166.42	-22.7	0.0	-1518.33	103.8	-2432.9
6	(H2)	741.92	-152.7	0.0	-1518.33	103.8	-2432.9

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Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
7	(H1)	3060.01	160.1	0.0	-1604.90	-22.1	-2464.8
7	(H2)	922.19	-57.1	0.0	-1604.90	-22.1	-2464.8
8	(H1)	3112.82	329.0	0.0	-1489.03	-132.3	-2486.9
8	(H2)	938.07	38.6	0.0	-1489.03	-132.3	-2486.9
9	(H1)	2389.73	512.3	0.0	-1176.50	-243.8	-2503.8
9	(H2)	789.56	134.2	0.0	-1176.50	-243.8	-2503.8
10	(H1)	1351.54	695.6	0.0	-666.42	-355.9	-2515.5
10	(H2)	476.65	229.8	0.0	-666.42	-355.9	-2515.5
11	(H1)	0.00	878.7	0.0	-35.65	-353.5	-2539.6
11	(H2)	0.00	325.4	0.0	-35.65	-353.5	-2539.6

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1) AB	1.6902	23.6	1668.8	0.01	207.74	--	25.00
	1	(H2) AB	1.6902	-529.8	1668.8	0.32	207.74	31.50	25.00
	2	(H1) AB	1.6923	300.2	1667.8	0.18	207.74	9.03	25.00
	2	(H2) AB	1.6923	-151.1	1667.8	0.09	207.74	--	25.00
	3	(H1) AB	1.6863	105.8	1670.7	0.06	207.74	--	25.00
	3	(H2) AB	1.6863	-243.5	1670.7	0.15	207.74	3.51	25.00
	4	(H1) AB	1.6807	27.0	1673.3	0.02	207.74	--	25.00
	4	(H2) AB	1.6807	-220.3	1673.3	0.13	207.74	1.23	25.00
	5	(H1) AB	1.6775	60.0	1674.8	0.04	207.74	--	25.00
	5	(H2) AB	1.6775	-85.3	1674.8	0.05	207.74	--	25.00
	6	(H1) AB	1.6728	109.3	1677.1	0.07	207.74	--	25.00
	6	(H2) AB	1.6728	-53.9	1677.1	0.03	207.74	--	25.00
	7	(H1) AB	1.6676	214.3	1679.6	0.13	207.74	0.65	25.00
	7	(H2) AB	1.6676	-50.2	1679.6	0.03	207.74	--	25.00
	8	(H1) AB	1.6620	322.2	1682.2	0.19	207.74	11.39	25.00
	8	(H2) AB	1.6620	-44.2	1682.2	0.03	207.74	--	25.00
	9	(H1) AB	1.6567	432.2	1684.7	0.26	207.74	22.40	25.00
	9	(H2) AB	1.6567	-36.2	1684.7	0.02	207.74	--	25.00
	10	(H1) AB	1.6549	540.8	1685.6	0.32	207.74	33.28	25.00
	10	(H2) AB	1.6549	-29.6	1685.6	0.02	207.74	--	25.00
	11	(H1) C	1.6719	1284.6	1677.5	0.77	0.00	127.04	25.00
	11	(H2) AB	1.6719	612.1	1677.5	0.36	207.74	39.99	25.00
2	1	(H1) AB	1.6719	-594.7	1677.5	0.35	207.74	38.27	25.00
	1	(H2) C	1.6719	-1377.4	1677.5	0.82	0.00	136.22	25.00
	2	(H1) AB	1.6827	-14.9	1672.4	0.01	207.74	--	25.00
	2	(H2) AB	1.6827	-638.2	1672.4	0.38	207.74	42.29	25.00
	3AI	(H1) AB	1.6999	230.6	1664.2	0.14	207.74	2.22	25.00
	3AI	(H2) AB	1.6999	-233.3	1664.2	0.14	207.74	2.49	25.00
	3AD	(H1) AB	1.6036	152.1	1709.8	0.09	207.74	--	25.00
	3AD	(H2) AB	1.6036	-311.7	1709.8	0.18	207.74	10.72	25.00
	4	(H1) AB	1.6062	238.7	1708.5	0.14	207.74	3.18	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	4	(H2) AB	1.6062	-119.0	1708.5	0.07	207.74	--	25.00
	5	(H1) AB	1.6170	127.7	1703.5	0.07	207.74	--	25.00
	5	(H2) AB	1.6170	-129.1	1703.5	0.08	207.74	--	25.00
	6	(H1) AB	1.6235	100.7	1700.4	0.06	207.74	--	25.00
	6	(H2) AB	1.6235	-67.2	1700.4	0.04	207.74	--	25.00
	7	(H1) AB	1.6283	176.1	1698.1	0.10	207.74	--	25.00
	7	(H2) AB	1.6283	-64.5	1698.1	0.04	207.74	--	25.00
	8	(H1) AB	1.6325	266.9	1696.2	0.16	207.74	5.99	25.00
	8	(H2) AB	1.6325	-79.9	1696.2	0.05	207.74	--	25.00
	9	(H1) AB	1.6361	356.1	1694.5	0.21	207.74	14.99	25.00
	9	(H2) AB	1.6361	-96.9	1694.5	0.06	207.74	--	25.00
	10	(H1) AB	1.6401	487.9	1692.6	0.29	207.74	28.24	25.00
	10	(H2) AB	1.6401	-124.5	1692.6	0.07	207.74	--	25.00
	11	(H1) C	1.6693	1416.2	1678.7	0.84	0.00	140.27	25.00
	11	(H2) AB	1.6693	644.2	1678.7	0.38	207.74	43.24	25.00
3	1	(H1) AB	1.6693	-609.7	1678.7	0.36	207.74	39.81	25.00
	1	(H2) C	1.6693	-1406.7	1678.7	0.84	0.00	139.34	25.00
	2	(H1) AB	1.6831	111.1	1672.2	0.07	207.74	--	25.00
	2	(H2) AB	1.6831	-526.5	1672.2	0.31	207.74	31.32	25.00
	3AI	(H1) AB	1.6999	215.6	1664.2	0.13	207.74	0.77	25.00
	3AI	(H2) AB	1.6999	-262.7	1664.2	0.16	207.74	5.34	25.00
	3AD	(H1) AB	1.6036	137.2	1709.8	0.08	207.74	--	25.00
	3AD	(H2) AB	1.6036	-341.1	1709.8	0.20	207.74	13.75	25.00
	4	(H1) AB	1.6062	223.8	1708.5	0.13	207.74	1.65	25.00
	4	(H2) AB	1.6062	-148.3	1708.5	0.09	207.74	--	25.00
	5	(H1) AB	1.6170	112.7	1703.5	0.07	207.74	--	25.00
	5	(H2) AB	1.6170	-162.2	1703.5	0.10	207.74	--	25.00
	6	(H1) AB	1.6235	89.4	1700.4	0.05	207.74	--	25.00
	6	(H2) AB	1.6235	-100.2	1700.4	0.06	207.74	--	25.00
	7	(H1) AB	1.6283	165.1	1698.1	0.10	207.74	--	25.00
	7	(H2) AB	1.6283	-100.6	1698.1	0.06	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	8	(H1) AB	1.6325	255.3	1696.2	0.15	207.74	4.82	25.00
	8	(H2) AB	1.6325	-116.0	1696.2	0.07	207.74	--	25.00
	9	(H1) AB	1.6361	344.5	1694.5	0.20	207.74	13.82	25.00
	9	(H2) AB	1.6361	-133.1	1694.5	0.08	207.74	--	25.00
	10	(H1) AB	1.6401	476.3	1692.6	0.28	207.74	27.07	25.00
	10	(H2) AB	1.6401	-160.7	1692.6	0.09	207.74	--	25.00
	11	(H1) C	1.6693	1404.5	1678.7	0.84	0.00	139.12	25.00
	11	(H2) AB	1.6693	608.1	1678.7	0.36	207.74	39.65	25.00
4	1	(H1) AB	1.6693	-607.4	1678.7	0.36	207.74	39.59	25.00
	1	(H2) C	1.6693	-1405.5	1678.7	0.84	0.00	139.21	25.00
	2	(H1) AB	1.6831	113.4	1672.2	0.07	207.74	--	25.00
	2	(H2) AB	1.6831	-525.3	1672.2	0.31	207.74	31.20	25.00
	3AI	(H1) AB	1.6999	217.9	1664.2	0.13	207.74	0.99	25.00
	3AI	(H2) AB	1.6999	-261.4	1664.2	0.16	207.74	5.22	25.00
	3AD	(H1) AB	1.6036	139.5	1709.8	0.08	207.74	--	25.00
	3AD	(H2) AB	1.6036	-339.9	1709.8	0.20	207.74	13.62	25.00
	4	(H1) AB	1.6062	226.0	1708.5	0.13	207.74	1.88	25.00
	4	(H2) AB	1.6062	-147.1	1708.5	0.09	207.74	--	25.00
	5	(H1) AB	1.6170	115.0	1703.5	0.07	207.74	--	25.00
	5	(H2) AB	1.6170	-158.2	1703.5	0.09	207.74	--	25.00
	6	(H1) AB	1.6235	97.7	1700.4	0.06	207.74	--	25.00
	6	(H2) AB	1.6235	-96.2	1700.4	0.06	207.74	--	25.00
	7	(H1) AB	1.6283	173.3	1698.1	0.10	207.74	--	25.00
	7	(H2) AB	1.6283	-99.7	1698.1	0.06	207.74	--	25.00
	8	(H1) AB	1.6325	257.8	1696.2	0.15	207.74	5.07	25.00
	8	(H2) AB	1.6325	-115.2	1696.2	0.07	207.74	--	25.00
	9	(H1) AB	1.6361	347.0	1694.5	0.20	207.74	14.07	25.00
	9	(H2) AB	1.6361	-132.2	1694.5	0.08	207.74	--	25.00
	10	(H1) AB	1.6401	478.8	1692.6	0.28	207.74	27.33	25.00
	10	(H2) AB	1.6401	-159.8	1692.6	0.09	207.74	--	25.00
	11	(H1) C	1.6693	1407.0	1678.7	0.84	0.00	139.37	25.00
	11	(H2) AB	1.6693	609.0	1678.7	0.36	207.74	39.74	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
5	1	(H1) AB	1.6693	-611.0	1678.7	0.36	207.74	39.94	25.00
	1	(H2) C	1.6693	-1407.4	1678.7	0.84	0.00	139.40	25.00
	2	(H1) AB	1.6831	109.9	1672.2	0.07	207.74	--	25.00
	2	(H2) AB	1.6831	-527.2	1672.2	0.32	207.74	31.38	25.00
	3AI	(H1) AB	1.6999	214.4	1664.2	0.13	207.74	0.64	25.00
	3AI	(H2) AB	1.6999	-263.3	1664.2	0.16	207.74	5.40	25.00
	3AD	(H1) AB	1.6036	135.9	1709.8	0.08	207.74	--	25.00
	3AD	(H2) AB	1.6036	-341.8	1709.8	0.20	207.74	13.82	25.00
	4	(H1) AB	1.6062	223.2	1708.6	0.13	207.74	1.59	25.00
	4	(H2) AB	1.6062	-148.2	1708.6	0.09	207.74	--	25.00
	5	(H1) AB	1.6168	116.0	1703.6	0.07	207.74	--	25.00
	5	(H2) AB	1.6168	-149.8	1703.6	0.09	207.74	--	25.00
	6	(H1) AB	1.6239	83.4	1700.2	0.05	207.74	--	25.00
	6	(H2) AB	1.6239	-106.3	1700.2	0.06	207.74	--	25.00
	7	(H1) AB	1.6284	168.9	1698.1	0.10	207.74	--	25.00
	7	(H2) AB	1.6284	-105.9	1698.1	0.06	207.74	--	25.00
	8	(H1) AB	1.6325	257.0	1696.2	0.15	207.74	4.99	25.00
	8	(H2) AB	1.6325	-115.0	1696.2	0.07	207.74	--	25.00
	9	(H1) AB	1.6360	348.8	1694.5	0.21	207.74	14.26	25.00
	9	(H2) AB	1.6360	-129.4	1694.5	0.08	207.74	--	25.00
	10	(H1) AB	1.6401	477.3	1692.6	0.28	207.74	27.18	25.00
	10	(H2) AB	1.6401	-160.3	1692.6	0.09	207.74	--	25.00
	11	(H1) C	1.6693	1403.9	1678.7	0.84	0.00	139.05	25.00
	11	(H2) AB	1.6693	606.8	1678.7	0.36	207.74	39.53	25.00
6	1	(H1) AB	1.6693	-633.6	1678.7	0.38	207.74	42.18	25.00
	1	(H2) C	1.6693	-1405.5	1678.7	0.84	0.00	139.21	25.00
	2	(H1) AB	1.6831	87.2	1672.2	0.05	207.74	--	25.00
	2	(H2) AB	1.6831	-525.3	1672.2	0.31	207.74	31.20	25.00
	3AI	(H1) AB	1.6999	191.7	1664.2	0.12	207.74	--	25.00
	3AI	(H2) AB	1.6999	-261.4	1664.2	0.16	207.74	5.22	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	3AD	(H1)	AB	1.6036	113.3	1709.8	0.07	207.74	--	25.00
	3AD	(H2)	AB	1.6036	-339.9	1709.8	0.20	207.74	13.62	25.00
	4	(H1)	AB	1.6062	199.8	1708.5	0.12	207.74	--	25.00
	4	(H2)	AB	1.6062	-147.1	1708.5	0.09	207.74	--	25.00
	5	(H1)	AB	1.6170	88.8	1703.5	0.05	207.74	--	25.00
	5	(H2)	AB	1.6170	-151.8	1703.5	0.09	207.74	--	25.00
	6	(H1)	AB	1.6235	77.8	1700.4	0.05	207.74	--	25.00
	6	(H2)	AB	1.6235	-90.0	1700.4	0.05	207.74	--	25.00
	7	(H1)	AB	1.6283	153.4	1698.1	0.09	207.74	--	25.00
	7	(H2)	AB	1.6283	-103.3	1698.1	0.06	207.74	--	25.00
	8	(H1)	AB	1.6325	238.8	1696.2	0.14	207.74	3.15	25.00
	8	(H2)	AB	1.6325	-118.7	1696.2	0.07	207.74	--	25.00
	9	(H1)	AB	1.6361	328.0	1694.5	0.19	207.74	12.15	25.00
	9	(H2)	AB	1.6361	-135.8	1694.5	0.08	207.74	--	25.00
	10	(H1)	AB	1.6401	459.8	1692.6	0.27	207.74	25.41	25.00
	10	(H2)	AB	1.6401	-163.4	1692.6	0.10	207.74	--	25.00
	11	(H1)	C	1.6693	1388.0	1678.7	0.83	0.00	137.48	25.00
	11	(H2)	AB	1.6693	605.4	1678.7	0.36	207.74	39.39	25.00
7	1	(H1)	AB	1.6693	-622.8	1678.7	0.37	207.74	41.11	25.00
	1	(H2)	C	1.6693	-1295.3	1678.7	0.77	0.00	128.30	25.00
	2	(H1)	AB	1.6831	98.0	1672.2	0.06	207.74	--	25.00
	2	(H2)	AB	1.6831	-415.1	1672.2	0.25	207.74	20.37	25.00
	3AI	(H1)	AB	1.6999	202.5	1664.2	0.12	207.74	--	25.00
	3AI	(H2)	AB	1.6999	-151.2	1664.2	0.09	207.74	--	25.00
	3AD	(H1)	AB	1.4468	-0.2	1781.1	0.00	207.74	--	25.00
	3AD	(H2)	AB	1.4468	-353.9	1781.1	0.20	207.74	16.70	25.00
	4	(H1)	AB	1.4476	96.1	1780.8	0.05	207.74	--	25.00
	4	(H2)	AB	1.4476	-170.0	1780.8	0.10	207.74	--	25.00
	5	(H1)	AB	1.4533	84.0	1778.3	0.05	207.74	--	25.00
	5	(H2)	AB	1.4533	-94.4	1778.3	0.05	207.74	--	25.00
	6	(H1)	C	1.4594	81.1	1775.6	0.05	207.74	--	25.00
	6	(H2)	AB	1.4594	-48.9	1775.6	0.03	207.74	--	25.00

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Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	7	(H1)	C	1.4645	138.0	1773.4	0.08	207.74	--	25.00
	7	(H2)	AB	1.4645	-79.2	1773.4	0.04	207.74	--	25.00
	8	(H1)	C	1.4680	196.7	1771.8	0.11	207.74	--	25.00
	8	(H2)	AB	1.4680	-93.7	1771.8	0.05	207.74	--	25.00
	9	(H1)	AB	1.4707	268.5	1770.6	0.15	207.74	6.83	25.00
	9	(H2)	AB	1.4707	-109.6	1770.6	0.06	207.74	--	25.00
	10	(H1)	AB	1.4725	339.7	1769.8	0.19	207.74	14.82	25.00
	10	(H2)	AB	1.4725	-126.0	1769.8	0.07	207.74	--	25.00
	11	(H1)	AB	1.4763	525.2	1768.1	0.30	207.74	35.55	25.00
	11	(H2)	AB	1.4763	-28.1	1768.1	0.02	207.74	--	25.00

Calculo de Comprobacion a Cortante - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio	=	0.90	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

			Esfuerzos de C. Exteriores			Esfuerzos de Pretensado		
V.	Sec		Momento (m x t)	Cortante (t)	Axil (t)	Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-142.6	0.0	-10.13	348.0	-3997.6
	1	(H2)	0.00	-695.9	0.0	-10.13	348.0	-3997.6
	2	(H1)	222.65	-80.0	0.0	-1024.84	513.3	-4013.4
	2	(H2)	1227.30	-531.4	0.0	-1024.84	513.3	-4013.4
	3	(H1)	320.13	-17.4	0.0	-1705.79	207.7	-3969.5
	3	(H2)	2125.42	-366.8	0.0	-1705.79	207.7	-3969.5
	4	(H1)	292.43	45.1	0.0	-1890.20	17.7	-3929.2
	4	(H2)	2694.36	-202.2	0.0	-1890.20	17.7	-3929.2
	5	(H1)	139.55	107.7	0.0	-1815.37	-60.7	-3906.1
	5	(H2)	2934.11	-37.6	0.0	-1815.37	-60.7	-3906.1
	6	(H1)	1518.96	218.0	0.0	-1564.10	-170.3	-3871.6
	6	(H2)	1016.53	54.8	0.0	-1564.10	-170.3	-3871.6
	7	(H1)	1343.01	381.9	0.0	-1096.10	-277.9	-3834.4
	7	(H2)	844.31	117.4	0.0	-1096.10	-277.9	-3834.4
	8	(H1)	414.71	546.4	0.0	-418.38	-383.2	-3794.5
	8	(H2)	546.91	180.0	0.0	-418.38	-383.2	-3794.5
	9	(H1)	-842.77	711.0	0.0	460.64	-486.5	-3756.8
	9	(H2)	124.34	242.6	0.0	460.64	-486.5	-3756.8
	10	(H1)	-2429.44	875.6	0.0	1538.51	-591.1	-3743.6
	10	(H2)	-423.41	305.2	0.0	1538.51	-591.1	-3743.6
	11	(H1)	-4345.29	1040.2	0.0	2222.00	-60.7	-3865.1
	11	(H2)	-1096.33	367.8	0.0	2222.00	-60.7	-3865.1
2	1	(H1)	-1096.33	-300.0	0.0	2222.00	8.4	-3865.1
	1	(H2)	-4359.64	-1082.6	0.0	2222.00	8.4	-3865.1
	2	(H1)	-311.67	-202.2	0.0	1243.65	414.4	-3943.6
	2	(H2)	-1378.29	-825.4	0.0	1243.65	414.4	-3943.6
	3AI	(H1)	167.39	-104.4	0.0	-242.32	486.0	-4068.9
	3AI	(H2)	799.38	-568.3	0.0	-242.32	486.0	-4068.9
	3AD	(H1)	167.39	-104.4	0.0	7.63	407.5	-3383.8
	3AD	(H2)	799.38	-568.3	0.0	7.63	407.5	-3383.8
	4	(H1)	316.97	-39.2	0.0	-851.55	378.2	-3401.8

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	4	(H2)	1804.55	-396.8	0.0	-851.55	378.2	-3401.8
	5	(H1)	330.77	26.0	0.0	-1359.33	151.3	-3476.4
	5	(H2)	2071.89	-230.8	0.0	-1359.33	151.3	-3476.4
	6	(H1)	208.79	91.2	0.0	-1564.53	8.5	-3521.7
	6	(H2)	2392.22	-76.7	0.0	-1564.53	8.5	-3521.7
	7	(H1)	2252.36	245.1	0.0	-1473.35	-120.7	-3555.7
	7	(H2)	453.10	4.5	0.0	-1473.35	-120.7	-3555.7
	8	(H1)	1563.37	416.5	0.0	-1105.27	-252.0	-3585.2
	8	(H2)	375.87	69.7	0.0	-1105.27	-252.0	-3585.2
	9	(H1)	517.31	587.9	0.0	-455.05	-385.0	-3610.1
	9	(H2)	162.86	134.9	0.0	-455.05	-385.0	-3610.1
	10	(H1)	-1721.70	845.1	0.0	1055.67	-586.4	-3638.7
	10	(H2)	-411.36	232.6	0.0	1055.67	-586.4	-3638.7
	11	(H1)	-4766.59	1102.4	0.0	2276.98	8.4	-3846.8
	11	(H2)	-1291.84	330.5	0.0	2276.98	8.4	-3846.8
3	1	(H1)	-1150.95	-303.0	0.0	2276.98	-2.2	-3846.8
	1	(H2)	-4703.13	-1100.0	0.0	2276.98	-2.2	-3846.8
	2	(H1)	-357.03	-205.2	0.0	1186.54	544.8	-3946.0
	2	(H2)	-1667.40	-842.8	0.0	1186.54	544.8	-3946.0
	3AI	(H1)	131.29	-107.4	0.0	-385.82	475.4	-4068.9
	3AI	(H2)	564.66	-585.7	0.0	-385.82	475.4	-4068.9
	3AD	(H1)	131.29	-107.4	0.0	-135.88	397.0	-3383.8
	3AD	(H2)	564.66	-585.7	0.0	-135.88	397.0	-3383.8
	4	(H1)	287.04	-42.2	0.0	-973.06	367.6	-3401.8
	4	(H2)	1606.09	-414.3	0.0	-973.06	367.6	-3401.8
	5	(H1)	307.01	23.0	0.0	-1458.84	140.8	-3476.4
	5	(H2)	1870.36	-251.9	0.0	-1458.84	140.8	-3476.4
	6	(H1)	2188.12	91.9	0.0	-1642.04	-2.1	-3521.7
	6	(H2)	2234.63	-97.8	0.0	-1642.04	-2.1	-3521.7
	7	(H1)	1836.29	246.0	0.0	-1528.86	-131.3	-3555.7
	7	(H2)	328.50	-19.7	0.0	-1528.86	-131.3	-3555.7

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Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	8	(H1)	1568.11	416.8	0.0	-1138.78	-262.6	-3585.2
	8	(H2)	301.68	45.5	0.0	-1138.78	-262.6	-3585.2
	9	(H1)	521.39	588.2	0.0	-466.56	-395.6	-3610.1
	9	(H2)	139.08	110.7	0.0	-466.56	-395.6	-3610.1
	10	(H1)	-1718.62	845.4	0.0	1077.16	-597.0	-3638.7
	10	(H2)	-359.51	208.4	0.0	1077.16	-597.0	-3638.7
	11	(H1)	-4764.50	1102.7	0.0	2331.49	-2.2	-3846.8
	11	(H2)	-1164.31	306.3	0.0	2331.49	-2.2	-3846.8
4	1	(H1)	-1149.82	-304.0	0.0	2331.49	0.8	-3846.8
	1	(H2)	-4740.48	-1102.0	0.0	2331.49	0.8	-3846.8
	2	(H1)	-352.71	-206.2	0.0	1231.61	547.8	-3946.0
	2	(H2)	-1698.45	-844.9	0.0	1231.61	547.8	-3946.0
	3AI	(H1)	138.79	-108.4	0.0	-350.21	478.4	-4068.9
	3AI	(H2)	539.92	-587.7	0.0	-350.21	478.4	-4068.9
	3AD	(H1)	138.79	-108.4	0.0	-100.26	400.0	-3383.8
	3AD	(H2)	539.92	-587.7	0.0	-100.26	400.0	-3383.8
	4	(H1)	296.67	-43.2	0.0	-943.74	370.7	-3401.8
	4	(H2)	1585.55	-416.3	0.0	-943.74	370.7	-3401.8
	5	(H1)	318.77	22.0	0.0	-1435.82	143.8	-3476.4
	5	(H2)	1864.63	-251.2	0.0	-1435.82	143.8	-3476.4
	6	(H1)	2227.53	96.9	0.0	-1625.31	0.9	-3521.7
	6	(H2)	2227.34	-97.1	0.0	-1625.31	0.9	-3521.7
	7	(H1)	1865.28	251.0	0.0	-1518.43	-128.3	-3555.7
	7	(H2)	318.87	-22.1	0.0	-1518.43	-128.3	-3555.7
	8	(H1)	1586.66	416.0	0.0	-1134.64	-259.6	-3585.2
	8	(H2)	297.04	43.1	0.0	-1134.64	-259.6	-3585.2
	9	(H1)	541.52	587.5	0.0	-468.72	-392.5	-3610.1
	9	(H2)	139.44	108.3	0.0	-468.72	-392.5	-3610.1
	10	(H1)	-1696.12	844.6	0.0	1065.55	-594.0	-3638.7
	10	(H2)	-351.66	206.0	0.0	1065.55	-594.0	-3638.7
	11	(H1)	-4739.63	1102.0	0.0	2310.44	0.8	-3846.8
	11	(H2)	-1148.97	303.9	0.0	2310.44	0.8	-3846.8

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
5	1	(H1)	-1163.46	-306.2	0.0	2310.44	-0.9	-3846.8
	1	(H2)	-4763.65	-1102.6	0.0	2310.44	-0.9	-3846.8
	2	(H1)	-359.48	-208.4	0.0	1216.07	546.0	-3946.0
	2	(H2)	-1719.86	-845.4	0.0	1216.07	546.0	-3946.0
	3AI	(H1)	138.89	-110.6	0.0	-360.21	476.7	-4068.9
	3AI	(H2)	520.25	-588.2	0.0	-360.21	476.7	-4068.9
	3AD	(H1)	138.89	-110.6	0.0	-110.27	398.2	-3383.7
	3AD	(H2)	520.25	-588.3	0.0	-110.27	398.2	-3383.7
	4	(H1)	301.35	-45.4	0.0	-949.98	369.6	-3401.5
	4	(H2)	1567.04	-416.8	0.0	-949.98	369.6	-3401.5
	5	(H1)	328.02	19.8	0.0	-1448.80	146.5	-3475.1
	5	(H2)	1835.28	-246.0	0.0	-1448.80	146.5	-3475.1
	6	(H1)	2234.04	97.8	0.0	-1624.74	-14.8	-3524.6
	6	(H2)	2187.14	-91.9	0.0	-1624.74	-14.8	-3524.6
	7	(H1)	1869.79	251.9	0.0	-1494.31	-134.1	-3556.4
	7	(H2)	305.90	-22.9	0.0	-1494.31	-134.1	-3556.4
	8	(H1)	1605.57	414.2	0.0	-1104.85	-259.0	-3584.9
	8	(H2)	285.78	42.2	0.0	-1104.85	-259.0	-3584.9
	9	(H1)	564.22	585.6	0.0	-443.31	-389.3	-3609.6
	9	(H2)	129.89	107.4	0.0	-443.31	-389.3	-3609.6
	10	(H1)	-1667.74	842.8	0.0	1083.73	-594.0	-3638.6
	10	(H2)	-358.65	205.2	0.0	1083.73	-594.0	-3638.6
	11	(H1)	-4705.57	1100.2	0.0	2333.59	-0.9	-3846.8
	11	(H2)	-1153.39	303.1	0.0	2333.59	-0.9	-3846.8
6	1	(H1)	-1294.28	-331.0	0.0	2333.59	3.2	-3846.8
	1	(H2)	-4769.03	-1102.9	0.0	2333.59	3.2	-3846.8
	2	(H1)	-412.61	-233.2	0.0	1226.27	550.2	-3946.0
	2	(H2)	-1724.18	-845.8	0.0	1226.27	550.2	-3946.0
	3AI	(H1)	163.45	-135.4	0.0	-362.97	480.8	-4068.9
	3AI	(H2)	517.01	-588.6	0.0	-362.97	480.8	-4068.9

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	3AD	(H1)	163.45	-135.4	0.0	-113.03	402.4	-3383.7
	3AD	(H2)	517.00	-588.6	0.0	-113.03	402.4	-3383.7
	4	(H1)	377.69	-70.3	0.0	-961.46	373.0	-3401.8
	4	(H2)	1564.50	-417.2	0.0	-961.46	373.0	-3401.8
	5	(H1)	456.16	-5.1	0.0	-1458.50	146.2	-3476.4
	5	(H2)	2254.94	-245.7	0.0	-1458.50	146.2	-3476.4
	6	(H1)	2396.54	76.1	0.0	-1652.94	3.3	-3521.7
	6	(H2)	212.78	-91.7	0.0	-1652.94	3.3	-3521.7
	7	(H1)	2077.63	230.1	0.0	-1551.02	-125.9	-3555.7
	7	(H2)	335.99	-26.6	0.0	-1551.02	-125.9	-3555.7
	8	(H1)	1811.72	396.2	0.0	-1172.18	-257.2	-3585.2
	8	(H2)	323.42	38.6	0.0	-1172.18	-257.2	-3585.2
	9	(H1)	807.99	567.6	0.0	-511.22	-390.2	-3610.1
	9	(H2)	175.08	103.8	0.0	-511.22	-390.2	-3610.1
	10	(H1)	-1367.51	824.7	0.0	1015.62	-591.6	-3638.7
	10	(H2)	-302.14	201.6	0.0	1015.62	-591.6	-3638.7
	11	(H1)	-4348.85	1082.1	0.0	2253.07	3.2	-3846.8
	11	(H2)	-1085.55	299.5	0.0	2253.07	3.2	-3846.8
7	1	(H1)	-1085.55	-367.2	0.0	2253.07	49.0	-3846.8
	1	(H2)	-4334.51	-1039.7	0.0	2253.07	49.0	-3846.8
	2	(H1)	-90.80	-269.4	0.0	1002.72	595.9	-3946.0
	2	(H2)	-1487.34	-782.5	0.0	1002.72	595.9	-3946.0
	3AI	(H1)	598.34	-171.6	0.0	-729.56	526.6	-4068.9
	3AI	(H2)	556.16	-525.3	0.0	-729.56	526.6	-4068.9
	3AD	(H1)	598.34	-171.6	0.0	-147.61	323.9	-2354.0
	3AD	(H2)	556.16	-525.3	0.0	-147.61	323.9	-2354.0
	4	(H1)	847.13	-117.8	0.0	-707.25	324.5	-2359.1
	4	(H2)	1337.61	-383.9	0.0	-707.25	324.5	-2359.1
	5	(H1)	1003.46	-64.0	0.0	-1210.95	216.8	-2394.5
	5	(H2)	1875.89	-242.4	0.0	-1210.95	216.8	-2394.5
	6	(H1)	2499.29	4.2	0.0	-1518.33	103.8	-2432.9
	6	(H2)	74.79	-125.7	0.0	-1518.33	103.8	-2432.9

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	7	(H1)	2382.53	145.2	0.0	-1604.90	-22.1	-2464.8
	7	(H2)	244.72	-72.0	0.0	-1604.90	-22.1	-2464.8
	8	(H1)	2496.92	272.3	0.0	-1489.03	-132.3	-2486.9
	8	(H2)	322.18	-18.2	0.0	-1489.03	-132.3	-2486.9
	9	(H1)	1907.33	413.7	0.0	-1176.50	-243.8	-2503.8
	9	(H2)	307.16	35.6	0.0	-1176.50	-243.8	-2503.8
	10	(H1)	1074.56	555.2	0.0	-666.42	-355.9	-2515.5
	10	(H2)	199.67	89.4	0.0	-666.42	-355.9	-2515.5
	11	(H1)	0.00	696.5	0.0	-35.65	-353.5	-2539.6
	11	(H2)	0.00	143.2	0.0	-35.65	-353.5	-2539.6

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1)	AB	1.6902	205.3	1668.8	0.12	207.74	--	25.00
	1	(H2)	AB	1.6902	-348.0	1668.8	0.21	207.74	13.72	25.00
	2	(H1)	AB	1.6923	433.3	1667.8	0.26	207.74	22.04	25.00
	2	(H2)	AB	1.6923	-18.0	1667.8	0.01	207.74	--	25.00
	3	(H1)	AB	1.6863	190.2	1670.7	0.11	207.74	--	25.00
	3	(H2)	AB	1.6863	-159.1	1670.7	0.10	207.74	--	25.00
	4	(H1)	AB	1.6807	62.8	1673.3	0.04	207.74	--	25.00
	4	(H2)	AB	1.6807	-184.5	1673.3	0.11	207.74	--	25.00
	5	(H1)	AB	1.6775	47.1	1674.8	0.03	207.74	--	25.00
	5	(H2)	AB	1.6775	-98.2	1674.8	0.06	207.74	--	25.00
	6	(H1)	AB	1.6728	47.7	1677.1	0.03	207.74	--	25.00
	6	(H2)	AB	1.6728	-115.5	1677.1	0.07	207.74	--	25.00
	7	(H1)	AB	1.6676	104.0	1679.6	0.06	207.74	--	25.00
	7	(H2)	AB	1.6676	-160.5	1679.6	0.10	207.74	--	25.00
	8	(H1)	AB	1.6620	163.3	1682.2	0.10	207.74	--	25.00
	8	(H2)	AB	1.6620	-203.2	1682.2	0.12	207.74	--	25.00
	9	(H1)	AB	1.6567	224.6	1684.7	0.13	207.74	1.68	25.00
	9	(H2)	AB	1.6567	-243.9	1684.7	0.14	207.74	3.61	25.00
	10	(H1)	AB	1.6549	284.5	1685.6	0.17	207.74	7.67	25.00
	10	(H2)	AB	1.6549	-286.0	1685.6	0.17	207.74	7.81	25.00
	11	(H1)	AB	1.6719	979.6	1677.5	0.58	207.74	76.33	25.00
	11	(H2)	AB	1.6719	307.1	1677.5	0.18	207.74	9.83	25.00
2	1	(H1)	AB	1.6719	-291.6	1677.5	0.17	207.74	8.29	25.00
	1	(H2)	AB	1.6719	-1074.2	1677.5	0.64	207.74	85.69	25.00
	2	(H1)	AB	1.6827	212.2	1672.4	0.13	207.74	0.43	25.00
	2	(H2)	AB	1.6827	-411.1	1672.4	0.25	207.74	19.98	25.00
	3AI	(H1)	AB	1.6999	381.6	1664.2	0.23	207.74	16.91	25.00
	3AI	(H2)	AB	1.6999	-82.3	1664.2	0.05	207.74	--	25.00
	3AD	(H1)	AB	1.6036	303.1	1709.8	0.18	207.74	9.83	25.00
	3AD	(H2)	AB	1.6036	-160.7	1709.8	0.09	207.74	--	25.00
	4	(H1)	AB	1.6062	339.0	1708.5	0.20	207.74	13.51	25.00

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
4	(H2)	AB	1.6062	-18.6	1708.5	0.01	207.74	--	25.00
5	(H1)	AB	1.6170	177.3	1703.5	0.10	207.74	--	25.00
5	(H2)	AB	1.6170	-79.5	1703.5	0.05	207.74	--	25.00
6	(H1)	AB	1.6235	99.6	1700.4	0.06	207.74	--	25.00
6	(H2)	AB	1.6235	-68.3	1700.4	0.04	207.74	--	25.00
7	(H1)	AB	1.6283	124.3	1698.1	0.07	207.74	--	25.00
7	(H2)	AB	1.6283	-116.2	1698.1	0.07	207.74	--	25.00
8	(H1)	AB	1.6325	164.4	1696.2	0.10	207.74	--	25.00
8	(H2)	AB	1.6325	-182.4	1696.2	0.11	207.74	--	25.00
9	(H1)	AB	1.6361	202.9	1694.5	0.12	207.74	--	25.00
9	(H2)	AB	1.6361	-250.1	1694.5	0.15	207.74	4.28	25.00
10	(H1)	AB	1.6401	258.7	1692.6	0.15	207.74	5.13	25.00
10	(H2)	AB	1.6401	-353.8	1692.6	0.21	207.74	14.72	25.00
11	(H1)	C	1.6693	1110.8	1678.7	0.66	0.00	110.02	25.00
11	(H2)	AB	1.6693	338.9	1678.7	0.20	207.74	12.99	25.00
3 1	(H1)	AB	1.6693	-305.1	1678.7	0.18	207.74	9.65	25.00
1	(H2)	C	1.6693	-1102.2	1678.7	0.66	0.00	109.17	25.00
2	(H1)	AB	1.6831	339.6	1672.2	0.20	207.74	12.95	25.00
2	(H2)	AB	1.6831	-298.1	1672.2	0.18	207.74	8.87	25.00
3AI	(H1)	AB	1.6999	368.1	1664.2	0.22	207.74	15.59	25.00
3AI	(H2)	AB	1.6999	-110.3	1664.2	0.07	207.74	--	25.00
3AD	(H1)	AB	1.6036	289.6	1709.8	0.17	207.74	8.44	25.00
3AD	(H2)	AB	1.6036	-188.7	1709.8	0.11	207.74	--	25.00
4	(H1)	AB	1.6062	325.5	1708.5	0.19	207.74	12.12	25.00
4	(H2)	AB	1.6062	-46.6	1708.5	0.03	207.74	--	25.00
5	(H1)	AB	1.6170	163.8	1703.5	0.10	207.74	--	25.00
5	(H2)	AB	1.6170	-111.2	1703.5	0.07	207.74	--	25.00
6	(H1)	AB	1.6235	89.8	1700.4	0.05	207.74	--	25.00
6	(H2)	AB	1.6235	-99.9	1700.4	0.06	207.74	--	25.00
7	(H1)	AB	1.6283	114.7	1698.1	0.07	207.74	--	25.00
7	(H2)	AB	1.6283	-151.0	1698.1	0.09	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
8	(H1)	AB	1.6325	154.2	1696.2	0.09	207.74	--	25.00
8	(H2)	AB	1.6325	-217.1	1696.2	0.13	207.74	0.95	25.00
9	(H1)	AB	1.6361	192.7	1694.5	0.11	207.74	--	25.00
9	(H2)	AB	1.6361	-284.9	1694.5	0.17	207.74	7.80	25.00
10	(H1)	AB	1.6401	248.4	1692.6	0.15	207.74	4.10	25.00
10	(H2)	AB	1.6401	-388.5	1692.6	0.23	207.74	18.23	25.00
11	(H1)	C	1.6693	1100.5	1678.7	0.66	0.00	109.01	25.00
11	(H2)	AB	1.6693	304.1	1678.7	0.18	207.74	9.55	25.00
4 1	(H1)	AB	1.6693	-303.1	1678.7	0.18	207.74	9.45	25.00
1	(H2)	C	1.6693	-1101.2	1678.7	0.66	0.00	109.07	25.00
2	(H1)	AB	1.6831	341.6	1672.2	0.20	207.74	13.15	25.00
2	(H2)	AB	1.6831	-297.1	1672.2	0.18	207.74	8.78	25.00
3AI	(H1)	AB	1.6999	370.1	1664.2	0.22	207.74	15.79	25.00
3AI	(H2)	AB	1.6999	-109.2	1664.2	0.07	207.74	--	25.00
3AD	(H1)	AB	1.6036	291.6	1709.8	0.17	207.74	8.65	25.00
3AD	(H2)	AB	1.6036	-187.7	1709.8	0.11	207.74	--	25.00
4	(H1)	AB	1.6062	327.5	1708.5	0.19	207.74	12.32	25.00
4	(H2)	AB	1.6062	-45.6	1708.5	0.03	207.74	--	25.00
5	(H1)	AB	1.6170	165.8	1703.5	0.10	207.74	--	25.00
5	(H2)	AB	1.6170	-107.4	1703.5	0.06	207.74	--	25.00
6	(H1)	AB	1.6235	97.8	1700.4	0.06	207.74	--	25.00
6	(H2)	AB	1.6235	-96.2	1700.4	0.06	207.74	--	25.00
7	(H1)	AB	1.6283	122.7	1698.1	0.07	207.74	--	25.00
7	(H2)	AB	1.6283	-150.4	1698.1	0.09	207.74	--	25.00
8	(H1)	AB	1.6325	156.5	1696.2	0.09	207.74	--	25.00
8	(H2)	AB	1.6325	-216.5	1696.2	0.13	207.74	0.89	25.00
9	(H1)	AB	1.6361	194.9	1694.5	0.12	207.74	--	25.00
9	(H2)	AB	1.6361	-284.3	1694.5	0.17	207.74	7.73	25.00
10	(H1)	AB	1.6401	250.7	1692.6	0.15	207.74	4.33	25.00
10	(H2)	AB	1.6401	-387.9	1692.6	0.23	207.74	18.16	25.00
11	(H1)	C	1.6693	1102.8	1678.7	0.66	0.00	109.23	25.00
11	(H2)	AB	1.6693	304.7	1678.7	0.18	207.74	9.61	25.00

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
5	1	(H1) AB	1.6693	-307.1	1678.7	0.18	207.74	9.84	25.00
	1	(H2) C	1.6693	-1103.5	1678.7	0.66	0.00	109.30	25.00
	2	(H1) AB	1.6831	337.6	1672.2	0.20	207.74	12.76	25.00
	2	(H2) AB	1.6831	-299.4	1672.2	0.18	207.74	9.00	25.00
	3AI	(H1) AB	1.6999	366.1	1664.2	0.22	207.74	15.40	25.00
	3AI	(H2) AB	1.6999	-111.6	1664.2	0.07	207.74	--	25.00
	3AD	(H1) AB	1.6036	287.6	1709.8	0.17	207.74	8.24	25.00
	3AD	(H2) AB	1.6036	-190.0	1709.8	0.11	207.74	--	25.00
	4	(H1) AB	1.6062	324.3	1708.6	0.19	207.74	11.99	25.00
	4	(H2) AB	1.6062	-47.2	1708.6	0.03	207.74	--	25.00
	5	(H1) AB	1.6168	166.3	1703.6	0.10	207.74	--	25.00
	5	(H2) AB	1.6168	-99.5	1703.6	0.06	207.74	--	25.00
	6	(H1) AB	1.6239	83.0	1700.2	0.05	207.74	--	25.00
	6	(H2) AB	1.6239	-106.7	1700.2	0.06	207.74	--	25.00
	7	(H1) AB	1.6284	117.8	1698.1	0.07	207.74	--	25.00
	7	(H2) AB	1.6284	-157.0	1698.1	0.09	207.74	--	25.00
	8	(H1) AB	1.6325	155.2	1696.2	0.09	207.74	--	25.00
	8	(H2) AB	1.6325	-216.8	1696.2	0.13	207.74	0.91	25.00
	9	(H1) AB	1.6360	196.3	1694.5	0.12	207.74	--	25.00
	9	(H2) AB	1.6360	-281.9	1694.5	0.17	207.74	7.49	25.00
	10	(H1) AB	1.6401	248.8	1692.6	0.15	207.74	4.14	25.00
	10	(H2) AB	1.6401	-388.8	1692.6	0.23	207.74	18.25	25.00
	11	(H1) C	1.6693	1099.2	1678.7	0.65	0.00	108.88	25.00
	11	(H2) AB	1.6693	302.2	1678.7	0.18	207.74	9.35	25.00
6	1	(H1) AB	1.6693	-327.8	1678.7	0.20	207.74	11.89	25.00
	1	(H2) C	1.6693	-1099.7	1678.7	0.66	0.00	108.93	25.00
	2	(H1) AB	1.6831	316.9	1672.2	0.19	207.74	10.73	25.00
	2	(H2) AB	1.6831	-295.6	1672.2	0.18	207.74	8.63	25.00
	3AI	(H1) AB	1.6999	345.4	1664.2	0.21	207.74	13.39	25.00
	3AI	(H2) AB	1.6999	-107.8	1664.2	0.06	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	3AD	(H1) AB	1.6036	266.9	1709.8	0.16	207.74	6.10	25.00
	3AD	(H2) AB	1.6036	-186.2	1709.8	0.11	207.74	--	25.00
	4	(H1) AB	1.6062	302.8	1708.5	0.18	207.74	9.78	25.00
	4	(H2) AB	1.6062	-44.1	1708.5	0.03	207.74	--	25.00
	5	(H1) AB	1.6170	141.1	1703.5	0.08	207.74	--	25.00
	5	(H2) AB	1.6170	-99.6	1703.5	0.06	207.74	--	25.00
	6	(H1) AB	1.6235	79.4	1700.4	0.05	207.74	--	25.00
	6	(H2) AB	1.6235	-88.4	1700.4	0.05	207.74	--	25.00
	7	(H1) AB	1.6283	104.3	1698.1	0.06	207.74	--	25.00
	7	(H2) AB	1.6283	-152.4	1698.1	0.09	207.74	--	25.00
	8	(H1) AB	1.6325	139.0	1696.2	0.08	207.74	--	25.00
	8	(H2) AB	1.6325	-218.6	1696.2	0.13	207.74	1.10	25.00
	9	(H1) AB	1.6361	177.4	1694.5	0.10	207.74	--	25.00
	9	(H2) AB	1.6361	-286.3	1694.5	0.17	207.74	7.94	25.00
	10	(H1) AB	1.6401	233.2	1692.6	0.14	207.74	2.56	25.00
	10	(H2) AB	1.6401	-390.0	1692.6	0.23	207.74	18.37	25.00
	11	(H1) AB	1.6693	1085.3	1678.7	0.65	207.74	86.92	25.00
	11	(H2) AB	1.6693	302.7	1678.7	0.18	207.74	9.40	25.00
7	1	(H1) AB	1.6693	-318.2	1678.7	0.19	207.74	10.94	25.00
	1	(H2) AB	1.6693	-990.7	1678.7	0.59	207.74	77.55	25.00
	2	(H1) AB	1.6831	326.5	1672.2	0.20	207.74	11.67	25.00
	2	(H2) AB	1.6831	-186.6	1672.2	0.11	207.74	--	25.00
	3AI	(H1) AB	1.6999	355.0	1664.2	0.21	207.74	14.32	25.00
	3AI	(H2) AB	1.6999	1.3	1664.2	0.00	207.74	--	25.00
	3AD	(H1) AB	1.4468	152.3	1781.1	0.09	207.74	--	25.00
	3AD	(H2) AB	1.4468	-201.4	1781.1	0.11	207.74	--	25.00
	4	(H1) AB	1.4476	206.7	1780.8	0.12	207.74	--	25.00
	4	(H2) AB	1.4476	-59.3	1780.8	0.03	207.74	--	25.00
	5	(H1) AB	1.4533	152.7	1778.3	0.09	207.74	--	25.00
	5	(H2) AB	1.4533	-25.6	1778.3	0.01	207.74	--	25.00
	6	(H1) AB	1.4594	108.0	1775.6	0.06	207.74	--	25.00
	6	(H2) AB	1.4594	-21.9	1775.6	0.01	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [0.90*Cm + 0.90*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [0.90*Cm + 0.90*Pp + 1.60*S(-)]+ 1.00*Pt

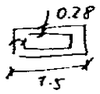
V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
7	(H1)	AB	1.4645	123.1	1773.4	0.07	207.74	--	25.00
7	(H2)	AB	1.4645	-94.1	1773.4	0.05	207.74	--	25.00
8	(H1)	AB	1.4680	139.9	1771.8	0.08	207.74	--	25.00
8	(H2)	AB	1.4680	-150.5	1771.8	0.08	207.74	--	25.00
9	(H1)	AB	1.4707	169.9	1770.6	0.10	207.74	--	25.00
9	(H2)	AB	1.4707	-208.2	1770.6	0.12	207.74	0.05	25.00
10	(H1)	AB	1.4725	199.3	1769.8	0.11	207.74	--	25.00
10	(H2)	AB	1.4725	-266.5	1769.8	0.15	207.74	6.59	25.00
11	(H1)	AB	1.4763	343.0	1768.1	0.19	207.74	15.15	25.00
11	(H2)	AB	1.4763	-210.4	1768.1	0.12	207.74	0.29	25.00

PROYECTO L.A.V ZARAGOZA- LLEIDA
SUBTRAMO 1 - E-1
CALCULO A TORSION
FECHA
HOJA N.º

CALCULO A TORSION

Empotramiento a torsión en pilas y estribos => Luz de cálculo: 25,0 m

$Td = 1.6 \times \left[(2.25 + 0.30) \times 12 + 0.4 \times 1.75 \times 5.99\right] \times \frac{25}{2} = 634$ mt

Sección rectangular equivalente: 

$he = \frac{1.58}{6} = 0.26$ $Ae = 1.32 \times 7.24 = 9.56\ m^2$

$\frac{At}{s} = \frac{634}{2 \times 9.56 \times 4.2} = 7.9\ cm^2/m$

$\frac{Al}{u} = 7.5\ cm^2/m$

$Tu_1 = 0.36 \times \frac{3500}{1.5} \times Ae \cdot he = 2088$ mt

COMPROBACION A CORTANTE Y TORSION

Sección pila: $\frac{Vrd}{Vu_1} + \frac{Td}{Tu_1} = 0.84 + 0.30$

↳ NO SON CONCOMITANTES (cortante máximo - momento torsor)

2 vías cargadas — 1 vía cargada.

Con 2 vías cargadas $Td = 1.6 \times \left[0.3 \times 24 + 0.4 \times 1.75 \times 5.99\right] \times \frac{25}{2} = 228$

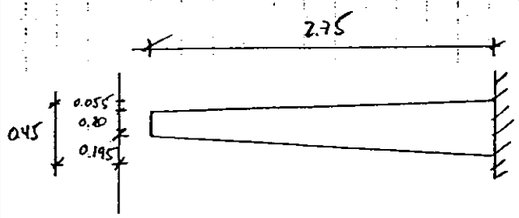
$\frac{Td}{Tu_1} = 0.11$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-1
ARMADURA DE VOLADIZO

FECHA

HOJA N.º

ARMADURA DE VOLADIZO



Peso propio $M = 0.20 \times \frac{2.75^2}{2} \times 2.5 + \frac{1}{2} 2.75 \times 0.25 \times 2.5 \times \frac{1}{3} 2.75 = 2.7 \text{ mt}$

Pasillos $M = 0.5 \times 1.75 \times 1.875 = 1.64 \text{ mt}$

Sobrecarga en pasillos $M = 0.4 \times 1.75 \times 1.875 = 1.31 \text{ mt}$

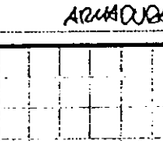
Barandilla : $0.05 \times 2.75 = 0.14 \text{ mt}$

Balasto $\frac{4.1}{9.92} \times 1 \times 0.50 = 0.21 \text{ mt}$

6 mt/m

$Md = 1.6 \times 6 = 9.6 \text{ mt/m} \rightarrow Vc = \frac{4000}{15} \times 0.4 = 1067 \quad Amec = 5.5 \text{ cm}^2/\text{m}$

Descargadamiento :



Aa)

$M = 6 + 1.5 \times (2.25 + 2.8 - 4.10) = 7.43 \text{ mt/m}$

Ab) $M = 6 + \frac{10}{n} = 9,18 \text{ mt/m}$

Ba) $M = 6 + 5 \times 0.95 = 10.75 \text{ mt/m}$

Bb) $M = 6 + \frac{22}{n} = 13 \text{ mt/m}$

$Amec\ (13 \text{ mt/m}) \rightarrow Amec = 7.4$

$Vc = \frac{25.00}{11} \times 1.0 \times 0.4 = 933 \rightarrow \underline{A = 7.4 \text{ cm}^2/\text{m}}$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-1
ARMADURA VOLADIZO

FECHA

HOJA N.º

CALCULO RASANTES

Mestático : $0.20 \times 2.75 \times (0.71055 - 0.055 - 0.10) +$

$+ \frac{1}{2} 2.75 \times 0.25 \times (0.71055 - 0.255 - \frac{1}{3} 0.25) = 0,433502 \text{ m}^3$

Armadura : $Vrd - \frac{Mest}{6 \cdot 5} \times b_x - \frac{1}{f_{yd}} = Vrd \times \frac{0.433502}{2.69706 \times 4.2} = 0.0383 \, Vrd$

Tomando valores medios por zonas:

	Vrd (t)	A (cm²/m)
Estribos:	384 394	15.1
2L/10 del estribo	266 242	10.2
2L/10 vano lateral	428 351	16.1
Pilas laterales	857 803	32.8
2L/10 vanos intermedios	353	13.5
Pilas intermedias	885	33.8

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-1
RIOSTRAS SOBRE PILAS
FECHA
HOJA N.º

RIOSTRAS SOBRE PILAS

Reacciones a todo el ancho:

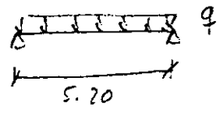
P. propio : 610 t

C. pavimento : 268 t

Tren : 645 t

Pretensado : 5 t

TOTAL : 1530 t → $q = \frac{1530}{5.20} = 295$ t/m



Flexión.

$M_d = 1.6 \times 295 \times \frac{5.2^2}{8} = 1596$ m·t

$U_c = \frac{3500}{1.5} \times 3.00 \times 1.55 = 10850$

$A_{nec} = \underline{\underline{243\ cm^2}}$

6 disponen $2 \times 26\ \phi 25$

Cortante $V_d = 1.6 \times 295 \times \frac{5.20}{2} = 1227$ t

$V_{u1} = 0.3 \times \frac{3500}{1.5} \times 3 \times 1.50 = 3150$ t

$V_{cu} = 5 \sqrt{\frac{3500}{1.5}} \times 3 \times 15 = 343$ t

$A_{nec} = \frac{1227 - 343}{0.9 \times 42 \times 1.5} = 15.5\ cm^2/m$

$A_{min} = 0.02 \times \frac{3500}{1.5} \times 3 \times \frac{1}{42} = 33\ cm^2/m$

Viga continua : $144\ cm^2 \times \frac{1}{68} \times 3 = 6.4\ cm^2$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-1
RIOSTRAS SOBRE PILAS
FECHA
HOJA N.º

Punzonamiento

$R_{dmax} = 880 \times 1.6$

Perímetro crítico: 2.55 / 2.15 / 1000×600

$V_{cu} = 2 \times 5 \sqrt{\frac{350}{1.5}} \times 9.40 \times 1.55 = 2225$; >> 1408 t

NO NECESITA ARMADURA DE PUNZONAMIENTO

Armadura reparto

$R_{dmax} = 1408$ t

$A = 0.3 \times 1408 \times \frac{1.15}{5.1} \times \left[1 - \frac{1.0}{1.60}\right] = 36\ cm^2$

$\times 10 = 95\ cm^2 \rightarrow \underline{\underline{3\ \#\ 10\ \phi 20}}$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SOBTRAMO 1 C-1
RIOSTRA SOBRE ESTRIBOS

FECHA

HOJA N.º

RIOSTRA SOBRE ESTRIBOS

Reacciones a todo el ancho:

P. propio:	197 t
C. permanente:	80 t
Tren:	222 t
Pretensado:	62 t
TOTAL:	561 t → $q = \frac{561}{58} = 9{,}7$ t/m

Flexión:

$$M_d = 1.6 \times 9.7 \times \frac{58^2}{8} = 653 \text{ m t}$$

$$U_c = \frac{3500}{15} \times 2.00 \times 1.55 = 7233$$

A_{nec} 97,5 cm²

Cortante

$$V_d = 1.6 \times 97 \times \frac{5.8}{2} = 450 \text{ t}$$

$$V_{u1} = 0.3 \times \frac{\cdot}{1.5} \times 2 \times 15 = 2400 \text{ t}$$

$$V_{cu} = 5\sqrt{\frac{350}{1.5}} \times 2 \times 15 = 229 \text{ t}$$

$$A_{nec} = \frac{450 - 229}{0.9 \times 4.7 \times 15} = 38{,}2 \text{ cm}^2/\text{m} \qquad A_{min} = 25.4 \text{ cm}^2/\text{m}$$

Viga cabecera: $\Rightarrow 34 \times \frac{3}{6.8} = 15 \text{ cm}^2/\text{m}$

A. reparto: $R_{dmax} = 323 \times 1.6 = 516$ $A = 0.3 \times 516 \times \frac{1.15}{51} \times \left[1 - \frac{0.9}{1.0}\right]$ $\times 1$ ~~238~~ 233 cm²

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LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 1. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	1.3407	-0.18361
2	1.1500	0.9788	-0.18361
3	8.0000	0.3500	0.00000
4	18.0000	1.0583	0.14167
5	20.0000	1.2000	0.00000
6	22.7500	1.2000	0.00000
7	24.2500	1.1200	-0.15000
8	26.2500	0.8200	-0.15000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	26.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.341	0.000	-0.1836	0.0000
2	0.000	1.187	0.000	-0.1797	0.0000
3	1.000	1.006	0.000	-0.1825	0.0000
4	2.000	0.832	0.000	-0.1608	0.0000
5	3.000	0.685	0.000	-0.1340	0.0000
6	4.000	0.564	0.000	-0.1072	0.0000
7	5.000	0.471	0.000	-0.0804	0.0000
8	6.000	0.404	0.000	-0.0536	0.0000
9	7.000	0.363	0.000	-0.0268	0.0000
10	8.000	0.350	0.000	0.0000	0.0000
11	9.000	0.357	0.000	0.0142	0.0000
12	10.000	0.378	0.000	0.0283	0.0000
13	11.000	0.414	0.000	0.0425	0.0000
14	12.000	0.463	0.000	0.0567	0.0000
15	13.000	0.527	0.000	0.0708	0.0000
16	14.000	0.605	0.000	0.0850	0.0000
17	15.000	0.697	0.000	0.0992	0.0000
18	16.000	0.803	0.000	0.1133	0.0000
19	17.000	0.924	0.000	0.1275	0.0000
20	18.000	1.058	0.000	0.1417	0.0000
21	19.000	1.165	0.000	0.0709	0.0000
22	20.000	1.200	0.000	0.0000	0.0000
23	21.000	1.200	0.000	0.0000	0.0000
24	22.000	1.200	0.000	0.0000	0.0000
25	23.000	1.199	0.000	-0.0069	0.0000
26	24.000	1.152	0.000	-0.1069	0.0000
27	25.000	1.008	0.000	-0.1500	0.0000
28	26.000	0.857	0.000	-0.1500	0.0000
29	26.250	0.820	0.000	-0.1500	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	-0.850	0.0000	0.0000	0.0000	510.00	501.61	92.10
2	0.000	0.0038	0.0000	0.0038	509.04	501.02	90.01
3	1.000	0.0011	0.0000	0.0011	508.70	500.43	91.32
4	2.000	0.0221	0.0000	0.0221	505.82	499.40	80.32
5	3.000	0.0484	0.0000	0.0484	502.40	497.95	66.74
6	4.000	0.0748	0.0000	0.0748	498.99	496.15	53.19
7	5.000	0.1014	0.0000	0.1014	495.59	494.00	39.72
8	6.000	0.1280	0.0000	0.1280	492.20	491.50	26.35
9	7.000	0.1548	0.0000	0.1548	488.83	488.65	13.10
10	8.000	0.1816	0.0000	0.1816	485.47	485.47	-0.00
11	9.000	0.1958	0.0000	0.1958	483.42	483.37	-6.85
12	10.000	0.2099	0.0000	0.2099	481.38	481.19	-13.63
13	11.000	0.2241	0.0000	0.2241	479.35	478.92	-20.35
14	12.000	0.2382	0.0000	0.2382	477.33	476.56	-27.00
15	13.000	0.2523	0.0000	0.2523	475.31	474.13	-33.58
16	14.000	0.2664	0.0000	0.2664	473.31	471.61	-40.08
17	15.000	0.2804	0.0000	0.2804	471.33	469.03	-46.51
18	16.000	0.3175	0.0000	0.3175	470.98	467.99	-53.04
19	17.000	0.3035	0.0000	0.3035	472.96	469.16	-59.82
	18.000	0.2896	0.0000	0.2896	474.94	470.25	-66.62
	19.000	0.2196	0.0000	0.2196	482.58	481.38	-34.11
22	20.000	0.1489	0.0000	0.1489	490.42	490.42	-0.00
23	21.000	0.1489	0.0000	0.1489	491.04	491.04	-0.00
24	22.000	0.1489	0.0000	0.1489	491.66	491.66	-0.00
25	23.000	0.1419	0.0000	0.1419	493.00	492.99	3.42
26	24.000	0.0424	0.0000	0.0424	504.05	501.20	53.60
27	25.000	0.0000	0.0000	0.0000	509.20	503.56	75.53
28	26.000	0.0000	0.0000	0.0000	509.84	504.20	75.63
29	26.250	0.0000	0.0000	0.0000	510.00	504.36	75.65

Alarg. tesado ext. inicial = 201.5 mm. Retesado = 6.4 mm.
Al: . tesado ext. final = 198.1 mm. Retesado = 9.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 2. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	0.7532	-0.07432
2	1.1500	0.6045	-0.07432
3	8.0000	0.3500	0.00000
4	18.0000	1.0583	0.14167
5	20.0000	1.2000	0.00000
6	22.4000	0.8560	-0.21436
7	24.2500	0.5400	-0.08500
8	26.2500	0.3700	-0.08500

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	26.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
:f. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
	-0.850	0.753	0.000	-0.0743	0.0000
	0.000	0.690	0.000	-0.0743	0.0000
3	1.000	0.616	0.000	-0.0743	0.0000
4	2.000	0.545	0.000	-0.0651	0.0000
5	3.000	0.486	0.000	-0.0542	0.0000
6	4.000	0.437	0.000	-0.0434	0.0000
7	5.000	0.399	0.000	-0.0325	0.0000
8	6.000	0.372	0.000	-0.0217	0.0000
9	7.000	0.355	0.000	-0.0108	0.0000
10	8.000	0.350	0.000	0.0000	0.0000
11	9.000	0.357	0.000	0.0142	0.0000
12	10.000	0.378	0.000	0.0283	0.0000
13	11.000	0.414	0.000	0.0425	0.0000
14	12.000	0.463	0.000	0.0567	0.0000
15	13.000	0.527	0.000	0.0708	0.0000
16	14.000	0.605	0.000	0.0850	0.0000
17	15.000	0.697	0.000	0.0992	0.0000
18	16.000	0.803	0.000	0.1133	0.0000
19	17.000	0.924	0.000	0.1275	0.0000
	18.000	1.058	0.000	0.1417	0.0000
21	19.000	1.165	0.000	0.0709	0.0000
22	20.000	1.200	0.000	0.0000	0.0000
23	21.000	1.123	0.000	-0.1420	0.0000
24	22.000	0.941	0.000	-0.2088	0.0000
25	23.000	0.730	0.000	-0.2002	0.0000
26	24.000	0.565	0.000	-0.1173	0.0000
27	25.000	0.476	0.000	-0.0850	0.0000
28	26.000	0.391	0.000	-0.0850	0.0000
29	26.250	0.370	0.000	-0.0850	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	510.00	508.60	37.80
2	0.000	0.0000	0.0000	0.0000	509.45	508.05	37.75
3	1.000	0.0000	0.0000	0.0000	508.81	507.41	37.71
4	2.000	0.0092	0.0000	0.0092	507.19	506.12	32.95
5	3.000	0.0200	0.0000	0.0200	505.41	504.66	27.38
6	4.000	0.0308	0.0000	0.0308	503.62	503.15	21.84
7	5.000	0.0416	0.0000	0.0416	501.85	501.58	16.33
8	6.000	0.0525	0.0000	0.0525	500.07	499.96	10.85
9	7.000	0.0633	0.0000	0.0633	498.31	498.28	5.41
10	8.000	0.0742	0.0000	0.0742	496.55	496.55	-0.00
11	9.000	0.0883	0.0000	0.0883	494.45	494.40	-7.00
12	10.000	0.1025	0.0000	0.1025	492.36	492.16	-13.94
13	11.000	0.1167	0.0000	0.1167	490.28	489.84	-20.82
14	12.000	0.1308	0.0000	0.1308	488.21	487.43	-27.62
15	13.000	0.1449	0.0000	0.1449	486.16	484.94	-34.35
16	14.000	0.1590	0.0000	0.1590	484.11	482.37	-41.00
17	15.000	0.1730	0.0000	0.1730	482.08	479.72	-47.57
18	16.000	0.1870	0.0000	0.1870	480.06	477.00	-54.06
19	17.000	0.2010	0.0000	0.2010	478.05	474.21	-60.46
	18.000	0.2149	0.0000	0.2149	476.05	471.35	-66.78
21	19.000	0.2849	0.0000	0.2849	468.52	467.34	-33.11
22	20.000	0.3375	0.0000	0.3375	471.37	471.37	-0.00
23	21.000	0.1964	0.0000	0.1964	486.16	481.33	68.37
24	22.000	0.1317	0.0000	0.1317	493.44	483.02	100.84
25	23.000	0.1128	0.0000	0.1128	496.03	486.38	97.37
26	24.000	0.0320	0.0000	0.0320	505.15	501.71	58.85
27	25.000	0.0000	0.0000	0.0000	509.20	507.37	43.13
28	26.000	0.0000	0.0000	0.0000	509.84	508.01	43.18
29	26.250	0.0000	0.0000	0.0000	510.00	508.17	43.19

Alarg. tesado ext. inicial = 203.5 mm. Retesado = 5.9 mm.
Alarg. tesado ext. final = 193.0 mm. Retesado = 16.5 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 1. FASE 2.

N° de puntos singulares en alzado = 8

P.	----X----	----Y----	----P----
1	0.0000	0.8200	-0.15000
2	2.0000	0.5200	-0.15000
3	6.2500	0.1800	0.00000
4	16.2500	1.0520	0.17440
5	18.7500	1.2700	0.00000
6	21.0000	1.2700	0.00000
7	23.0000	1.1200	-0.15000
8	25.0000	0.8200	-0.15000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	25.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.820	0.000	-0.1500	0.0000
2	1.000	0.670	0.000	-0.1500	0.0000
3	2.000	0.520	0.000	-0.1500	0.0000
4	3.000	0.385	0.000	-0.1201	0.0000
5	4.000	0.281	0.000	-0.0869	0.0000
6	5.000	0.212	0.000	-0.0503	0.0000
7	6.000	0.181	0.000	-0.0105	0.0000
8	7.000	0.185	0.000	0.0131	0.0000
9	8.000	0.207	0.000	0.0305	0.0000
10	9.000	0.246	0.000	0.0480	0.0000
11	10.000	0.303	0.000	0.0654	0.0000
12	11.000	0.377	0.000	0.0828	0.0000
13	12.000	0.468	0.000	0.1003	0.0000
14	13.000	0.577	0.000	0.1177	0.0000
15	14.000	0.704	0.000	0.1352	0.0000
16	15.000	0.848	0.000	0.1526	0.0000
17	16.000	1.009	0.000	0.1700	0.0000
18	17.000	1.163	0.000	0.1221	0.0000
19	18.000	1.250	0.000	0.0523	0.0000
	19.000	1.270	0.000	0.0000	0.0000
21	20.000	1.270	0.000	0.0000	0.0000
22	21.000	1.270	0.000	0.0000	0.0000
23	22.000	1.233	0.000	-0.0750	0.0000
24	23.000	1.120	0.000	-0.1500	0.0000
25	24.000	0.970	0.000	-0.1500	0.0000
26	25.000	0.820	0.000	-0.1500	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	0.000	0.6431	0.0000	0.6431	431.76	426.98	64.05
2	1.000	0.6431	0.0000	0.6431	432.30	427.52	64.13
3	2.000	0.6431	0.0000	0.6431	432.84	428.06	64.21
4	3.000	0.6137	0.0000	0.6137	436.07	432.96	52.00
5	4.000	0.5809	0.0000	0.5809	439.64	437.99	38.06
6	5.000	0.5445	0.0000	0.5445	443.57	443.01	22.30
7	6.000	0.5047	0.0000	0.5047	447.86	447.84	4.70
8	7.000	0.4811	0.0000	0.4811	450.65	450.61	-5.89
9	8.000	0.4637	0.0000	0.4637	452.87	452.66	-13.82
10	9.000	0.4463	0.0000	0.4463	455.11	454.58	-21.80
11	10.000	0.4289	0.0000	0.4289	457.35	456.37	-29.85
12	11.000	0.4116	0.0000	0.4116	459.59	458.02	-37.94
13	12.000	0.3943	0.0000	0.3943	461.85	459.54	-46.08
14	13.000	0.3770	0.0000	0.3770	464.11	460.92	-54.26
15	14.000	0.3599	0.0000	0.3599	466.37	462.17	-62.47
16	15.000	0.3428	0.0000	0.3428	468.64	463.27	-70.70
17	16.000	0.3258	0.0000	0.3258	470.90	464.24	-78.94
18	17.000	0.2704	0.0000	0.2704	477.02	473.50	-57.81
19	18.000	0.2012	0.0000	0.2012	484.61	483.95	-25.32
	19.000	0.1489	0.0000	0.1489	490.58	490.58	-0.00
21	20.000	0.1489	0.0000	0.1489	491.20	491.20	-0.00
22	21.000	0.1489	0.0000	0.1489	491.82	491.82	-0.00
23	22.000	0.0740	0.0000	0.0740	500.24	498.84	37.41
24	23.000	0.0000	0.0000	0.0000	508.72	503.09	75.46
25	24.000	0.0000	0.0000	0.0000	509.36	503.72	75.56
26	25.000	0.0000	0.0000	0.0000	510.00	504.36	75.65

Alargamiento = 182.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 2. FASE 2.

N° de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	0.3700	-0.08500
2	2.0000	0.2000	-0.08500
3	2.5000	0.1800	0.00000
4	6.2500	0.1800	0.00000
5	16.2500	1.0520	0.17440
6	18.7500	1.2700	0.00000
7	21.1000	0.8970	-0.23872
8	23.0000	0.5400	-0.08500
9	25.0000	0.3700	-0.08500

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	25.0000	0.0000	0.00000

C f. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	510.000 t.
Area del cable	=	3360 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.370	0.000	-0.0850	0.0000
2	1.000	0.285	0.000	-0.0850	0.0000
3	2.000	0.200	0.000	-0.0850	0.0000
4	3.000	0.180	0.000	0.0000	0.0000
5	4.000	0.180	0.000	0.0000	0.0000
6	5.000	0.180	0.000	0.0000	0.0000
7	6.000	0.180	0.000	0.0000	0.0000
8	7.000	0.185	0.000	0.0131	0.0000
9	8.000	0.207	0.000	0.0305	0.0000
10	9.000	0.246	0.000	0.0480	0.0000
11	10.000	0.303	0.000	0.0654	0.0000
12	11.000	0.377	0.000	0.0828	0.0000
13	12.000	0.468	0.000	0.1003	0.0000
14	13.000	0.577	0.000	0.1177	0.0000
15	14.000	0.704	0.000	0.1352	0.0000
16	15.000	0.848	0.000	0.1526	0.0000
17	16.000	1.009	0.000	0.1700	0.0000
18	17.000	1.163	0.000	0.1221	0.0000
19	18.000	1.250	0.000	0.0523	0.0000
	19.000	1.264	0.000	-0.0478	0.0000
21	20.000	1.140	0.000	-0.1858	0.0000
22	21.000	0.921	0.000	-0.2382	0.0000
23	22.000	0.692	0.000	-0.2048	0.0000
24	23.000	0.540	0.000	-0.0850	0.0000
25	24.000	0.455	0.000	-0.0850	0.0000
26	25.000	0.370	0.000	-0.0850	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.8140	0.0000	0.8140	416.54	415.04	35.28
2	1.000	0.8140	0.0000	0.8140	417.06	415.56	35.32
3	2.000	0.8140	0.0000	0.8140	417.59	416.09	35.37
4	3.000	0.7292	0.0000	0.7292	425.63	425.63	-0.00
5	4.000	0.7292	0.0000	0.7292	426.16	426.16	-0.00
6	5.000	0.7292	0.0000	0.7292	426.70	426.70	-0.00
7	6.000	0.7292	0.0000	0.7292	427.24	427.24	-0.00
8	7.000	0.7161	0.0000	0.7161	428.95	428.92	-5.61
9	8.000	0.6987	0.0000	0.6987	431.07	430.87	-13.15
10	9.000	0.6813	0.0000	0.6813	433.19	432.70	-20.75
11	10.000	0.6639	0.0000	0.6639	435.33	434.40	-28.41
12	11.000	0.6465	0.0000	0.6465	437.46	435.97	-36.12
13	12.000	0.6293	0.0000	0.6293	439.61	437.42	-43.86
14	13.000	0.6120	0.0000	0.6120	441.76	438.73	-51.65
15	14.000	0.5949	0.0000	0.5949	443.91	439.91	-59.46
16	15.000	0.5778	0.0000	0.5778	446.07	440.97	-67.29
17	16.000	0.5608	0.0000	0.5608	448.23	441.89	-75.14
18	17.000	0.5054	0.0000	0.5054	454.05	450.70	-55.02
19	18.000	0.4361	0.0000	0.4361	461.28	460.65	-24.10
	19.000	0.3361	0.0000	0.3361	471.67	471.13	22.54
21	20.000	0.2002	0.0000	0.2002	485.93	477.76	88.76
22	21.000	0.1500	0.0000	0.1500	491.70	478.32	113.93
23	22.000	0.1173	0.0000	0.1173	495.72	485.63	99.48
24	23.000	0.0000	0.0000	0.0000	508.72	506.89	43.09
25	24.000	0.0000	0.0000	0.0000	509.36	507.53	43.14
26	25.000	0.0000	0.0000	0.0000	510.00	508.17	43.19

Alargamiento = 176.5 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 1. FASE 3.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	0.8200	-0.15000
2	2.0000	0.5200	-0.15000
3	5.7500	0.1350	0.00000
4	12.6000	0.9248	0.23060
5	14.6000	1.3386	0.23060

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	14.6000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 319.000 t.
Area del cable = 2100 mm2.
N... de elasticidad = 19000000 t/m2.
C...igo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.820	0.000	-0.1500	0.0000
2	1.000	0.670	0.000	-0.1500	0.0000
3	2.000	0.520	0.000	-0.1500	0.0000
4	3.000	0.372	0.000	-0.1425	0.0000
5	4.000	0.243	0.000	-0.1113	0.0000
6	5.000	0.157	0.000	-0.0566	0.0000
7	6.000	0.136	0.000	0.0084	0.0000
8	7.000	0.161	0.000	0.0421	0.0000
9	8.000	0.220	0.000	0.0757	0.0000
10	9.000	0.313	0.000	0.1094	0.0000
11	10.000	0.439	0.000	0.1431	0.0000
12	11.000	0.599	0.000	0.1767	0.0000
13	12.000	0.793	0.000	0.2104	0.0000
14	13.000	1.012	0.000	0.2078	0.0000
15	14.000	1.210	0.000	0.2007	0.0000
16	14.600	1.339	0.000	0.2306	0.0000

Cables tesados desde el extremo final.

pto	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	0.000	0.3755	0.0000	0.3755	289.44	286.23	42.94
2	1.000	0.3755	0.0000	0.3755	289.80	286.59	42.99
3	2.000	0.3755	0.0000	0.3755	290.17	286.96	43.04
4	3.000	0.3681	0.0000	0.3681	290.98	288.07	41.04
5	4.000	0.3375	0.0000	0.3375	293.23	291.43	32.44
6	5.000	0.2831	0.0000	0.2831	296.97	296.50	16.77
7	6.000	0.2182	0.0000	0.2182	301.43	301.42	-2.54
8	7.000	0.1846	0.0000	0.1846	303.95	303.68	-12.78
9	8.000	0.1510	0.0000	0.1510	306.48	305.61	-23.15
10	9.000	0.1177	0.0000	0.1177	309.03	307.19	-33.61
11	10.000	0.0845	0.0000	0.0845	311.58	308.44	-44.13
12	11.000	0.0517	0.0000	0.0517	314.13	309.33	-54.67
13	12.000	0.0193	0.0000	0.0193	316.67	309.89	-65.20
14	13.000	0.0217	0.0000	0.0217	316.91	310.28	-64.49
15	14.000	0.0285	0.0000	0.0285	316.85	310.66	-62.36
16	14.600	0.0000	0.0000	0.0000	319.00	310.84	-71.68

Alargamiento = 111.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-1. CABLE 2. FASE 3.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----p----
1	0.0000	0.3700	-0.08500
2	2.0000	0.2000	-0.08500
3	4.0000	0.1350	0.00000
4	5.7500	0.1350	0.00000
5	12.6000	0.5505	0.12131
6	14.6000	0.7931	0.12131

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----p----
1	0.0000	0.0000	0.00000
2	14.6000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 319.000 t.
Á a del cable = 2100 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
	0.000	0.370	0.000	-0.0850	0.0000
2	1.000	0.285	0.000	-0.0850	0.0000
3	2.000	0.200	0.000	-0.0850	0.0000
4	3.000	0.146	0.000	-0.0275	0.0000
5	4.000	0.135	0.000	0.0000	0.0000
6	5.000	0.135	0.000	0.0000	0.0000
7	6.000	0.136	0.000	0.0044	0.0000
8	7.000	0.149	0.000	0.0221	0.0000
9	8.000	0.180	0.000	0.0398	0.0000
10	9.000	0.229	0.000	0.0576	0.0000
11	10.000	0.295	0.000	0.0753	0.0000
12	11.000	0.379	0.000	0.0930	0.0000
13	12.000	0.481	0.000	0.1107	0.0000
14	13.000	0.599	0.000	0.1213	0.0000
15	14.000	0.720	0.000	0.1213	0.0000
16	14.600	0.793	0.000	0.1213	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.2055	0.0000	0.2055	299.96	298.88	25.40
2	1.000	0.2055	0.0000	0.2055	300.33	299.26	25.44
3	2.000	0.2055	0.0000	0.2055	300.71	299.63	25.47
4	3.000	0.1482	0.0000	0.1482	304.74	304.62	8.38
5	4.000	0.1207	0.0000	0.1207	306.89	306.89	-0.00
6	5.000	0.1207	0.0000	0.1207	307.28	307.28	-0.00
7	6.000	0.1163	0.0000	0.1163	307.95	307.95	-1.36
8	7.000	0.0986	0.0000	0.0986	309.49	309.41	-6.85
9	8.000	0.0809	0.0000	0.0809	311.03	310.78	-12.38
10	9.000	0.0632	0.0000	0.0632	312.58	312.06	-17.96
11	10.000	0.0456	0.0000	0.0456	314.13	313.25	-23.58
12	11.000	0.0280	0.0000	0.0280	315.69	314.34	-29.23
13	12.000	0.0105	0.0000	0.0105	317.26	315.33	-34.90
14	13.000	0.0000	0.0000	0.0000	318.36	316.04	-38.34
15	14.000	0.0000	0.0000	0.0000	318.76	316.44	-38.39
16	14.600	0.0000	0.0000	0.0000	319.00	316.68	-38.42

Alargamiento = 113.5 mm.

Reacciones y giros acumulados por peso propio

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	188.14	-.000445
11	591.15	0.000111
21	598.05	0.000289
31	599.40	0.000296
41	596.71	0.000304
51	606.94	0.000274
61	576.78	0.000387
71	195.40	0.000500

Reacciones y giros acumulados por peso propio

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	179.17	-.000387
11	598.32	-.000006
21	600.19	0.000028
31	598.64	0.000023
41	598.42	0.000026
51	600.92	0.000018
61	597.14	0.000047
71	179.76	0.000392

Reacciones y giros debidos a cargas muertas

Apoyo	Reaccion (t)	Giro (gr)
1	79.57	-.000170
11	267.19	-.000008
21	267.82	0.000002
31	267.01	-.000001
41	267.01	0.000001
51	267.82	-.000002
61	267.19	0.000008
71	79.57	0.000170

Reacciones y giros debidos a temperatura

Apoyo	Reaccion (t)	Giro (gr)
1	19.04	0.000176
11	-22.74	-.000052
21	4.63	0.000014
31	-0.92	-.000005
41	-0.93	0.000005
51	4.64	-.000014
61	-22.77	0.000052
71	19.05	-.000175

Reacciones y giros por ferrocarril (RENFE)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	222.218	-43.805	0.0002855	-0.0006492
11	605.620	-54.874	0.0004994	-0.0005710
21	644.576	-54.115	0.0006519	-0.0006166
31	645.394	-53.186	0.0006555	-0.0006488
41	645.394	-53.186	0.0006488	-0.0006555
51	644.576	-54.115	0.0006166	-0.0006519
61	605.620	-54.875	0.0005710	-0.0004994
71	222.217	-43.805	0.0006492	-0.0002855

Reacciones y giros por ferrocarril (UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	181.067	-37.322	0.0002432	-0.0005720
11	493.189	-46.802	0.0003913	-0.0004865
21	511.154	-46.301	0.0005012	-0.0005051
31	511.941	-46.146	0.0005061	-0.0005064
41	511.941	-46.147	0.0005064	-0.0005061
51	511.153	-46.301	0.0005051	-0.0005012
61	493.189	-46.802	0.0004865	-0.0003913
71	181.067	-37.322	0.0005720	-0.0002432

Reacciones y giros por ferrocarril (RENFE/UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	222.218	-43.805	0.0002855	-0.0006492
11	605.620	-54.874	0.0004994	-0.0005710
21	644.576	-54.115	0.0006519	-0.0006166
31	645.394	-53.186	0.0006555	-0.0006488
41	645.394	-53.186	0.0006488	-0.0006555
51	644.576	-54.115	0.0006166	-0.0006519
61	605.620	-54.875	0.0005710	-0.0004994
71	222.217	-43.805	0.0006492	-0.0002855

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Reacciones y giros por sobrecarga total

(sobrecarga repartida+carro)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro (gr) maximo	Giro (gr) minimo
1	222.218	-43.805	0.0002855	-0.0006492
11	605.620	-54.874	0.0004994	-0.0005710
21	644.576	-54.115	0.0006519	-0.0006166
31	645.394	-53.186	0.0006555	-0.0006488
41	645.394	-53.186	0.0006488	-0.0006555
51	644.576	-54.115	0.0006166	-0.0006519
61	605.620	-54.875	0.0005710	-0.0004994
71	222.217	-43.805	0.0006492	-0.0002855

Reacciones y giros por pretensado (sin ponderar)

0.9537

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	46.52	0.001808
11	-47.80	-.000521
21	1.49	-.000364
31	-1.31	-.000373
41	5.18	-.000393
51	-19.31	-.000321
61	-14.64	-.000591
71	29.87	-.001111

Reacciones y giros por pretensado (sin ponderar)

0.8655

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	65.15	0.001491
11	-75.47	-.000174
21	13.15	0.000018
31	-3.94	-.000030
41	2.71	-.000024
51	-6.89	-.000002
61	-44.50	-.000095
71	49.79	-.000910

radianes

→ 0,1° con la pedida definitiva.

PROYECTO: TAV ZARAGOZA. E-1

FECHA:

HOJA N.º 0

REACCIONES VERTICALES (A TODO ANCHO)

	P.P.I.	P.P.F.	C.H	TEMP	PESFE		Pic I.	Pic F.
E FIJO	188,1	179,2	79.6	19.0	222.2	-43.8	46.1	67.2
P21	591,2	598,3	267.2	-22.7	605.6	-54.8	-47.8	-75.5
P20	598,1	600,2	267.8	4.6	644.6	-54.1	1.5	13.2
P19	599,4	598,6	267.0	-0.9	645.4	-53.2	-1.3	-3.9
⋮								
P3	596,7	598,4	267.0	-0.9	645.4	-53.2	1.2	2.7
P2	606,9	600,9	267.8	4.6	644.6	-54.1	-19.3	-6.9
P1	576,8	597,1	267.2	-22.8	605.6	-54.9	-14.6	-44.5
E MOVIL	195,6	179,8	79.6	19.0	222.2	-43.8	29.9	49.8

REACCIONES HORIZONTALES LONGITUDINALES (A TODO ANCHO)

- FRENADA

Longitud puente = 542 metros

$F_H = (533.6 \times 8 + 100) \times 2 \times \frac{1}{4} = 2184.4\ t$

- RETRACCION, FLUENCIA Y TEMPERATURA

PILAS CON TEFLÓN: 5% DE LA CARGA PERMANENTE

En total tenemos los siguientes reacciones longitudinales:

ELEMENTO	F_{HL} (por fuste)	
E. MOVIL (E-1)	28,3	
P-1 a P-17	21.7	- pila con teflón.
P-18	15.1	} pilas con neopreno
P-19	19.8	
P-20	14.2	
P-21	4.2	

PROYECTO TRV. ZARAGOZA-LERIDA
SUB-TRAMO I
ESTRUCTURA E-1

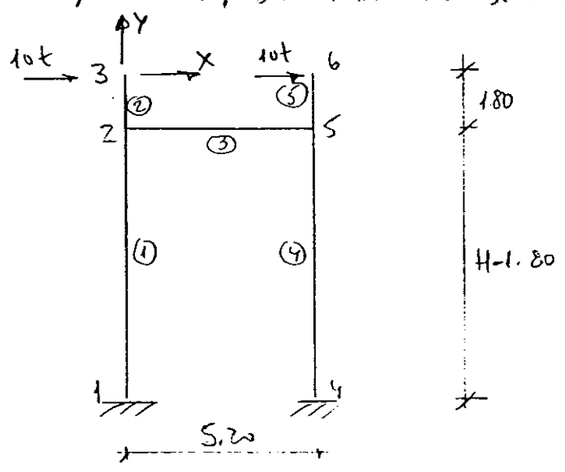
FECHA 3-XII-76

HOJA N.º

RELACIONES TRANSVERSALES

Se calculan previamente las rigideces transversales de las pilas, para poder hacer un reparto de las cargas de viento y sismo transversal de acuerdo con la rigidez de cada uno de los apoyos.

Para ello se calculan unos pórticos, que idealizan las pilas, de acuerdo con el esquema siguiente:



- Barra (1),(2),(4),(5)

A = 1.35 m²
I = 0.154 m⁴

- Barra (3)

A = 0.643 m²
I = 0.077 m⁴

Se somete a dos cargas horizontales de 10 t en los nudos 3, 6, hallando la rigidez por la relación:

$$1/R = \frac{\text{Desp. horizontal nudo 3}}{20}$$


```
PILA1                                                          pag.   1

PILA 1.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -10.65
2 0 -1.8
3 0 0
4 5.2 -10.65
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 1.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001864	0.000036	-0.000179
3	0.002222	0.000036	-0.000209
4	0.000000	-0.000000	-0.000000
5	0.001864	-0.000036	-0.000179
6	0.002222	-0.000036	-0.000209

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-19.75	55.15
4	-10.00	19.75	55.15

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	19.75	-55.15	-10.00
	2	19.75	33.35	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	51.35	19.75
	5	0.00	-51.35	19.75
4	4	-19.75	-55.15	-10.00
	5	-19.75	33.35	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00

:


```
PILA 2.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -11.40
2 0 -1.8
3 0 0
4 5.2 -11.40
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

:

PILA 2.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.002296	0.000042	-0.000193
3	0.002681	0.000042	-0.000223
4	0.000000	-0.000000	-0.000000
5	0.002296	-0.000042	-0.000193
6	0.002681	-0.000042	-0.000223

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-21.21	58.86
4	-10.00	21.21	58.86

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	21.21	-58.86	-10.00
	2	21.21	37.14	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	-0.00	-10.00
3	2	0.00	55.14	21.21
	5	0.00	-55.14	21.21
4	4	-21.21	-58.86	-10.00
	5	-21.21	37.14	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00


```
PILAS 3 Y 4.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -12.70
2 0 -1.8
3 0 0
4 5.2 -12.70
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILAS 3 Y 4.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.003195	0.000053	-0.000219
3	0.003625	0.000053	-0.000249
4	0.000000	-0.000000	-0.000000
5	0.003195	-0.000053	-0.000219
6	0.003625	-0.000053	-0.000249

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-23.72	65.32
4	-10.00	23.72	65.32

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	23.72	-65.32	-10.00
	2	23.72	43.68	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	0.00	61.68	23.72
	5	0.00	-61.68	23.72
4	4	-23.72	-65.32	-10.00
	5	-23.72	43.68	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 5.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -12.93
2 0 -1.8
3 0 0
4 5.2 -12.93
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 5.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.003374	0.000055	-0.000223
3	0.003812	0.000055	-0.000253
4	0.000000	-0.000000	-0.000000
5	0.003374	-0.000055	-0.000223
6	0.003812	-0.000055	-0.000253

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-24.17	66.46
4	-10.00	24.17	66.46

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	24.17	-66.46	-10.00
	2	24.17	44.83	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	62.83	24.17
	5	0.00	-62.83	24.17
4	4	-24.17	-66.46	-10.00
	5	-24.17	44.83	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 6.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -13.66
2 0 -1.8
3 0 0
4 5.2 -13.66
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 6.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.003989	0.000062	-0.000238
3	0.004453	0.000062	-0.000268
4	0.000000	-0.000000	-0.000000
5	0.003989	-0.000062	-0.000238
6	0.004453	-0.000062	-0.000268

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-25.57	70.11
4	-10.00	25.57	70.11

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	25.57	-70.11	-10.00
	2	25.57	48.49	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	-0.00	66.49	25.57
	5	-0.00	-66.49	25.57
4	4	-25.57	-70.11	-10.00
	5	-25.57	48.49	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 7.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -14.12
2 0 -1.8
3 0 0
4 5.2 -14.12
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 7.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004413	0.000067	-0.000247
3	0.004893	0.000067	-0.000277
4	0.000000	-0.000000	-0.000000
5	0.004413	-0.000067	-0.000247
6	0.004893	-0.000067	-0.000277

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-26.46	72.41
4	-10.00	26.46	72.41

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	26.46	-72.41	-10.00
	2	26.46	50.79	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	68.79	26.46
	5	0.00	-68.79	26.46
4	4	-26.46	-72.41	-10.00
	5	-26.46	50.79	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 8.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -14.38
2 0 -1.8
3 0 0
4 5.2 -14.38
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 8.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004664	0.000070	-0.000252
3	0.005154	0.000070	-0.000282
4	0.000000	-0.000000	-0.000000
5	0.004664	-0.000070	-0.000252
6	0.005154	-0.000070	-0.000282

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-26.96	73.70
4	-10.00	26.96	73.70

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	26.96	-73.70	-10.00
	2	26.96	52.09	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	-0.00	70.09	26.96
	5	-0.00	-70.09	26.96
4	4	-26.96	-73.70	-10.00
	5	-26.96	52.09	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 9.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -14.25
2 0 -1.8
3 0 0
4 5.2 -14.25
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 9.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004537	0.000068	-0.000250
3	0.005023	0.000068	-0.000280
4	0.000000	-0.000000	-0.000000
5	0.004537	-0.000068	-0.000250
6	0.005023	-0.000068	-0.000280

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-26.71	73.06
4	-10.00	26.71	73.06

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	26.71	-73.06	-10.00
	2	26.71	51.44	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	0.00	-10.00
3	2	0.00	69.44	26.71
	5	0.00	-69.44	26.71
4	4	-26.71	-73.06	-10.00
	5	-26.71	51.44	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 10.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -14.51
2 0 -1.8
3 0 0
4 5.2 -14.51
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 10.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004794	0.000071	-0.000255
3	0.005289	0.000071	-0.000285
4	0.000000	-0.000000	-0.000000
5	0.004794	-0.000071	-0.000255
6	0.005289	-0.000071	-0.000285

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-27.21	74.36
4	-10.00	27.21	74.36

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	27.21	-74.36	-10.00
	2	27.21	52.74	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	-0.00	70.75	27.21
	5	-0.00	-70.74	27.21
4	4	-27.21	-74.36	-10.00
	5	-27.21	52.74	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00


```
PILAS 11-12-13 Y 14.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -14.60
2 0 -1.8
3 0 0
4 5.2 -14.60
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILAS 11-12-13 Y 14.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004885	0.000072	-0.000257
3	0.005383	0.000072	-0.000287
4	0.000000	-0.000000	-0.000000
5	0.004885	-0.000072	-0.000257
6	0.005383	-0.000072	-0.000287

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-27.38	74.81
4	-10.00	27.38	74.81

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	27.38	-74.81	-10.00
	2	27.38	53.19	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	71.19	27.38
	5	0.00	-71.19	27.38
4	4	-27.38	-74.81	-10.00
	5	-27.38	53.19	-10.00
5	5	-0.00	-18.00	-10.00
	6	-0.00	-0.00	-10.00


```
PILAS 15-16 Y 17.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -15.00
2 0 -1.8
3 0 0
4 5.2 -15.00
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILAS 15-16 Y 17.VIADUCTO 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.005303	0.000076	-0.000265
3	0.005816	0.000076	-0.000295
4	0.000000	-0.000000	-0.000000
5	0.005303	-0.000076	-0.000265
6	0.005816	-0.000076	-0.000295

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-28.15	76.81
4	-10.00	28.15	76.81

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	28.15	-76.81	-10.00
	2	28.15	55.19	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	0.00	-10.00
3	2	0.00	73.19	28.15
	5	0.00	-73.19	28.15
4	4	-28.15	-76.81	-10.00
	5	-28.15	55.19	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	-0.00	-10.00


```
PILA 18.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -12.61
2 0 -1.8
3 0 0
4 5.2 -12.61
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 18.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.003126	0.000052	-0.000217
3	0.003553	0.000052	-0.000247
4	0.000000	-0.000000	-0.000000
5	0.003126	-0.000052	-0.000217
6	0.003553	-0.000052	-0.000247

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-23.55	64.87
4	-10.00	23.55	64.87

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	23.55	-64.87	-10.00
	2	23.55	43.23	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	61.23	23.55
	5	0.00	-61.23	23.55
4	4	-23.55	-64.87	-10.00
	5	-23.55	43.23	-10.00
5	5	-0.00	-18.00	-10.00
	6	-0.00	-0.00	-10.00


```
PILAS 19 Y 20.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -9.45
2 0 -1.8
3 0 0
4 5.2 -9.45
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILAS 19 Y 20.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001289	0.000027	-0.000156
3	0.001606	0.000027	-0.000186
4	0.000000	-0.000000	-0.000000
5	0.001289	-0.000027	-0.000156
6	0.001606	-0.000027	-0.000186

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-17.41	49.25
4	-10.00	17.41	49.25

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	17.41	-49.25	-10.00
	2	17.41	27.25	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	0.00	45.25	17.41
	5	0.00	-45.25	17.41
4	4	-17.41	-49.25	-10.00
	5	-17.41	27.25	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00


```
PILA 21.VIADUCTO 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -10.40
2 0 -1.8
3 0 0
4 5.2 -10.40
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA 21.VIADUCTO 1

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001732	0.000034	-0.000174
3	0.002082	0.000034	-0.000204
4	0.000000	-0.000000	-0.000000
5	0.001732	-0.000034	-0.000174
6	0.002082	-0.000034	-0.000204

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-19.26	53.92
4	-10.00	19.26	53.92

Esfuerzos en extremos de barras

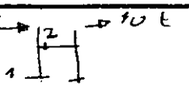
Barra	Ext.	Axil	Flector	Cortante
1	1	19.26	-53.92	-10.00
	2	19.26	32.08	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	0.00	50.08	19.26
	5	0.00	-50.08	19.26
4	4	-19.26	-53.92	-10.00
	5	-19.26	32.08	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00

PROYECTO E-1 Transversal

FECHA 3-XII-96

HOJA N.º

ESTRUCTURA 1. Rigideces.



Carga viento 24,6 t/pila

PILA	H	u	M_1	M_2	K_1	K_2	K	
1	10,65	0.002222	-55,2	51.4	9001			15.8
2	11,40	2681	-58.9	55.2	7460			26.5
3	12,67	3625	- 65.3	61,7	5517			26.7
4	12.53	3812	-66.5	62.8	5247			29.7
5	12,70	3625	-65.3	61.7	5517			34.3
6	13,66	4453	-70.1	66,5	4491			29.9
7	14.12	4893	-72.4	68,8	4087			28.8
8	14,38	5154	- 73.7	70,1	3880			28.5
9	14,25	5023	- 73.1	69.4	3982			30.0
10	14.51	5289	- 74.4	70.8	3781			29.0
11	14.77	5383	- 74.8	71.2	3715			28.8
12	14.54	5383	- 74.8	71.2	3715			29.4
13	14.48	5383	- 74.8	71.2	3715			30.8
14	14.56	5383	- 74.8	71,2	3715			32.0
15	15.23	5811	- 76.8	73,2	3439			31.8
16	15.09	5816	- 76.3	73.2	3438			34.5
17	14.75	5383	- 74.8	71,2	3715			40.1
18	12.61	3553	- 64.9	61,2	5629	2526	1744	19.4
19	9,38	1606	- 49.2	45.3	12453	2526	2100	21.6
20	9,54	1606	- 49,2	45.3	12453	2526	2100	16.6
21	10,40	2082	-53,7	50,1	9606	2526	2000	7.9

EFTO

```
ESTRUCTURA E-1.TAV.TRANSVERSAL.
CONTROL
23 22 1 1
:
NUDOS
1 0 0
2 20 0
3 45 0
4 70 0
5 95 0
6 120 0
7 145 0
8 170 0
9 195 0
10 220 0
11 245 0
12 270 0
13 295 0
14 320 0
15 345 0
16 370 0
17 395 0
18 420 0
19 445 0
20 470 0
21 495 0
22 520 0
23 540 0
:
BARRAS TIPO
1
9.63 90.54 4000000
:
BARRAS
1 1 2 1
2 2 3 1
3 3 4 1
4 4 5 1
5 5 6 1
6 6 7 1
7 7 8 1
8 8 9 1
9 9 10 1
10 10 11 1
11 11 12 1
12 12 13 1
13 13 14 1
14 14 15 1
15 15 16 1
16 16 17 1
17 17 18 1
18 18 19 1
19 19 20 1
20 20 21 1
21 21 22 1
22 22 23 1
:
APOYOS
23
```



```
1 1 1 0
2 0 9001 0
3 0 7460 0
4 0 5517 0
5 0 5247 0
6 0 5517 0
7 0 4491 0
8 0 4087 0
9 0 3880 0
10 0 3982 0
11 0 3781 0
12 0 3715 0
13 0 3715 0
14 0 3715 0
15 0 3715 0
16 0 3439 0
17 0 3439 0
18 0 3715 0
19 0 1744 0
20 0 2100 0
21 0 2100 0
22 0 2000 0
23 0 1 0
:
CARGAS
H-1 FUERZA DE VIENTO.1.18T/M
0
22
1  2 1.18 90
2  2 1.18 90
3  2 1.18 90
4  2 1.18 90
5  2 1.18 90
6  2 1.18 90
7  2 1.18 90
8  2 1.18 90
9  2 1.18 90
10 2 1.18 90
11 2 1.18 90
12 2 1.18 90
13 2 1.18 90
14 2 1.18 90
15 2 1.18 90
16 2 1.18 90
17 2 1.18 90
18 2 1.18 90
19 2 1.18 90
20 2 1.18 90
21 2 1.18 90
22 2 1.18 90
:
```

ESTRUCTURA E-1.TAV.TRANSVERSAL.

Hip. nº 1 H-1 FUERZA DE VIENTO.1.18T/M

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.000000	0.000091
2	-0.000000	0.001760	0.000083
3	-0.000000	0.003563	0.000061
4	-0.000000	0.004834	0.000041
5	-0.000000	0.005656	0.000026
6	-0.000000	0.006213	0.000020
7	-0.000000	0.006670	0.000017
8	-0.000000	0.007049	0.000013
9	-0.000000	0.007332	0.000009
10	-0.000000	0.007523	0.000006
11	-0.000000	0.007659	0.000005
12	-0.000000	0.007775	0.000005
13	-0.000000	0.007922	0.000007
14	-0.000000	0.008174	0.000013
15	-0.000000	0.008604	0.000021
16	-0.000000	0.009245	0.000029
17	-0.000000	0.010034	0.000033
18	-0.000000	0.010790	0.000025
19	-0.000000	0.011094	-0.000006
20	-0.000000	0.010262	-0.000063
21	-0.000000	0.007881	-0.000128
22	-0.000000	0.003933	-0.000184
23	-0.000000	0.000000	-0.000203

Reacciones en apoyos

	Nudo	Fza. x	Fza. y	Mto. z
E-1	1	0.00	-23.50	0.00
P.1	2	-0.00	-15.84	-0.00
	3	0.00	-26.58	-0.00
	4	0.00	-26.67	-0.00
	5	0.00	-29.68	-0.00
	6	-0.00	-34.28	0.00
	7	0.00	-29.95	0.00
	8	-0.00	-28.81	-0.00
	9	0.00	-28.45	0.00
	10	0.00	-29.96	0.00
	11	-0.00	-28.96	0.00
	12	0.00	-28.88	-0.00
	13	0.00	-29.43	0.00
	14	-0.00	-30.37	0.00
	15	0.00	-31.96	-0.00
	16	-0.00	-31.79	-0.00
	17	-0.00	-34.51	0.00
	18	0.00	-40.08	-0.01
	19	-0.00	-19.35	-0.00
	20	-0.00	-21.55	0.00
	21	0.00	-16.55	0.00
P.2	22	0.00	-7.87	0.00
E-2	23	-0.00	-42.19	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	-0.00	23.50
	2	-0.00	-234.03	-0.10
2	2	-0.00	-234.03	15.74
	3	-0.00	-258.81	-13.76
3	3	-0.00	-258.81	12.82
	4	-0.00	-210.52	-16.68
4	4	-0.00	-210.52	9.99
	5	-0.00	-91.41	-19.51
5	5	-0.00	-91.41	10.16
	6	-0.00	23.30	-19.34
6	6	-0.00	23.30	14.94
	7	-0.00	18.62	-14.56
7	7	-0.00	18.62	15.39
	8	-0.00	2.62	-14.11
8	8	-0.00	2.62	14.70
	9	-0.00	3.86	-14.80
9	9	-0.00	3.86	13.65
	10	-0.00	31.38	-15.85
10	10	-0.00	31.38	14.11
	11	-0.00	47.43	-15.39
11	11	-0.00	47.43	13.57
	12	-0.00	76.97	-15.93
12	12	-0.00	76.97	12.95
	13	-0.00	121.89	-16.55
13	13	-0.00	121.89	12.88
	14	-0.00	168.57	-16.62
14	14	-0.00	168.56	13.75
	15	-0.00	193.59	-15.75
15	15	-0.00	193.59	16.21
	16	-0.00	157.02	-13.29
16	16	-0.00	157.02	18.51
	17	-0.00	63.13	-10.99
17	17	-0.00	63.13	23.51
	18	-0.00	-155.90	-5.99
18	18	-0.00	-155.89	34.09
	19	-0.00	-639.51	4.59
19	19	-0.00	-639.51	23.94
	20	-0.00	-869.33	-5.56
20	20	-0.00	-869.33	15.99
	21	-0.00	-900.43	-13.51
21	21	-0.00	-900.43	3.04
	22	-0.00	-607.79	-26.46
22	22	-0.00	-607.79	-18.59
	23	-0.00	0.00	-42.19

	PROYECTO E-1	FECHA 3-XII-96
		HOJA N.º 1

SISMO TRANSVERSAL

Carga debida al pp + c.p + 0.6 sobrecarga:

$$p = 2.5 + 9.63 + 9.50 + 0.6 \times 2 \times 10 = 45.6 \text{ t/m}$$

Por tanto, los desplazamientos de los nudos son los que dá el cálculo de viento multiplicados por $\frac{45.6}{1.18}$

Aplicando la fórmula de Lord Rayleigh:

$$T = 2\pi \sqrt{\frac{\Sigma m \cdot u^2}{g \Sigma m \cdot u}}$$

Las masas con las que actúan inicialmente en cada pila, que, por tanto, son $m = q \times 25 \times 45,6$, iguales en todas ellas. Por tanto queda: $T = 2\pi \sqrt{\frac{\Sigma u^2}{g \Sigma u}}$

PILA	u	u^2
1	0.06801	0.00463
2	0,13769	0,01896
3	0,18681	0,03490
4	0,21857	0,04777
5	0,24010	0,05765
6	0,25376	0.06644
7	0,27240	0.07421
8	0.28334	0,08028
9	0,29072	0,08452
10	0,29597	0.08760
11	0.30046	0,09027
12	0,30614	0.09372
13	0.31588	0,09978
14	0,33241	0.11055
15	0,35726	0,12764
16	0,38775	0,15035
17	0.41697	0,17386
18	0,42872	0,18380
19	0,39697	0,15726
20	0,30455	0.09275
21	0,15199	0,02310
Σ	5.95014	1.86004

$$T = 2\pi \sqrt{\frac{1.86004}{9.81 \times 5.95014}} = 1,12 \text{ seg.}$$

	PROYECTO	FECHA 3-XII-96
		HOJA N.º 2

Coeficiente sísmico $\underline{S}$:

$$S = \alpha \times \eta \times \beta \times \delta$$

$$\alpha = c \cdot \Omega = \frac{0.08}{2 \times 1.12} \times 1 = 0.036 \text{ (grado VII)}.$$

$$\eta = u \times \frac{\Sigma Q \times u}{\Sigma Q \times u^2} = u \times \frac{\Sigma u}{\Sigma u^2} = u \times \frac{5,95014}{1.86004}$$

PILA	η	S	F_{pila}
1	0,218	0,0055	6.25
2	0,441	0,0111	12.65
3	0,598	0.0151	17.17
4	0.699	0,0176	20,09
5	0,768	0.0194	22.06
6	0.825	0,0208	23.69
7	0.871	0,0220	25.03
8	0.906	0,0228	26.04
9	0.930	0.0234	26,72
10	0.947	0.0239	27,20
11	0.961	0.0242	27.61
12	0,979	0.0247	28,13
13	1,010	0.0255	29.03
14	1,064	0.0268	30.56
15	1,143	0.0288	32.83
16	1.240	0.0313	35.63
17	1,334	0,0336	38,32
18	1.371	0,0346	39.40
19	1.270	0.0320	36.48
20	0,974	0.0246	27.99
21	0.486	0,0123	13.97

$\beta = 1$

$\delta = 0,7$ (pérdida resistentes por el fuste).

$F_{pila} = S \times 25 \times 45,6$ t

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PROYECTO ..... FECHA 3-XII-96

HOJA N.º .....

FUSTES

Combinaciones de cargas.

H-1

1.6 × (P. propio + c. permanente + def diferidas + sobrecarga + + frenado + f. centrífuga + lago).

H-2

1,44 × (P propio + c permanente + sobrecarga + def diferidas + + frenado + f. centrífuga + lago + viento)

H-3

1,28 (P. propio + c permanente + sobrecarga + def diferida + + 0,25 × viento) + 2º modo transversal.

PILA	F(1,44 × viento)	F (0,25×1,28 × viento + 1 transversal)
1	22,8	11.3
2	38.3	21.2
3	38.5	25.7
4	42.8	29.6
5	49.4	33.1
6	43.1	33.3
7	41.5	34.3
8	41.0	35.2
9	43.2	36.3
10	41.8	36.5
11	41.6	36.9
12	42.3	37.5
13	43.8	38.8
14	46.1	40.8
15	45.8	43.1
16	49.7	46.7
17	57.7	51,2
18	27.9	45.6
19	31.1	43.4
20	23.9	33.3
21	11.4	16.5

(A todo ancho)

PROYECTO TOV - ZARAGOZA - CORUÑA SUBTRAMO 1. E-1 FECHA 3-XII-96

HOJA N.º .....

Cálculo de los fustes trabajando en celosía de pilas, para calcular éstas como vigas huecas, para tener en cuenta el efecto pórtico.

$F_{y\,calculo} = \frac{\text{Momento}}{h}$ (para $F = 10$ t).

para $F = R$ → $F_{y\,calculo} = \frac{F_{y\,calculo}}{10} \times R$

Momento = momento de cálculo del pórtico cuando lo sometemos a fuerza de 10 t. en cualquier celosía de fuste

Pilas	Momento	h	$F_{y\,calculo} = \frac{M}{h} \cdot \frac{1}{10}$
P-1	55.15	10.65	0,518
P-2	58.86	11.40	0,516
P-3 y P-5	65,32	12,70	0,514
P-4	66.46	12.93	0,514
P-6	70.11	13.66	0,513
P-7	72.41	14.12	0,513
P-8	73.70	14.38	0,513
P-9	73.06	14.25	0,513
P-10	74,36	14.51	0,512
P-11, 12, 13, 14, 17	74,81	14.60	0,512
P-15 y P-16	76.81	15.00	0,512
P-18	64.87	12.61	0,514
P-19 y P-20	49.25	9.45	0,521
P-21	53.92	10.40	0,518

Por tanto, multiplicamos todas las fuerzas transversales por 0,52 a todo lo ancho.

PROYECTO

FECHA 3-XII-96

HOJA N.º

Fuerza mayorada en cabeza de pilas

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
1	10.65	34.6	2.1	1134.8	0	0
		31.2	7.8	1019.0	0	0
		27.7	3.0	903.1	0	0
2	11.40	34.7	2.1	1220.4	0	0
		31.3	11.9	1099.0	0	0
		27.8	5.5	977.6	0	0
3	12.67	34.7	2.1	1209.5	0	0
		31.2	11.9	1088.6	0	0
		27.7	6.7	967.8	0	0
4	12.93	34.7	2.1	1209.5	0	0
		31.2	13.0	1088.6	0	0
		27.7	7.7	967.8	0	0
5	12.70	34.7	2.1	1209.5	0	0
		31.2	14.7	1088.6	0	0
		27.7	8.6	967.8	0	0
6	13.66	34.7	2.1	1209.5	0	0
		31.2	13.1	1088.6	0	0
		27.7	8.7	967.8	0	0
7	14.12	34.7	2.1	1209.5	0	0
		31.2	12.7	1088.6	0	0
		27.7	8.9	967.8	0	0

PROYECTO

FECHA 3-XII-96

HOJA N.º

Fuerza mayorada en cabeza de pila

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
8	14.38	34.7	2.1	1209.5	0	0
		31.2	12.6	1088.6	0	0
		27.7	9.2	967.8	0	0
9	14.25	34.7	2.1	1209.5	0	0
		31.2	13.1	1088.6	0	0
		27.7	9.5	967.8	0	0
10	14.51	34.7	2.1	1209.5	0	0
		31.2	12.8	1088.6	0	0
		27.7	9.5	967.8	0	0
11	14.77	34.7	2.1	1209.5	0	0
		31.2	12.7	1088.6	0	0
		27.7	9.6	967.8	0	0
12	14.54	34.7	2.1	1209.5	0	0
		31.2	12.9	1088.6	0	0
		27.7	9.8	967.8	0	0
13	14.48	34.7	2.1	1209.5	0	0
		31.2	13.3	1088.6	0	0
		27.7	10.1	967.8	0	0
14	14.56	34.7	2.1	1209.5	0	0
		31.2	13.9	1088.6	0	0
		27.7	10.6	967.8	0	0

PROYECTO .....

FECHA 3-XII-96

HOJA N.º .....

Fuerza mayorada en cabeza de pila.

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
15	15,23	34,7	2,1	1209,5	0	0
		31,2	13,8	1088,6	0	0
		27,7	11,2	967,8	0	0
16	15,09	34,7	2,1	1209,8	0	0
		31,2	14,8	1088,6	0	0
		27,7	12,2	967,8	0	0
17	14,75	34,7	2,1	1209,5	0	0
		31,2	16,9	1088,6	0	0
		27,7	13,3	967,8	0	0
18	12,61	24,2	2,1	1209,5	0	0
		21,8	9,2	1088,6	0	0
		19,3	11,9	967,8	0	0
19	9,38	31,4	2,1	1207,5	0	0
		28,2	10,0	1088,6	0	0
		25,1	11,3	967,8	0	0
20	9,54	21,5	2,1	1215,2	0	0
		19,3	8,1	1093,8	0	0
		17,2	8,7	971,8	0	0
21	10,40	8,8	2,1	1150,4	0	0
		7,9	4,9	1034,6	0	0
		7,1	4,3	918,8	0	0

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VIADUCTO 1.PILAS 1 Y 2.(40 0 32)-(32 0 32)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 11.40

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
320.0	320.0	320.0	320.0	320.0	320.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	34.7	2.10	1220.40	0.00	0.00	0	0.0	0	0.0	1.60
2	31.3	11.90	1099.00	0.00	0.00	0	0.4	0	0.4	1.44
3	27.8	5.50	977.60	0.00	0.00	0	0.1	0	0.1	1.28

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VIADUCTO 1.PILAS 1 Y 2.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	31.13	631.42	1283.75	1.412	28.639
1	0.002	0.000	28.62	589.48	1277.41	1.238	25.496
2	0.007	0.000	25.91	543.33	1271.08	1.075	22.540
3	0.015	0.001	23.02	493.50	1264.74	0.911	19.544
4	0.026	0.001	19.98	440.51	1258.41	0.752	16.588
5	0.039	0.002	16.82	384.88	1252.07	0.601	13.756
6	0.053	0.003	13.57	327.11	1245.74	0.520	12.534
7	0.069	0.003	10.24	267.40	1239.40	0.374	9.778
8	0.087	0.004	6.85	206.22	1233.07	0.246	7.406
9	0.105	0.005	3.43	143.97	1226.73	0.123	5.146
10	0.124	0.006	-0.01	81.02	1220.40	0.123	2.886

Exc. totales result. cabeza 0.06639 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 1 Y 2.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	200.62	546.22	1156.01	8.718	23.735
1	0.002	0.001	181.47	508.76	1150.31	7.603	21.317
2	0.006	0.002	161.70	468.13	1144.61	6.503	18.827
3	0.013	0.005	141.49	424.73	1138.91	5.437	16.320
4	0.021	0.008	121.02	378.96	1133.21	4.425	13.856
5	0.032	0.011	100.43	331.20	1127.51	3.489	11.505
6	0.044	0.015	79.88	281.83	1121.81	2.959	10.439
7	0.058	0.020	59.43	231.00	1116.10	2.110	8.199
8	0.072	0.025	39.23	179.07	1110.40	1.373	6.266
9	0.088	0.030	19.38	126.32	1104.70	0.676	4.405
10	0.104	0.035	-0.02	73.02	1099.00	0.676	2.539

Exc. totales result. cabeza 0.06644 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 1 Y 2.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	82.60	463.71	1028.28	3.309	18.575
1	0.001	0.000	74.88	430.78	1023.21	2.903	16.702
2	0.005	0.001	66.90	395.64	1018.14	2.501	14.790
3	0.010	0.002	58.72	358.56	1013.08	2.109	12.876
4	0.017	0.003	50.40	319.82	1008.01	1.735	11.008
5	0.025	0.004	41.99	279.68	1002.94	1.386	9.234
6	0.035	0.006	33.54	238.38	997.87	1.184	8.413
7	0.046	0.008	25.07	196.04	992.80	0.861	6.735
8	0.057	0.010	16.63	152.89	987.74	0.568	5.220
9	0.069	0.011	8.26	109.13	982.67	0.281	3.717
10	0.082	0.013	-0.01	64.95	977.60	0.281	2.208

Exc. totales result. cabeza 0.06644 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 3-4-5 (32 0 32+32 0 25)-(32 0 32)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 12.93

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
413.1	413.1	413.1	413.1	413.1	413.1	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	34.7	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	31.2	14.70	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	27.7	8.60	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILAS 3-4-5 (32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	36.92	733.92	1281.35	1.433	28.481
1	0.002	0.000	34.05	686.01	1274.17	1.280	25.783
2	0.009	0.000	30.91	632.63	1266.98	1.125	23.018
3	0.020	0.001	27.54	574.45	1259.80	0.965	20.133
4	0.034	0.002	23.96	512.11	1252.61	0.805	17.196
5	0.050	0.002	20.23	446.29	1245.43	0.648	14.289
6	0.069	0.003	16.36	377.61	1238.24	0.662	15.276
7	0.091	0.004	12.37	305.92	1231.06	0.464	11.491
8	0.115	0.006	8.28	232.03	1223.87	0.298	8.345
9	0.140	0.007	4.15	156.61	1216.69	0.148	5.589
10	0.166	0.008	-0.01	80.23	1209.50	0.148	2.851

Exc. totales result. cabeza 0.06634 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 3-4-5 (32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	288.88	631.19	1153.27	11.016	24.070
1	0.002	0.001	262.47	588.54	1146.80	9.729	21.816
2	0.008	0.003	234.86	541.72	1140.33	8.425	19.433
3	0.017	0.007	206.34	491.25	1133.87	7.127	16.968
4	0.028	0.013	177.16	437.63	1127.40	5.859	14.474
5	0.042	0.019	147.59	381.36	1120.93	4.649	12.014
6	0.059	0.026	117.86	322.94	1114.47	4.623	12.668
7	0.077	0.033	87.98	262.27	1108.00	3.208	9.565
8	0.097	0.041	58.22	199.96	1101.53	2.039	7.002
9	0.118	0.050	28.82	136.48	1095.07	1.003	4.752
10	0.140	0.059	-0.05	72.28	1088.60	1.003	2.509

Exc. totales result. cabeza 0.06640 -0.00004
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 3-4-5 (32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	147.63	531.12	1025.28	5.246	18.874
1	0.002	0.000	134.47	493.69	1019.53	4.655	17.092
2	0.006	0.002	120.69	453.36	1013.78	4.054	15.227
3	0.013	0.004	106.40	410.49	1008.04	3.451	13.314
4	0.022	0.006	91.71	365.42	1002.29	2.861	11.399
5	0.033	0.009	76.72	318.49	996.54	2.295	9.526
6	0.046	0.012	61.54	270.05	990.79	2.256	9.899
7	0.060	0.016	46.17	220.05	985.04	1.608	7.665
8	0.076	0.020	30.72	168.87	979.30	1.048	5.761
9	0.093	0.024	15.29	116.84	973.55	0.520	3.974
10	0.110	0.028	-0.03	64.26	967.80	0.520	2.181

Exc. totales result. cabeza 0.06640 -0.00003
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 6.(32 0 32+32 0 25)-(32 0 32)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 13.66

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
413.1	413.1	413.1	413.1	413.1	413.1	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	34.7	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	31.2	13.10	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	27.7	8.70	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILA 6.(32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	42.15	833.34	1285.41	1.843	36.433
1	0.003	0.000	39.06	781.58	1277.82	1.593	31.870
2	0.013	0.001	35.60	722.27	1270.23	1.367	27.731
3	0.027	0.001	31.81	656.48	1262.63	1.175	24.253
4	0.046	0.002	27.76	585.10	1255.04	0.980	20.662
5	0.069	0.003	23.48	509.05	1247.45	0.787	17.064
6	0.095	0.005	19.02	429.20	1239.86	0.819	18.472
7	0.125	0.006	14.39	345.30	1232.27	0.562	13.477
8	0.157	0.008	9.64	258.53	1224.68	0.350	9.391
9	0.191	0.009	4.83	169.86	1217.09	0.172	6.067
10	0.226	0.011	-0.02	80.08	1209.50	0.172	2.846

Exc. totales result. cabeza 0.06621 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 6.(32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	293.35	697.54	1156.92	11.623	27.638
1	0.003	0.001	267.12	651.95	1150.08	10.249	25.014
2	0.010	0.004	239.44	601.02	1143.25	8.893	22.321
3	0.021	0.009	210.64	545.39	1136.42	7.532	19.501
4	0.036	0.015	181.03	485.72	1129.59	6.193	16.616
5	0.054	0.022	150.90	422.66	1122.76	4.905	13.738
6	0.075	0.030	120.54	356.85	1115.93	4.926	14.583
7	0.099	0.039	89.96	288.16	1109.09	3.364	10.776
8	0.124	0.049	59.50	217.41	1102.26	2.095	7.656
9	0.151	0.059	29.42	145.26	1095.43	1.025	5.060
10	0.179	0.069	-0.05	72.26	1088.60	1.025	2.509

Exc. totales result. cabeza 0.06638 -0.00005
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 6.(32 0 32+32 0 25)-(32 0 32)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	164.38	579.28	1028.53	6.028	21.244
1	0.002	0.001	150.14	539.41	1022.45	5.368	19.285
2	0.008	0.002	135.08	495.88	1016.38	4.686	17.204
3	0.016	0.005	119.32	449.13	1010.31	3.996	15.041
4	0.028	0.008	103.02	399.61	1004.24	3.312	12.849
5	0.042	0.012	86.30	347.76	998.16	2.651	10.682
6	0.058	0.016	69.30	294.01	992.09	2.620	11.116
7	0.076	0.021	52.03	238.30	986.02	1.841	8.434
8	0.096	0.026	34.64	181.16	979.95	1.183	6.189
9	0.116	0.031	17.24	123.01	973.87	0.587	4.185
10	0.138	0.037	-0.03	64.23	967.80	0.587	2.180

Exc. totales result. cabeza 0.06637 -0.00003
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 15.23

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
512.0	512.0	512.0	512.0	512.0	512.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	34.7	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	31.2	13.80	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	27.7	11.20	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	50.17	979.72	1294.13	1.904	37.171
1	0.004	0.000	46.69	921.30	1285.67	1.667	32.899
2	0.016	0.001	42.71	853.15	1277.21	1.446	28.889
3	0.035	0.002	38.31	776.57	1268.74	1.256	25.462
4	0.059	0.003	33.55	692.67	1260.28	1.061	21.899
5	0.089	0.004	28.50	602.61	1251.82	0.863	18.241
6	0.123	0.006	23.20	507.51	1243.35	1.100	24.062
7	0.162	0.008	17.60	405.79	1234.89	0.736	16.977
8	0.206	0.010	11.81	299.56	1226.43	0.441	11.187
9	0.252	0.012	5.91	190.52	1217.96	0.212	6.814
10	0.299	0.015	-0.02	79.95	1209.50	0.212	2.842

Exc. totales result. cabeza 0.06610 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	365.53	808.68	1164.77	12.656	28.000
1	0.003	0.001	333.99	757.39	1157.15	11.261	25.536
2	0.012	0.006	300.38	699.29	1149.53	9.873	22.984
3	0.027	0.012	265.11	635.16	1141.92	8.454	20.254
4	0.046	0.020	228.58	565.79	1134.30	7.030	17.402
5	0.069	0.030	191.19	492.00	1126.68	5.632	14.492
6	0.096	0.041	153.35	414.62	1119.07	6.806	18.403
7	0.127	0.054	114.76	332.67	1111.45	4.548	13.185
8	0.161	0.068	76.02	247.58	1103.83	2.731	8.895
9	0.197	0.083	37.62	160.47	1096.22	1.312	5.595
10	0.234	0.098	-0.07	72.22	1088.60	1.312	2.507

Exc. totales result. cabeza 0.06635 -0.00006
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	243.81	665.17	1035.50	7.930	21.635
1	0.003	0.001	223.60	620.39	1028.73	7.128	19.777
2	0.010	0.003	201.93	570.93	1021.96	6.284	17.767
3	0.021	0.008	179.03	517.31	1015.19	5.413	15.641
4	0.036	0.013	155.11	460.11	1008.42	4.531	13.440
5	0.054	0.019	130.41	399.86	1001.65	3.657	11.213
6	0.074	0.026	105.14	337.15	994.88	4.255	13.644
7	0.098	0.035	79.16	271.43	988.11	2.923	10.021
8	0.124	0.043	52.81	203.59	981.34	1.822	7.024
9	0.152	0.053	26.34	134.33	974.57	0.896	4.572
10	0.180	0.062	-0.05	64.22	967.80	0.896	2.179

Exc. totales result. cabeza 0.06636 -0.00005
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 15.09

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
512.0	512.0	512.0	512.0	512.0	512.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	34.7	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	31.2	14.80	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	27.7	12.20	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	48.66	950.81	1293.35	1.794	35.048
1	0.004	0.000	45.23	893.30	1284.97	1.574	31.077
2	0.015	0.001	41.34	826.76	1276.58	1.383	27.659
3	0.032	0.002	37.06	752.30	1268.20	1.203	24.415
4	0.055	0.003	32.43	670.96	1259.81	1.015	21.000
5	0.083	0.004	27.53	583.81	1251.43	0.825	17.500
6	0.115	0.006	22.40	491.91	1243.04	1.042	22.877
7	0.152	0.008	16.99	393.84	1234.66	0.701	16.243
8	0.192	0.010	11.40	291.52	1226.27	0.423	10.817
9	0.235	0.012	5.71	186.53	1217.89	0.204	6.669
10	0.280	0.014	-0.02	80.06	1209.50	0.204	2.845

Exc. totales result. cabeza 0.06619 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	379.51	793.50	1164.07	13.073	27.334
1	0.003	0.001	346.80	742.80	1156.52	11.658	24.969
2	0.012	0.006	311.94	685.58	1148.97	10.220	22.460
3	0.026	0.012	275.37	622.56	1141.43	8.751	19.784
4	0.044	0.021	237.49	554.53	1133.88	7.279	16.995
5	0.067	0.031	198.71	482.26	1126.33	5.832	14.154
6	0.092	0.042	159.42	406.54	1118.79	7.027	17.920
7	0.122	0.055	119.35	326.46	1111.24	4.705	12.869
8	0.154	0.069	79.10	243.36	1103.69	2.835	8.723
9	0.189	0.084	39.16	158.32	1096.15	1.365	5.519
10	0.224	0.099	-0.09	72.18	1088.60	1.365	2.506

Exc. totales result. cabeza 0.06630 -0.00009
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILAS 7 a 17.(64 0 32)-(32 0 32).

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	259.82	654.87	1034.88	8.438	21.268
1	0.002	0.001	238.26	610.58	1028.17	7.582	19.431
2	0.009	0.004	215.16	561.76	1021.47	6.683	17.449
3	0.020	0.008	190.76	508.94	1014.76	5.756	15.357
4	0.034	0.013	165.28	452.66	1008.05	4.818	13.195
5	0.052	0.020	138.97	393.46	1001.34	3.889	11.010
6	0.072	0.027	112.05	331.87	994.63	4.517	13.380
7	0.094	0.036	84.39	267.40	987.92	3.107	9.845
8	0.120	0.045	56.31	200.87	981.22	1.941	6.924
9	0.146	0.055	28.09	132.97	974.51	0.956	4.526
10	0.174	0.065	-0.04	64.24	967.80	0.956	2.180

Exc. totales result. cabeza 0.06638 -0.00004
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 18.(40 0 32)-(32 0 32)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 12.61

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
320.0	320.0	320.0	320.0	320.0	320.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	24.2	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	21.8	9.20	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	19.3	11.90	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILA 18.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	36.00	538.25	1279.57	1.486	22.220
1	0.002	0.000	33.21	505.48	1272.56	1.330	20.244
2	0.007	0.000	30.14	468.63	1265.56	1.166	18.129
3	0.015	0.001	26.84	428.19	1258.55	0.999	15.940
4	0.025	0.002	23.35	384.61	1251.54	0.834	13.747
5	0.038	0.002	19.69	338.38	1244.54	0.676	11.622
6	0.052	0.003	15.91	289.95	1237.53	0.590	10.757
7	0.068	0.004	12.02	239.51	1230.52	0.434	8.643
8	0.086	0.005	8.05	187.49	1223.51	0.288	6.712
9	0.104	0.007	4.03	134.30	1216.51	0.144	4.788
10	0.124	0.008	-0.01	80.31	1209.50	0.144	2.854

Exc. totales result. cabeza 0.06640 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 18.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	189.82	461.80	1151.67	7.655	18.624
1	0.001	0.001	171.48	432.61	1145.36	6.699	16.899
2	0.006	0.002	152.56	400.36	1139.05	5.749	15.088
3	0.012	0.005	133.25	365.41	1132.75	4.828	13.240
4	0.021	0.008	113.72	328.12	1126.44	3.955	11.412
5	0.031	0.012	94.14	288.85	1120.13	3.148	9.658
6	0.043	0.017	74.67	247.93	1113.83	2.684	8.913
7	0.057	0.022	55.39	205.52	1107.52	1.944	7.213
8	0.071	0.027	36.43	161.92	1101.21	1.271	5.651
9	0.087	0.032	17.92	117.42	1094.91	0.624	4.086
10	0.103	0.038	-0.03	72.32	1088.60	0.624	2.510

Exc. totales result. cabeza 0.06643 -0.00003
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 18.(40 0 32)-(32 0 32)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	196.24	390.66	1023.86	7.609	15.147
1	0.001	0.001	179.10	365.10	1018.25	6.734	13.728
2	0.005	0.002	161.04	337.32	1012.65	5.850	12.253
3	0.010	0.005	142.21	307.59	1007.04	4.977	10.765
4	0.017	0.008	122.76	276.18	1001.43	4.134	9.299
5	0.026	0.012	102.83	243.33	995.83	3.339	7.902
6	0.035	0.017	82.56	209.28	990.22	2.877	7.292
7	0.046	0.022	62.01	174.13	984.62	2.120	5.954
8	0.058	0.027	41.33	138.12	979.01	1.408	4.706
9	0.071	0.033	20.61	101.45	973.41	0.701	3.449
10	0.084	0.039	-0.02	64.31	967.80	0.701	2.183

Exc. totales result. cabeza 0.06645 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 19.(32 0 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 9.38

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	31.4	2.10	1209.50	0.00	0.00	0	0.0	0	0.0	1.60
2	28.2	10.00	1088.60	0.00	0.00	0	0.4	0	0.4	1.44
3	25.1	11.30	967.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILA 19.(32 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	25.55	496.08	1261.62	2.051	39.825
1	0.002	0.000	23.46	464.42	1256.41	1.612	31.914
2	0.006	0.000	21.20	429.25	1251.20	1.277	25.853
3	0.013	0.001	18.80	391.26	1245.99	1.035	21.547
4	0.022	0.001	16.29	350.95	1240.77	0.829	17.854
5	0.032	0.002	13.69	308.75	1235.56	0.649	14.633
6	0.044	0.002	11.02	265.00	1230.35	0.494	11.877
7	0.056	0.003	8.31	220.04	1225.14	0.360	9.542
8	0.070	0.003	5.55	174.12	1219.92	0.238	7.474
9	0.084	0.004	2.78	127.46	1214.71	0.119	5.440
10	0.099	0.005	-0.01	80.30	1209.50	0.119	3.412

Exc. totales result. cabeza 0.06639 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 19.(32 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	134.52	416.25	1135.51	8.281	25.624
1	0.001	0.000	121.38	388.52	1130.82	6.977	22.334
2	0.004	0.001	107.90	358.58	1126.13	5.793	19.251
3	0.009	0.003	94.21	326.75	1121.44	4.725	16.386
4	0.015	0.005	80.41	293.33	1116.75	3.779	13.785
5	0.023	0.007	66.61	258.58	1112.06	2.957	11.480
6	0.031	0.009	52.87	222.75	1107.36	2.250	9.480
7	0.040	0.012	39.28	186.04	1102.67	1.636	7.749
8	0.050	0.015	25.90	148.62	1097.98	1.073	6.158
9	0.061	0.018	12.78	110.66	1093.29	0.527	4.567
10	0.072	0.021	-0.03	72.30	1088.60	0.527	2.975

Exc. totales result. cabeza 0.06642 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 19.(32 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	128.91	355.42	1009.50	7.153	19.720
1	0.001	0.000	117.16	331.01	1005.33	6.148	17.369
2	0.003	0.001	104.96	305.06	1001.16	5.195	15.100
3	0.007	0.002	92.38	277.79	996.99	4.313	12.970
4	0.012	0.004	79.53	249.41	992.82	3.515	11.022
5	0.018	0.006	66.46	220.08	988.65	2.803	9.281
6	0.024	0.008	53.25	189.98	984.48	2.174	7.754
7	0.032	0.011	39.95	159.23	980.31	1.608	6.410
8	0.040	0.013	26.60	127.96	976.14	1.067	5.134
9	0.048	0.016	13.27	96.28	971.97	0.531	3.852
10	0.057	0.019	-0.02	64.31	967.80	0.531	2.567

Exc. totales result. cabeza 0.06645 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 20.(32 0 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 9.54

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1	157.1

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	21.5	2.10	1215.70	0.00	0.00	0	0.0	0	0.0	1.60
2	19.3	8.10	1093.80	0.00	0.00	0	0.4	0	0.4	1.44
3	17.2	8.70	971.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILA 20.(32 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	24.59	359.70	1268.71	1.273	18.614
1	0.001	0.000	22.52	338.12	1263.41	1.121	16.831
2	0.003	0.000	20.31	314.61	1258.11	0.973	15.072
3	0.007	0.000	18.00	289.39	1252.81	0.832	13.380
4	0.012	0.001	15.59	262.67	1247.51	0.699	11.783
5	0.018	0.001	13.10	234.64	1242.21	0.575	10.293
6	0.025	0.002	10.55	205.48	1236.91	0.457	8.898
7	0.033	0.002	7.95	175.35	1231.60	0.343	7.555
8	0.041	0.003	5.32	144.43	1226.30	0.228	6.194
9	0.050	0.003	2.66	112.86	1221.00	0.114	4.820
10	0.060	0.004	-0.00	80.80	1215.70	0.114	3.440

Exc. totales result. cabeza 0.06646 -0.00000
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 20.(32 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	112.63	311.70	1141.51	5.546	15.347
1	0.001	0.000	101.16	292.49	1136.74	4.793	13.857
2	0.003	0.001	89.56	271.86	1131.97	4.088	12.410
3	0.006	0.002	77.90	249.96	1127.20	3.438	11.032
4	0.010	0.003	66.26	226.94	1122.43	2.845	9.743
5	0.015	0.005	54.70	202.95	1117.66	2.304	8.547
6	0.021	0.007	43.28	178.12	1112.88	1.806	7.432
7	0.027	0.009	32.05	152.56	1108.11	1.332	6.340
8	0.034	0.011	21.06	126.39	1103.34	0.872	5.235
9	0.042	0.013	10.36	99.74	1098.57	0.428	4.120
10	0.049	0.015	-0.01	72.71	1093.80	0.428	2.995

Exc. totales result. cabeza 0.06647 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 20.(32 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	100.80	268.48	1014.21	4.641	12.361
1	0.001	0.000	91.42	251.50	1009.97	4.073	11.205
2	0.002	0.001	81.76	233.50	1005.73	3.531	10.083
3	0.005	0.002	71.87	214.58	1001.49	3.019	9.014
4	0.008	0.003	61.80	194.85	997.25	2.540	8.010
5	0.012	0.004	51.60	174.42	993.00	2.092	7.071
6	0.017	0.006	41.30	153.36	988.76	1.666	6.184
7	0.022	0.008	30.96	131.76	984.52	1.245	5.299
8	0.028	0.009	20.60	109.72	980.28	0.826	4.402
9	0.034	0.011	10.26	87.30	976.04	0.411	3.495
10	0.040	0.013	-0.01	64.61	971.80	0.411	2.582

Exc. totales result. cabeza 0.06648 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 21.(32 0 20)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 10.40

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5	100.5

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	8.8	2.10	1150.40	0.00	0.00	0	0.0	0	0.0	1.60
2	7.9	4.90	1034.60	0.00	0.00	0	0.4	0	0.4	1.44
3	7.1	4.30	918.80	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 1.PILA 21.(32 0 20)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	27.85	224.74	1208.19	1.386	11.186
1	0.001	0.000	25.58	214.86	1202.41	1.260	10.588
2	0.002	0.000	23.14	203.61	1196.63	1.130	9.944
3	0.005	0.001	20.56	191.09	1190.85	0.996	9.263
4	0.009	0.001	17.85	177.39	1185.08	0.861	8.557
5	0.014	0.002	15.03	162.62	1179.30	0.722	7.810
6	0.019	0.002	12.13	146.88	1173.52	0.580	7.024
7	0.026	0.003	9.15	130.28	1167.74	0.436	6.203
8	0.033	0.004	6.13	112.94	1161.96	0.291	5.357
9	0.040	0.004	3.07	94.97	1156.18	0.145	4.489
10	0.048	0.005	-0.00	76.49	1150.40	0.145	3.603

Exc. totales result. cabeza 0.06649 -0.00000
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 21.(32 0 20)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	87.83	192.92	1086.61	4.188	9.200
1	0.000	0.000	78.38	184.16	1081.41	3.695	8.682
2	0.002	0.001	68.93	174.40	1076.21	3.220	8.148
3	0.004	0.002	59.54	163.69	1071.01	2.762	7.594
4	0.007	0.003	50.27	152.12	1065.81	2.324	7.032
5	0.011	0.005	41.18	139.76	1060.61	1.897	6.438
6	0.016	0.006	32.30	126.68	1055.40	1.483	5.817
7	0.021	0.008	23.70	112.96	1050.20	1.085	5.171
8	0.027	0.010	15.42	98.69	1045.00	0.704	4.505
9	0.033	0.012	7.51	83.93	1039.80	0.342	3.821
10	0.040	0.014	-0.01	68.78	1034.60	0.342	3.124

Exc. totales result. cabeza 0.06648 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 1.PILA 21.(32 0 20)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	59.15	165.53	965.03	2.670	7.473
1	0.000	0.000	53.52	157.76	960.41	2.402	7.080
2	0.002	0.001	47.74	149.26	955.79	2.133	6.669
3	0.003	0.001	41.85	140.07	951.16	1.865	6.243
4	0.006	0.002	35.88	130.25	946.54	1.595	5.791
5	0.009	0.003	29.86	119.85	941.92	1.325	5.316
6	0.013	0.004	23.82	108.93	937.29	1.054	4.821
7	0.017	0.005	17.78	97.53	932.67	0.785	4.306
8	0.022	0.007	11.78	85.72	928.05	0.519	3.777
9	0.027	0.008	5.85	73.56	923.42	0.257	3.235
10	0.033	0.010	-0.00	61.10	918.80	0.257	2.682

Exc. totales result. cabeza 0.06650 -0.00000
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

PROYECTO .....

FECHA

HOJA N.º

ARMADURA DE ATADO

$N_{máx} = 802{,}4$ t

$A = 0{,}3 \times 1{,}6 \times 802{,}4 \times \frac{1{,}33 - 0{,}60}{1{,}33} \times \frac{1{,}15}{5{,}1} = 47{,}7$ cm²

PROYECTO TAV. ZARAGOZA – LÉRIDA
TRAMO I
ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2,5(11,65 \times 1,39 + 1,90 \times 0,536 \times 1,24) = 40,1$ t

PILA	ACCIONES	APOY	N	F_L	F_T	M_L	M_T
P-1 (h: 10,65 m)	PESO PROPIO	1	299,2	—	—	—	—
		2	299,2	—	—	—	—
	CARGA PERMANENTE	1	133,6	—	—	—	—
		2	133,6	—	—	—	—
	SOBRECARGA MÁXIMA	1	337,8	—	—	—	—
		2	267,9	—	—	—	—
	SOBRECARGA MÍNIMA	1	-24,2	—	—	—	—
		2	-30,6	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-11,4	*	—	*	—
		2	-11,4	*	—	*	—
	FRENADO	1	—	21,7	—	231,1	—
		2	—	21,7	—	231,1	—
	PRETENSADO INICIAL	1	-7,3	—	—	—	—
		2	-7,3	—	—	—	—
	PRETENSADO FINAL	1	-22,3	—	—	—	—
		2	-22,3	—	—	—	—
	VIENTO	1	16,8	—	7,9	—	46,5
		2	-16,8	—	7,9	—	46,5
	SISMO	1	6,6	—	3,1	—	18,4
		2	-6,6	—	3,1	—	18,4

* INCLUIDA EN FRENADO

PROYECTO TAV. ZARAGOZA – LÉRIDA
TRAMO I
ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2,5(11,40 \times 1,39 + 1,90 \times 0,536 \times 1,24) = 42,7$ t

PILA	ACCIONES	APOY	N	F_L	F_T	M_L	M_T
P-2 (h: 11,40 m)	PESO PROPIO	1	300,1	—	—	—	—
		2	300,1	—	—	—	—
	CARGA PERMANENTE	1	133,9	—	—	—	—
		2	133,9	—	—	—	—
	SOBRECARGA MÁXIMA	1	359,5	—	—	—	—
		2	285,1	—	—	—	—
	SOBRECARGA MÍNIMA	1	-23,9	—	—	—	—
		2	-30,2	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	2,3	*	—	*	—
		2	2,3	*	—	*	—
	FRENADO	1	—	21,7	—	247,4	—
		2	—	21,7	—	247,4	—
	PRETENSADO INICIAL	1	0,8	—	—	—	—
		2	0,8	—	—	—	—
	PRETENSADO FINAL	1	6,6	—	—	—	—
		2	6,6	—	—	—	—
	VIENTO	1	30,2	—	13,3	—	83,8
		2	-30,2	—	13,3	—	83,8
	SISMO	1	14,4	—	6,4	—	39,9
		2	-14,4	—	6,4	—	39,9

PROYECTO TAV. ZARAGOZA – LÉRIDA
TRAMO I
ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º 342

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2{,}5\,(13{,}66 \times 1{,}39 + 1{,}90 \times 0{,}536 \times 1{,}20) = 50{,}5$ t

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-3 a P-6 (h=13.66 m)	PESO PROPIO	1	299.3	—	—	—	—
		2	299.3	—	—	—	—
	SOBRECARGA PERMANENTE	1	133.5	—	—	—	—
		2	133.5	—	—	—	—
	SOBRECARGA MÁXIMA	1	359.7	—	—	—	—
		2	285.5	—	—	—	—
	SOBRECARGA MÍNIMA	1	−23.5	—	—	—	—
		2	−27.7	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−0.5	*	—	*	—
		2	−0.5	*	—	*	—
	FRENADO	1	—	21.7	—	296.4	—
		2	—	21.7	—	296.4	—
	PRETENSADO INICIAL	1	2.6	—	—	—	—
		2	2.6	—	—	—	—
	PRETENSADO FINAL	1	1.4	—	—	—	—
		2	1.4	—	—	—	—
	VIENTO	1	43.7	—	17.1	—	119.9
		2	−43.7	—	17.1	—	119.9
	SISMO	1	30.2	—	11.8	—	82.7
		2	−30.2	—	11.8	—	82.7

* INCLUIDA EN FRENADO

PROYECTO TAV. ZARAGOZA – LÉRIDA
TRAMO I
ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º 343

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2{,}5\,(15{,}23 \times 1{,}39 + 1{,}90 \times 0{,}536 \times 1{,}20) = 56{,}0$ t

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-7 a P-17 (h=15.23 m)	PESO PROPIO	1	299.3	—	—	—	—
		2	299.3	—	—	—	—
	SOBRECARGA PERMANENTE	1	133.5	—	—	—	—
		2	133.5	—	—	—	—
	SOBRECARGA MÁXIMA	1	359.7	—	—	—	—
		2	285.5	—	—	—	—
	SOBRECARGA MÍNIMA	1	−23.5	—	—	—	—
		2	−27.7	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−0.5	*	—	*	—
		2	−0.5	*	—	*	—
	FRENADO	1	—	21.7	—	330.5	—
		2	—	21.7	—	330.5	—
	PRETENSADO INICIAL	1	2.6	—	—	—	—
		2	2.6	—	—	—	—
	PRETENSADO FINAL	1	1.4	—	—	—	—
		2	1.4	—	—	—	—
	VIENTO	1	56.3	—	20.0	—	153.6
		2	−56.3	—	20.0	—	153.6
	SISMO	1	53.8	—	19.1	—	146.7
		2	−53.8	—	19.1	—	146.7

* INCLUIDA EN FRENADO

	PROYECTO TAV. ZARAGOZA – LÉRIDA TRAMO I ESTRUCTURA E-1	FECHA 3-XII-96 HOJA N.º

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2.5(12.6 \times 1.39 + 1.90 \times 0.536 \times 1.20) = 46.9\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-18 (h = 12.6 m)	· PESO PROPIO	1	299.3	—	—	—	—
		2	299.3	—	—	—	—
	CARGA PERMANENTE	1	133.5	—	—	—	—
		2	133.5	—	—	—	—
	SOBRECARGA MÁXIMA	1	359.9	—	—	—	—
		2	285.5	—	—	—	—
	SOBRECARGA MÍNIMA	1	−23.5	—	—	—	—
		2	−29.7	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−0.5	*	—	—	—
		2	−0.5	*	—	—	—
	FRENADO	1	—	21.7	—	273.6	—
		2	—	21.7	—	273.6	—
	PRETENSADO INICIAL	1	2.6	—	—	—	—
		2	2.6	—	—	—	—
	PRETENSADO FINAL	1	1.4	—	—	—	—
		2	1.4	—	—	—	—
	VIENTO	1	27.8	—	9.7	—	62.9
		2	−27.8	—	9.7	—	62.9
	SISMO	1	46.3	—	19.7	—	127.7
		2	−46.3	—	19.7	—	127.7

* INCLUIDA EN FRENADO

PROYECTO TAV. ZARAGOZA – LÉRIDA
TRAMO I
ESTRUCTURA E-1
FECHA 3-XII-96
HOJA N.º

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2.5(9.54 \times 1.39 + 1.90 \times 1.536 \times 1.20) = 36.2\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-19 y P-20 (h = 9.54 m)	· PESO PROPIO	1	300.5	—	—	—	—
		2	300.5	—	—	—	—
	CARGA PERMANENTE	1	133.9	—	—	—	—
		2	133.9	—	—	—	—
	SOBRECARGA MÁXIMA	1	359.5	—	—	—	—
		2	285.1	—	—	—	—
	SOBRECARGA MÍNIMA	1	−23.9	—	—	—	—
		2	−30.2	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	2.3	—	—	—	—
		2	2.3	—	—	—	—
	FRENADO	1	—	9.9	—	94.5	—
		2	—	9.9	—	94.5	—
	PRETENSADO INICIAL	1	−9.7	—	—	—	—
		2	−9.7	—	—	—	—
	PRETENSADO FINAL	1	−3.5	—	—	—	—
		2	−3.5	—	—	—	—
	VIENTO	1	18.8	—	10.8	—	53.2
		2	−18.8	—	10.8	—	53.2
	SISMO	1	31.7	—	18.2	—	89.7
		2	−31.7	—	18.2	—	89.7

PROYECTO TAV. ZARAGOZA - HUESCA
TRAMO I
ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º

CIMENTACION DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2.5(10,50 \times 1,39 + 1,90 \times 0,536 \times 1,20) = 430\,t$

PILA	ACCIONES	APOY	N	F_L	F_T	M_L	M_T
P-21 (h = 10,40)	PESO PROPIO	1	298,6	—	—	—	—
		2	298,6	—	—	—	—
	CARGA PERMANENTE	1	133,6	—	—	—	—
		2	133,6	—	—	—	—
	SOBRECARGA MÁXIMA	1	337,8	—	—	—	—
		2	267,9	—	—	—	—
	SOBRECARGA MÍNIMA	1	-24,2	—	—	—	—
		2	-30,6	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-11,4	—	—	—	—
		2	-11,4	—	—	—	—
	FRENADO	1	—	2,1	—	21,9	—
		2	—	2,1	—	21,9	—
	PRETENSADO INICIAL	1	-7,3	—	—	—	—
		2	-7,3	—	—	—	—
	PRETENSADO FINAL	1	-22,3	—	—	—	—
		2	-22,3	—	—	—	—
	VIENTO	1	7,5	—	3,9	—	21,1
		2	-7,5	—	3,9	—	21,1
	SISMO	1	13,5	—	7,0	—	37,9
		2	-13,5	—	7,0	—	37,9

PROYECTO

FECHA

HOJA N.º

HIPOTESIS COMBINADAS

H-1 - P. PROPIO + C. PERMANENTE + SOBRECARGA MÁXIMA + DEFORMACIONES DIFERIDAS + FRENADO + PRETENSADO

H-2 Como H-1 con sobrecarga mínima

H-3 Como H-1 con viento

H-4 Como H-2 con viento

H-5 - Como H-1 con 1/4 viento + sismo

H-6 Como H-2 con 1/4 viento + sismo

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ENCEPADO P-1

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Reacc. pilote máx= 611.00 Pilote: 1 Hipót.: 3
Reacc. pilote mín= 171.62 Pilote: 4 Hipót.: 4

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1536.9	43.4	0.0	462.2	181.8
H- 2	838.2	43.4	0.0	462.2	16.7
H- 3	1536.9	43.4	15.8	462.2	362.2
H- 4	838.2	43.4	15.8	462.2	197.1
H- 5	1536.9	43.4	10.2	462.2	298.0
H- 6	838.2	43.4	10.2	462.2	132.9

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1882.8	43.4	0.0	570.7	181.8
H- 2	1184.1	43.4	0.0	570.7	16.7
H- 3	1882.8	43.4	15.8	570.7	401.7
H- 4	1184.1	43.4	15.8	570.7	236.6
H- 5	1882.8	43.4	10.2	570.7	323.5
H- 6	1184.1	43.4	10.2	570.7	158.4

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	584.5	549.6	391.8	356.9
H- 2	394.0	390.8	201.3	198.1
H- 3	611.0	523.1	418.3	330.4
H- 4	420.4	364.3	227.8	171.6
H- 5	601.6	532.5	408.9	339.8
H- 6	411.0	373.7	218.4	181.0

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	935.26	571.01	17.36	60.76	0.441	0.269	0.019
H- 2	630.38	316.93	17.36	60.76	0.297	0.150	0.019
H- 3	977.60	528.67	18.47	64.66	0.461	0.249	0.020
H- 4	672.72	274.59	18.47	64.66	0.317	0.130	0.020
H- 5	962.55	543.72	17.83	62.42	0.454	0.257	0.020
H- 6	657.67	289.64	17.83	62.42	0.310	0.137	0.020

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	609.7	572.5	408.3	371.1
H- 2	414.0	410.8	212.6	209.4
H- 3	656.3	526.0	454.9	324.6
H- 4	460.5	364.3	259.2	162.9
H- 5	643.7	538.6	442.3	337.2
H- 6	447.9	376.9	246.5	175.5

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	975.57	593.82	17.36	60.76	0.460	0.280	0.019
H- 2	662.37	335.10	17.36	60.76	0.313	0.158	0.019
H- 3	1050.07	519.32	20.36	71.26	0.495	0.245	0.022
H- 4	736.86	260.61	20.36	71.26	0.348	0.123	0.022
H- 5	1029.87	539.52	19.03	66.61	0.486	0.255	0.021
H- 6	716.66	280.81	19.03	66.61	0.338	0.132	0.021

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Reacc. pilote máx= 656.29 Pilote: 1 Hipót.: 3
Reacc. pilote mín= 162.88 Pilote: 4 Hipót.: 4

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1615.8	43.4	0.0	494.8	193.5
H- 2	900.9	43.4	0.0	494.8	16.4
H- 3	1615.8	43.4	26.6	494.8	518.1
H- 4	900.9	43.4	26.6	494.8	341.0
H- 5	1615.8	43.4	19.5	494.8	429.4
H- 6	900.9	43.4	19.5	494.8	252.3

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1961.7	43.4	0.0	603.3	193.5
H- 2	1246.8	43.4	0.0	603.3	16.4
H- 3	1961.7	43.4	26.6	603.3	584.6
H- 4	1246.8	43.4	26.6	603.3	407.5
H- 5	1961.7	43.4	19.5	603.3	478.1
H- 6	1246.8	43.4	19.5	603.3	301.0

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	623.2	585.9	395.6	358.4
H- 2	430.6	427.5	203.1	200.0
H- 3	687.8	521.3	460.3	293.8
H- 4	495.2	362.9	267.7	135.3
H- 5	684.0	525.1	456.4	297.6
H- 6	491.4	366.7	263.9	139.2

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	997.04	573.47	17.36	60.76	0.470	0.271	0.019
H- 2	688.95	319.96	17.36	60.76	0.325	0.151	0.019
H- 3	1100.46	470.05	22.10	77.36	0.519	0.222	0.024
H- 4	792.36	216.55	22.10	77.36	0.374	0.102	0.024
H- 5	1094.33	476.18	21.62	75.66	0.516	0.225	0.024
H- 6	786.24	222.67	21.62	75.66	0.371	0.105	0.024

Amin flexión =	70.65
Amin cortante =	8.57
W máxima =	0
A necesaria =	0

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Reacc. pilote máx= 687.78 Pilote: 1 Hipót.: 3
Reacc. pilote mín= 135.34 Pilote: 4 Hipót.: 4

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1617.2	43.4	0.0	592.8	193.5
H- 2	915.2	43.4	0.0	592.8	16.1
H- 3	1617.2	43.4	34.2	592.8	660.5
H- 4	915.2	43.4	34.2	592.8	483.1
H- 5	1617.2	43.4	32.2	592.8	632.7
H- 6	915.2	43.4	32.2	592.8	455.3

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1963.1	43.4	0.0	701.3	193.5
H- 2	1261.1	43.4	0.0	701.3	16.1
H- 3	1963.1	43.4	34.2	701.3	746.0
H- 4	1261.1	43.4	34.2	701.3	568.6
H- 5	1963.1	43.4	32.2	701.3	713.2
H- 6	1261.1	43.4	32.2	701.3	535.8

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ENCEPADO P-7 A P-17.

Dimensiones encepado
- Canto = 2.60
- Ancho L = 8.20
- Ancho T = 8.20

Reacc. pilote máx= 721.74 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 152.44 Pilote: 4 Hipót.: 6

Dimensiones pila
- Ancho L = 1.15
- Ancho T = 6.35

Datos pilotes
- Número = 4
- Diámetro= 1.50
- Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.600	2.600
2	2.600	-2.600
3	-2.600	2.600
4	-2.600	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1628.2	43.4	0.0	661.0	193.5
H- 2	926.2	43.4	0.0	661.0	16.1
H- 3	1628.2	43.4	40.0	661.0	793.5
H- 4	926.2	43.4	40.0	661.0	616.1
H- 5	1628.2	43.4	48.2	661.0	916.7
H- 6	926.2	43.4	48.2	661.0	739.3

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2065.3	43.4	0.0	773.8	193.5
H- 2	1363.3	43.4	0.0	773.8	16.1
H- 3	2065.3	43.4	40.0	773.8	897.5
H- 4	1363.3	43.4	40.0	773.8	720.1
H- 5	2065.3	43.4	48.2	773.8	1042.0
H- 6	1363.3	43.4	48.2	773.8	864.6

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	623.9	586.7	445.9	408.7
H- 2	431.4	428.3	253.3	250.3
H- 3	705.1	505.6	527.1	327.5
H- 4	512.5	347.1	334.5	169.1
H- 5	721.7	488.9	543.7	310.9
H- 6	529.2	330.5	351.2	152.4

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	998.29	653.91	17.36	60.76	0.471	0.309	0.019
H- 2	690.20	400.41	17.36	60.76	0.326	0.189	0.019
H- 3	1128.14	524.07	23.61	82.63	0.532	0.247	0.026
H- 4	820.05	270.56	23.61	82.63	0.387	0.128	0.026
H- 5	1154.79	497.42	25.94	90.80	0.545	0.235	0.029
H- 6	846.70	243.91	25.94	90.80	0.399	0.115	0.029

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ENCEPADO P-18

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Reacc. pilote máx= 694.41 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 125.11 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1610.0	43.4	0.0	547.2	193.5
H- 2	908.0	43.4	0.0	547.2	16.1
H- 3	1610.0	43.4	19.4	547.2	437.9
H- 4	908.0	43.4	19.4	547.2	260.5
H- 5	1610.0	43.4	44.3	547.2	750.8
H- 6	908.0	43.4	44.3	547.2	573.4

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1955.9	43.4	0.0	655.7	193.5
H- 2	1253.9	43.4	0.0	655.7	16.1
H- 3	1955.9	43.4	19.4	655.7	486.4
H- 4	1253.9	43.4	19.4	655.7	309.0
H- 5	1955.9	43.4	44.3	655.7	861.5
H- 6	1253.9	43.4	44.3	655.7	684.2

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	615.3	578.1	399.9	362.7
H- 2	422.7	419.6	207.4	204.3
H- 3	650.0	543.4	434.6	328.0
H- 4	457.4	384.9	242.0	169.6
H- 5	694.4	498.9	479.1	283.6
H- 6	501.9	340.5	286.5	125.1

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	984.43	580.32	17.36	60.76	0.464	0.274	0.019
H- 2	676.34	326.81	17.36	60.76	0.319	0.154	0.019
H- 3	1039.94	524.81	19.02	66.55	0.491	0.248	0.021
H- 4	731.85	271.30	19.02	66.55	0.345	0.128	0.021
H- 5	1111.06	453.69	24.81	86.82	0.524	0.214	0.027
H- 6	802.97	200.18	24.81	86.82	0.379	0.094	0.027

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ENCEPADO P-19 y P-20.

Dimensiones encepado
- Canto = 2.50
- Ancho L = 6.75
- Ancho T = 8.20

Reacc. pilote máx= 604.11 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 198.67 Pilote: 4 Hipót.: 6

Dimensiones pila
- Ancho L = 1.15
- Ancho T = 6.35

Datos pilotes
- Número = 4
- Diámetro= 1.50
- Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1583.4	19.8	0.0	189.0	193.5
H- 2	867.7	19.8	0.0	189.0	16.4
H- 3	1583.4	19.8	21.6	189.0	397.7
H- 4	867.7	19.8	21.6	189.0	220.6
H- 5	1583.4	19.8	41.8	189.0	588.8
H- 6	867.7	19.8	41.8	189.0	411.7

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1929.3	19.8	0.0	238.5	193.5
H- 2	1213.6	19.8	0.0	238.5	16.4
H- 3	1929.3	19.8	21.6	238.5	451.7
H- 4	1213.6	19.8	21.6	238.5	274.6
H- 5	1929.3	19.8	41.8	238.5	693.3
H- 6	1213.6	19.8	41.8	238.5	516.2

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	542.0	504.8	459.9	422.7
H- 2	346.0	342.9	263.9	260.8
H- 3	574.1	472.7	492.0	390.6
H- 4	378.1	310.8	296.0	228.7
H- 5	604.1	442.6	522.0	360.6
H- 6	408.2	280.7	326.1	198.7

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu= 84.27
Fyk=	51000	1.15	
Acciones		1.60	

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	867.17	676.30	7.92	27.72	0.409	0.319	0.009
H- 2	553.64	417.27	7.92	27.72	0.261	0.197	0.009
H- 3	918.52	624.95	11.72	41.02	0.433	0.295	0.013
H- 4	605.00	365.91	11.72	41.02	0.285	0.173	0.013
H- 5	966.57	576.90	18.50	64.75	0.456	0.272	0.020
H- 6	653.04	317.87	18.50	64.75	0.308	0.150	0.020

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ZAPATA P-21

Zapata:
H = 1.500 m
BL = 6.000 m
BT = 8.000 m
Fuste:
AL = 1.150 m
AT = 6.350 m

Materiales:
Hormigón.: Fck = 2500 T/m2 gc = 1.500
Acero....: Fyk = 51000 T/m2 gs = 1.150 r = 0.050 m

Esfuerzos en arranque de fuste: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	1541.50	4.20	0.00	43.80	181.80
2	1541.50	4.20	7.80	43.80	262.90
3	1541.50	4.20	16.00	43.80	348.00

Esfuerzos en cara inferior de zapata: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	1541.50	4.20	0.00	50.10	181.80
2	1541.50	4.20	7.80	50.10	274.60
3	1541.50	4.20	16.00	50.10	372.00

Esfuerzos en hipótesis combinadas: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	1721.50	4.20	0.00	50.10	181.80
2	1721.50	4.20	7.80	50.10	274.60
3	1721.50	4.20	16.00	50.10	372.00

Tensiones: (T/m2)

---	---T1--	---T2--	---T3--	---T4--	---TC--
1	31.98	37.66	34.07	39.75	37.20
2	30.53	39.11	32.62	41.20	37.72
3	29.01	40.63	31.10	42.72	38.28

Tmáx = 42.72 Tmín = 29.01 TCmáx = 38.28

PROYECTO T.A.V. ZARAGOZA - LERIDA TRAMO 1 ESTRUCTURA E-1

FECHA 3-XII-96

HOJA N.º

ARMADURA DE ENCEPADOS

$f_{ck} = 25 N/mm^2$; $\gamma_c = 1.50$

$f_{yd} = 5100 kg/cm^2$; $\gamma_d = 1.15$

γ_{acero} { sin viento : 1.60; con viento : 1.44; con viento : 1.28

Ancho de banda: 3.00 m.

Pilas 1 a 6, 18 a 20

- Flexión

$N_{d\,máx} = 997.1$ t. (P-3 a P-6)

$M_{cd} = 997.1 \times 1.875 = 1869.6$ mt

$A = 1869.6 \times \frac{1}{2.35} \times \frac{1.15}{5.1} = 179.4$ t/banda $= 59.8$ cm²/m

Se disponen 2 φ 25/0.15 en las bandas de 3 m. sobre pilotes y φ 25/0.15 entre bandas.

Transversalmente se dispone una parrilla de φ 25/0.15

($A_{min} = 0.04 U_c = 0.04 \times \frac{250}{1.5} \times 2.35 \times \frac{1.15}{5.1} = 35.3$ cm²/m).

- Cortante

$V_{cd} = 997.1$ t

$V_{cu\,banda} = 3 \times 5 \sqrt{\frac{250}{1.5}} \times 3.00 \times 2.35 = 1365.2$ t. $> V_{cd}$

- Comprobación de esfuerzo

$V_d = 997.1$ t.

$V_{cu} = 1.70 \times 5 \sqrt{\frac{250}{1.5}} \times (1.50 + 2.35) \times 2.35 = 992.8$ t $\simeq V_d$

PROYECTO

FECHA 3-XI-96

HOJA N.º

PILAS 7 a 17

- Flexion

Nd max: 1015,4 t

Mcd = 1015,4 × 2.60 = 2640,0 mt

$A = 2640,0 \times \frac{1}{2,43} \times \frac{1.15}{5,1} = 245.0\ cm^2/banda = 81.7\ cm^2/m$

Se disponen 2 capas de ϕ25/0.10 m. en las bandas de 3 m. sobre pilota y ϕ25/0,10 entre bandas.
Transversalmente se dispone una parrilla de ϕ25/0,15

- Cortante

Vcd: 1015.4 t

Vcu banda = 1411,7 t > Vcd

- comprobación de esquina.

Vd = 1015,4 t. Vcu = 1048,0 t > Vd

CARGAS DE SUSPENSION (PARA TODAS LAS ENCEPADAS)

Nd max = 1.6 (156.0 + 299.3 + 133.5 + 319.9 + 2,6) = 1362,1 t.

$F = \frac{1362.1}{1.5 \times 4} = 227.0\ t \rightarrow A = \frac{227.0}{4.2} = 54.1\ cm^2/\text{punta}$

Se disponen 14 ϕ 16 en cada banda longitudinal

PROYECTO

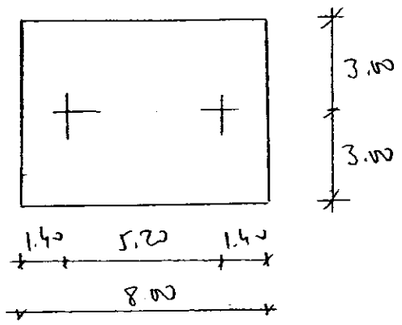
FECHA

HOJA N.º

ARMADURA DE LA ZAPATA DE P-21

Se calcula como viga flotante. (canto 1.50 m).

NP: 5 NH: 1



$x_1 = 0$
$x_2 = 1.40$
$x_3 = 4.60$
$x_4 = 6.60$
$x_5 = 8,00$

B: 1.00 m
1.00 m

A = 6.00 m

$I = \frac{1.00 \times 1.5^3}{12} = 1.6875\ m^4$

$E = 2,5 \times 10^6\ t/m^2$

L = 8,00 m.

$x_1 = 1.40$ F = 813,2 t; M = 20,8 mt

$x_2 = 6.60$ F = 728,3 t; M = 20,8 mt

1. punto

$x_1 = 1.40$, $x_2 = 6.60$ → F = 2.5 × 2.80 − 1.50 × 6.00 = 63.0 t.

$x_3 = 4.00$ → F = 2,5 × 2.40 × 1.10 × 6.00 = 54.0 t

VIGA SOBRE FUNDACION ELASTICA.

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ZAPATA P-21.

Coeficiente de balasto.....= 1000.00000

Ancho de la viga.....= 6.00000

Inercia de la viga.....= 1.68750

Módulo de elasticidad de la viga...= 2500000.00000

Longitud de la viga.....= 8.00000

Número de puntos de resultados.....= 5

Punto	Abcisa
1	0.000
2	1.400
3	4.000
4	6.600
5	8.000

Número de hipótesis de carga.....= 1

Hipótesis de carga 1. Número de puntos cargados 3

Punto	Abcisa	Fuerza	Momento
1	1.400	876.200	20.800
2	4.000	54.000	0.000
3	6.600	791.360	20.800

----------> RESULTADOS <----------

Hipótesis de carga 1.

		Izquierda		Derecha	
Abcisa	Tensión	Momento	Cortante	Momento	Cortante
0.000	40.222	0.000	0.000	0.000	0.000
1.400	38.609	233.356	331.112	212.556	-545.088
4.000	35.670	-442.209	33.734	-442.209	-20.265
6.600	33.283	211.597	517.033	190.797	-274.326
8.000	32.028	0.000	-0.000	0.000	-0.000

VIGA SOBRE FUNDACION ELASTICA.

TAV ZARAGOZA-LERIDA.TRAMO 1.E-1.ZAPATA P-21.

Coeficiente de balasto.....= 10000.00000

Ancho de la viga.....= 6.00000

Inercia de la viga.....= 1.68750

Módulo de elasticidad de la viga...= 2500000.00000

Longitud de la viga.....= 8.00000

Número de puntos de resultados.....= 5

Punto	Abcisa
1	0.000
2	1.400
3	4.000
4	6.600
5	8.000

Número de hipótesis de carga.....= 1

Hipótesis de carga 1. Número de puntos cargados 3

Punto	Abcisa	Fuerza	Momento
1	1.400	876.200	20.800
2	4.000	54.000	0.000
3	6.600	791.360	20.800

----------> RESULTADOS <----------

Hipótesis de carga 1.

		Izquierda		Derecha	
Abcisa	Tensión	Momento	Cortante	Momento	Cortante
0.000	42.279	0.000	0.000	0.000	0.000
1.400	39.278	242.866	342.777	222.066	-533.423
4.000	34.072	-409.427	33.689	-409.427	-20.310
6.600	33.945	221.079	505.424	200.279	-285.936
8.000	34.088	0.000	-0.000	0.000	-0.000

	PROYECTO	FECHA
		HOJA N.°

ARMADURAS

FLEXION

LONGITUDINAL

$\sigma_{mín_c} = 89{,}3\ t/m^2$

$M_{cd} = 1.6 \times 39.3 \times \frac{3.00^2}{2} = 283{,}0\ mt/m$

$U_c = \frac{2.00}{1.5} 1.00 \times 1.40 = 2333\ t$

$A = U_c \left[1 - \sqrt{1 - \frac{2 M_{cd}}{U_c \times 1.40}}\right] \times \frac{1.15}{5.1} = 47{,}8\ cm^2/m \rightarrow \phi 25/0{,}10$

TRANSVERSAL

$M_{Td\ máx} = 1.6 - 242.9 = 388{,}7\ mt.$

$M_{Td\ mín} = -1.6 \times 442.21 = -707{,}6\ mt.$

$U_c = \frac{2.00}{1.5} \times 6.00 \times 1.40 = 14000\ t.$

$A = U_c \left[1 - \sqrt{1 - \frac{2 M_d}{U_c \times 1.40}}\right] \times \frac{1.15}{5.1}$ $\left.\begin{array}{l} A_{inf} = 63.3\ cm^2 \\ A_{sup} = 116.1\ cm^2 \end{array}\right\}$

$A_{inf} = 0{,}75 \times 63.3\ \frac{1}{3.00} = 15{,}8\ cm^2/m$

$A_{sup} = 0.75 \times 116.1 \times \frac{1}{3.00} = 29{,}1\ cm^2/m \rightarrow \phi 25/0{,}15$

$A_{mín} = 0.04 U_c \times \frac{1.15}{5.1} = 21.0\ cm^2/m \rightarrow \phi 20/0{,}15$

CORTANTE

$V_{d\ máx} = 1.6 \times 545{,}1 = 872{,}2\ t$

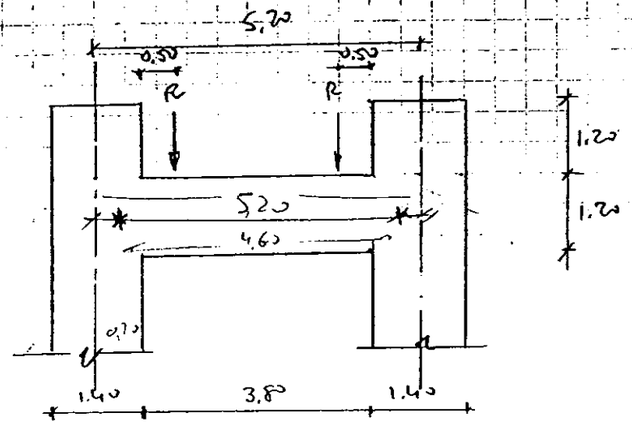
$V_{cu} = 5 \sqrt{\frac{200}{1.5}} \times 6.00 \times 1.40 = 542{,}2\ t$

$A_{Tj} = \frac{872{,}2 - 542{,}2}{0.9 \times 1.40 \times 4.2} = 62{,}4\ cm^2/m$ ($A_{mín} = 47{,}6\ cm^2/m$ **3.70**

RIOSTRA SUPERIOR

PROYECTO TAV ZARAGOZA - LERIDA
TRAMO 1
E-1
FECHA
HOJA N.º

RIOSTRA SUPERIOR DE PILAS

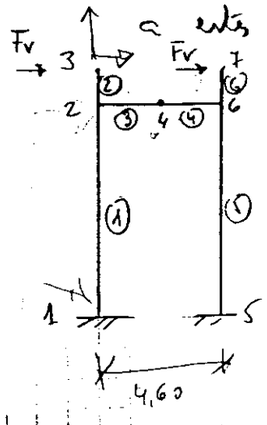


Se dimensiona para que pueda servir de apoyo a los gatos para levantar el puente y cambiar los aparatos de apoyo.

Se considera la reacción de peso propio + permanente + pretensado.

$R_{máx} = 300 + 134 + 6 = 440$ t.

Se calcula la pila sometida a su peso propio y a esta reacción + viento.



1,80

P-1: 3,70 (mínimo)

P-16: 11,60 (máximo)

0,5 Combinación 6 /

Fv = 11,4 t (P-1)

Fv = 21,1 t (P-16)

Fv por postes

Se toma una luz de cálculo de

$4,60 = 5,20 - 2 \times 0,30$


```
PILA1                                                          pag.   1

PILA 1.VIADUCTO 1.RIOSTRA SUPERIOR.
CONTROL
7 6 2 3
:
NUDOS
1 0 -5.50
2 0 -1.8
3 0 0
4 2.3 -1.8
5 4.6 -5.50
6 4.6 -1.8
7 4.6 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1 PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2 VIENTO
2
3 11.4 0 0
7 11.4 0 0
4
1 2 0.28 0
2 2 0.28 0
5 2 0.28 0
6 2 0.28 0
H-3 LEVANTAMIENTO DE TABLERO
0
2
3 1 440 0.90 270
4 1 440 1.40 270
:
```

PILA 1.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. n° 1 H-1 PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000001	-0.000012	-0.000004
3	0.000009	-0.000014	-0.000004
4	0.000000	-0.000024	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000001	-0.000012	0.000004
7	-0.000009	-0.000014	0.000004

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.91	22.84	-1.05
5	-0.91	22.84	1.05

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-22.84	1.05	0.91
	2	-9.97	-2.33	0.91
2	2	-6.26	0.00	-0.00
	3	-0.00	-0.00	0.00
3	2	-0.91	-2.33	-3.70
	4	-0.91	1.93	0.00
4	4	-0.91	1.93	-0.00
	6	-0.91	-2.33	3.70
5	5	-22.84	-1.05	-0.91
	6	-9.97	2.33	-0.91
6	6	-6.26	-0.00	-0.00
	7	-0.00	0.00	-0.00

PILA 1.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. n° 2 H-2 VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.000265	0.000010	-0.000091
3	0.000471	0.000010	-0.000126
4	0.000265	0.000000	0.000039
5	0.000000	-0.000000	-0.000000
6	0.000265	-0.000010	-0.000091
7	0.000471	-0.000010	-0.000126

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-12.94	-13.22	36.53
5	-12.94	13.22	36.53

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	13.22	-36.53	-12.94
	2	13.22	9.43	-11.90
2	2	0.00	-20.97	-11.90
	3	0.00	-0.00	-11.40
3	2	0.00	30.40	13.22
	4	0.00	0.00	13.22
4	4	0.00	-0.00	13.22
	6	0.00	-30.40	13.22
5	5	-13.22	-36.53	-12.94
	6	-13.22	9.43	-11.90
6	6	0.00	-20.97	-11.90
	7	0.00	-0.00	-11.40

PILA 1.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. nº 3 H-3 LEVANTAMIENTO DE TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000105	-0.000335	-0.000490
3	0.000988	-0.000335	-0.000490
4	0.000000	-0.001461	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000105	-0.000335	0.000490
7	-0.000988	-0.000335	0.000490

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	102.49	440.00	-118.15
5	-102.49	440.00	118.15

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-440.00	118.15	102.49
	2	-440.00	-261.05	102.49
2	2	0.00	-0.00	-0.00
	3	0.00	0.00	-0.00
3	2	-102.49	-261.05	-440.00
	4	-102.49	134.95	0.00
4	4	-102.49	134.95	-0.00
	6	-102.49	-261.05	440.00
5	5	-440.00	-118.15	-102.49
	6	-440.00	261.05	-102.49
6	6	0.00	-0.00	-0.00
	7	0.00	0.00	-0.00


```
PILA 16.VIADUCTO 1.RIOSTRA SUPERIOR.
CONTROL
7 6 2 3
:
NUDOS
1 0 -13.40
2 0 -1.8
3 0 0
4 2.3 -1.8
5 4.6 -13.40
6 4.6 -1.8
7 4.6 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1 PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2 VIENTO
2
3 11.4 0 0
7 11.4 0 0
4
1 2 0.28 0
2 2 0.28 0
5 2 0.28 0
6 2 0.28 0
H-3 LEVANTAMIENTO DE TABLERO
0
2
3 1 440 0.90 270
4 1 440 1.40 270
:
```

PILA 16.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. n° 1 H-1 PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000000	-0.000072	-0.000009
3	0.000017	-0.000073	-0.000009
4	0.000000	-0.000090	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000000	-0.000072	0.000009
7	-0.000017	-0.000073	0.000009

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.22	50.33	-0.87
5	-0.22	50.34	0.87

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-50.33	0.87	0.22
	2	-9.97	-1.74	0.22
2	2	-6.26	-0.00	-0.00
	3	-0.00	-0.00	0.00
3	2	-0.22	-1.74	-3.70
	4	-0.22	2.52	0.00
	6	-0.22	-1.74	3.70
5	5	-50.34	-0.87	-0.22
	6	-9.97	1.74	-0.22
6	6	-6.26	-0.00	-0.00
	7	0.00	0.00	-0.00

PILA 16.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. n° 2 H-2 VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.004861	0.000087	-0.000275
3	0.005398	0.000087	-0.000310
4	0.004861	0.000000	0.000081
5	0.000000	-0.000000	-0.000000
6	0.004861	-0.000087	-0.000275
7	0.005398	-0.000087	-0.000310

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-15.15	-36.31	94.39
5	-15.15	36.31	94.39

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	36.31	-94.39	-15.15
	2	36.31	62.53	-11.90
2	2	0.00	-20.97	-11.90
	3	0.00	0.00	-11.40
3	2	-0.00	83.51	36.31
	4	0.00	-0.00	36.31
	6	0.00	-83.51	36.31
5	5	-36.31	-94.39	-15.15
	6	-36.31	62.53	-11.90
6	6	0.00	-20.97	-11.90
	7	0.00	-0.00	-11.40

PILA 16.VIADUCTO 1.RIOSTRA SUPERIOR.

Hip. nº 3 H-3 LEVANTAMIENTO DE TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000026	-0.001049	-0.001053
3	0.001921	-0.001049	-0.001053
4	0.000000	-0.002822	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000026	-0.001049	0.001053
7	-0.001921	-0.001049	0.001053

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	25.20	440.00	-97.25
5	-25.20	440.00	97.25

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-440.00	97.25	25.20
	2	-440.00	-195.12	25.20
2	2	-0.00	-0.00	-0.00
	3	-0.00	-0.00	-0.00
3	2	-25.20	-195.12	-440.00
	4	-25.20	200.88	0.00
4	4	-25.20	200.88	0.00
	6	-25.20	-195.12	440.00
5	5	-440.00	-97.25	-25.20
	6	-440.00	195.12	-25.20
6	6	0.00	-0.00	-0.00
	7	0.00	0.00	-0.00

PROYECTO ..... FECHA .....

HOJA N.º .....

ARMADURA.

Flexión

P-1 $\begin{cases} M_d^- = 1.28(2.33+30.40+267.05) = 376.1 \text{ mt} \\ M_d^+ = 1.28\,(1.93+0+134.95) = 175,2 \text{ mt} \end{cases}$

P-16 $\begin{cases} M_d^- = 1.28(1.74+83.51+195,12) = -358.9 \text{ mt} \\ M_d^+ = 1.28(2.52+0+200,88) = 260,4 \text{ mt} \end{cases}$

$$A = U_c\left(1-\sqrt{1-\frac{2Md}{U_c \times 1.15}}\right) \times \frac{1.15}{5.1}$$

$$U_c = \frac{300}{1.5} \times 0,536 \times 1.15 = 1232,8 \text{ t}$$

$A_{sup} = 87.5 \text{ cm}^2$

$A_{inf} = 56.9 \text{ cm}^2 \rightarrow 8\,\phi 32 \rightarrow 64 \text{ cm}^2 \rightarrow U_{s_2} = 283.8 \text{ t}$

$$A_{sup} = U_c\left(1-\sqrt{1-2\,\frac{376.1-283.8(1,145-0.052)}{U_c \times 1.145}}\right) \times \frac{1.15}{5.1} + 64.1 = 77,3 \text{ cm}^2 \quad (10\,\phi 32)$$

Cortante

Al estar situada la carga a menos de $0.75\,h$ del apoyo, tomamos como valor de cálculo del cortante:

distancia $= 0,50$ m

$0.75 \cdot h = 0.90$ m.

$$V = \frac{0.50}{0.90} \times V_{calculo}$$

$$V_d = 1,28\left(3.70+36.31+\frac{0,50}{0.90} \times 440\right) = 364.1 \text{ t}$$

$$V_{cu} = 5\sqrt{\frac{300}{1,5}} \times 0,536 \times 1.15 = 436 \text{ t}$$

$$A_{sf} = \frac{364.1-436}{0.9 \times 1.15 \times 4.2} = 73,7 \text{ cm}^2 \rightarrow 2\,c\,\phi\,16/0.10$$

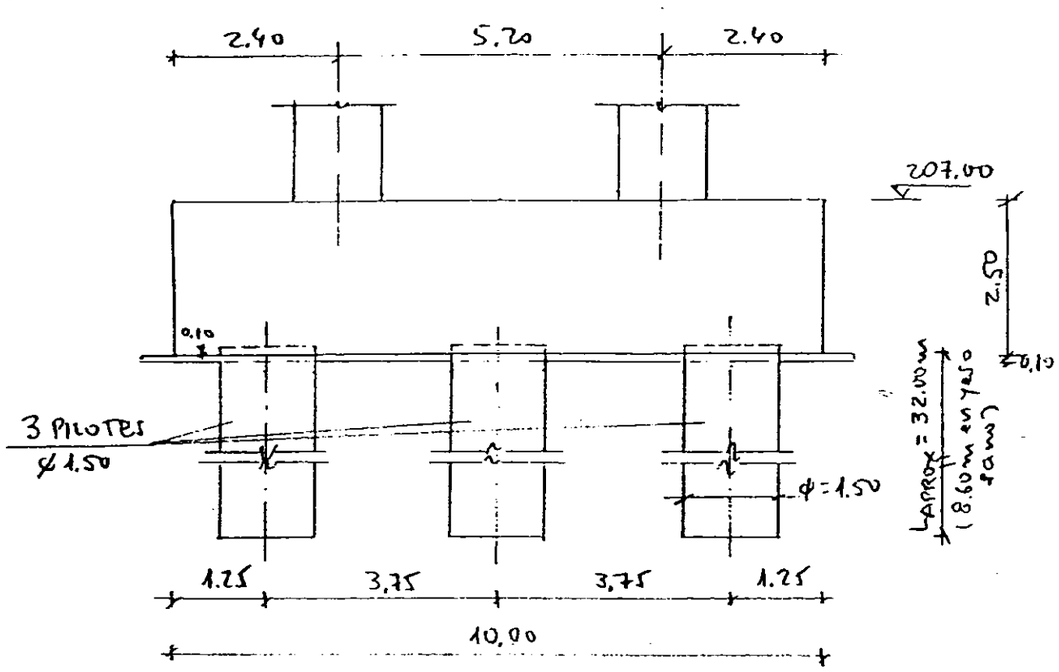
PROYECTO T.A.V. ZARAGOZA-LERIDA
SUBTRAMO 1
E-1

FECHA

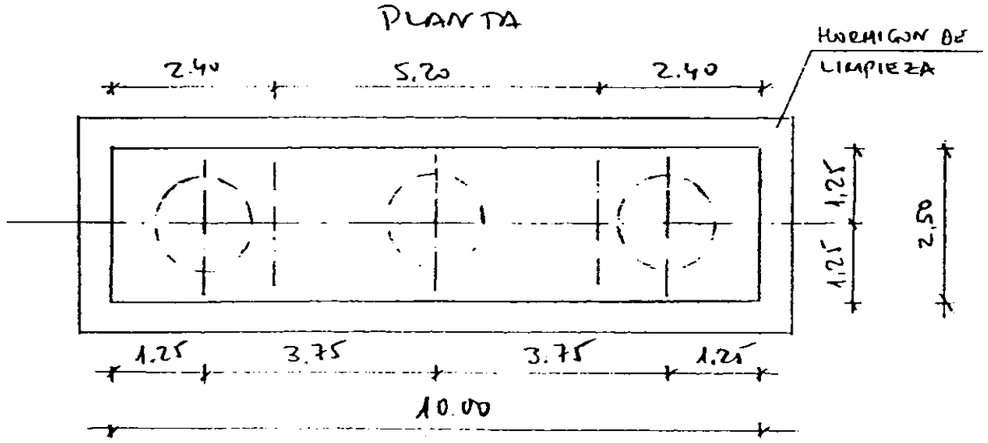
HOJA N.º 1

CIMENTACION PILA P-18

ALZADO



PLANTA



PROYECTO T.A.V. ZARAGOZA-LERIDA
SUBTRAMO 1
E-1

FECHA

HOJA N.º 2

CIMENTACION PILA P-18

SECCION A-A
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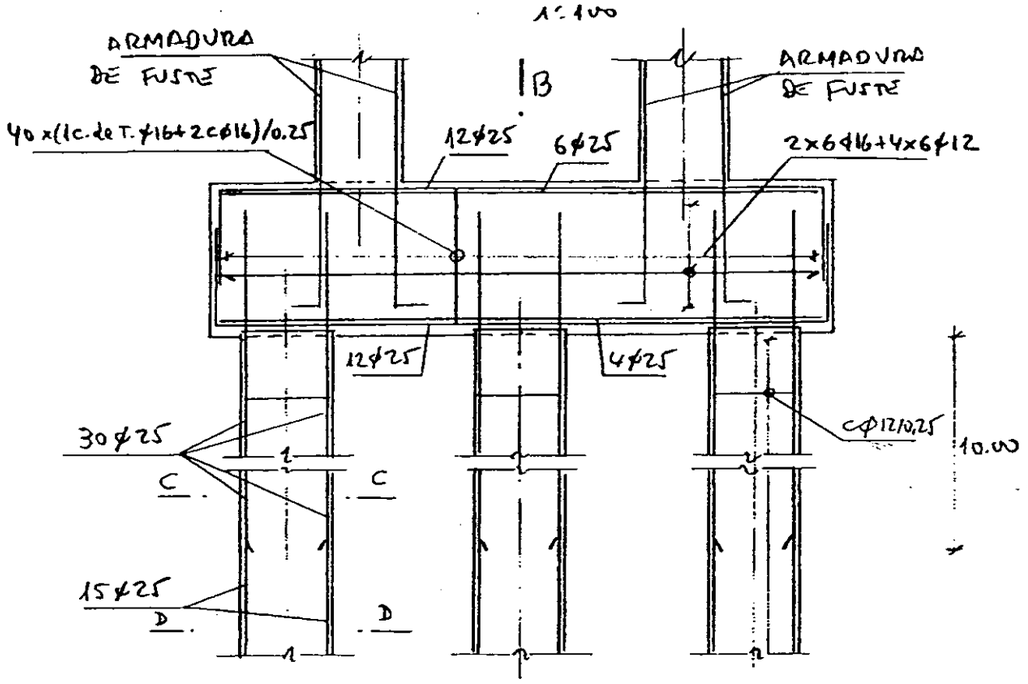

SECCION B-B
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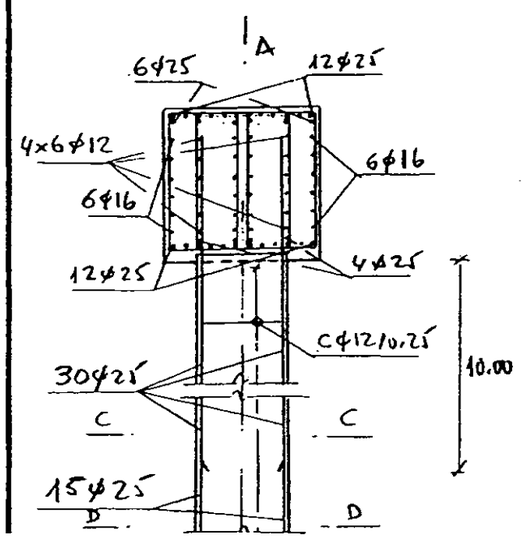
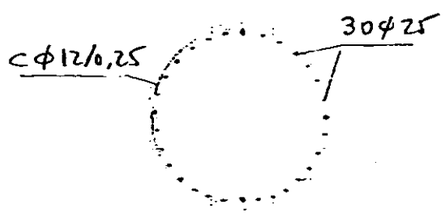
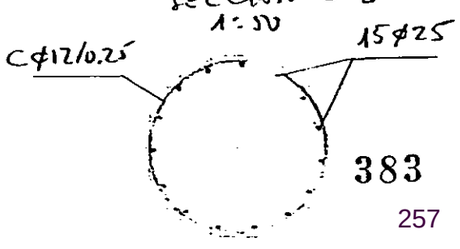
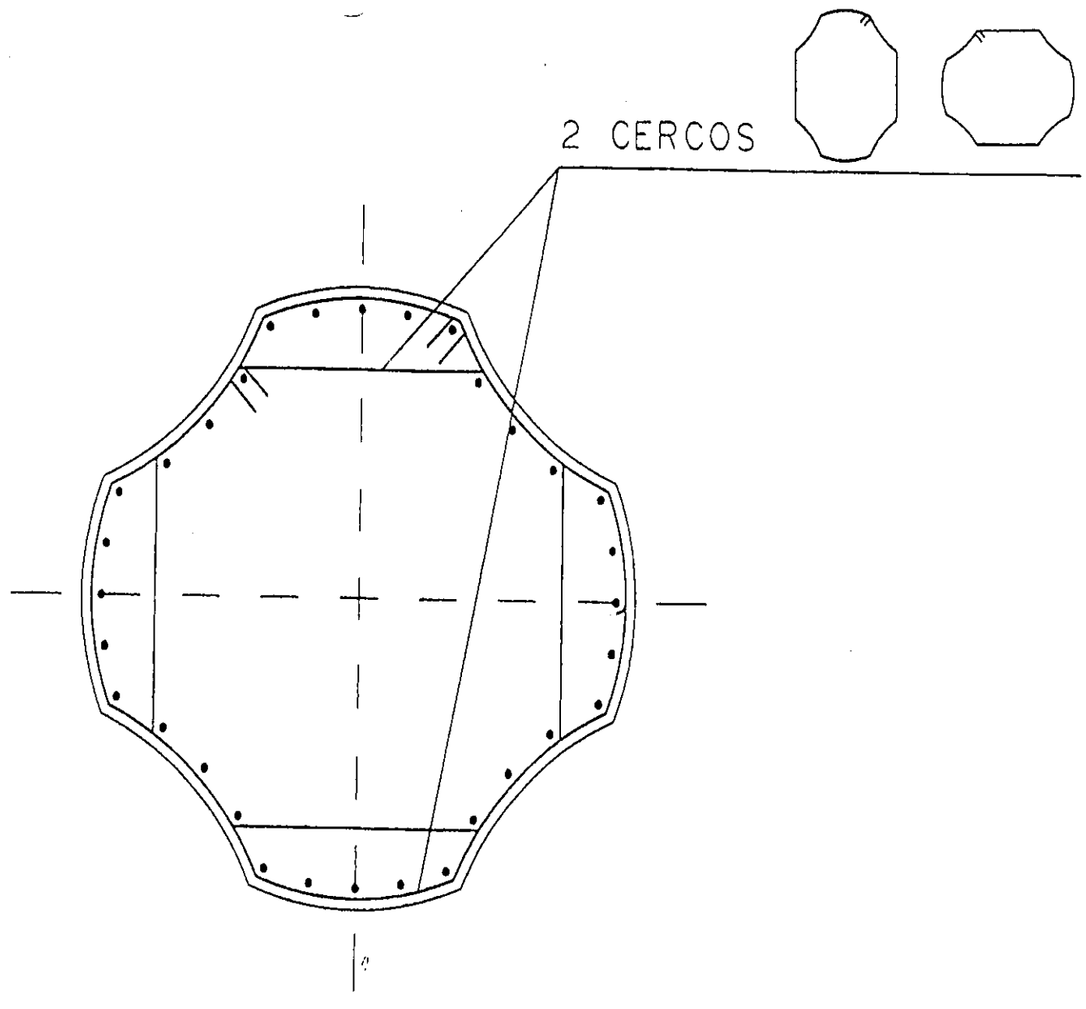


SECCION C-C
1:50



SECCION D-D
1:50





PILA ESTRUCTURA E-1

L.A.V. ZARAGOZA - LLEIDA (SUBTRAMO I)

CÁLCULOS ESTRUCTURALES
ESTRUCTURA E-1
ESTRIBO-1

REVISIÓN 1 (21-03-97)

IBERINSA

CÁLCULOS ESTRUCTURALES

L.A.V. ZARAGOZA - LÉRIDA.
SUBTRAMO I. ESTRUCTURA E-1.

ESTRIBO-1.
CÁLCULOS JUSTIFICATIVOS.

1.- INTRODUCCIÓN. 2
2.- FORMAS. 4
3.- ARMADURAS MURO FRONTAL. 7
4.- ARMADURAS EN ALETAS 17
5.- ARMADURAS BAJO APOYOS. 21
6.- CIMENTACIÓN POR PILOTES. 22
(43)

1.- ESTRIBO-1. INTRODUCCIÓN.

El presente cálculo se engloba dentro de los trabajos que IBERINSA realiza para llevar a cabo el "Control y Vigilancia de la Línea de Alta Velocidad Zaragoza-Lérida. Subtramo I".

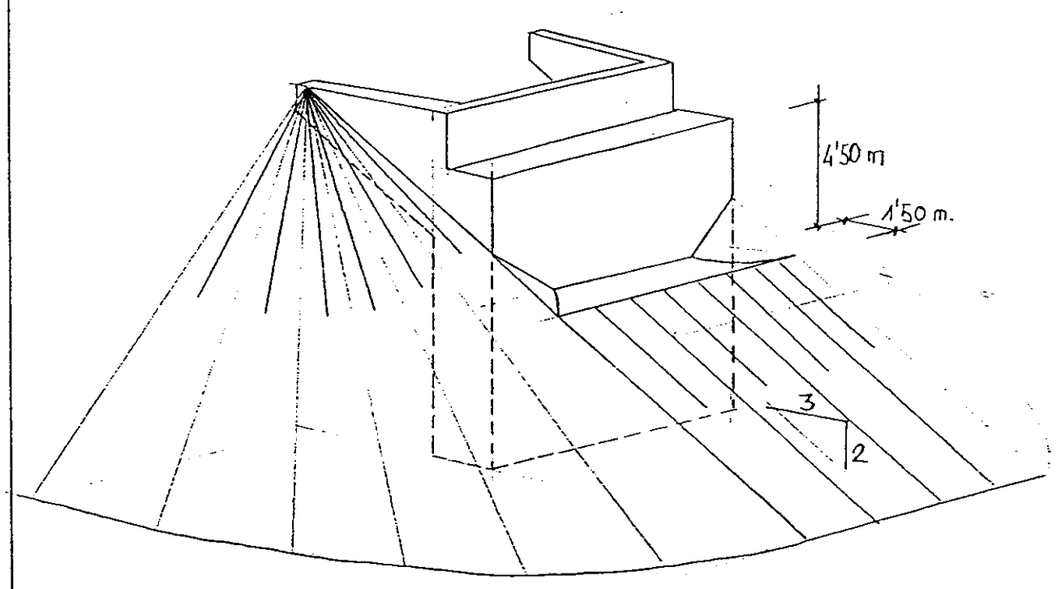
Dentro de estas obras se inscribe la estructura E-1, cuyo trazado en alzado ha sido modificado, incrementándose la altura del estribo-1, objeto del presente cálculo, en 5'24 metros sobre la última modificación proyectada.

El estribo-1, no aviado, consiste en un estribo cerrado con aletas en vuelta, y cimentado en un encepado sobre pilotes.

La cota de la cara superior del encepado es la +206.004, que coincide sensiblemente con el terreno circundante, mientras que la nueva cota del estribo bajo apoyos es la +215.004, resultando un muro frontal de 9'0 metros de altura al que se le ha proporcionado un espesor constante de 2'0 metros; la coronación del muro frontal la constituye un murete de aproximadamente 1'80 metros de altura y 0'40 metros de espesor.

Las aletas en vuelta tienen una longitud de 6'0 metros y un espesor de 0'50 metros. Han sido dimensionadas de tal forma que el derrame de tierras (3H:2V), permita dejar completamente

visible la mitad de la altura del muro frontal, es decir, aproximadamente 4'5 metros; a esta altura se efectuará un relleno del intradós del estribo, dejando una superficie de tierras horizontal de 1'5 metros, y a partir de ahí se produce el derrame. El croquis siguiente nos muestra la situación descrita:

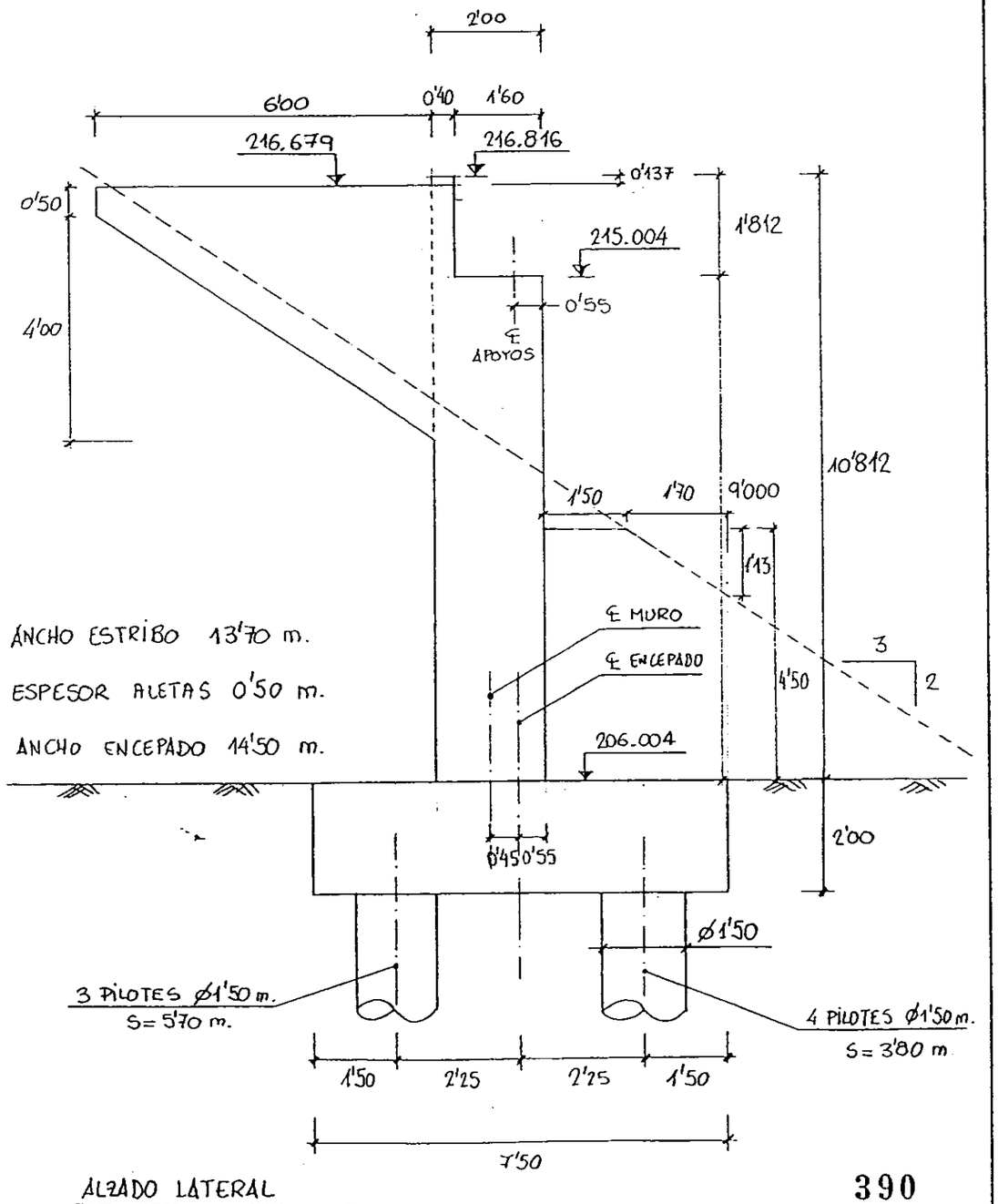


El encepado tiene unas dimensiones de 14'5 x 7'5 x 2'0 metros, y en él se empotran rígidamente 7 pilotes de ∅ 1'50 metros, una fila hacia el trasdós de 3 pilotes, y otra hacia el intradós de 4 pilotes.

Los materiales empleados son:

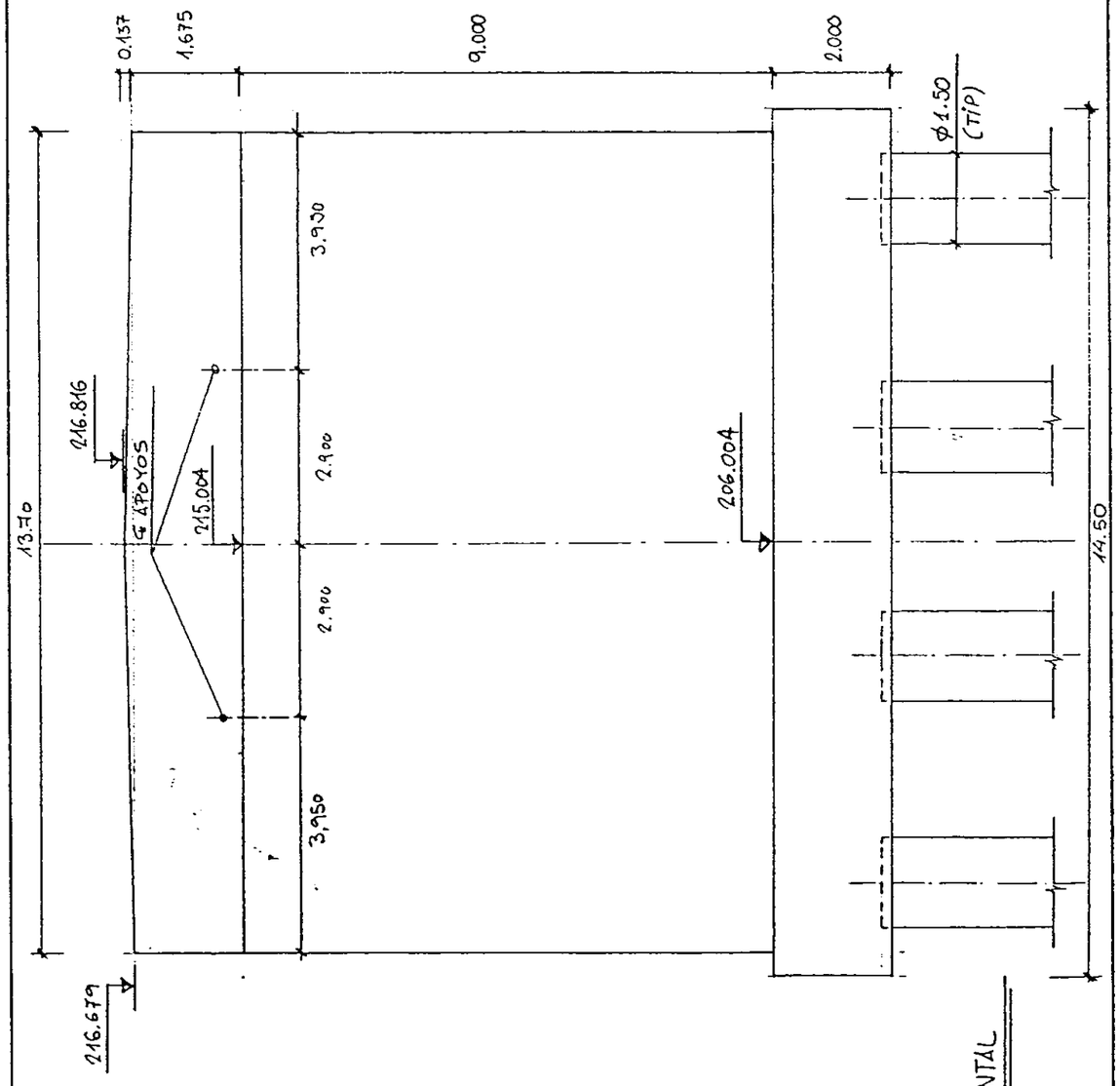
- hormigón H-250 en muro, aletas y encepado
- hormigón H-200 en pilotes
- acero ΔEH-500 en todos los elementos

2.- ESTRIBO - 1 . FORMAS.



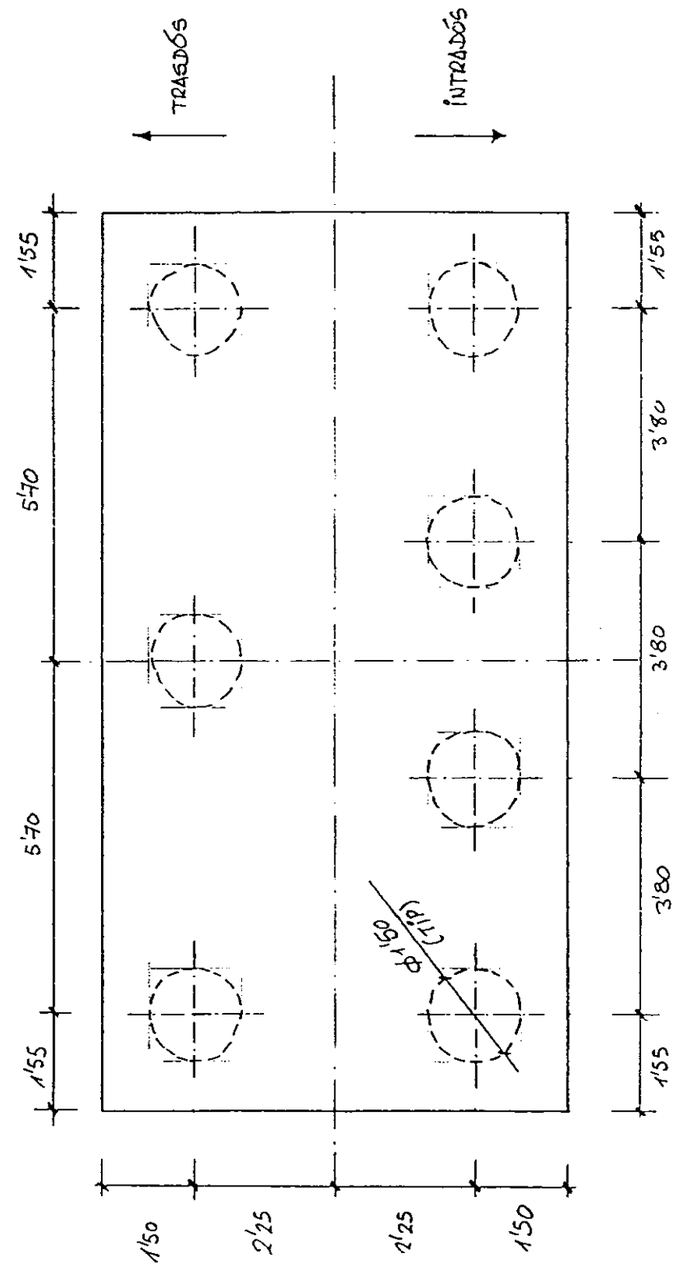
ALZADO LATERAL

390



ALZADO FRONTAL

391



PLANTA ENCEPADO Y PILOTES

3.- ESTRIBO - 1. ARMADURAS MURO FRONTAL.

MATERIALES

hormigón H-250 $\gamma_c = 1'50/0'9$ por hormigonado vertical

acero AEH-500N $\gamma_s = 1'15$

$f_{ck} = 250$ Kp/cm² $f_{cd} = 1500$ Tn/m²

$f_{yk} = 5100$ Kp/cm² $f_{yd} = 4'435$ Tn/cm²

ACCIONES TRANSMITIDAS POR EL TABLERO

CARGAS VERTICALES (Tn)							
APOYO	PESO PROPIO	CM	DEF. DIFERIDAS	SOBRECARGAS		PRETENSADO	
				MÁXIMA	MÍNIMA	INICIAL	FINAL
R_1	97'7	39'8	9'5	122'6	-24'2	15'5	24'9
R_2	97'7	39'8	9'5	99'6	-19'6	15'5	24'9
TOTAL	195'4	79'6	19'0	222'2	-43'8	31'0	49'8

CARGAS HORIZONTALES : 5% de la carga total vertical máxima

$N_{max.total} = 566$ Tn

5% s/566 = 28'30 Tn (valor máximo)

$N_{cargas\ permanentes} = 343'80$ Tn ; $H = 0'05 \times 343'80 = 17'19$ Tn

$N_{sobrecargas\ máximas} = 222'20$ Tn ; $H = 0'05 \times 222'20 = 11'11$ Tn

ACCIONES SOBRE EL ESTRIBO (ADEMÁS DE LAS DEL TABLERO)

PESO PROPIO ESTRIBO :-

$N_{muro} = 2'50 \times \left[9'0 \times 2'0 + 1'798 \times 0'40 \right] = 46'80 \ Tn/mL$

$N_{aletas} = 2'50 \times \left[6'0 \times 0'5 + \frac{1}{2} \times 6'0 \times 4'0 \right] = 37'50 \ Tn / 13'70 \ m = 2'74 \ Tn/mL$

$N_{macizos} = 2'50 \times 2 \times 1'60 \times 1'30 \times 3'25 = 33'80 \ Tn/13'70 \ m = 2'47 \ Tn/mL$

$N_{PP} = 52'01 \ Tn/mL$

EMPUJE DE TIERRAS :-

Se toma el empuje activo :

$$Ka = tg^2 \left(45° - \frac{\phi}{2} \right) \qquad \phi = 35° \qquad Ka = 0'271$$

- Empuje por peso del terreno :

$E_H = \frac{1}{2} \gamma H^2 Ka = \frac{1}{2} \times 2'00 \times 10'798^2 \times 0'271 = 31'60 \ Tn/mL$

aplicado a $\frac{1}{3} H = 3'599$ m.

- Empuje por peso del camino de rodadura : ($0'684 \ Tn/m^2$)

$E_H = 0'684 \times 10'798 \times 0'271 = 2'00 \ Tn/mL$ aplicado a $\frac{1}{2} H = 5'399$ m.

- Empuje por sobrecarga de $3 \ Tn/m^2$:

$E_H = 3'0 \times 10'798 \times 0'271 = 8'78 \ Tn/mL$ aplicado a 5'399 m.

ACCIÓN SÍSMICA :-

- Coeficiente sísmico básico $c = 0'08$
- Coeficiente de empuje activo dinámico según la teoría de Mononobe - Okabe :

$$Kae = \frac{\cos^2(\phi - \psi)}{\cos^2 \psi \times \left[1 + \sqrt{\frac{\operatorname{sen} \phi \ \operatorname{sen} (\phi - \psi)}{\cos \psi}} \right]^2}$$

siendo : ϕ = rozamiento interno $= 35°$

$\psi = \operatorname{arctg} c = 4'574°$

$Kae = 0'316$

- Aplicación del empuje dinámico según el método de Arango (1969):

$Kae - Ka = 0'045 = \Delta Kae$ con resultante a $0'6H = 6'479$ m.

- Incrementos de empujes por acción sísmica :

- empuje por peso del terreno : $\Delta E_H = 5'25 \ Tn/mL$
- empuje por peso del ramivo : $\Delta E_H = 0'33 \ Tn/mL$
- empuje por sc $3 \ Tn/m^2$: $\Delta E_H = 1'46 \ Tn/mL$

		ESFUERZOS POR M.L. DE MURO		
		AXIL (Tn)	MOMENTO (m Tn)	
TABLERO	CARGAS PERMANENTES	25'10	35'14	(1)
	SOBRECARGAS MAX.	16'22	22'71	(2)
ESTRIBO	PESO PROPIO	52'01	———	(3)
EMPUJE DE TIERRAS	PESO TERRENO	———	113'73	(4)
	PESO BALASTO	———	10'80	(5)
	SC 3 Tn/m²	———	47'40	(6)
EMPUJE CON SISMO (INCREMENTO)	PESO TERRENO	———	34'02	(7)
	PESO BALASTO	———	2'14	(8)
	SC 3 Tn/m²	———	9'46	(9)

COMBINACIONES DE ACCIONES EN ESTADO LÍMITE ÚLTIMO (EH-91 p.83)

HIPÓTESIS I no sísmica :

$$\gamma_{fg} \cdot G + \gamma_{fq} \cdot Q$$

donde $\gamma_{fg} = \gamma_{fq} = 1'60$

G = cargas permanentes totales

Q = cargas variables totales

Por tanto :

$$\gamma_{fg} \cdot G + \gamma_{fq} \cdot Q = 1'60 \times [(1)+(2)+(3)+(4)+(5)+(6)]$$

$N_d^I = 149'33$ Tn/m

$M_d^I = 367'65$ m Tn/m

HIPÓTESIS III sísmica :

$$0'8 \times (\gamma_{fg} \cdot G + \gamma_{fq} \cdot Q_{eq}) + F_{eq}$$

donde $\gamma_{fg} = \gamma_{fq} = 1'60$

G = cargas permanentes totales

Q_{eq} = 60% de las cargas variables totales

F_{eq} = valor característico de la acción sísmica

Por tanto la expresión anterior equivale a :

$$1'28 \times [(1)+(3)+(4)+(5)+0'60(2)+0'60(6)] + (7)+(8)+0'60(9)$$

$N_d^{III} = 111'16$ Tn/m

$M_d^{III} = 300'06$ m Tn/m

ARMADO DE LA SECCIÓN DE EMPOTRAMIENTO *

• Esfuerzos de cálculo **:

$N_d^I = 149'33$ Tn $N_d^{III} = 111'16$ Tn

$M_d^I = 367'65$ mTn $M_d^{III} = 300'06$ mTn

** referidos al cdg de la sección

• Armaduras mínimas :

Art. 38.1 (EH-91)

armadura tracción As | $A_c = 2\ m^2$; $f_{cd} = 1500\ Tn/m^2$

armadura compresión A's | $d = 1'95$ m $d' = 0'05$; $f_{yd} = 4'435\ Tn/cm^2$

- si $A_s \cdot f_{yd} < 0'04 \cdot F_{cd} \cdot A_c = 120$ Tn

se dispondrá $\alpha \cdot A_s \cdot f_{yd}$ donde $\alpha = 1'5 - 12'5 \cdot \frac{A_s \cdot f_{yd}}{A_c \cdot f_{cd}}$

$$\alpha = 1'5 - 12'5 \cdot \frac{A_s f_{yd}}{3000} = 1'5 - \frac{A_s \cdot f_{yd}}{240}$$

- armadura mínima de compresión $A'_s \cdot f_{yd} \geq 0'05 \cdot N_d$

Art. 38.3 (EH-91)

cuantías geométricas mínimas para acero AEH-500 :

- horizontal 1'6 ‰ s/Aa = .320 cm²/ml total ambas caras (φ16 a 0'125)
- vertical 0'9 ‰ s/Ac → 18 cm²/ml total ambas caras
  (mínimo 6 cm²/ml en una cara = 26'61 Tn)

* Se prescinde del empuje de tierras en el intradós.

• Método del momento tope para flexión compuesta (EH-91 p. 257):

$M_d^I / N_d^I = 2'462$ m ; $e^I = 2'462 + 0'95 = 3'412$ m

$M_d^{III} / N_d^{III} = 2'699$ m ; $e^{III} = 2'699 + 0'95 = 3'649$ m

- Armadura mínima de compresión :

	(caso I)	(caso III)
$U_{s2} \geq U_{s\,min} = MAX \begin{cases} 0'05\, N_d \\ \dfrac{N_d \cdot e - 0'35 \cdot U_c \cdot d}{d - d'} \end{cases}$	7'47 Tn	5'56 Tn
	0	0

donde $U_c = f_{cd} \cdot b \cdot d = 2925$ Tn ; $0'04 \cdot U_c = 117$ Tn

por mínima geométrica se toma $U_{s2} = 26'61$ Tn → 6 cm²/ml

disponiéndose 4φ16 pml = 8'05 cm²/ml = 35'68 Tn = U_{s2}

- Armadura de tracción :

$$U_{s1} = U_c \left[1 - \sqrt{1 - 2 \cdot \frac{N_d \cdot e - U_{s2} \cdot (d - d')}{U_c \cdot d}} \right] + U_{s2} - N_d$$

(caso I) $U_{s1}^I = 122'40$ Tn $\not< 0'04 \cdot U_c$

(caso III) $U_{s1}^{III} = 103'23$ Tn $< 0'04 \cdot U_c$ → $U_{s1}^{III} = 117$ Tn

corrección por Art. 38.1 (EH-91) :

$U_{s1}^{III} = 117$ Tn < 120 Tn

$\alpha = 1'013$ $\alpha U_{s1} = 118'46$ Tn

por tanto $U_{s1} = 122'40$ Tn = 27'60 cm²/ml

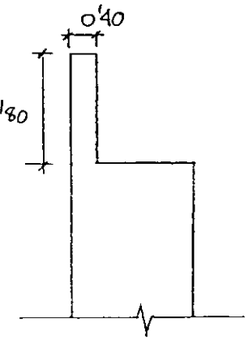
disponiéndose φ25 a 0'15

ARMADURA FINAL SECCIÓN EMPOTRAMIENTO.-

TRASDÓS	VERTICAL	∅25 c./0'15	(32'73 cm²/ml)
INTRADÓS	VERTICAL	∅16 c./0'25	(8'04 cm²/ml)
TRASDÓS	HORIZONTAL	∅16 c./0'125	(16'09 cm²/ml)
INTRADÓS	HORIZONTAL	∅16 c./0'125	(16'09 cm²/ml)

ESTRIBO-1. ARMADURAS EN CORONACIÓN MURO FRONTAL

FORMAS Y MATERIALES



hormigón H-250 f_{ck} = 250 Kp/cm² γ_c = 1'5/0'9

acero AEH-500 f_{yk} = 5100 Kp/cm² γ_s = 1'15

f_{cd} = 1500 Tn/m²

f_{yd} = 4'435 Tn/cm²

ACCIONES (por metro lineal)

EMPUJES DE TIERRAS:-

e_1 = peso tierras = $\frac{1}{2} \times 2'0 \times 1'80^2 \times 0'271 = 0'88$ Tn/ml a 0'60 m. = 0'53 mTn

e_2 = peso camino = $0'684 \times 1'80 \times 0'271 = 0'33$ Tn/ml a 0'90 m. = 0'30 mTn

e_3 = sc 3 Tn/m² = $3'0 \times 1'80 \times 0'271 = 1'46$ Tn/ml a 0'90 m. = 1'31 mTn

• Acción sísmica:

Δe_1 = 0'15 Tn/ml a 1'08 m. = 0'16 mTn

Δe_2 = 0'05 Tn/ml a 1'08 m. = 0'05 mTn

Δe_3 = 0'24 Tn/ml a 1'08 m. = 0'26 mTn

CÁLCULO ARMADURAS:-

Hipótesis no sísmica: $Md = 1'60 \times (0'53 + 0'30 + 1'31) = 3'42$ mTn

Hipótesis sísmica: $Md = 1'28 \cdot (0'53 + 0'30 + 0'6 \cdot 1'31) + 0'37 = 2'44$ mTn

$b = 1\ m.$
$h = 0'40\ m.$
$d = 0'35\ m.$
$\Big\}\ U_c = 525\ T_n\ ;\ 0'04 U_c = 21'00\ T_n$

$U_{s1} = 21'0\ T_n \rightarrow A_{nec} = 4'74\ cm^2/ml$

• Armaduras mínimas :

horizontal $1'6\ ‰\ s/A_c = 6'40\ cm^2/ml$ total ambas caras
$\phi 12\ c/0'25$ ambas caras

vertical $0'9\ ‰\ s/A_c = 3'60\ cm^2/ml$ total ambas caras

ARMADURAS QUE SE DISPONEN

TRASDÓS VERTICAL : $\phi 25\ c/0'30$ ($16'36\ cm^2/ml$)
(llega desde la base del muro frontal)

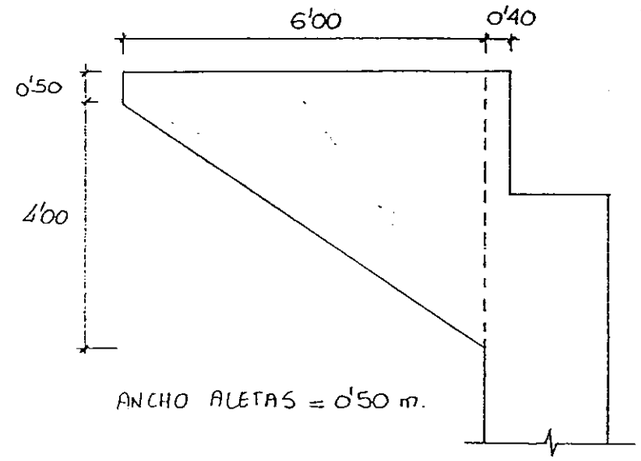
INTRADÓS VERTICAL : $\phi 12\ c/0'25$ ($4'52\ cm^2/ml$)

TRASDÓS HORIZONTAL : $\phi 12\ c/0'25$ ($4'52\ cm^2/ml$)

INTRADÓS HORIZONTAL : $\phi 12\ c/0'25$ ($4'52\ cm^2/ml$)

4.- ESTRIBO-1. ARMADURAS EN ALETAS.

FORMAS Y MATERIALES



hormigón	H-250	$F_{ck} = 250\ Kp/cm^2$	$\gamma_c = 1'50/0'9$	$f_{cd} = 1500\ T_n/m^2$
acero	AEH-500	$f_{yk} = 5100\ Kp/cm^2$	$\gamma_s = 1'15$	$f_{yd} = 4'435\ T_n/cm^2$

ACCIONES

FLEXIÓN EN EL PLANO VERTICAL :

• PESO PROPIO DE LA ALETA :

$$PP = 2'50 \times 0'50 \times \left(0'50 \times 6'00 + \frac{1}{2} \times 6'00 \times 4'00\right) =$$
$$= 2'50 \times 0'50 \times \left(3'00 + 12'00\right) = 18'75\ T_n$$

$$cdg_{PP} = \frac{3'00 \times 3'00 + 2 \times 6 \times 12'00}{15'00} = 2'20\ m.$$

$$M_{PP} = 1'60 \times 18'75 \times 2'20 = 66'00\ mT_n$$

• CARGA DE 6 Tn EN PUNTO MÁS DESFAVORABLE :

$M_{6Tn} = 1'60 \times 6'00 \times 6'00 = 57'60$ mTn

• IMPOSTA Y BARANDILLA :

peso baraudilla ≃ 0'063 Tn/ml
peso imposta ≃ 0'627 Tn/ml
} 0'69 Tn/ml ≃ 0'70 Tn/ml

$M_{imp+bar} = 1'60 \times 0'70 \times 6'00 \times 3'00 = 20'16$ mTn

• CÁLCULO DE ARMADURA :

$Md = 66'00 + 57'60 + 20'16 = 143'76$ mTn

b = 0'50 m.
h = 4'50 m.
d = 4'45 m.
} $Uc = fcd \cdot b \cdot d = 3337'5$ Tn ; $0'04 Uc = 133'5$ Tn

$Us1 = 32'46$ Tn $< 0'04 \cdot fcd \cdot Ac = 135$ Tn

$Us1 = \frac{32'46}{4'435} \times \left(1'5 - 12'5 \cdot \frac{32'46}{3375}\right) = 10'10$ cm² 3ϕ25

FLEXIÓN EN EL PLANO HORIZONTAL :

• EMPUJE DE TIERRAS DEL TRASDÓS DE LA ALETA :

$e_1 = \frac{1}{2} \times 2'0 \times 0'50^2 \times 0'271 \times 6'00 = 0'41$ Tn a 3'0 metros

$e_2 = \frac{1}{2} \cdot 4'0 \cdot 6'0 \cdot 2'0 \cdot 0'5 \cdot 0'271 = 3'25$ Tn a 2'0 metros

$e_3 = \frac{1}{3} \cdot \frac{1}{2} \cdot 4'0 \times 6'0 \cdot 2'0 \cdot 4'0 \cdot 0'271 = 8'67$ Tn a 1'75 metros

$M = 0'41 \times 3'0 + 3'25 \cdot 2'0 + 8'67 \cdot 1'75 = 22'90$ mTn

• EMPUJE POR CAMINO DE RODADURA (0'684 Tn/m²) :

$e_4 = 0'684 \times 0'271 \times 15'00 = 2'78$ Tn a 2'20 metros

$M = 2'78 \times 2'20 = 6'12$ mTn

• EMPUJE POR SC 3 Tn/m² :

$e_5 = 3'0 \times 0'271 \times 15'00 = 12'20$ Tn a 2'20 metros

$M = 12'20 \times 2'20 = 26'83$ mTn

• ACCIÓN SÍSMICA :

$\Delta e_1 = 0'07$ Tn a 3'0 metros

$\Delta e_2 = 0'54$ Tn a 2'0 metros

$\Delta e_3 = 1'44$ Tn a 2'0 metros

$\Delta M = 4'17$ mTn

• CÁLCULO DE ARMADURA :

hipótesis no sísmica : $Md = 1'60 \times (22'90 + 6'12 + 26'83) = 89'36$ mTn

hipótesis sísmica : $Md = 1'28 \times (22'90 + 6'12 + 0'6 \times 26'83) + 3'02 = 60'77$ mTn

Md = 89'36 mTn

b = 4'5 m.
h = 0'50 m.
d = 0'45 m.
} $Uc = 3037'5$ Tn ; $0'04 Uc = 121'50$ Tn

$Us1 = 205'53$ Tn → $Anec = 46'34$ cm²/4'5 m = 10'30 cm²/ml

ϕ20 a 0'25

ARMADURAS

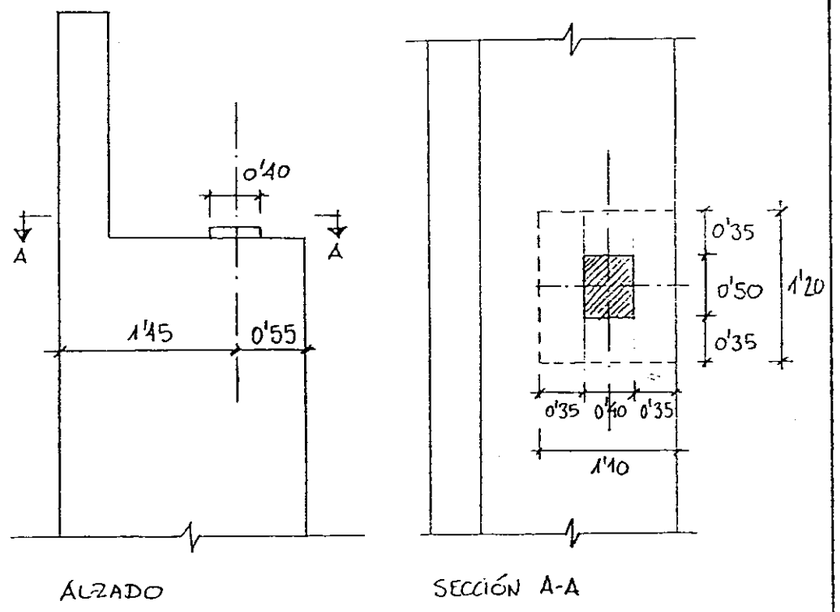
- Mínima vertical: 1'6‰ s/Ac = 8'00 cm²/ml total ambas caras
  Ø12 c/0'20 ambas caras
- Mínima horizontal: 0'9‰ s/Ac = 4'50 cm²/ml total ambas caras (se cumple)

RESUMEN DE ARMADURAS EN ALETA

TRASDÓS HORIZONTAL	:	Ø20 c/0'25	(12'57 cm²/ml)
INTRADÓS HORIZONTAL	:	Ø12 c/0'20	(5'66 cm²/ml)
VERTICAL	: cercos	Ø12 c/0'20	(2x5'66 cm²/ml)
BORDE SUPERIOR	:	3Ø25	(14'73 cm²)
BORDE INFERIOR	:	3Ø16	(6'03 cm²)

5.- ESTRIBO - 1. ARMADURA POR CARGAS CONCENTRADAS

APOYOS DEL TABLERO



- Axil máximo transmitido al apoyo por el tablero:

$$N_d = 1'60 \cdot (97'70 + 39'80 + 9'50 + 122'60 + 24'90) = 471'20\ T_n$$

$$0'3 \cdot 471'20 \cdot \left(\frac{1'10 - 0'40}{1'10}\right) = 89'96\ T_n \rightarrow 20'28\ cm^2 \quad 7Ø20$$

$$0'3 \cdot 471'20 \cdot \left(\frac{1'20 - 0'50}{1'20}\right) = 82'46\ T_n$$

- Se dispone entonces una parrilla de 7Ø20 por sentido bajo cada apoyo del tablero.

6.- ESTRIBO-1. CIMENTACIÓN POR PILOTES.

MATERIALES (encepado)

hormigón H-250 $\gamma_c = 1'50$

acero AEH-500 $\gamma_s = 1'15$

$f_{ck} = 250\ Kp/cm^2$ $f_{cd} = 1666'67\ Tn/m^2$

$f_{yk} = 5100\ Kp/cm^2$ $f_{yd} = 4'435\ Tn/cm^2$

ACCIONES SOBRE EL PILOTAJE (sobre cabezas de pilotes)

- Vamos a evaluar las acciones que llegan al cdg de la cara inferior del encepado:
  - Acciones indicadas en la página 10 del presente cálculo.
  - Peso de tierras sobre encepado en trasdós e intradós de estribo.
  - Sobrecargas de 3 Tn/m^2 sobre planta del encepado en trasdós de estribo
  - Peso propio del encepado.

PESO DE TIERRAS EN TRASDÓS:-

$\gamma = 2'0\ Tn/m^3$

ancho del encepado = 14'5 m.

$N_{tierras} = 2'0 \times 14'5 \times 2'30 \times 10'798 = 720'23\ Tn$

El camino de rodadura ejerce 0'684 Tn/m^2 en la coronación del muro, de área $2'30 \times 14'00\ m^2$:

$$N = 0'684 \times 2'30 \times 14'00 = 22'02\ Tn$$

SOBRECARGA 3 Tn/m^2 EN TRASDÓS:-

$$N_{Sc} = 3'0 \times 13'70 \times 2'30 = 94'53\ Tn$$

PESO PROPIO DEL ENCEPADO:-

$$N_{euc} = 2'50 \times 14'50 \times 7'50 \times 2'00 = 543'75\ Tn.$$

PESO DE TIERRAS EN INTRADÓS:-

$\gamma = 2'0\ Tn/m^3$ ancho del encepado = 14'5 m.

$$N = 2'0 \times 14'5 \times \left(4'50 \times 1'50 + 3'367 \times 1'70 + \frac{1}{2} \times 1'70 \times 1'133\right) =$$

$$= 195'75 + 165'99 + 27'94 = 389'68\ Tn$$

ESFUERZOS CARACTERÍSTICOS EN CDG DE CARA INFERIOR DEL ENCEPADO

		AXIL (Tn)	MOMENTO (mTn)	Hloug (Tn)	
TABLERO	CARGAS PERM.	343'80	189'09	17'19	(1)
	SOBREC. MAX.	222'20	122'21	11'11	(2)
	PP ESTRIBO	712'54	-320'64	———	(3)
EMPUJES	PESO TERRENO	———	2423'92	432'92	(4)
	PESO BALASTO	———	202'73	27'40	(5)
	SC 3 Tn/m²	———	890'00	120'29	(6)
PESOS	PESO TIERRAS	720'23 + 389'68	-1872'60 + 808'96	———	(7)
	PESO BALASTO	22'02	-57'25	———	(8)
	SC 3 Tn/m²	94'53	-245'78	———	(9)
	PP ENCEPADO	543'75	———	———	(10)
EMPUJE SÍSMICO (INCREMENTO)	PESO TIERRAS	———	609'85	71'93	(11)
	PESO BALASTO	———	38'33	4'52	(12)
	SC 3 Tn/m²	———	169'60	20'00	(13)

COMBINACIONES DE ACCIONES EN ESTADO LÍMITE DE SERVICIO (EH-91 p.81)

HIPÓTESIS I no sísmica :

$$\gamma_{Fg} \cdot G + \gamma_{Fq} \cdot Q \qquad \text{con} \quad \gamma_{Fg} = \gamma_{Fq} = 1'0$$

por tanto :

$$\gamma_{Fg} \cdot G + \gamma_{Fq} \cdot Q = \Sigma ((1) \text{ a } (10))$$

$$\begin{cases} N^{I} = 3048'75 \text{ Tn} \\ M^{I} = 2140'64 \text{ mTn} \\ H_{loug}^{I} = 608'91 \text{ Tn} \end{cases}$$

HIPÓTESIS III sísmica :

$$0'8 \cdot (\gamma_{Fg} \cdot G + \gamma_{Fq} \cdot Q) + F_{eq} \qquad \text{con} \quad \gamma_{Fg} = \gamma_{Fq} = 1'0$$

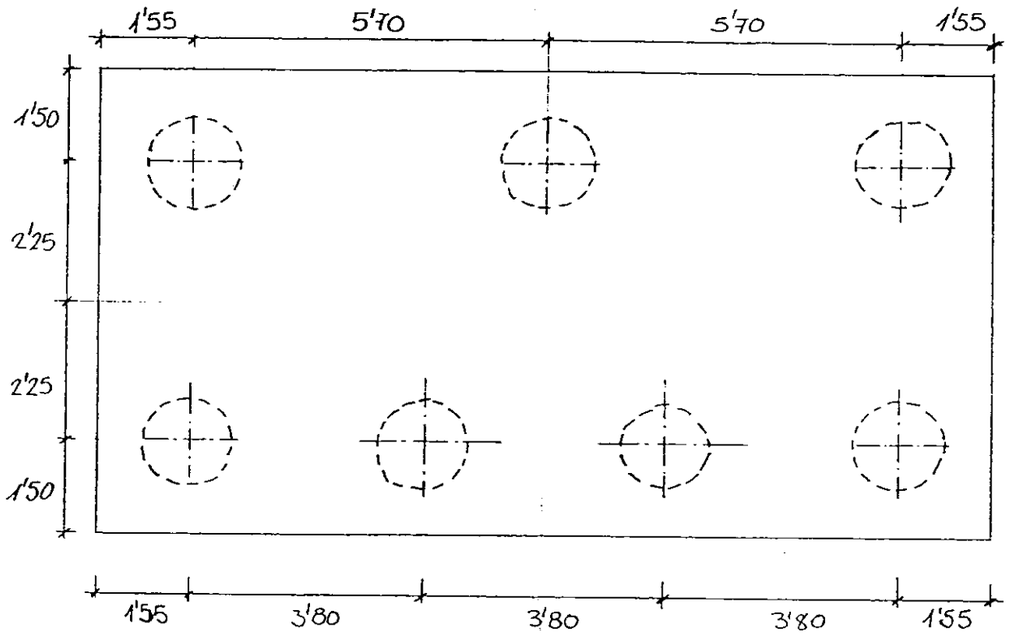
por tanto equivale a :

$$0'80 \cdot [(1)+(3)+(4)+(5)+(7)+(8)+(10)+0'60\,(2)+0'60(6)+0'60(9)] +$$
$$+ (11) + (12) + 0'60(13)$$

$$\begin{cases} N^{III} = 2337'65 \text{ Tn} \\ M^{III} = 2217'19 \text{ mTn} \\ H_{loug}^{III} = 533'53 \text{ Tn} \end{cases}$$

REPARTO DE CARGAS A CABEZA DE PILOTES

• La planta del encepado es la siguiente:



• Se disponen 7 pilotes circulares de las siguientes características:

diámetro 1'50 m. $I_p = \frac{\pi \phi^4}{64} = 0'24850489\ m^4$

hormigón H-200 $E_p = 3.10^6\ Tn/m^2$

• La longitud reducida de pilotes en pórtico equivalente (Oteo, 1973) será:

$$L^r = 1'2 \sqrt[4]{\frac{E_p I_p}{E/3}}$$ E = cte. en toda la longitud

donde E = módulo de deformación del terreno = 1920 Tn/m^2
(valor ponderado entre limos yesíferos blandos y compactos)

$L^r = 7'00$ m.

• Las cargas verticales máxima y mínima por pilote son:

$$N_{max} = \frac{N}{7} + \frac{M}{7 \times 2'25} + \frac{H \times (L^r/2)}{7 \times 2'25} \qquad (1)$$

$$N_{min} = \frac{N}{7} - \frac{M}{7 \times 2'25} - \frac{H \times (L^r/2)}{7 \times 2'25} \qquad (2)$$

las fórmulas (1) y (2) se han deducido a partir de "Curso aplicado de cimentaciones" Vol. II. Operando queda:

$$N_{max} = \frac{N}{7} + \frac{M}{15'75} + \frac{H}{4'50}$$

$$N_{min} = \frac{N}{7} - \frac{M}{15'75} - \frac{H}{4'50}$$

HIPÓTESIS I no sísmica:

$N_{max} = 706'76$ Tn $< Q_{max} = \frac{\pi \times 1'50^2}{4} \times 400 = 706'86$ Tn

$N_{min} = 164'31$ Tn

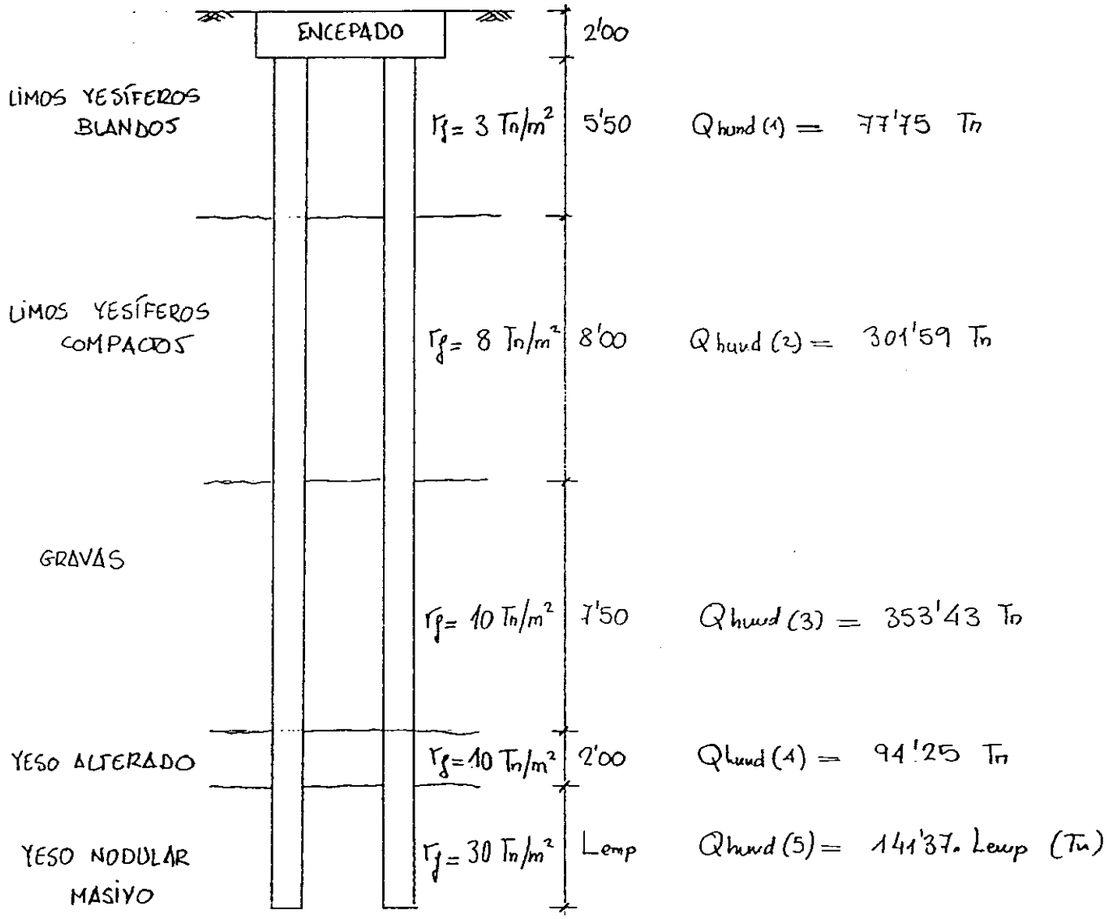
↓ tope estructural 40 kg/cm²

HIPÓTESIS III sísmica:

$N_{max} = 593'29$ Tn

$N_{min} = 74'61$ Tn

LONGITUD DE PILOTES



$$Q_{adm} = \frac{Q_{hund.}}{F} - Q_N$$

donde: Q_N = rozamiento negativo = $0'25 \cdot \pi \cdot \phi \cdot \frac{\gamma L_{(1)}^2}{2}$ (en limos yesif. blandos)

con $\gamma = 1'70$ Tn/m³ y $L_{(1)} = 5'50$ m. queda

Q_N = 30'29 Tn

$Q_{hund} = \pi \phi \Sigma r_{fi} L_i$ = 77'75 + 301'59 + 353'43 + 94'25 +
+ 141'37. Lemp = 827'02 + 141'37. Lemp

F = 2'5 (coeficiente de seguridad)

por tanto:

Q_{adm} = 330'81 + 56'55. Lemp − 30'29 = 300'52 + 56'55. Lemp

haciendo $Q_{adm} = T_e$ = 706'86 Tn

quedará:

706'86 = 300'52 + 56'55. Lemp

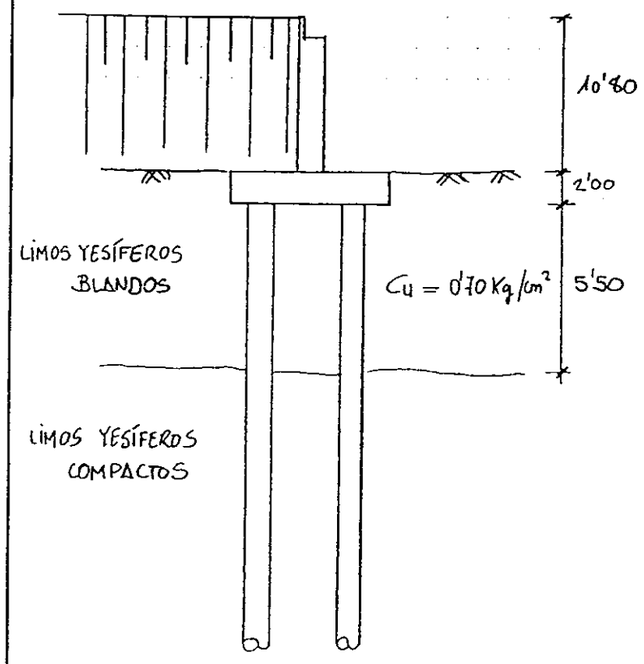
Lemp = 7'19 metros (< 3ϕ = 4'50 m.)

Y la longitud total del pilote será:

L = 5'50 + 8'00 + 7'50 + 2'00 + 7'19 = 30'19 m.

tomaremos **Lpilote = 30'5 metros**

EMPUJE LATERAL SOBRE PILOTES



- Relleno del trasdós:

$\gamma = 2'0$ Tn/m³

$H = 10'80$ m.

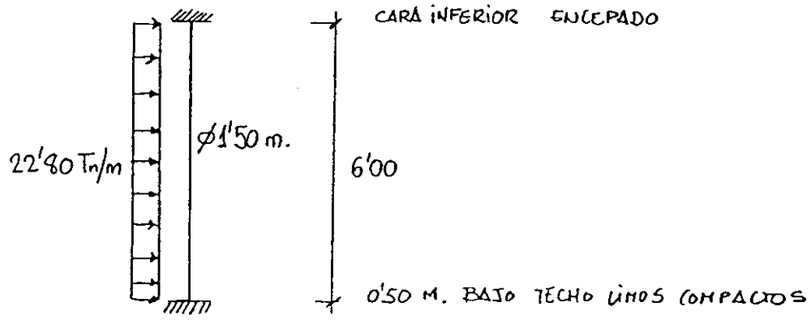
$P_v = \gamma H = 21'60$ Tn/m²

- De acuerdo con el Informe Geotécnico:

$P_h = P_v - 2C_u = 21'60 - 2 \times 7'0 = 7'60$ Tn/m²

$P_l = P_h \cdot 2\phi = 7'60 \times 2 \times 1'50 = 22'80$ Tn/ml

- El modelo equivalente de cálculo será:



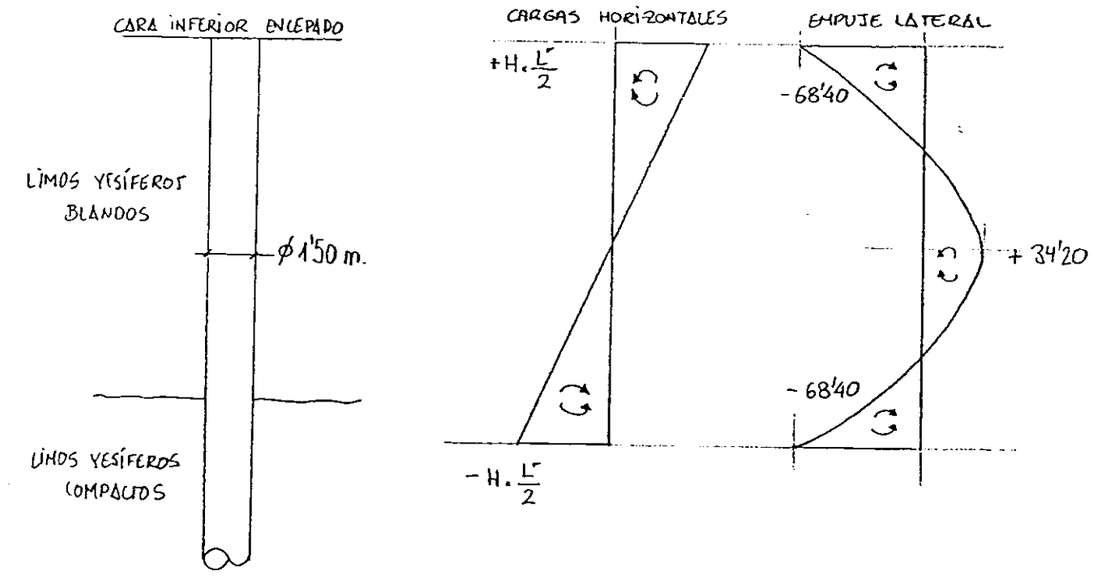
- Los momentos flectores y cortantes máximos por empuje lateral son:

empotramientos $\frac{22'80 \cdot 6'00^2}{12} = 68'40$ mTn ; $Q = 68'40$ Tn

centro estrato blando $\frac{22'80 \cdot 6'00^2}{24} = 34'20$ mTn

ESFUERZOS SOBRE LOS PILOTES (TOTALES)

MOMENTOS FLECTORES (mTn)



donde $L' = 7'0$ m.

H = carga horizontal en cabeza de pilote = $\begin{cases} 46'99 & \text{no sísmica} \\ 76'22 & \text{sísmica} \end{cases}$

por tanto, para cargas horizontales:

no sísmica 304'47 mTn.

sísmica 266'77 mTn

y los axiles máximos concomitantes son:

no sísmica 164'31 Tn (I)

sísmica 74'61 Tn (III)

• Las hipótesis pésimas de cálculo del pilote son así: (sin mayorar)

$M^I = 304'47 + 68'40 = 372'87$ mTn ; $M^{III} = 266'77 + 68'40 = 335'17$ mTn

$N^I = 164'31$ Tn ; $N^{III} = 74'61$ Tn

$Q^I = 86'99 + 68'40 = 155'39$ Tn ; $Q^{III} = 76'22 + 68'40 = 144'62$ Tn

• Adoptando $\gamma_f = 1'60$, los esfuerzos de cálculo son:

	HIP. NO SÍSMICA	HIP. SÍSMICA
Md (mTn)	596'59	536'27
Nd (Tn)	262'90	119'38
Qd (Tn)	248'62	231'39

ARMADURA DE PILOTES.-

hormigón H-200 $\gamma_c = 1'50/0'9$ $F_{cd} = 1200$ Tn/m²

acero AEH-500 $\gamma_s = 1'15$ $F_{yd} = 4'435$ Tn/cm²

$A_c = \frac{\pi \phi^2}{4} = 1'7671$ m²

• Las dos hipótesis se han calculado con el "PRONTUARIO INFORMÁTICO DEL HORMIGÓN", cuyos listados se adjuntan:

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TN4

Obra : ZARAGOZA-LERIDA.SUBTRAMO I. ESTRUCTURA E-1.ESTRIBO-1.PILOTES
Fecha: 10/3/1997
Hora : 13:38

CALCULO DE SECCIONES CIRCULARES A FLEXION COMPUESTA RECTA

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
Gc = 1.67
Gs = 1.15

- Sección

ø Sección [cm] = 150.00
r [cm] = 5.0
nº de redondos = 43

2. Dimensionamiento

Nd [Mp] = 262.90
Md [m·Mp] = 596.59

Plano de deformación de agotamiento

x [cm] = 55.2
1/r [1/m]·1.E-3 = 6.34
Deformación s ·1.E-3 = 3.50
Deformación i ·1.E-3 = -6.01

Deformacion y tensión de armaduras superior e inferior

Profundidad [cm]	Deformación ·1.E-3	Tensión [kp/cm²]
5.0	3.18	4434.8
145.0	-5.69	-4434.8

Propuesta armadura dimensionamiento

Aest [cm²]	øest [mm]	A [cm²]	ø [mm]	Nu [Mp]	Mu [m·Mp]
210.9	25.0	211.1	25	263.0	596.7

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TN4

Obra : ZARAGOZA-LERIDA.SUBTRAMO I. ESTRUCTURA E-1.ESTRIBO-1.PILOTES
Fecha: 10/3/1997
Hora : 13:39

CALCULO DE SECCIONES CIRCULARES A FLEXION COMPUESTA RECTA

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
Gc = 1.67
Gs = 1.15

- Sección

ø Sección [cm] = 150.00
r [cm] = 5.0
nº de redondos = 43

2. Dimensionamiento

Nd [Mp] = 119.38
Md [m·Mp] = 536.27

Plano de deformación de agotamiento

x [cm] = 47.5
1/r [1/m]·1.E-3 = 7.37
Deformación s ·1.E-3 = 3.50
Deformación i ·1.E-3 = -7.55

Deformacion y tensión de armaduras superior e inferior

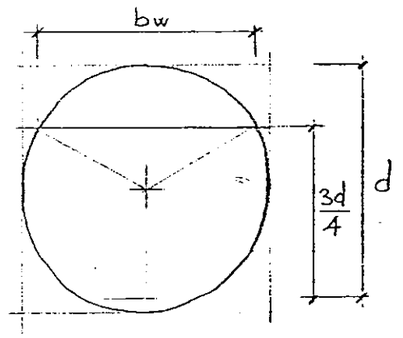
Profundidad [cm]	Deformación ·1.E-3	Tensión [kp/cm²]
5.0	3.13	4434.8
145.0	-7.18	-4434.8

Propuesta armadura dimensionamiento

Aest [cm²]	øest [mm]	A [cm²]	ø [mm]	Nu [Mp]	Mu [m·Mp]
201.3	24.4	211.1	25	124.3	558.2

- Por tanto se disponen 43ø25 desde el encepado y hasta llegar a la longitud máxima de las barras, 12 metros, con lo que desde cara inferior de encepado esta armadura llegará aproximadamente a 10 metros de profundidad.
A partir de esta profundidad se dejan 22ø25 hasta llegar a la longitud total del pilote.

- En cuanto al cortante se tiene:



ø 1'50 m.

$d = 1'45$ m.

$3d/4 = 1'088$ m.

$\frac{3d}{4} - 0'70 = 0'388$ m.

$bw = 2 \cdot \sqrt{0'75^2 - 0'388^2} = 1'284$ m.

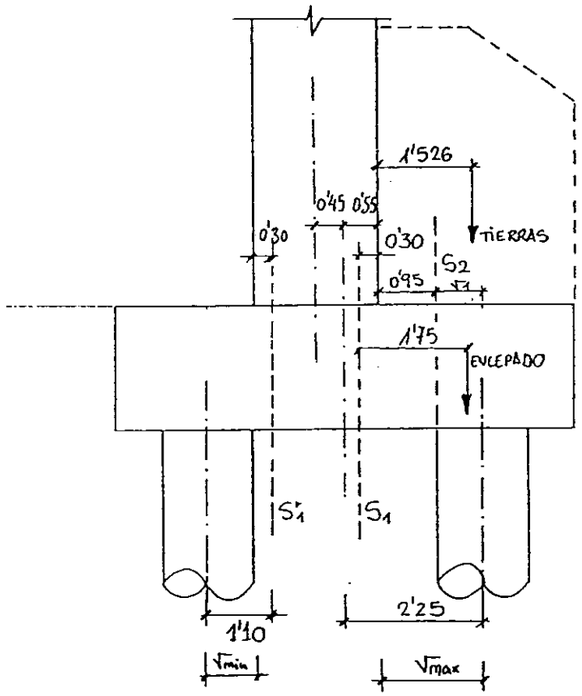
$V_{cu} = 5'0 \cdot \sqrt{120} \cdot 1'284 \cdot 1'45 = 101'98$ Tn

$A_{90^\circ} = \frac{248'62 - 101'98}{4'2 \cdot 0'9 \cdot 1'45} = 26'75$ cm²/m c.ø16 c./0'15

Esta armadura se dispondrá hasta la sección más profunda donde lleguen los 43ø25 longitudinales, pasando después a disponer como armadura transversal c.ø16 c./0'30.

ARMADURA DEL ENCEPADO

• En este caso el encepado es de tipo I (Art. 58.3 EH-91) :



$\sigma_{max} = 2'25 - 0'55 = 1'70$ m. $= \alpha \cdot h$; $h = 2'0$ m → $\alpha = 0'85$ tipo I.

CÁLCULO A FLEXIÓN.-

• La sección de referencia S1 se indica en el croquis anterior. Tiene las siguientes dimensiones :

ANCHO $= 1'55 + \frac{1'50}{2} + \frac{1'95}{2} = 3'275$ (corresponde al pilote extremo)

CANTO $= 2'0$ m ; CANTO ÚTIL $= 1'95$ m.

tiene por tanto las siguientes características mecánicas :

$b = 3'275$ m. | $f_{ck} = 250$ Kp/cm² $\gamma_c = 1'5 \rightarrow f_{cd} = 1666'67$ Tn/m²
$h = 2'0$ m | $f_{yk} = 5100$ Kp/cm² $\gamma_s = 1'15 \rightarrow f_{yd} = 4'435$ Tn/cm²
$d = 1'95$ m.

$U_c = f_{cd} \cdot b \cdot d = 10643'75$ Tn ; $0'04 U_c = 425'75$ Tn

• Los esfuerzos de cálculo se deducen a partir de las acciones que existen a la derecha de S_1 :

- peso de tierras en intradós del muro
- peso propio del encepado
- reacción máxima en pilote

• Las reacciones máxima y mínima para cálculo en estado límite último se deducen de igual forma que las de estado de servicio (págs. 12 y 13 del presente Cálculo) aplicando $\gamma_{fg} = \gamma_{fq} = 1'60$:

hipótesis I no sísmica :

$N_d^I = 4878'00$ Tn — $N_{max,d}^I = 1130'82$ Tn
$M_d^I = 3425'02$ mTn — $N_{min,d}^I = 262'89$ Tn
$H_d^I = 974'26$ Tn

hipótesis III sísmica :

$N_d^{III} = 3740'23$ Tn — $N_{max,d}^{III} = 908'90$ Tn
$M_d^{III} = 3097'55$ mTn — $N_{min,d}^{III} = 159'74$ Tn
$H_d^{III} = 800'56$ Tn

IB - 130

• El peso de las tierras de intradós es:

$$N_{tierras,d} = 1'60 \times 2'0 \times 3'275 \times \left(4'5 \times 1'5 + 3'37 \times 1'70 + \frac{1}{2} \cdot 1'7 \times 1'13\right) =$$

$$= 140'85 \text{ Tn} \qquad a \ 1'826 \text{ m. de } S_1$$

• El peso propio del encepado es:

$$N_{enc,d} = 1'60 \times 2'5 \times 3'275 \times 2'0 \times 3'5 = 91'70 \text{ Tn}$$

a 1'175 m de S_1

• Por tanto, la máxima flexión sobre S1 será:

$$M_d = 1130'82 \times 2'00 - 140'85 \times 1'826 - 91'70 \times 1'175 = 1843'97 \text{ mTn}$$

$U_{s1} = 991'84$ Tn → Anec = 223'65 cm² / 3'275 m = 68'29 cm²/mL

disponiéndose 3 x 5ϕ25 pmL como armadura inferior del encepado en sentido normal al plano del muro frontal, y a todo lo ancho del estribo, pues $\phi + d = 3'45 \geq S_{min} = 3'80$ m.

• Veamos si hace falta armadura longitudinal superior en el encepado; para ello tomamos la sección de referencia S1 indicada en el croquis anterior, con las características mecánicas siguientes:

ANCHO = $\phi + d = 1'50 + 1'20 = 2'70$ m.

CANTO ÚTIL = $\min\left(1'95 ;\ 1'50 \cdot \underbrace{\sqrt{\text{Smin}}}_{0'80}\right) = 1'20$ m.

$U_c = 5.400'00$ Tn ; $0'04 U_c = 216'0$ Tn

• Los esfuerzos de cálculo sobre S_1 serán:

peso tierras trasdós = 2'3 x 10'798 x 2'70 x 2'0 x 1'6 = 214'58 Tn
(a 1'45 m. de S_1)

peso encepado = 2'60 x 2'0 x 2'70 x 2'5 x 1'6 = 56'16 Tn
(a 1'30 m. de S_1)

peso camino rodadura = 0'684 x 2'30 x 2'70 x 1'6 = 6'80 Tn
(a 1'45 m. de S_1)

peso sc 3 Tn/m² = 3'0 x 2'30 x 2'70 x 1'6 = 29'81 Tn
(a 1'45 m de S_1)

Hipótesis I no sísmica:

$$M_d^{I} = 214'58 \times 1'45 + 56'16 \times 1'30 + 6'80 \times 1'45 + 29'81 \times 1'45 - 262'89 \times 1'10 =$$

$$= 148'06 \text{ mTn}$$

Hipótesis III sísmica:

$$M_d^{III} = 214'58 \times 1'45 + 56'16 \times 1'30 + 6'80 \times 1'45 + 0'6 \times 29'81 \times 1'45 -$$

$$- 159'74 \times 1'10 = 244'23 \text{ mTn}$$

$U_{s1}^{III} = 207'51$ Tn → Anec = 48'70 cm² / 2'70 m = 18'04 cm²/mL

18'04 cm²/ml en bandas de 2'70 m. de ancho sobre los 3 pilotes del trasdós del estribo.

Entre las bandas se dispone mínimo $\frac{1}{4}$ de la de las bandas.

- Armadura mínima longitudinal (Art. 58.8.2 EH-91)

$\rho \geq 0'0018 \frac{4100}{5100} = 0'00145$

$A_c = 14'5 \times 2'0 \times 10^4 = 290000\ cm^2 \qquad \rho A_c = 420'50\ cm^2$

$A_{s1} = 3.5\phi 25\ pml = 73'64\ cm^2/ml \times 14'5m = 1068\ cm^2 > \rho A_c$

perímetro = 33 m. $\quad 420'50/33 = 12'74\ cm^2/m \quad \phi 20\ c/o'25$ perimetrales

- Longitudinal superior : mín. $\frac{1}{10} \times 73'64 = 7'36\ cm^2/m \quad \phi 16\ c/o'25\ (8'04\ cm^2/ml)$

en zonas de bandas sobre pilotes se tiene $18'04 - 8'04 = 10'0\ cm^2/ml$, con lo que se refuerza con $\phi 20$ c./o'25

- Armadura mínima transversal

$A_c = 7'50 \times 2'0 \times 10^4 = 150000\ cm^2 \qquad \rho A_c = 217'5\ cm^2$

perímetro = 19 m. $\quad 217'5/19 = 11'45\ cm^2/m \quad \phi 20\ c/o'25$ perimetrales

A_{s1} = mínimo $\frac{1}{4} \times 73'64 = 18'41\ cm^2/ml \quad \phi 25\ c/o'25 \quad (19'64\ cm^2/ml)$

$A_{s2} = \phi 16\ c/o'25 \quad (8'04\ cm^2/ml)$

RESUMEN DE ARMADURAS HORIZONTALES :-

LONGITUDINAL	INFERIOR	:	$3 \times \phi 25\ c/o'20$	$(73'64\ cm^2/ml)$
LONGITUDINAL	SUPERIOR	:	$\phi 16\ c/o'25$	$(8'04\ cm^2/ml)$
			$\phi 20\ c/o'25$ (3 bandas de 2'75 m) } $36\phi 20$	$(113'11\ cm^2)$
TRANSVERSAL	INFERIOR	:	$\phi 25\ c/o'25$	$(19'64\ cm^2/ml)$
TRANSVERSAL	SUPERIOR	:	$\phi 16\ c/o'25$	$(8'04\ cm^2/ml)$
PERIMETRAL		:	$7\phi 20$/cara	$(21'99\ cm^2/cara)$

$\text{CUANTÍA LONGITUDINAL} = \frac{73'64 \times 14'50 + 8'04 \times 14'50 + 113'11 + 2 \times 21'99}{290000} = 0'0046$

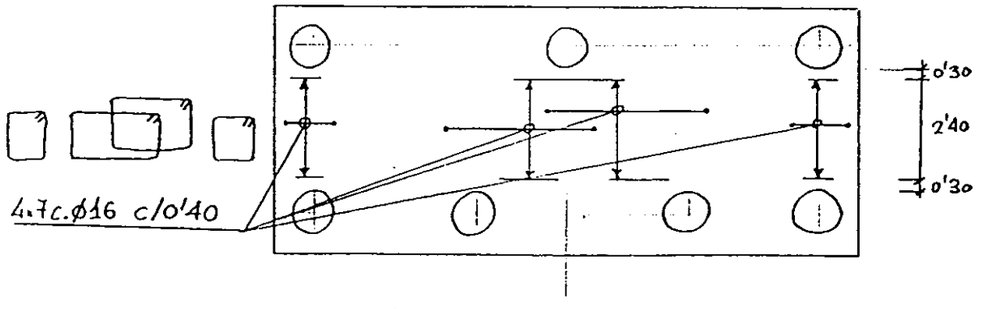
$\text{CUANTÍA TRANSVERSAL} = \frac{19'64 \times 7'50 + 8'04 \times 7'50 + 2 \times 21'99}{150000} = 0'0017$

ARMADURA DE SUSPENSIÓN :-

$\bar{N}$ = reacción máxima del muro frontal = $N_d^1 = 4878'0\ T_n$

$4878'0/1'5 \times 7 = 464'57\ T_n \rightarrow 104'75\ cm^2/8\ ramas = 13'09\ cm^2/rama$

disponiéndose 4×7 cercos $\phi 16$ entre filas de pilotes :



CÁLCULO A CORTANTE :-

- La sección de referencia S_2 se ha indicado en el croquis anterior; sus dimensiones son:

  Vuelo $\sqrt{1} = 0'75$ m.

  ANCHO $b_2 = 13'70 + 1'90 = 15'6 \not> 14'5$; ANCHO $b_2 = 14'5$ m.

- La reacción máxima en cada uno de los cuatro pilotes de la fila es:

$$N_{max,d}^{I} = 1130'82 \text{ Tn} \times 4 = 4523'28 \text{ Tn}$$

- El peso de las tierras de intradós es:

$$N_{tierras,d} = 14'5 \cdot 2'0 \cdot (0'55 \cdot 4'50 + 3'37 \cdot 1'70 + \tfrac{1}{2} \cdot 1'7 \cdot 1'13) \cdot 1'6 =$$
$$= 425'23 \text{ Tn}$$

- El peso propio del encepado es:

$$N_{enc,d} = 14'5 \cdot 2'5 \cdot 1'6 \cdot 2'0 \cdot 2'25 = 261'00 \text{ Tn}$$

- El cortante de cálculo será:

$$V_d = 4523'28 - 425'23 - 261'00 = 3837'05 \text{ Tn} / 14'5 \text{m.}$$
$$V_d = 264'62 \text{ Tn/mL}$$

comprobación de cortante:

$$V_d \leq 3 \cdot b_2 \cdot d_2 \cdot \left(1 - \frac{v}{5 \cdot d}\right) \cdot f_{cv}$$

donde:

$$f_{cv} = 0'5\sqrt{F_{cd}} = 0'5\sqrt{250/1'5} = 6'455 \text{ Kp/cm}^2$$

$b_2 = 100$ cm

$d_2 = 195$ cm

$v = 75$ cm

$d = 195$ cm

$$V_d = 264'62 \text{ Tn/mL} \leq 348'57 \text{ Tn/mL}$$

luego no es necesaria armadura de cortante en el encepado.

EL INGENIERO DE CAMINOS
COLEGIADO Nº 4351

FDO. ANTONIO MORIÑIGO RODRÍGUEZ

ESTRIBO 2 (FIJO)

PROYECTO TRV. ZARAGOZA-LERIDA
SUB-TRAMO I
ESTRUCTURA E-1

FECHA

HOJA N.º

ESTRIBO 2 (FINO)

PROYECTO
ESTRUCTURA E-1

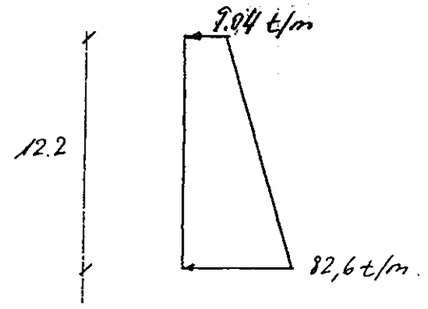
FECHA

HOJA N.º 1

ESTRIBO FNO. — (E-2)

Empuje de tierras.

$\varphi = 40^\circ$ $K_A = 0.22$



ACCIONES RESPECTO PUNTO DELANTERO ZAPATA. —

		N	H	M_A
Zapata	17,7 x 2 x 18 x 2,5 17,7 x 0,75 x 18 x 2,5	1646 t 617		15308 mt 7654
Muro frontal		1192		5960
Muro longitudinales		652		7830
Muro transversal		298		5215
Relleno hormigón		2141		25693
Tierra trasera		485		3382
Tierras laterales		606		7757
Carga permanente (estribo)		114		1482
Tablero		565		2034
Empuje de tierras			559	-1629
Frenado + reología			± 2154	∓ 21387
Empuje tierras reposo			915	- 2666

PROYECTO

ESTRUCTURA E-1

FECHA

HOJA N.° 2

H-1 .— Peso Propio + Sobrecarga + Retráctica + Frenado + E. Tierra

$N = 8016\ t \qquad H = 2713\ t$

$\gamma_d = \frac{8016 \times 0{,}475}{2713} = 1.40 > 1.35$

$M_A = 82315 - 23016 = 59299\ mt$

$e_A = 7{,}40 \qquad M_{centro} = 15.256\ mt$

$\sigma = -24{,}3 \pm 15{,}0 \begin{cases} -39{,}2\ t/m^2 & \text{Punta delantera} \\ -9{,}3\ t/m^2 & \text{Punta trasera} \end{cases}$

H-2 .— Peso Propio + Sobrecarga + Calentam - Frenado + E. Reposo.

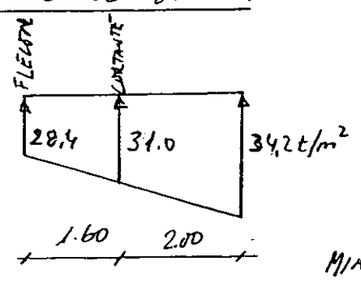
$N = 8016\ t \qquad H = 1239\ t$

$M_A = 82315 + 18721 = 101.036\ mt$

$e_A = 12.6 \qquad M_{centro} = 26487\ mt$

$\sigma = -24{,}3 \pm 26.0 \begin{cases} -50{,}3\ t/m^2 & \text{Punta trasera} \\ +1{,}7\ t/m^2 & \text{Punta delantera} \end{cases}$

ARMADO DE ZAPATA.



$M_d = 1{,}6 \times \left[28.4 \times \frac{3{,}6^2}{2} + 5{,}8 \times \frac{3.6^2}{3}\right] = 335\ mt/m$

CANTO = 2,27 m 34.8 cm²/m

MINIMA 34,1 cm²/m $\phi 25/12{,}5$

CORTANTE $V_d = 1{,}6 \times 32{,}6 \times 2 = 104\ t < 2 \times 64{,}5 \times 2.10 = 271\ t$

CANTO 2.17

NO NECESITA ARMADURA DE CORTANTE.

PROYECTO

FECHA

HOJA N.° 3

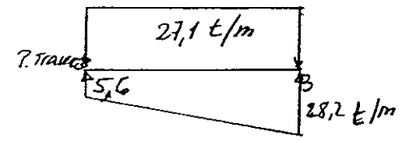
ARMADURA TRANSVERSAL INFERIOR .—

$M_d = 1{,}6 \times 29{,}4 \times \frac{2.50^2}{2} = 147\ mt$

CANTO 2.22 Armadura 15,4 cm²/m $\phi 25/25$

MINIMA 33,4 cm²

VUELO TRASERO. —



$M_d = 1{,}6 \times \left[21{,}5 \times \frac{12{,}2^2}{2} - 22.6 \times \frac{12{,}2^2}{6}\right] = 1663\ mt/m$

Por fatiga $M_d = 9812\ mt$

CANTO 11.08 m

Armadura en 3 metros superiores 233 cm²

$\phi 32/0.15$

CORTANTE TRASERO. —

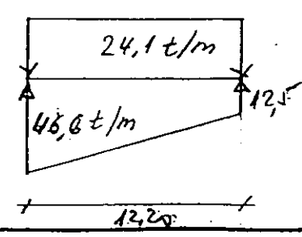
$V_d = 1{,}6\left[21.5 \times 12{,}2 - 22.6 \times \frac{12{,}2}{2}\right] = 125\ t$

Por fatiga $V_d = 738\ t$

$V_{cu} = 64{,}5 \times 11 = 710\ t$

$V_s = 28\ t$ 0,7 cm²/m total

HIPOTESIS 2 . —



$M_d = 1{,}6 \times \left[34.1 \times \frac{12{,}2^2}{3} - 11.6 \times \frac{12.2^2}{2}\right] = 1326\ mt/m$

Por fatiga $M_d = 7823\ mt$

Armadura 186 cm² 31,5 cm²/m $\phi 25/0{,}15$

PROYECTO

FECHA

HOJA N.° 4

Cortante $V_d = 1{,}6 \times \left[34{,}1 \times \frac{12{,}2}{2} - 11{,}6 \times 12{,}2\right] = 106{,}4$ t/m

Por fatiga $V_d = 628$ t

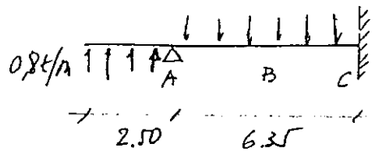
$V_{cu} = 710$ t Máxima.

ARMADURA TRANSVERSAL DE LOSA INFERIOR. (ZONA TRASERA).

Es una losa de 5,35 x 11,00. Calculamos como viga en la zona media de la losa.

Carga hacia abajo.— CANTO 2.94

$p = 8{,}2$ t/m

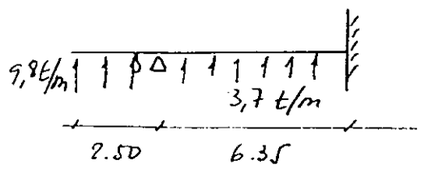


$M_A = 2{,}5$ mt/m

$M_C = -42{,}6$ mt/m $\quad M_d = 68{,}2$ mt/m $\quad 5{,}4$ cm²/m.

$M_B = 21{,}3$ mt/m

Carga hacia arriba.—



$M_A = 30{,}6$ mt/m $\quad M_d = 49{,}0 \quad 3{,}9$ cm²/m.

$M_C = 3{,}3$ mt/m

$M_B = 1{,}7$ mt/m

PROYECTO

FECHA

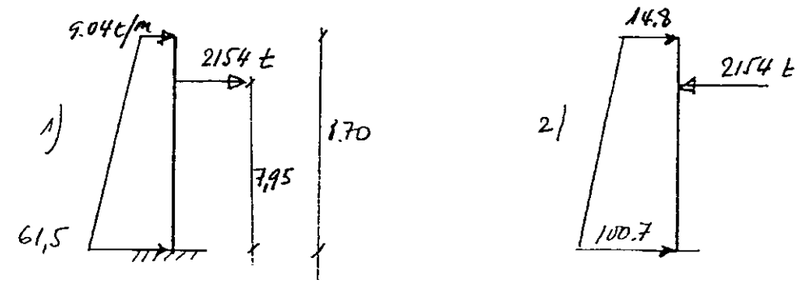
HOJA N.° 5

Vuelo transversal en parte trasera. Canto 3.50

$M_d = -1{,}6 \times 13{,}9 \times \frac{2{,}5^2}{2} = 69{,}5$ mt $\quad 14{,}6$ cm²/m superior

$M_d = 1{,}6 \times 21{,}7 \times \frac{2{,}5^2}{2} = 109$ mt $\quad 7{,}2$ cm²/m inferior.

ARMADURA DE CUERPO DE ESTRIBO Y TABIQUES.—



1) Por fatiga

$M_d = \frac{1{,}6}{3} \times \left[2154 \times 7{,}95 + 9{,}04 \times \frac{8{,}7^2}{2} + 52{,}5 \times \frac{8{,}7^2}{6}\right] = 9669$ mt

CANTO 16 metros

Tomando 3 metros como zona eficaz de armadura 150 cm²

$\phi 20/0.15$ en fatiga trasero y longitudinal

2) $M_d = 1{,}6 \times \left[2154 \times 7{,}95 - 14{,}8 \times \frac{8{,}7^2}{2} - 85{,}9 \times \frac{8{,}7^2}{6}\right] = 24769$ mt

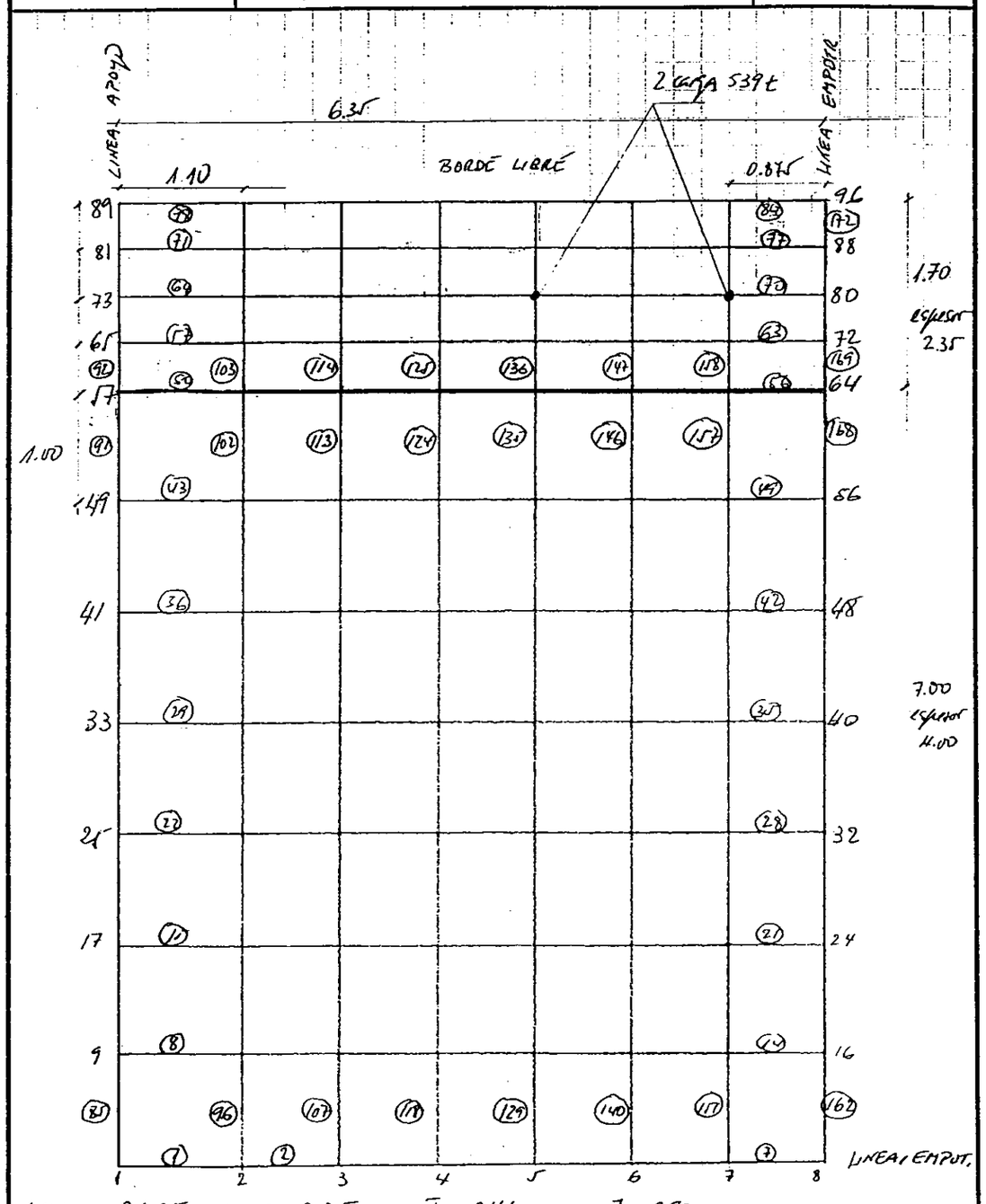
canto eficaz 13.50 $\quad 414$ cm² entre los dos cara del cuerpo del estribo.

PROYECTO

FECHA

E-1 ESTRIBO FIJO

HOJA N.° 6



PROYECTO

FECHA

HOJA N.° 7.

ARMADO DE ESPALDON.

Sentido horizontal.

$M_d = 1,6 \times 280 = 448$ mt/m 46 cm² ϕ25/0.10 sobre cara contacto

Barra 41 $M_d = 360$ mt/m 21 cm² por mínima ϕ25/0.15

42 $M_d = 140$ mt/m 8,2 cm² por mínima ϕ25/0.15

Momento en cada apoyo

$M_d = 1,6 \times 132 = 211$ mt/m 21,6 cm² por mínima ϕ25/0.15

Sentido vertical.

$H_d = 1,6 \times 112 = 179$ mt/m 18,4 cm² por mínima 24,4 cm²

CORTANTE.

Barra 70 $V_d = 1,6 \times 355 = 568$ t/m

$V_{cu} = 64,5 \times 2,30 = 148$ t

$V_s = 420$ t 48 cm²/m 5 ramas ϕ16/0.20

Barra 136 $V_d = 1,6 \times 220 = 352$ t/m

$V_s = 204$ t 23,5 cm²/m 5 ramas ϕ16/0.40

Barra 56 $V_d = 1,6 \times 340 = 544$ t

Pata de 2,35 recibe 31,5 + 92,4 = 124 t

Pata de 4,00 de canto $V_d = 420$ t

$V_{cu} = 64,5 \times 0,50 \times 3,95 = 127$ t

$V_s = 293$ t 19,6 cm² 2,5 ramas ϕ16/0.25

PROYECTO .....

FECHA .....

HOJA N.° 8

Tirón de fatiga longitudinal central.

Punto		$F_d = 2 \times 1{,}6 \times 846 = 271$ t
	96	
	88	516
	80	573
	72	408
	64	1116
	56	325

TOTAL 3149 t 710 cm² 88 ϕ32

2 capas ϕ32/0.125/cara en los 3 primeros metros.

ESTRIBO FIJO E-1
CONTROL
96 172 8 1

..JDOS

1	0.000	0.000
2	1.100	0.000
3	1.975	0.000
4	2.850	0.000
5	3.725	0.000
6	4.600	0.000
7	5.475	0.000
8	6.350	0.000
9	0.000	1.000
10	1.100	1.000
11	1.975	1.000
12	2.850	1.000
13	3.725	1.000
14	4.600	1.000
15	5.475	1.000
16	6.350	1.000
17	0.000	2.000
18	1.100	2.000
[illegible]	1.975	2.000
20	2.850	2.000
21	3.725	2.000
22	4.600	2.000
23	5.475	2.000
24	6.350	2.000
25	0.000	3.000
26	1.100	3.000
27	1.975	3.000
28	2.850	3.000
29	3.725	3.000
30	4.600	3.000
31	5.475	3.000
32	6.350	3.000
33	0.000	4.000
34	1.100	4.000
35	1.975	4.000
36	2.850	4.000
37	3.725	4.000
38	4.600	4.000
[illegible]	5.475	4.000
[illegible]	6.350	4.000
41	0.000	5.000
42	1.100	5.000
43	1.975	5.000
44	2.850	5.000
45	3.725	5.000
46	4.600	5.000
47	5.475	5.000
48	6.350	5.000
49	0.000	6.000
50	1.100	6.000
51	1.975	6.000
52	2.850	6.000
53	3.725	6.000
54	4.600	6.000
55	5.475	6.000
56	6.350	6.000
57	0.000	7.000
58	1.100	7.000
59	1.975	7.000
60	2.850	7.000
61	3.725	7.000
62	4.600	7.000
63	5.475	7.000
64	6.350	7.000
65	0.000	7.425
66	1.100	7.425
67	1.975	7.425
68	2.850	7.425
69	3.725	7.425
70	4.600	7.425
71	5.475	7.425
72	6.350	7.425
73	0.000	7.850
74	1.100	7.850
75	1.975	7.850
76	2.850	7.850
77	3.725	7.850
78	4.600	7.850
79	5.475	7.850
80	6.350	7.850
81	0.000	8.275
82	1.100	8.275
83	1.975	8.275
84	2.850	8.275
85	3.725	8.275
86	4.600	8.275
	5.475	8.275
88	6.350	8.275
89	0.000	8.700
90	1.100	8.700
91	1.975	8.700
92	2.850	8.700
93	3.725	8.700
94	4.600	8.700
95	5.475	8.700
96	6.350	8.700

:

SECCIONES
6

0.230000	0.460000	300	125
0.460000	0.920000	300	125
2.900000	5.800000	300	125
5.330000	10.670000	300	125
0.950000	1.900000	300	125
4.670000	9.330000	300	125

:

BAR[illegible]S

[illegible]	1	2	4
2	2	3	4
3	3	4	4
4	4	5	4
5	5	6	4
6	6	7	4
7	7	8	4
8	9	10	4
9	10	11	4
10	11	12	4
11	12	13	4
12	13	14	4
13	14	15	4
14	15	16	4
15	17	18	4
16	18	19	4
17	19	20	4
18	20	21	4
19	21	22	4
20	22	23	4
21	23	24	4
22	25	26	4
23	26	27	4
24	27	28	4

25	28	29	4
26	29	30	4
27	30	31	4
8	31	32	4
29	33	34	4
30	34	35	4
31	35	36	4
32	36	37	4
33	37	38	4
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36	41	42	4
37	42	43	4
38	43	44	4
39	44	45	4
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41	46	47	4
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43	49	50	4
44	50	51	4
45	51	52	4
46	52	53	4
47	53	54	4
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55	62	63	3
56	63	64	3
57	65	66	2
8	66	67	2
59	67	68	2
60	68	69	2
61	69	70	2
62	70	71	2
63	71	72	2
64	73	74	2
65	74	75	2
66	75	76	2
67	76	77	2
[illegible]	77	78	2
[illegible]	78	79	2
70	79	80	2
71	81	82	2
72	82	83	2
73	83	84	2
74	84	85	2
75	85	86	2
76	86	87	2
77	87	88	2
78	89	90	1
79	90	91	1
80	91	92	1
81	92	93	1
82	93	94	1
83	94	95	1
84	95	96	1
85	1	9	6
86	9	17	6
87	17	25	6
8	25	33	6
89	33	41	6
90	41	49	6
91	49	57	6
92	57	65	5

93	65	73	5
94	73	81	5
95	81	89	5
96	2	10	6
97	10	18	6
98	18	26	6
99	26	34	6
100	34	42	6
101	42	50	6
102	50	58	6
103	58	66	5
104	66	74	5
105	74	82	5
106	82	90	5
107	3	11	6
108	11	19	6
109	19	27	6
110	27	35	6
111	35	43	6
112	43	51	6
113	51	59	6
114	59	67	5
115	67	75	5
[illegible]	75	83	5
117	83	91	5
118	4	12	6
119	12	20	6
120	20	28	6
121	28	36	6
122	36	44	6
123	44	52	6
124	52	60	6
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126	68	76	5
127	76	84	5
128	84	92	5
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132	29	37	6
133	37	45	6
134	45	53	6
135	53	61	6
[illegible]	61	69	5
[illegible]	69	77	5
138	77	85	5
139	85	93	5
140	6	14	6
141	14	22	6
142	22	30	6
143	30	38	6
144	38	46	6
145	46	54	6
146	54	62	6
147	62	70	5
148	70	78	5
149	78	86	5
150	86	94	5
151	7	15	6
152	15	23	6
153	23	31	6
154	31	39	6
155	39	47	6
156	47	55	6
157	55	63	6
158	63	71	5
159	71	79	5
160	79	87	5

```
 161   87   95    5
 162    8   16    6
 163   16   24    6
 164   24   32    6
       32   40    6
 166   40   48    6
 167   48   56    6
 168   56   64    6
 169   64   72    5
 170   72   80    5
 171   80   88    5
 172   88   96    5
:
APOYOS
30
   1          0          0          1
   2          1          0          1
   3          1          0          1
   4          1          0          1
   5          1          0          1
   6          1          0          1
   7          1          0          1
   8          0          0          1
  16          0          1          1
  24          0          1          1
  32          0          1          1
  40          0          1          1
  48          0          1          1
  56          0          1          1
  64          0          1          1
  72          0          1          1
  80          0          1          1
  88          0          1          1
              0          1          1
              0          0          1
  17          0          0          1
  25          0          0          1
  33          0          0          1
  41          0          0          1
  49          0          0          1
  57          0          0          1
  65          0          0          1
  73          0          0          1
  81          0          0          1
  89          0          0          1
:
HIPOTESIS DE CARGA
ANCLAJES
     2
  77    0.000000    0.000000 539.000000
  79    0.000000    0.000000 539.000000
0
:
```


ESTRIBO FIJO E-1

Hip. nº 1 ANCLAJES

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	0.000097	0.000412	-0.000000
2	-0.000000	0.000007	0.000000
3	-0.000000	0.000028	0.000000
4	-0.000000	-0.000040	0.000000
5	-0.000000	-0.000063	-0.000000
6	-0.000000	-0.000054	-0.000000
7	0.000000	-0.000010	-0.000000
8	0.000004	0.000004	-0.000000
9	-0.000237	0.002481	-0.000000
10	-0.003278	0.001197	0.001728
11	-0.004529	0.000276	0.002290
12	-0.004340	-0.000644	0.002103
13	-0.003021	-0.001143	0.001347
14	-0.001373	-0.000965	0.000485
15	-0.000275	-0.000293	0.000016
16	-0.000010	0.000000	-0.000000
17	-0.000465	0.008155	-0.000000
18	-0.007435	0.005123	0.007061
19	-0.010893	0.001688	0.009930
20	-0.011238	-0.001906	0.009738
21	-0.008725	-0.004210	0.006996
22	-0.004775	-0.004176	0.003323
23	-0.001414	-0.002060	0.000687
24	-0.000107	-0.000000	-0.000000
25	-0.000917	0.019251	-0.000000
26	-0.014249	0.013483	0.017862
27	-0.021627	0.005589	0.026097
28	-0.023424	-0.003436	0.026861
29	-0.019313	-0.010189	0.020685
30	-0.011355	-0.011601	0.010989
31	-0.003649	-0.007030	0.002836
32	-0.000273	-0.000000	-0.000000
33	-0.001635	0.038506	-0.000000
34	-0.024689	0.029165	0.037353
35	-0.038852	0.014349	0.056361
36	-0.044165	-0.004312	0.060510
37	-0.038562	-0.020474	0.049206
38	-0.024117	-0.026630	0.028049
39	-0.008217	-0.018408	0.007977
40	-0.000637	-0.000000	-0.000000
41	-0.002518	0.068489	-0.000000
42	-0.038413	0.055820	0.069091
43	-0.063241	0.032055	0.107794
44	-0.076319	-0.001558	0.120975
45	-0.071506	-0.035591	0.103978
46	-0.048442	-0.054340	0.063340
47	-0.017762	-0.042621	0.019420
48	-0.001304	-0.000000	0.000000
49	-0.003824	0.109359	0.000000
50	-0.052867	0.096242	0.115098
51	-0.091474	0.064157	0.186255
52	-0.119293	0.011596	0.219998

53	-0.121859	-0.052764	0.201331
54	-0.090790	-0.099787	0.132322
55	-0.037814	-0.090834	0.044424
56	-0.003100	-0.000000	0.000000
57	-0.003406	0.152866	0.000000
58	-0.063030	0.146316	0.173468
59	-0.114322	0.111319	0.290904
60	-0.162285	0.043821	0.364147
61	-0.184271	-0.065681	0.357815
62	-0.141776	-0.160207	0.251773
63	-0.069534	-0.168661	0.095626
64	-0.005182	-0.000000	0.000000
65	-0.000266	0.184087	0.000000
66	-0.073099	0.177374	0.202473
67	-0.138085	0.144468	0.344975
68	-0.213637	0.080873	0.446045
69	-0.281680	-0.070684	0.461773
70	-0.203519	-0.201749	0.328110
71	-0.122941	-0.230123	0.138942
72	-0.001263	-0.000000	0.000000
73	-0.001206	0.212321	-0.000000
74	-0.079472	0.208436	0.234981
75	-0.148127	0.178189	0.406186
76	-0.216444	0.116133	0.538965
77	-0.247974	-0.075271	0.580697
78	-0.193256	-0.243831	0.414597
79	-0.086421	-0.290059	0.187957
80	-0.001690	-0.000000	0.000000
81	-0.001011	0.237064	0.000000
82	-0.082362	0.238815	0.269442
83	-0.148737	0.209139	0.469552
84	-0.198868	0.133965	0.627645
85	-0.182600	-0.081198	0.669262
86	-0.158077	-0.282592	0.489572
87	-0.035327	-0.340167	0.210028
88	-0.000279	-0.000000	0.000000
89	-0.001093	0.251974	0.000000
90	-0.083103	0.260531	0.304661
91	-0.147586	0.229482	0.532588
92	-0.190517	0.139986	0.710231
93	-0.171037	-0.087140	0.743645
94	-0.143739	-0.308494	0.553279
95	-0.031954	-0.370365	0.223528
96	-0.000628	-0.000000	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	-0.00	0.00	-4.49
2	5.22	0.00	4.38
3	6.56	0.00	1.01
4	5.52	0.00	0.01
5	2.86	0.00	-2.57
6	0.23	0.00	-4.04
7	-0.64	0.00	-2.78
8	0.00	-0.00	-0.12
16	0.00	-0.87	-4.14
24	0.00	1.08	-8.35
32	-0.00	9.85	-11.30

40	-0.00	32.69	-10.84
48	-0.00	87.58	1.44
56	-0.00	224.69	101.57
64	-0.00	316.58	348.91
72	0.00	77.67	127.64
80	-0.00	111.78	160.24
88	-0.00	119.84	161.35
96	-0.00	62.46	84.59
9	-0.00	0.00	-8.98
17	0.00	0.00	-9.20
25	0.00	-0.00	-11.89
33	0.00	0.00	-11.52
41	-0.00	-0.00	-8.00
49	0.00	-0.00	21.62
57	-0.00	0.00	95.96
65	0.00	0.00	25.39
73	-0.00	-0.00	-2.61
81	-0.00	-0.00	10.66
89	0.00	-0.00	34.09

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	-0.12	2.41	-3.32
	2	-0.12	-1.24	-3.32
2	2	-0.00	0.15	-0.44
	3	-0.00	-0.23	-0.44
3	3	0.00	0.06	0.15
	4	0.00	0.19	0.15
4	4	0.00	-0.52	1.28
	5	0.00	0.60	1.28
5	5	0.00	-0.66	1.47
	6	0.00	0.63	1.47
6	6	0.00	-0.43	0.81
	7	0.00	0.27	0.81
7	7	0.01	-0.06	0.07
	8	0.01	0.01	0.07
8	9	-3.69	4.20	-4.25
	10	-3.69	-0.47	-4.25
9	10	-1.91	2.72	-2.36
	11	-1.91	0.65	-2.36
10	11	0.29	2.01	-0.74
	12	0.29	1.36	-0.74
11	12	2.01	0.59	0.73
	13	2.01	1.23	0.73
12	13	2.51	-1.09	1.74
	14	2.51	0.44	1.74
13	14	1.67	-2.25	2.33
	15	1.67	-0.21	2.33
14	15	0.40	-1.94	3.21
	16	0.40	0.87	3.21
15	17	-8.45	6.32	-3.48
	18	-8.45	2.49	-3.48
16	18	-5.27	7.67	-3.18
	19	-5.27	4.89	-3.18
17	19	-0.53	7.79	-2.79
	20	-0.53	5.35	-2.79
18	20	3.83	5.04	-1.89
	21	3.83	3.38	-1.89

19	21	6.02	-0.01	-0.11
	22	6.02	-0.11	-0.11
20	22	5.12	-5.02	2.64
	23	5.12	-2.71	2.64
21	23	1.99	-6.45	6.14
	24	1.99	-1.08	6.14
22	25	-16.16	9.51	-2.05
	26	-16.16	7.26	-2.05
23	26	-11.25	15.79	-3.13
	27	-11.25	13.06	-3.13
24	27	-2.74	18.72	-5.10
	28	-2.74	14.26	-5.10
25	28	6.27	15.03	-6.14
	29	6.27	9.65	-6.14
26	29	12.13	4.63	-4.68
	30	12.13	0.53	-4.68
27	30	11.75	-8.34	-0.04
	31	11.75	-8.37	-0.04
28	31	5.15	-15.84	6.85
	32	5.15	-9.85	6.85
29	33	-27.95	12.51	1.94
	34	-27.95	14.64	1.94
30	34	-21.59	27.44	-0.84
	35	-21.59	26.71	-0.84
31	35	-8.10	37.14	-6.95
	36	-8.10	31.06	-6.95
32	36	8.54	35.29	-13.16
	37	8.54	23.78	-13.16
33	37	22.02	18.14	-15.75
	38	22.02	4.36	-15.75
34	38	24.24	-10.43	-10.51
	39	24.24	-19.62	-10.51
35	39	11.55	-34.59	2.18
	40	11.55	-32.69	2.18
36	41	-43.52	12.70	10.40
	42	-43.52	24.14	10.40
37	42	-37.84	40.19	7.39
	43	-37.84	46.66	7.39
38	43	-19.93	63.45	-4.63
	44	-19.93	59.40	-4.63
39	44	7.34	71.53	-21.33
	45	7.34	52.86	-21.33
40	45	35.16	50.46	-37.03
	46	35.16	18.06	-37.03
41	46	46.77	-2.62	-42.95
	47	46.77	-40.21	-42.95
42	47	25.09	-68.20	-22.15
	48	25.09	-87.58	-22.15
43	49	-59.46	3.07	29.08
	50	-59.46	35.06	29.08
44	50	-58.85	46.32	28.15
	51	-58.85	70.95	28.15
45	51	-42.40	88.51	17.24
	52	-42.40	103.59	17.24
46	52	-3.91	125.83	-18.79
	53	-3.91	109.40	-18.79
47	53	47.36	114.36	-64.98
	54	47.36	57.50	-64.98
48	54	80.75	40.04	-128.91

	55	80.75	-72.76	-128.91
49	55	52.92	-107.30	-134.16
	56	52.92	-224.69	-134.16
50	57	-39.30	-33.29	69.95
	58	-39.30	43.65	69.95
51	58	-42.50	2.61	73.57
	59	-42.50	66.99	73.57
52	59	-39.74	30.51	83.67
	60	-39.74	103.72	83.67
53	60	-18.22	86.84	50.37
	61	-18.22	130.91	50.37
54	61	35.21	143.18	-112.45
	62	35.21	44.79	-112.45
55	62	59.86	92.04	-191.16
	63	59.86	-75.23	-191.16
56	63	53.32	-18.81	-340.31
	64	53.32	-316.58	-340.31
57	65	-7.61	-1.67	4.57
	66	-7.61	3.35	4.57
58	66	-8.54	3.36	4.19
	67	-8.54	7.02	4.19
59	67	-9.93	7.34	6.14
	68	-9.93	12.72	6.14
60	68	-8.94	11.71	27.86
	69	-8.94	36.09	27.86
61	69	10.27	36.32	-35.78
	70	10.27	5.02	-35.78
62	70	10.59	4.72	-0.55
	71	10.59	4.23	-0.55
63	71	15.99	5.09	-94.58
	72	15.99	-77.67	-94.58
64	73	-8.18	-1.95	4.43
	74	-8.18	2.93	4.43
65	74	-9.02	2.55	5.09
	75	-9.02	7.00	5.09
66	75	-8.98	5.45	9.92
	76	-8.98	14.13	9.92
67	76	-4.14	4.39	58.97
	77	-4.14	55.99	58.97
68	77	7.19	55.24	-65.49
	78	7.19	-2.07	-65.49
69	78	14.04	-0.21	17.15
	79	14.04	14.79	17.15
70	79	11.14	20.28	-150.93
	80	11.14	-111.78	-150.93
71	81	-8.50	-5.49	9.59
	82	-8.50	5.06	9.59
72	82	-8.72	0.21	10.21
	83	-8.72	9.15	10.21
73	83	-6.59	3.22	19.74
	84	-6.59	20.49	19.74
74	84	2.14	13.89	45.81
	85	2.14	53.98	45.81
75	85	3.22	53.97	-50.75
	86	3.22	9.56	-50.75
76	86	16.13	16.74	-17.52
	87	16.13	1.42	-17.52
77	87	4.61	12.54	-151.30
	88	4.61	-119.84	-151.30

78	89	-4.29	-8.33	14.17
	90	-4.29	7.26	14.17
79	90	-4.24	-4.88	16.74
	91	-4.24	9.77	16.74
80	91	-2.82	-1.59	19.78
	92	-2.82	15.71	19.78
81	92	1.28	12.34	12.72
	93	1.28	23.48	12.72
82	93	1.79	26.80	-21.35
	94	1.79	8.11	-21.35
83	94	7.35	22.59	-40.48
	95	7.35	-12.83	-40.48
84	95	2.06	4.05	-76.00
	96	2.06	-62.46	-76.00
85	1	2.41	0.12	-1.17
	9	2.41	-1.06	-1.17
86	9	6.62	2.63	-5.90
	17	6.62	-3.27	-5.90
87	17	12.94	5.18	-11.62
	25	12.94	-6.44	-11.62
88	25	22.46	9.72	-21.45
	33	22.46	-11.73	-21.45
89	33	34.97	16.22	-34.91
	41	34.97	-18.69	-34.91
90	41	47.66	24.83	-53.32
	49	47.66	-28.49	-53.32
91	49	50.74	30.98	-60.78
	57	50.74	-29.80	-60.78
92	57	17.45	9.49	-34.77
	65	17.45	-5.28	-34.77
93	65	15.78	2.33	-13.94
	73	15.78	-3.59	-13.94
94	73	13.83	4.59	-20.99
	81	13.83	-4.33	-20.99
95	81	8.33	4.18	-19.91
	89	8.33	-4.29	-19.91
96	2	1.39	-5.34	1.50
	10	1.39	-3.85	1.50
97	10	4.58	-5.63	-0.39
	18	4.58	-6.02	-0.39
98	18	9.75	-9.20	-0.70
	26	9.75	-9.90	-0.70
99	26	18.29	-14.81	0.37
	34	18.29	-14.44	0.37
100	34	31.09	-20.80	3.15
	42	31.09	-17.65	3.15
101	42	47.14	-23.33	6.16
	50	47.14	-17.17	6.16
102	50	58.40	-17.79	7.09
	58	58.40	-10.69	7.09
103	58	17.36	-7.49	3.47
	66	17.36	-6.02	3.47
104	66	17.36	-5.09	3.84
	74	17.36	-3.46	3.84
105	74	16.98	-2.62	3.19
	82	16.98	-1.26	3.19
106	82	12.14	-1.04	2.57
	90	12.14	0.05	2.57
107	3	0.29	-6.56	0.43

	11	0.29	-6.13	0.43
108	11	1.65	-8.32	-1.19
	19	1.65	-9.51	-1.19
109	19	4.55	-14.25	-1.57
	27	4.55	-15.83	-1.57
110	27	10.22	-24.33	0.40
	35	10.22	-23.93	0.40
111	35	20.65	-37.42	6.51
	43	20.65	-30.91	6.51
112	43	37.44	-48.82	18.54
	51	37.44	-30.29	18.54
113	51	55.00	-46.73	29.44
	59	55.00	-17.29	29.44
114	59	18.52	-20.05	19.35
	67	18.52	-11.82	19.35
115	67	18.84	-10.43	17.41
	75	18.84	-3.04	17.41
116	75	17.30	-3.08	12.57
	83	17.30	2.26	12.57
117	83	11.37	0.13	3.03
	91	11.37	1.42	3.03
118	4	-0.71	-5.52	-1.12
	12	-0.71	-6.64	-1.12
119	12	-1.47	-8.37	-2.60
	20	-1.47	-10.96	-2.60
120	20	-1.78	-15.32	-3.50
	28	-1.78	-18.82	-3.50
121	28	-1.02	-27.83	-2.46
	36	-1.02	-30.29	-2.46
122	36	3.21	-46.93	3.76
	44	3.21	-43.17	3.76
123	44	15.34	-70.44	20.46
	52	15.34	-49.98	20.46
124	52	37.58	-88.47	56.48
	60	37.58	-31.99	56.48
125	60	20.71	-53.51	89.78
	68	20.71	-15.36	89.78
126	68	19.70	-16.35	68.06
	76	19.70	12.58	68.06
127	76	9.96	7.75	19.01
	84	9.96	15.83	19.01
128	84	3.37	7.10	-7.05
	92	3.37	4.10	-7.05
129	5	-1.26	-2.86	-2.75
	13	-1.26	-5.61	-2.75
130	13	-3.58	-6.11	-3.76
	21	-3.58	-9.87	-3.76
131	21	-6.97	-12.06	-5.54
	29	-6.97	-17.60	-5.54
132	29	-11.99	-23.47	-7.00
	37	-11.99	-30.47	-7.00
133	37	-17.63	-43.95	-4.42
	45	-17.63	-48.36	-4.42
134	45	-20.03	-76.18	11.28
	53	-20.03	-64.91	11.28
135	53	-15.06	-116.17	57.47
	61	-15.06	-58.70	57.47
136	61	-2.80	-112.13	220.28
	69	-2.80	-18.51	220.28

137	69	-2.56	-37.73	283.91
	77	-2.56	82.93	283.91
138	77	-3.31	71.60	-130.63
	85	-3.31	16.08	-130.63
139	85	-3.32	14.99	-34.07
	93	-3.32	0.51	-34.07
140	6	-1.06	-0.23	-3.39
	14	-1.06	-3.62	-3.39
141	14	-3.75	-2.78	-3.97
	22	-3.75	-6.75	-3.97
142	22	-8.66	-5.86	-6.72
	30	-8.66	-12.58	-6.72
143	30	-17.53	-12.20	-11.37
	38	-17.53	-23.56	-11.37
144	38	-32.32	-25.78	-16.60
	46	-32.32	-42.38	-16.60
145	46	-53.00	-53.99	-10.68
	54	-53.00	-64.67	-10.68
146	54	-70.47	-98.06	53.26
	62	-70.47	-44.80	53.26
147	62	-23.21	-69.45	131.98
	70	-23.21	-13.36	131.98
148	70	-23.52	-13.68	96.75
	78	-23.52	27.44	96.75
149	78	-21.66	20.59	14.11
	86	-21.66	26.59	14.11
150	86	-14.47	13.68	-19.12
	94	-14.47	5.55	-19.12
151	7	-0.33	0.63	-2.04
	15	-0.33	-1.41	-2.04
152	15	-2.06	-0.14	-2.92
	23	-2.06	-3.05	-2.92
153	23	-5.80	0.08	-6.42
	31	-5.80	-6.34	-6.42
154	31	-13.27	0.26	-13.31
	39	-13.27	-13.05	-13.31
155	39	-28.24	-0.37	-26.00
	47	-28.24	-26.37	-26.00
156	47	-56.23	-4.69	-46.80
	55	-56.23	-51.50	-46.80
157	55	-90.77	-23.66	-41.55
	63	-90.77	-65.22	-41.55
158	63	-34.35	-58.68	107.59
	71	-34.35	-12.95	107.59
159	71	-33.49	-18.35	201.62
	79	-33.49	67.33	201.62
160	79	-28.00	70.24	-169.31
	87	-28.00	-1.72	-169.31
161	87	-16.88	9.81	-35.53
	95	-16.88	-5.29	-35.53
162	8	-0.01	0.01	-0.05
	16	-0.01	-0.05	-0.05
163	16	-0.00	0.36	-0.98
	24	-0.00	-0.63	-0.98
164	24	-0.00	1.36	-3.20
	32	-0.00	-1.83	-3.20
165	32	-0.00	3.32	-7.65
	40	-0.00	-4.33	-7.65
166	40	-0.00	7.22	-16.31

	48	-0.00	-9.09	-16.31
167	48	-0.00	15.99	-37.02
	56	-0.00	-21.02	-37.02
168	56	-0.00	31.89	-69.62
	64	-0.00	-37.73	-69.62
169	64	0.00	15.59	-61.02
	72	0.00	-10.34	-61.02
170	72	-0.00	5.65	-27.96
	80	-0.00	-6.23	-27.96
171	80	-0.00	4.91	-18.64
	88	-0.00	-3.02	-18.64
172	88	0.00	1.59	-8.59
	96	0.00	-2.06	-8.59

ESTRUCTURA E-2

ESTRUCTURA E-2

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4 CÁLCULOS (Continuación)

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L.A.V. ZARAGOZA-LLEIDA

SUBTRAMO-I

E-2

GENERALIDADES

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Union Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril" de 25 de junio de 1975.
- "L.A.V. Zaragoza-Lérida. Proyecto de Estructuras de Puentes de Ferrocarril. Bases del Cálculo" de 29 de julio de 1993.
- "Instrucción EP-93, para el proyecto y ejecución de obras de hormigón pretensado".
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

. Encepados y zapatas..... $f_{ck} \geq 250$ Kp/cm^2
. Pilotes..... $f_{ck} \geq 200$ Kp/cm^2
. Alzados de estribos ..... $f_{ck} \geq 250$ kp/cm^2
. Alzados de pilas ..... $f_{ck} \geq 300$ Kp/cm^2
. Tablero postesado..... $f_{ck} \geq 350$ kp/cm^2
. Coeficiente de seguridad ..... $\gamma_c = 1,5$

Armaduras activas

. Tensión de rotura $\geq$ 190 Kp/mm^2
. Límite elástico $\geq$ 170 Kp/mm^2
. Coeficiente de seguridad $\gamma_s = 1,1$

Armaduras pasivas

. Límite elástico $\geq$ 5100 Kp/cm^2
. Coeficiente de seguridad $\gamma_s = 1,15$

Cargas

Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

3.- Criterios generales de cálculo

Para el cálculo de la estructura se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

El cálculo del viaducto se ha realizado básicamente en las siguientes fases:

- Tablero:
  - Cálculo longitudinal
  - Cálculo transversal
- Reacciones y aparatos de apoyo
- Pilas
- Estribos

La obtención de esfuerzos que permiten realizar el análisis longitudinal del tablero, se ha realizado con la ayuda de un programa de cálculo matricial basado en el método de la rigidez, discretizándose el tablero como viga contínua, sometida a las acciones de peso propio, carga permanente, sobrecarga, gradiente térmico y pretensado, tanto inicial como final, con sus correspondientes coeficientes de ponderación. De este cálculo como viga se obtienen los estados tensionales en servicio y la comprobación a rotura por flexión y cortante.

En el análisis transversal, se ha estudiado la flexión transversal, la armadura necesaria en el voladizo, el rasante y las costillas sobre pilas y estribos, en particular el anclaje del tablero al estribo.

En cuanto al cálculo de pilas y estribos se han tenido en cuenta, además de las acciones verticales, las horizontales debidas a los acortamientos por retracción, fluencia y temperatura, frenado, viento, empuje de tierras y efectos sísmicos.

En la distribución de acciones horizontales en los distintos elementos se han tenido en cuenta las distintas rigideces de éstos, tanto para cargas rápidas como de larga duración.

En la comprobación de las pilas se ha empleado un programa que tiene en cuenta los efectos de 2° orden, considerando la no linealidad, tanto geométrica como del material.

En la comprobación de los elementos de hormigón armado y pretensado, se ha tenido en cuenta lo prescrito en las Instrucciones correspondientes EH-91 y EP-93, respectivamente.

4.- Equipo redactor del proyecto

El cálculo del proyecto ha sido realizado por la oficina **SIEGRIST Y MORENO, S.L.**

Madrid, 25 de junio de 1997

Fdo.: Carlos Siegrist Fernández

PROGRAMA GENERAL DE PUENTES CONTINUOS (VI-0)

- Objeto del programa y campo de aplicación: El programa está diseñado para el cálculo matricial en teoría de primer orden de una viga contínua recta, teniendo en cuenta el proceso constructivo de la estructura. Se aplica a estructuras de varios vanos cuyo comportamiento pueda considerarse tipo viga. Permite la introducción de un coeficiente de excentricidad para tener en cuenta los efectos de cargas locales que hagan que el comportamiento tipo viga no se real.

- Identificación: Este programa ha sido desarrollado en la oficina SIEGRIST Y MORENO S.L. por Juan Moreno Torres y Miguel Angel Utrilla Arroyo. La última revisión del mismo, utilizada en estos calculos, se realizó en enero de 1994.

- Datos de entrada:

  - Definición de **vanos, cargas y características de los materiales** que componen la estructura.
  - Definición de **secciones de cálculo** en la estructura final con sus características geométricas.
  - Definición de **estados** de la estructura. (Proceso constructivo).
  - Definición de los **cables de pretensado** con los puntos singulares del trazado y fuerzas de tesado.

- Resultados:

  - **Esfuerzos** en las secciones de cálculo en las hipótesis:

    . Peso propio estructura en cada uno de los estados constructivos y peso propio de la estructura completa en los estados inicial y final (teniendo en cuenta el reajuste por fluencia). En todos los casos se tiene en cuenta la construcción por fases.
    . Cargas muertas
    . Temperatura
    . Descenso de apoyos
    . Envolvente de cortantes y momentos para sobrecarga tipo renfe y tipo UIC.

  - Definición general de los **cables de pretensado**, con su replanteo.

  - **Esfuerzos unitarios producidos por los cables de pretensado**, tanto en las estructuras parciales como en la completa.

  - **Coeficientes de pérdidas de pretensado y resumen de familias de cables**.

  - **Esfuerzos de pretensado** en estado inicial y final.

  - **Tensiones en construcción** en cada uno de los estados evolutivos. En

cada fase se calculan cuatro hipótesis: Pretensado con pérdidas instantáneas ponderado y sin ponderar; peso propio; y la suma de peso propio y pretensado ponderado.

- **Tensiones en servicio** en estados inicial y final, ponderando el pretensado con 0,9 y 1,1 y considerando las diferentes envolventes de sobrecarga, así como la sobrecarga frecuente.

- **Reacciones y giros** en cada una de las hipótesis en que se han dado esfuerzos.

- **Comprobación a cortante**. En este apartado se detallan inicialmente los esfuerzos, tanto de cargas exteriores (envolvente de esfuerzos máximos y mínimos ponderados) como de pretensado, en cada una de las secciones de cálculo. A partir de estos esfuerzos el programa obtiene de acuerdo con la EP-93 el esfuerzo cortante reducido, así como la armadura necesaria en cada sección. También se obtiene la armadura mínima de las secciones y se comprueba la compresión en el hormigón (Vrd/Vu1).

- **Comprobación a rotura**. Se calcula el momento de cálculo, (envolventes de momentos máximos y mínimos), el momento hiperestático de pretensado y el momento último de cada sección. En este cálculo se tiene en cuenta tanto el pretensado como la armadura pasiva del tablero. En los momentos totales se suma a los momentos de cálculo el momento hiperestático ponderado por 1.1 o por 0.9 según sea desfavorable o favorable.

1.- CALCULO TABLERO

CALCULO DEL TABLERO

Para el cálculo del tablero se han seguido los siguientes pasos:

- Sección transversal del tablero

- Cálculo longitudinal

  - Cálculo como viga contínua
  - Comprobación de tensiones
  - Comprobación a rotura por flexión
  - Combrobación a cortante
  - Cálculo a torsión
  - Cálculo armaduras anclajes de pretensado

- Cálculo transversal

  - Armadura de voladizos
  - Armadura de rasante
  - Vigas riostras sobre pilas
  - Vigas riostras sobre estribos

- Cálculo de alargamientos de tesado

SECCION TRANSVERSAL

PROYECTO LAV ZARAGOZA - LERIDA
SUBTRAMO 1
PUENTES LOSA (E-1 y E-2)

FECHA

HOJA N.º

CALCULO DE VIENTO

Según la instrucción de acciones en puentes de ferrocarril:

presión básica: $f_w = 154\,(2 - 0.7\lambda) = 200\ kp/m^2$

$\lambda = \frac{l_u}{A_{bt}} = 1$

Superficie a considerar: 1.65 (canto tablero) + 0.75 (balasto + carril) + + 3.50 (tren) = $5.9\ m^2/m$

Presión sobre el tablero $0{,}2\ T/m^2 \times 5.9\ m^2 = \underline{1.18\ T/m}$

Pilotes: $S = 1.40\ m^2/m$ => Presión = $0{,}2 \times 1.4 = \underline{0{,}28\ T/m}$

COEFICIENTE DE IMPACTO

- RENFE. Según la instrucción:

Tramos apoyados continuos: $I = 65\,\frac{\mu}{1 - \mu + \mu^2} = 29.7$

Se toma 30% $\underline{I = 1.30}$

$\mu = \frac{V \cdot T}{2L} = 0.3522$

$V = 200\ Km/h = 55.56\ m/s$

$L = 25\ m$

$T = \frac{2\pi}{\omega}$ $\omega = \sqrt{\frac{EJ\pi^4}{m l^4}}$ $EJ = 3{,}5 \cdot 10^{12} \times 2.097$

$T = 0.317$

$m = \frac{1}{9.8}\left(\underbrace{9.63 \times 25}_{\text{P. propio}} + \underbrace{10.686}_{\text{c. muerta}} + \underbrace{24}_{\text{sob.}}\right) = 6.0$

UIC

$L_m = \frac{1}{22}(20 \times 2 + 25 \times 20) = 24{,}54\ m$ $L\phi = 1.5 \cdot L_m = 36.8$

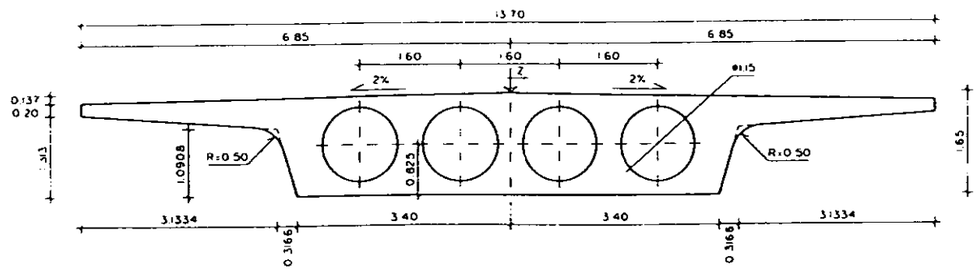
Tomando ϕ_2 para 30-40 -> IMPACTO = 1,09

PROYECTO L.A.V ZARAGOZA - LERIDA
SUBTRAMO I
SECCION LOSA.

FECHA

HOJA N.° 1/5

SECCION TRANSVERSAL TIPO



Area: 9.634 m²

I_{LONG}: 2.697 m⁴

y_{Gi} ↑: 0.939 m

SECCION: L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. LOSA ALIGERADA.

NUM. CONTORNOS	NUM. CIRCULOS
1	4

CONTORNO 1 PUNTOS 9

	COORD. X	Y
1	3.400	0.000
2	3.717	1.091
3	6.850	1.313
4	6.850	1.513
5	0.000	1.650
6	-6.850	1.513
7	-6.850	1.313
8	-3.717	1.091
9	-3.400	0.000

CIRCULOS 4

	RADIOS	COORD. X	Y
1	0.575	-2.400	0.825
2	0.575	-0.800	0.825
3	0.575	0.800	0.825
4	0.575	2.400	0.825

FIBRA INFERIOR X	Y	FIBRA SUPERIOR X	Y
-0.000	0.000	-0.000	1.650

RESULTADOS

AREA = 9.63421 m2

CENTRO DE GRAVEDAD Xg= -0.00000 Yg= 0.93943

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 9.0506454	Ixx = 11.1995087	ANG. FI = 0.0000
My = -0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.6970758	ANG. FI = 0.0000
My = 0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.6970758	ANG. FI = 0.0000
My = 0.0000000	Iyy = 93.1431808	
	Ixy = 0.0000001	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 0.93943	Ds = 0.71057		
Wi = 2.87098	Ws = 3.79564		
Radio Giro X-X = 0.52910	Radio Giro Y-Y= 3.10934		

SECCION: L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. LOSA SECCION MACIZA.

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.400	0.000
2	3.717	1.091
3	6.850	1.313
4	6.850	1.513
5	0.000	1.650
6	-6.850	1.513
7	-6.850	1.313
8	-3.717	1.091
9	-3.400	0.000

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
-0.000	0.000	-0.000	1.650

RESULTADOS

AREA = 13.78897 m2

CENTRO DE GRAVEDAD Xg= -0.00000 Yg= 0.90495

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 12.4783272	Ixx = 14.3707619	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 3.0785017	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 3.0785017	ANG. FI = 0.0000
My = -0.0000000	Iyy = 106.7818527	
	Ixy = 0.0000001	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

==========

Di = 0.90495 Ds = 0.74505

Wi = 3.40185 Ws = 4.13194

Radio Giro X-X = 0.47250 Radio Giro Y-Y= 2.78281

CALCULO LONGITUDINAL

014

CALCULO COMO VIGA CONTINUA

Los datos introducidos en el cálculo como viga continua son:

- Definición de vanos de la estructura y estados de la misma.
- Hipótesis de cargas actuantes.
- Características de los materiales empleados
- Características geométricas de las secciones en que se divide el tablero.
- Definición del pretensado (se introduce el cable medio).

A partir de estos datos se obtiene:

- Esfuerzos en las secciones de la viga para las distintas hipótesis de carga consideradas.
- Definición del pretensado, acciones unitarias de los cables y esfuerzos de pretensado
- Reacciones en las distintas hipótesis de cargas
- Tensiones ponderadas en los distintos estados de la estructura.
- Cálculo a cortante
- Comprobación a rotura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Programa general de puentes continuos (V1-0)
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Proyecto : VIADUCTO 2 TAV TRES VANOS
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Definicion geometrica de vanos

	Longitud
Vano 1	20.0000 m
Vano 2	25.0000 m
Vano 3	20.0000 m

Definicion de cargas

Cargas muertas (t.I) ..... = 0.780 t/m2
Cargas muertas (t.II)..... = 0.000 t/m

Sobrecarga repartida ..... = 0.000 t/m2

Tanque :

	Coeficientes de excentricidad			
	Flexion		Cortante	
	C.Vano	Apoyos	C.Vano	Apoyos
Vano 1	1.00	1.00	1.00	1.00
Vano 2	1.00	1.00	1.00	1.00
Vano 3	1.00	1.00	1.00	1.00

Ancho de aceras 1.300 m
Coef. de impacto para tren de RENFE 1.300
Coef. de impacto para tren de U.I.C. 1.090
Numero de vias 2

Temperatura :

Coef. de dilatacion termica de 1E-04
Gradiente lineal termico de ..... 5.000 grad

Caracteristicas de los materiales

Resistencia caracteristica del hormigon ..... = 350.00 kg/cm2
Densidad del hormigon ..... = 2.50 t/m3

Modulo de elasticidad del acero de pretensar .. = 19000.00 kg/mm2
Tension de rotura de los cables ..... = 190.00 kg/mm2
Porcentaje a que se tesan los cables ..... = 75. %

Retraccion del hormigon .... = 0.00025
Coeficiente de relajacion del acero ..... = 0.06000
Coeficiente de fluencia del hormigon ..... = 2.50000

Coef. de ponderacion maximo del pretensado .... = 1.1000
Coef. de ponderacion minimo del pretensado .... = 0.9000
Coef. de perdidas finales en estado inicial ... = 0.3000

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
1	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	2.000	0.711	0.939	1.65	9.63	2.6970	13.70
	3	4.000	0.711	0.939	1.65	9.63	2.6970	13.70
	4	6.000	0.711	0.939	1.65	9.63	2.6970	13.70
	5	8.000	0.711	0.939	1.65	9.63	2.6970	13.70
	6	10.000	0.711	0.939	1.65	9.63	2.6970	13.70
	7	12.000	0.711	0.939	1.65	9.63	2.6970	13.70
	8	14.000	0.711	0.939	1.65	9.63	2.6970	13.70
	9	16.000	0.711	0.939	1.65	9.63	2.6970	13.70
	10	18.000	0.711	0.939	1.65	9.63	2.6970	13.70
	11	20.000	0.711	0.939	1.65	9.63	2.6970	13.70
2	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	2.500	0.711	0.939	1.65	9.63	2.6970	13.70
	3	5.000	0.711	0.939	1.65	9.63	2.6970	13.70
	4	7.500	0.711	0.939	1.65	9.63	2.6970	13.70
	5	10.000	0.711	0.939	1.65	9.63	2.6970	13.70
	6	12.500	0.711	0.939	1.65	9.63	2.6970	13.70
	7	15.000	0.711	0.939	1.65	9.63	2.6970	13.70
	8	17.500	0.711	0.939	1.65	9.63	2.6970	13.70
	9	20.000	0.711	0.939	1.65	9.63	2.6970	13.70
	10	22.500	0.711	0.939	1.65	9.63	2.6970	13.70
	11	25.000	0.711	0.939	1.65	9.63	2.6970	13.70
3	1	0.000	0.711	0.939	1.65	9.63	2.6970	13.70
	2	2.000	0.711	0.939	1.65	9.63	2.6970	13.70
	3	4.000	0.711	0.939	1.65	9.63	2.6970	13.70
	4	6.000	0.711	0.939	1.65	9.63	2.6970	13.70
	5	8.000	0.711	0.939	1.65	9.63	2.6970	13.70
	6	10.000	0.711	0.939	1.65	9.63	2.6970	13.70
	7	12.000	0.711	0.939	1.65	9.63	2.6970	13.70
	8	14.000	0.711	0.939	1.65	9.63	2.6970	13.70
	9	16.000	0.711	0.939	1.65	9.63	2.6970	13.70
	10	18.000	0.711	0.939	1.65	9.63	2.6970	13.70
	11	20.000	0.711	0.939	1.65	9.63	2.6970	13.70

Definicion de estados de la estructura

	Numero de secciones	Numero de secciones activas
Estado 1	31	de 1 a 31

Cable Numero 1 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 31 (65.000) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.326	-.1611
2	1.150	-0.648	-.1611
3	8.000	-1.200	0.0000
4	18.000	-0.533	0.1333
5	20.000	-0.400	0.0000
6	22.500	-0.614	-.1712
7	32.500	-1.470	0.0000
8	42.500	-0.614	0.1712
9	45.000	-0.400	0.0000
10	47.000	-0.533	-.1333
11	57.000	-1.200	0.0000
12	63.850	-0.648	0.1611
13	65.850	-0.326	0.1611

Cable Numero 2 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 31 (65.000) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.915	-.0525
2	1.150	-1.020	-.0525
3	8.000	-1.200	0.0000
4	18.000	-0.533	0.1333
5	20.000	-0.400	0.0000
6	22.500	-0.614	-.1712
7	32.500	-1.470	0.0000
8	42.500	-0.614	0.1712
9	45.000	-0.400	0.0000
10	47.000	-0.533	-.1333
11	57.000	-1.200	0.0000
12	63.850	-1.020	0.0525
13	65.850	-0.915	0.0525

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-179.00	0.00	0.00	0.00
	2	309.83	-130.83	0.00	8.17	-10.79
	3	523.33	-82.66	0.00	13.80	-18.22
	4	640.48	-34.49	0.00	16.88	-22.30
	5	661.29	13.68	0.00	17.43	-23.02
	6	585.77	61.85	0.00	15.44	-20.39
	7	413.90	110.02	0.00	10.91	-14.41
	8	145.69	158.19	0.00	3.84	-5.07
	9	-218.85	206.36	0.00	-5.77	7.62
	10	-679.74	254.53	0.00	-17.92	23.67
	11	-1236.97	302.70	0.00	-32.61	43.07
2	1	-1236.97	-301.06	0.00	-32.61	43.07
	2	-559.58	-240.85	0.00	-14.75	19.48
	3	-32.73	-180.64	0.00	-0.86	1.14
	4	343.60	-120.42	0.00	9.06	-11.96
	5	569.39	-60.21	0.00	15.01	-19.82
	6	644.66	0.00	0.00	16.99	-22.44
	7	569.39	60.21	0.00	15.01	-19.82
	8	343.60	120.42	0.00	9.06	-11.96
	9	-32.73	180.64	0.00	-0.86	1.14
	10	-559.58	240.85	0.00	-14.75	19.48
	11	-1236.97	301.06	0.00	-32.61	43.07
3	1	-1236.97	-302.70	0.00	-32.61	43.07
	2	-679.74	-254.53	0.00	-17.92	23.67
	3	-218.85	-206.36	0.00	-5.77	7.62
	4	145.69	-158.19	0.00	3.84	-5.07
	5	413.90	-110.02	0.00	10.91	-14.41
	6	585.77	-61.85	0.00	15.44	-20.39
	7	661.29	-13.68	0.00	17.43	-23.02
	8	640.48	34.49	0.00	16.88	-22.30
	9	523.33	82.66	0.00	13.80	-18.22
	10	309.83	130.83	0.00	8.17	-10.79
	11	0.00	179.00	0.00	0.00	0.00

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Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-179.00	0.00	0.00	0.00
	2	309.83	-130.83	0.00	8.17	-10.79
	3	523.33	-82.66	0.00	13.80	-18.22
	4	640.48	-34.49	0.00	16.88	-22.30
	5	661.29	13.68	0.00	17.43	-23.02
	6	585.77	61.85	0.00	15.44	-20.39
	7	413.90	110.02	0.00	10.91	-14.41
	8	145.69	158.19	0.00	3.84	-5.07
	9	-218.85	206.36	0.00	-5.77	7.62
	10	-679.74	254.53	0.00	-17.92	23.67
	11	-1236.97	302.70	0.00	-32.61	43.07
2	1	-1236.97	-301.06	0.00	-32.61	43.07
	2	-559.58	-240.85	0.00	-14.75	19.48
	3	-32.73	-180.64	0.00	-0.86	1.14
	4	343.60	-120.42	0.00	9.06	-11.96
	5	569.39	-60.21	0.00	15.01	-19.82
	6	644.66	0.00	0.00	16.99	-22.44
	7	569.39	60.21	0.00	15.01	-19.82
	8	343.60	120.42	0.00	9.06	-11.96
	9	-32.73	180.64	0.00	-0.86	1.14
	10	-559.58	240.85	0.00	-14.75	19.48
	11	-1236.97	301.06	0.00	-32.61	43.07
3	1	-1236.97	-302.70	0.00	-32.61	43.07
	2	-679.74	-254.53	0.00	-17.92	23.67
	3	-218.85	-206.36	0.00	-5.77	7.62
	4	145.69	-158.19	0.00	3.84	-5.07
	5	413.90	-110.02	0.00	10.91	-14.41
	6	585.77	-61.85	0.00	15.44	-20.39
	7	661.29	-13.68	0.00	17.43	-23.02
	8	640.48	34.49	0.00	16.88	-22.30
	9	523.33	82.66	0.00	13.80	-18.22
	10	309.83	130.83	0.00	8.17	-10.79
	11	0.00	179.00	0.00	0.00	0.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-79.42	0.00	0.00	0.00
	2	137.47	-58.05	0.00	3.62	-4.79
	3	232.19	-36.67	0.00	6.12	-8.08
	4	284.17	-15.30	0.00	7.49	-9.89
	5	293.40	6.07	0.00	7.73	-10.22
	6	259.89	27.44	0.00	6.85	-9.05
	7	183.64	48.81	0.00	4.84	-6.39
	8	64.64	70.18	0.00	1.70	-2.25
	9	-97.10	91.56	0.00	-2.56	3.38
	10	-301.59	112.93	0.00	-7.95	10.50
	11	-548.82	134.30	0.00	-14.47	19.11
2	1	-548.82	-133.58	0.00	-14.47	19.11
	2	-248.27	-106.86	0.00	-6.55	8.64
	3	-14.52	-80.14	0.00	-0.38	0.51
	4	152.45	-53.43	0.00	4.02	-5.31
	5	252.63	-26.71	0.00	6.66	-8.80
	6	286.02	0.00	0.00	7.54	-9.96
	7	252.63	26.72	0.00	6.66	-8.80
	8	152.45	53.43	0.00	4.02	-5.31
	9	-14.52	80.14	0.00	-0.38	0.51
	10	-248.27	106.86	0.00	-6.55	8.64
	11	-548.82	133.57	0.00	-14.47	19.11
3	1	-548.82	-134.30	0.00	-14.47	19.11
	2	-301.59	-112.93	0.00	-7.95	10.50
	3	-97.10	-91.56	0.00	-2.56	3.38
	4	64.64	-70.18	0.00	1.70	-2.25
	5	183.64	-48.81	0.00	4.84	-6.39
	6	259.89	-27.44	0.00	6.85	-9.05
	7	293.40	-6.07	0.00	7.73	-10.22
	8	284.17	15.30	0.00	7.49	-9.89
	9	232.19	36.67	0.00	6.12	-8.08
	10	137.47	58.05	0.00	3.62	-4.79
	11	0.00	79.42	0.00	0.00	0.00

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-16.90	0.00	0.00	0.00
	2	33.80	-16.90	0.00	0.89	-1.18
	3	67.60	-16.90	0.00	1.78	-2.35
	4	101.40	-16.90	0.00	2.67	-3.53
	5	135.20	-16.90	0.00	3.56	-4.71
	6	169.00	-16.90	0.00	4.46	-5.88
	7	202.80	-16.90	0.00	5.35	-7.06
	8	236.60	-16.90	0.00	6.24	-8.24
	9	270.40	-16.90	0.00	7.13	-9.41
	10	304.20	-16.90	0.00	8.02	-10.59
	11	338.00	-16.90	0.00	8.91	-11.77
2	1	338.00	0.00	0.00	8.91	-11.77
	2	338.00	0.00	0.00	8.91	-11.77
	3	338.00	0.00	0.00	8.91	-11.77
	4	338.00	0.00	0.00	8.91	-11.77
	5	338.00	0.00	0.00	8.91	-11.77
	6	338.00	0.00	0.00	8.91	-11.77
	7	338.00	0.00	0.00	8.91	-11.77
	8	338.00	0.00	0.00	8.91	-11.77
	9	338.00	0.00	0.00	8.91	-11.77
	10	338.00	0.00	0.00	8.91	-11.77
	11	338.00	0.00	0.00	8.91	-11.77
3	1	338.00	16.90	0.00	8.91	-11.77
	2	304.20	16.90	0.00	8.02	-10.59
	3	270.40	16.90	0.00	7.13	-9.41
	4	236.60	16.90	0.00	6.24	-8.24
	5	202.80	16.90	0.00	5.35	-7.06
	6	169.00	16.90	0.00	4.46	-5.88
	7	135.20	16.90	0.00	3.56	-4.71
	8	101.40	16.90	0.00	2.67	-3.53
	9	67.60	16.90	0.00	1.78	-2.35
	10	33.80	16.90	0.00	0.89	-1.18
	11	0.00	16.90	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	54.14	0.00	0.00	0.00	0.00
		Q(-)	-284.89	0.00	0.00	0.00	0.00
	2	Q(+)	54.14	-108.27	0.00	2.85	-3.77
		Q(-)	-221.13	506.02	0.00	-13.34	17.62
	3	Q(+)	54.14	-216.55	0.00	5.71	-7.54
		Q(-)	-157.38	884.54	0.00	-23.32	30.80
	4	Q(+)	54.14	-324.82	0.00	8.56	-11.31
		Q(-)	-93.63	1135.55	0.00	-29.94	39.54
	5	Q(+)	54.14	-433.10	0.00	11.42	-15.08
		Q(-)	-29.88	1259.06	0.00	-33.19	43.84
	6	Q(+)	86.25	471.25	0.00	-12.42	16.41
		Q(-)	-10.66	106.61	0.00	-2.81	3.71
	7	Q(+)	147.44	525.83	0.00	-13.86	18.31
		Q(-)	-10.66	127.93	0.00	-3.37	4.45
	8	Q(+)	211.19	167.21	0.00	-4.41	5.82
		Q(-)	-10.66	149.25	0.00	-3.93	5.20
	9	Q(+)	274.94	-318.92	0.00	8.41	-11.10
		Q(-)	-10.66	170.57	0.00	-4.50	5.94
	10	Q(+)	338.69	-932.56	0.00	24.58	-32.47
		Q(-)	-10.66	191.89	0.00	-5.06	6.68
	11	Q(+)	402.45	-1673.69	0.00	44.12	-58.27
		Q(-)	-10.66	213.22	0.00	-5.62	7.42
2	1	Q(+)	39.23	213.22	0.00	-5.62	7.42
		Q(-)	-431.28	-1725.11	0.00	45.48	-60.06
	2	Q(+)	39.23	115.14	0.00	-3.04	4.01
		Q(-)	-351.59	-746.52	0.00	19.68	-25.99
	3	Q(+)	39.23	17.06	0.00	-0.45	0.59
		Q(-)	-271.90	32.85	0.00	-0.87	1.14
	4	Q(+)	39.23	-81.02	0.00	2.14	-2.82
		Q(-)	-192.21	612.99	0.00	-16.16	21.34
	5	Q(+)	39.23	-179.10	0.00	4.72	-6.24
		Q(-)	-112.52	993.91	0.00	-26.20	34.60
	6	Q(+)	39.23	900.77	0.00	-23.75	31.36
		Q(-)	-39.23	900.77	0.00	-23.75	31.36
	7	Q(+)	112.52	993.91	0.00	-26.20	34.60
		Q(-)	-39.23	-179.10	0.00	4.72	-6.24
	8	Q(+)	192.21	612.99	0.00	-16.16	21.34
		Q(-)	-39.23	-81.02	0.00	2.14	-2.82
	9	Q(+)	271.90	32.85	0.00	-0.87	1.14
		Q(-)	-39.23	17.06	0.00	-0.45	0.59
	10	Q(+)	351.59	-746.52	0.00	19.68	-25.99
		Q(-)	-39.23	115.14	0.00	-3.04	4.01
	11	Q(+)	431.28	-1725.11	0.00	45.48	-60.06
		Q(-)	-39.23	213.22	0.00	-5.62	7.42
3	1	Q(+)	10.66	213.22	0.00	-5.62	7.42
		Q(-)	-402.45	-1673.69	0.00	44.12	-58.27
	2	Q(+)	10.66	191.89	0.00	-5.06	6.68
		Q(-)	-338.69	-932.56	0.00	24.58	-32.47

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	10.66	170.57	0.00	-4.50	5.94
		Q(-)	-274.94	-318.92	0.00	8.41	-11.10
	4	Q(+)	10.66	149.25	0.00	-3.93	5.20
		Q(-)	-211.19	167.21	0.00	-4.41	5.82
	5	Q(+)	10.66	127.93	0.00	-3.37	4.45
		Q(-)	-147.44	525.83	0.00	-13.86	18.31
	6	Q(+)	10.66	106.61	0.00	-2.81	3.71
		Q(-)	-86.25	471.25	0.00	-12.42	16.41
	7	Q(+)	29.88	1259.06	0.00	-33.19	43.84
		Q(-)	-54.14	-433.10	0.00	11.42	-15.08
	8	Q(+)	93.63	1135.55	0.00	-29.94	39.54
		Q(-)	-54.14	-324.82	0.00	8.56	-11.31
	9	Q(+)	157.38	884.54	0.00	-23.32	30.80
		Q(-)	-54.14	-216.55	0.00	5.71	-7.54
	10	Q(+)	221.13	506.02	0.00	-13.34	17.62
		Q(-)	-54.14	-108.27	0.00	2.85	-3.77
	11	Q(+)	284.89	0.00	0.00	0.00	0.00
		Q(-)	-54.14	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-284.89	0.00	0.00	0.00
		M(-)	0.00	54.14	0.00	0.00	0.00
	2	M(+)	506.02	-221.13	0.00	13.34	-17.62
		M(-)	-108.27	54.14	0.00	-2.85	3.77
	3	M(+)	884.54	-157.38	0.00	23.32	-30.80
		M(-)	-216.55	54.14	0.00	-5.71	7.54
	4	M(+)	1135.55	-93.63	0.00	29.94	-39.54
		M(-)	-324.82	54.14	0.00	-8.56	11.31
	5	M(+)	1259.06	-29.88	0.00	33.19	-43.84
		M(-)	-433.10	54.14	0.00	-11.42	15.08
	6	M(+)	1255.07	33.87	0.00	33.09	-43.70
		M(-)	-541.37	54.14	0.00	-14.27	18.85
	7	M(+)	1123.57	97.63	0.00	29.62	-39.12
		M(-)	-649.65	54.14	0.00	-17.13	22.62
	8	M(+)	864.57	161.38	0.00	22.79	-30.10
		M(-)	-757.92	54.14	0.00	-19.98	26.39
	9	M(+)	478.06	225.13	0.00	12.60	-16.64
		M(-)	-866.20	54.14	0.00	-22.84	30.16
	10	M(+)	191.89	-10.66	0.00	5.06	-6.68
		M(-)	-1072.43	299.66	0.00	-28.27	37.34
	11	M(+)	213.22	-10.66	0.00	5.62	-7.42
		M(-)	-1725.11	353.02	0.00	-45.48	60.06
2	1	M(+)	213.22	39.23	0.00	5.62	-7.42
		M(-)	-1725.11	-431.28	0.00	-45.48	60.06
	2	M(+)	115.14	39.23	0.00	3.04	-4.01
		M(-)	-825.35	-305.99	0.00	-21.76	28.74
	3	M(+)	525.33	-206.24	0.00	13.85	-18.29
		M(-)	-571.42	-39.23	0.00	-15.06	19.89
	4	M(+)	1009.12	-159.38	0.00	26.60	-35.13
		M(-)	-473.34	-39.23	0.00	-12.48	16.48
	5	M(+)	1307.96	-79.69	0.00	34.48	-45.54
		M(-)	-418.46	-12.90	0.00	-11.03	14.57
	6	M(+)	1407.57	0.00	0.00	37.11	-49.01
		M(-)	-394.34	-6.40	0.00	-10.40	13.73
	7	M(+)	1307.96	79.69	0.00	34.48	-45.54
		M(-)	-418.46	12.90	0.00	-11.03	14.57
	8	M(+)	1009.12	159.38	0.00	26.60	-35.13
		M(-)	-473.34	39.23	0.00	-12.48	16.48
	9	M(+)	525.33	206.24	0.00	13.85	-18.29
		M(-)	-571.42	39.23	0.00	-15.06	19.89
	10	M(+)	115.14	-39.23	0.00	3.04	-4.01
		M(-)	-825.35	305.99	0.00	-21.76	28.74
	11	M(+)	213.22	-39.23	0.00	5.62	-7.42
		M(-)	-1725.11	431.28	0.00	-45.48	60.06
3	1	M(+)	213.22	10.66	0.00	5.62	-7.42
		M(-)	-1725.11	-353.02	0.00	-45.48	60.06
	2	M(+)	191.89	10.66	0.00	5.06	-6.68
		M(-)	-1072.43	-299.66	0.00	-28.27	37.34

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Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	478.06	-225.13	0.00	12.60	-16.64
		M(-)	-866.20	-54.14	0.00	-22.84	30.16
	4	M(+)	864.57	-161.38	0.00	22.79	-30.10
		M(-)	-757.92	-54.14	0.00	-19.98	26.39
	5	M(+)	1123.57	-97.63	0.00	29.62	-39.12
		M(-)	-649.65	-54.14	0.00	-17.13	22.62
	6	M(+)	1255.07	-33.87	0.00	33.09	-43.70
		M(-)	-541.37	-54.14	0.00	-14.27	18.85
	7	M(+)	1259.06	29.88	0.00	33.19	-43.84
		M(-)	-433.10	-54.14	0.00	-11.42	15.08
	8	M(+)	1135.55	93.63	0.00	29.94	-39.54
		M(-)	-324.82	-54.14	0.00	-8.56	11.31
	9	M(+)	884.54	157.38	0.00	23.32	-30.80
		M(-)	-216.55	-54.14	0.00	-5.71	7.54
	10	M(+)	506.02	221.13	0.00	13.34	-17.62
		M(-)	-108.27	-54.14	0.00	-2.85	3.77
	11	M(+)	0.00	284.89	0.00	0.00	0.00
		M(-)	0.00	-54.14	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	40.25	0.00	0.00	0.00	0.00
		Q(-)	-197.27	0.00	0.00	0.00	0.00
	2	Q(+)	40.25	-80.51	0.00	2.12	-2.80
		Q(-)	-162.39	359.67	0.00	-9.48	12.52
	3	Q(+)	40.25	-161.02	0.00	4.24	-5.61
		Q(-)	-127.51	649.57	0.00	-17.12	22.62
	4	Q(+)	40.25	-241.52	0.00	6.37	-8.41
		Q(-)	-92.63	869.72	0.00	-22.93	30.28
	5	Q(+)	40.25	-322.03	0.00	8.49	-11.21
		Q(-)	-24.18	1010.86	0.00	-26.65	35.19
	6	Q(+)	61.25	259.48	0.00	-6.84	9.03
		Q(-)	-8.42	84.22	0.00	-2.22	2.93
	7	Q(+)	114.44	534.15	0.00	-14.08	18.60
		Q(-)	-8.42	101.06	0.00	-2.66	3.52
	8	Q(+)	182.89	212.50	0.00	-5.60	7.40
		Q(-)	-8.42	117.90	0.00	-3.11	4.11
	9	Q(+)	217.77	-188.16	0.00	4.96	-6.55
		Q(-)	-8.42	134.75	0.00	-3.55	4.69
	10	Q(+)	252.65	-658.58	0.00	17.36	-22.93
		Q(-)	-8.42	151.59	0.00	-4.00	5.28
	11	Q(+)	287.53	-1198.76	0.00	31.60	-41.74
		Q(-)	-8.42	168.44	0.00	-4.44	5.86
2	1	Q(+)	30.99	168.44	0.00	-4.44	5.86
		Q(-)	-292.66	-1225.04	0.00	32.30	-42.65
	2	Q(+)	30.99	90.96	0.00	-2.40	3.17
		Q(-)	-249.06	-547.89	0.00	14.44	-19.08
	3	Q(+)	30.99	13.48	0.00	-0.36	0.47
		Q(-)	-205.46	20.25	0.00	-0.53	0.70
	4	Q(+)	30.99	-64.01	0.00	1.69	-2.23
		Q(-)	-161.86	479.39	0.00	-12.64	16.69
	5	Q(+)	30.99	-141.49	0.00	3.73	-4.93
		Q(-)	-130.46	833.81	0.00	-21.98	29.03
	6	Q(+)	30.99	-218.97	0.00	5.77	-7.62
		Q(-)	-30.99	-218.97	0.00	5.77	-7.62
	7	Q(+)	130.46	833.81	0.00	-21.98	29.03
		Q(-)	-30.99	-141.49	0.00	3.73	-4.93
	8	Q(+)	161.86	479.39	0.00	-12.64	16.69
		Q(-)	-30.99	-64.01	0.00	1.69	-2.23
	9	Q(+)	205.46	20.25	0.00	-0.53	0.70
		Q(-)	-30.99	13.48	0.00	-0.36	0.47
	10	Q(+)	249.06	-547.89	0.00	14.44	-19.08
		Q(-)	-30.99	90.96	0.00	-2.40	3.17
	11	Q(+)	292.66	-1225.04	0.00	32.30	-42.65
		Q(-)	-30.99	168.44	0.00	-4.44	5.86
3	1	Q(+)	8.42	168.44	0.00	-4.44	5.86
		Q(-)	-287.53	-1198.76	0.00	31.60	-41.74
	2	Q(+)	8.42	151.59	0.00	-4.00	5.28
		Q(-)	-252.65	-658.58	0.00	17.36	-22.93

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	8.42	134.75	0.00	-3.55	4.69
		Q(-)	-217.77	-188.16	0.00	4.96	-6.55
	4	Q(+)	8.42	117.90	0.00	-3.11	4.11
		Q(-)	-182.89	212.50	0.00	-5.60	7.40
	5	Q(+)	8.42	101.06	0.00	-2.66	3.52
		Q(-)	-114.44	534.15	0.00	-14.08	18.60
	6	Q(+)	8.42	84.22	0.00	-2.22	2.93
		Q(-)	-61.25	259.48	0.00	-6.84	9.03
	7	Q(+)	24.18	1010.86	0.00	-26.65	35.19
		Q(-)	-40.25	-322.03	0.00	8.49	-11.21
	8	Q(+)	92.63	869.72	0.00	-22.93	30.28
		Q(-)	-40.25	-241.52	0.00	6.37	-8.41
	9	Q(+)	127.51	649.57	0.00	-17.12	22.62
		Q(-)	-40.25	-161.02	0.00	4.24	-5.61
	10	Q(+)	162.39	359.67	0.00	-9.48	12.52
		Q(-)	-40.25	-80.51	0.00	2.12	-2.80
	11	Q(+)	197.27	0.00	0.00	0.00	0.00
		Q(-)	-40.25	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-197.27	0.00	0.00	0.00
		M(-)	0.00	40.25	0.00	0.00	0.00
	2	M(+)	359.67	-162.39	0.00	9.48	-12.52
		M(-)	-80.51	40.25	0.00	-2.12	2.80
	3	M(+)	649.57	-127.51	0.00	17.12	-22.62
		M(-)	-161.02	40.25	0.00	-4.24	5.61
	4	M(+)	869.72	-92.63	0.00	22.93	-30.28
		M(-)	-241.52	40.25	0.00	-6.37	8.41
	5	M(+)	1010.86	-24.18	0.00	26.65	-35.19
		M(-)	-322.03	40.25	0.00	-8.49	11.21
	6	M(+)	1015.63	30.32	0.00	26.77	-35.36
		M(-)	-402.54	40.25	0.00	-10.61	14.01
	7	M(+)	889.59	84.82	0.00	23.45	-30.97
		M(-)	-483.05	40.25	0.00	-12.73	16.82
	8	M(+)	627.17	153.27	0.00	16.53	-21.84
		M(-)	-563.55	40.25	0.00	-14.86	19.62
	9	M(+)	285.75	188.15	0.00	7.53	-9.95
		M(-)	-644.06	40.25	0.00	-16.98	22.42
	10	M(+)	151.59	-8.42	0.00	4.00	-5.28
		M(-)	-788.61	200.77	0.00	-20.79	27.46
	11	M(+)	168.44	-8.42	0.00	4.44	-5.86
		M(-)	-1225.04	235.65	0.00	-32.30	42.65
2	1	M(+)	168.44	30.99	0.00	4.44	-5.86
		M(-)	-1225.04	-292.66	0.00	-32.30	42.65
	2	M(+)	90.96	30.99	0.00	2.40	-3.17
		M(-)	-630.78	-205.39	0.00	-16.63	21.96
	3	M(+)	342.22	-162.53	0.00	9.02	-11.91
		M(-)	-451.41	-30.99	0.00	-11.90	15.72
	4	M(+)	738.37	-140.39	0.00	19.47	-25.71
		M(-)	-373.93	-30.99	0.00	-9.86	13.02
	5	M(+)	1039.12	-109.00	0.00	27.39	-36.18
		M(-)	-296.45	-30.99	0.00	-7.82	10.32
	6	M(+)	1137.22	0.00	0.00	29.98	-39.59
		M(-)	-218.97	30.99	0.00	-5.77	7.62
	7	M(+)	1039.12	109.00	0.00	27.39	-36.18
		M(-)	-296.45	30.99	0.00	-7.82	10.32
	8	M(+)	738.37	140.39	0.00	19.47	-25.71
		M(-)	-373.93	30.99	0.00	-9.86	13.02
	9	M(+)	342.22	162.53	0.00	9.02	-11.91
		M(-)	-451.41	30.99	0.00	-11.90	15.72
	10	M(+)	90.96	-30.99	0.00	2.40	-3.17
		M(-)	-630.78	205.39	0.00	-16.63	21.96
	11	M(+)	168.44	-30.99	0.00	4.44	-5.86
		M(-)	-1225.04	292.66	0.00	-32.30	42.65
3	1	M(+)	168.44	8.42	0.00	4.44	-5.86
		M(-)	-1225.04	-235.65	0.00	-32.30	42.65
	2	M(+)	151.59	8.42	0.00	4.00	-5.28
		M(-)	-788.61	-200.77	0.00	-20.79	27.46

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	285.75	-188.15	0.00	7.53	-9.95
		M(-)	-644.06	-40.25	0.00	-16.98	22.42
	4	M(+)	627.17	-153.27	0.00	16.53	-21.84
		M(-)	-563.55	-40.25	0.00	-14.86	19.62
	5	M(+)	889.59	-84.82	0.00	23.45	-30.97
		M(-)	-483.05	-40.25	0.00	-12.73	16.82
	6	M(+)	1015.63	-30.32	0.00	26.77	-35.36
		M(-)	-402.54	-40.25	0.00	-10.61	14.01
	7	M(+)	1010.86	24.18	0.00	26.65	-35.19
		M(-)	-322.03	-40.25	0.00	-8.49	11.21
	8	M(+)	869.72	92.63	0.00	22.93	-30.28
		M(-)	-241.52	-40.25	0.00	-6.37	8.41
	9	M(+)	649.57	127.51	0.00	17.12	-22.62
		M(-)	-161.02	-40.25	0.00	-4.24	5.61
	10	M(+)	359.67	162.39	0.00	9.48	-12.52
		M(-)	-80.51	-40.25	0.00	-2.12	2.80
	11	M(+)	0.00	197.27	0.00	0.00	0.00
		M(-)	0.00	-40.25	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	54.14	0.00	0.00	0.00	0.00
		Q(-)	-284.89	0.00	0.00	0.00	0.00
	2	Q(+)	54.14	-108.27	0.00	2.85	-3.77
		Q(-)	-221.13	506.02	0.00	-13.34	17.62
	3	Q(+)	54.14	-216.55	0.00	5.71	-7.54
		Q(-)	-157.38	884.54	0.00	-23.32	30.80
	4	Q(+)	54.14	-324.82	0.00	8.56	-11.31
		Q(-)	-93.63	1135.55	0.00	-29.94	39.54
	5	Q(+)	54.14	-433.10	0.00	11.42	-15.08
		Q(-)	-29.88	1259.06	0.00	-33.19	43.84
	6	Q(+)	86.25	471.25	0.00	-12.42	16.41
		Q(-)	-10.66	106.61	0.00	-2.81	3.71
	7	Q(+)	147.44	525.83	0.00	-13.86	18.31
		Q(-)	-10.66	127.93	0.00	-3.37	4.45
	8	Q(+)	211.19	167.21	0.00	-4.41	5.82
		Q(-)	-10.66	149.25	0.00	-3.93	5.20
	9	Q(+)	274.94	-318.92	0.00	8.41	-11.10
		Q(-)	-10.66	170.57	0.00	-4.50	5.94
	10	Q(+)	338.69	-932.56	0.00	24.58	-32.47
		Q(-)	-10.66	191.89	0.00	-5.06	6.68
	11	Q(+)	402.45	-1673.69	0.00	44.12	-58.27
		Q(-)	-10.66	213.22	0.00	-5.62	7.42
2	1	Q(+)	39.23	213.22	0.00	-5.62	7.42
		Q(-)	-431.28	-1725.11	0.00	45.48	-60.06
	2	Q(+)	39.23	115.14	0.00	-3.04	4.01
		Q(-)	-351.59	-746.52	0.00	19.68	-25.99
	3	Q(+)	39.23	17.06	0.00	-0.45	0.59
		Q(-)	-271.90	32.85	0.00	-0.87	1.14
	4	Q(+)	39.23	-81.02	0.00	2.14	-2.82
		Q(-)	-192.21	612.99	0.00	-16.16	21.34
	5	Q(+)	39.23	-179.10	0.00	4.72	-6.24
		Q(-)	-130.46	833.81	0.00	-21.98	29.03
	6	Q(+)	39.23	900.77	0.00	-23.75	31.36
		Q(-)	-39.23	900.77	0.00	-23.75	31.36
	7	Q(+)	130.46	833.81	0.00	-21.98	29.03
		Q(-)	-39.23	-179.10	0.00	4.72	-6.24
	8	Q(+)	192.21	612.99	0.00	-16.16	21.34
		Q(-)	-39.23	-81.02	0.00	2.14	-2.82
	9	Q(+)	271.90	32.85	0.00	-0.87	1.14
		Q(-)	-39.23	17.06	0.00	-0.45	0.59
	10	Q(+)	351.59	-746.52	0.00	19.68	-25.99
		Q(-)	-39.23	115.14	0.00	-3.04	4.01
	11	Q(+)	431.28	-1725.11	0.00	45.48	-60.06
		Q(-)	-39.23	213.22	0.00	-5.62	7.42
3	1	Q(+)	10.66	213.22	0.00	-5.62	7.42
		Q(-)	-402.45	-1673.69	0.00	44.12	-58.27
	2	Q(+)	10.66	191.89	0.00	-5.06	6.68
		Q(-)	-338.69	-932.56	0.00	24.58	-32.47

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Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	10.66	170.57	0.00	-4.50	5.94
		Q(-)	-274.94	-318.92	0.00	8.41	-11.10
	4	Q(+)	10.66	149.25	0.00	-3.93	5.20
		Q(-)	-211.19	167.21	0.00	-4.41	5.82
	5	Q(+)	10.66	127.93	0.00	-3.37	4.45
		Q(-)	-147.44	525.83	0.00	-13.86	18.31
	6	Q(+)	10.66	106.61	0.00	-2.81	3.71
		Q(-)	-86.25	471.25	0.00	-12.42	16.41
	7	Q(+)	29.88	1259.06	0.00	-33.19	43.84
		Q(-)	-54.14	-433.10	0.00	11.42	-15.08
	8	Q(+)	93.63	1135.55	0.00	-29.94	39.54
		Q(-)	-54.14	-324.82	0.00	8.56	-11.31
	9	Q(+)	157.38	884.54	0.00	-23.32	30.80
		Q(-)	-54.14	-216.55	0.00	5.71	-7.54
	10	Q(+)	221.13	506.02	0.00	-13.34	17.62
		Q(-)	-54.14	-108.27	0.00	2.85	-3.77
	11	Q(+)	284.89	0.00	0.00	0.00	0.00
		Q(-)	-54.14	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-197.27	0.00	0.00	0.00
		M(-)	0.00	40.25	0.00	0.00	0.00
	2	M(+)	506.02	-221.13	0.00	13.34	-17.62
		M(-)	-108.27	54.14	0.00	-2.85	3.77
	3	M(+)	884.54	-157.38	0.00	23.32	-30.80
		M(-)	-216.55	54.14	0.00	-5.71	7.54
	4	M(+)	1135.55	-93.63	0.00	29.94	-39.54
		M(-)	-324.82	54.14	0.00	-8.56	11.31
	5	M(+)	1259.06	-29.88	0.00	33.19	-43.84
		M(-)	-433.10	54.14	0.00	-11.42	15.08
	6	M(+)	1255.07	33.87	0.00	33.09	-43.70
		M(-)	-541.37	54.14	0.00	-14.27	18.85
	7	M(+)	1123.57	97.63	0.00	29.62	-39.12
		M(-)	-649.65	54.14	0.00	-17.13	22.62
	8	M(+)	864.57	161.38	0.00	22.79	-30.10
		M(-)	-757.92	54.14	0.00	-19.98	26.39
	9	M(+)	478.06	225.13	0.00	12.60	-16.64
		M(-)	-866.20	54.14	0.00	-22.84	30.16
	10	M(+)	191.89	-10.66	0.00	5.06	-6.68
		M(-)	-1072.43	299.66	0.00	-28.27	37.34
	11	M(+)	213.22	-10.66	0.00	5.62	-7.42
		M(-)	-1725.11	353.02	0.00	-45.48	60.06
2	1	M(+)	213.22	39.23	0.00	5.62	-7.42
		M(-)	-1725.11	-431.28	0.00	-45.48	60.06
	2	M(+)	115.14	39.23	0.00	3.04	-4.01
		M(-)	-825.35	-305.99	0.00	-21.76	28.74
	3	M(+)	525.33	-206.24	0.00	13.85	-18.29
		M(-)	-571.42	-39.23	0.00	-15.06	19.89
	4	M(+)	1009.12	-159.38	0.00	26.60	-35.13
		M(-)	-473.34	-39.23	0.00	-12.48	16.48
	5	M(+)	1307.96	-79.69	0.00	34.48	-45.54
		M(-)	-418.46	-12.90	0.00	-11.03	14.57
	6	M(+)	1407.57	0.00	0.00	37.11	-49.01
		M(-)	-394.34	-6.40	0.00	-10.40	13.73
	7	M(+)	1307.96	79.69	0.00	34.48	-45.54
		M(-)	-418.46	12.90	0.00	-11.03	14.57
	8	M(+)	1009.12	159.38	0.00	26.60	-35.13
		M(-)	-473.34	39.23	0.00	-12.48	16.48
	9	M(+)	525.33	206.24	0.00	13.85	-18.29
		M(-)	-571.42	39.23	0.00	-15.06	19.89
	10	M(+)	115.14	-39.23	0.00	3.04	-4.01
		M(-)	-825.35	305.99	0.00	-21.76	28.74
	11	M(+)	213.22	-39.23	0.00	5.62	-7.42
		M(-)	-1725.11	431.28	0.00	-45.48	60.06
3	1	M(+)	213.22	10.66	0.00	5.62	-7.42
		M(-)	-1725.11	-353.02	0.00	-45.48	60.06
	2	M(+)	191.89	10.66	0.00	5.06	-6.68
		M(-)	-1072.43	-299.66	0.00	-28.27	37.34

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	478.06	-225.13	0.00	12.60	-16.64
		M(-)	-866.20	-54.14	0.00	-22.84	30.16
	4	M(+)	864.57	-161.38	0.00	22.79	-30.10
		M(-)	-757.92	-54.14	0.00	-19.98	26.39
	5	M(+)	1123.57	-97.63	0.00	29.62	-39.12
		M(-)	-649.65	-54.14	0.00	-17.13	22.62
	6	M(+)	1255.07	-33.87	0.00	33.09	-43.70
		M(-)	-541.37	-54.14	0.00	-14.27	18.85
	7	M(+)	1259.06	29.88	0.00	33.19	-43.84
		M(-)	-433.10	-54.14	0.00	-11.42	15.08
	8	M(+)	1135.55	93.63	0.00	29.94	-39.54
		M(-)	-324.82	-54.14	0.00	-8.56	11.31
	9	M(+)	884.54	157.38	0.00	23.32	-30.80
		M(-)	-216.55	-54.14	0.00	-5.71	7.54
	10	M(+)	506.02	221.13	0.00	13.34	-17.62
		M(-)	-108.27	-54.14	0.00	-2.85	3.77
	11	M(+)	0.00	197.27	0.00	0.00	0.00
		M(-)	0.00	-40.25	0.00	0.00	0.00

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	54.14	0.00	0.00	0.00	0.00
		Q(-)	-284.89	0.00	0.00	0.00	0.00
	2	Q(+)	54.14	-108.27	0.00	-2.85	3.77
		Q(-)	-221.13	506.02	0.00	13.34	-17.62
	3	Q(+)	54.14	-216.55	0.00	-5.71	7.54
		Q(-)	-157.38	884.54	0.00	23.32	-30.80
	4	Q(+)	54.14	-324.82	0.00	-8.56	11.31
		Q(-)	-93.63	1135.55	0.00	29.94	-39.54
	5	Q(+)	54.14	-433.10	0.00	-11.42	15.08
		Q(-)	-29.88	1259.06	0.00	33.19	-43.84
	6	Q(+)	86.25	471.25	0.00	12.42	-16.41
		Q(-)	-10.66	106.61	0.00	2.81	-3.71
	7	Q(+)	147.44	525.83	0.00	13.86	-18.31
		Q(-)	-10.66	127.93	0.00	3.37	-4.45
	8	Q(+)	211.19	167.21	0.00	4.41	-5.82
		Q(-)	-10.66	149.25	0.00	3.93	-5.20
	9	Q(+)	274.94	-318.92	0.00	-8.41	11.10
		Q(-)	-10.66	170.57	0.00	4.50	-5.94
	10	Q(+)	338.69	-932.56	0.00	-24.58	32.47
		Q(-)	-10.66	191.89	0.00	5.06	-6.68
	11	Q(+)	402.45	-1673.69	0.00	-44.12	58.27
		Q(-)	-10.66	213.22	0.00	5.62	-7.42
2	1	Q(+)	39.23	213.22	0.00	5.62	-7.42
		Q(-)	-431.28	-1725.11	0.00	-45.48	60.06
	2	Q(+)	39.23	115.14	0.00	3.04	-4.01
		Q(-)	-351.59	-746.52	0.00	-19.68	25.99
	3	Q(+)	39.23	17.06	0.00	0.45	-0.59
		Q(-)	-271.90	32.85	0.00	0.87	-1.14
	4	Q(+)	39.23	-81.02	0.00	-2.14	2.82
		Q(-)	-192.21	612.99	0.00	16.16	-21.34
	5	Q(+)	39.23	-179.10	0.00	-4.72	6.24
		Q(-)	-130.46	833.81	0.00	21.98	-29.03
	6	Q(+)	39.23	900.77	0.00	23.75	-31.36
		Q(-)	-39.23	900.77	0.00	23.75	-31.36
	7	Q(+)	130.46	833.81	0.00	21.98	-29.03
		Q(-)	-39.23	-179.10	0.00	-4.72	6.24
	8	Q(+)	192.21	612.99	0.00	16.16	-21.34
		Q(-)	-39.23	-81.02	0.00	-2.14	2.82
	9	Q(+)	271.90	32.85	0.00	0.87	-1.14
		Q(-)	-39.23	17.06	0.00	0.45	-0.59
	10	Q(+)	351.59	-746.52	0.00	-19.68	25.99
		Q(-)	-39.23	115.14	0.00	3.04	-4.01
	11	Q(+)	431.28	-1725.11	0.00	-45.48	60.06
		Q(-)	-39.23	213.22	0.00	5.62	-7.42
3	1	Q(+)	10.66	213.22	0.00	5.62	-7.42
		Q(-)	-402.45	-1673.69	0.00	-44.12	58.27
	2	Q(+)	10.66	191.89	0.00	5.06	-6.68
		Q(-)	-338.69	-932.56	0.00	-24.58	32.47

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	10.66	170.57	0.00	4.50	-5.94
		Q(-)	-274.94	-318.92	0.00	-8.41	11.10
	4	Q(+)	10.66	149.25	0.00	3.93	-5.20
		Q(-)	-211.19	167.21	0.00	4.41	-5.82
	5	Q(+)	10.66	127.93	0.00	3.37	-4.45
		Q(-)	-147.44	525.83	0.00	13.86	-18.31
	6	Q(+)	10.66	106.61	0.00	2.81	-3.71
		Q(-)	-86.25	471.25	0.00	12.42	-16.41
	7	Q(+)	29.88	1259.06	0.00	33.19	-43.84
		Q(-)	-54.14	-433.10	0.00	-11.42	15.08
	8	Q(+)	93.63	1135.55	0.00	29.94	-39.54
		Q(-)	-54.14	-324.82	0.00	-8.56	11.31
	9	Q(+)	157.38	884.54	0.00	23.32	-30.80
		Q(-)	-54.14	-216.55	0.00	-5.71	7.54
	10	Q(+)	221.13	506.02	0.00	13.34	-17.62
		Q(-)	-54.14	-108.27	0.00	-2.85	3.77
	11	Q(+)	284.89	0.00	0.00	0.00	0.00
		Q(-)	-54.14	0.00	0.00	0.00	0.00

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-197.27	0.00	0.00	0.00
		M(-)	0.00	40.25	0.00	0.00	0.00
	2	M(+)	506.02	-221.13	0.00	13.34	-17.62
		M(-)	-108.27	54.14	0.00	-2.85	3.77
	3	M(+)	884.54	-157.38	0.00	23.32	-30.80
		M(-)	-216.55	54.14	0.00	-5.71	7.54
	4	M(+)	1135.55	-93.63	0.00	29.94	-39.54
		M(-)	-324.82	54.14	0.00	-8.56	11.31
	5	M(+)	1259.06	-29.88	0.00	33.19	-43.84
		M(-)	-433.10	54.14	0.00	-11.42	15.08
	6	M(+)	1255.07	33.87	0.00	33.09	-43.70
		M(-)	-541.37	54.14	0.00	-14.27	18.85
	7	M(+)	1123.57	97.63	0.00	29.62	-39.12
		M(-)	-649.65	54.14	0.00	-17.13	22.62
	8	M(+)	864.57	161.38	0.00	22.79	-30.10
		M(-)	-757.92	54.14	0.00	-19.98	26.39
	9	M(+)	478.06	225.13	0.00	12.60	-16.64
		M(-)	-866.20	54.14	0.00	-22.84	30.16
	10	M(+)	191.89	-10.66	0.00	5.06	-6.68
		M(-)	-1072.43	299.66	0.00	-28.27	37.34
	11	M(+)	213.22	-10.66	0.00	5.62	-7.42
		M(-)	-1725.11	353.02	0.00	-45.48	60.06
2	1	M(+)	213.22	39.23	0.00	5.62	-7.42
		M(-)	-1725.11	-431.28	0.00	-45.48	60.06
	2	M(+)	115.14	39.23	0.00	3.04	-4.01
		M(-)	-825.35	-305.99	0.00	-21.76	28.74
	3	M(+)	525.33	-206.24	0.00	13.85	-18.29
		M(-)	-571.42	-39.23	0.00	-15.06	19.89
	4	M(+)	1009.12	-159.38	0.00	26.60	-35.13
		M(-)	-473.34	-39.23	0.00	-12.48	16.48
	5	M(+)	1307.96	-79.69	0.00	34.48	-45.54
		M(-)	-418.46	-12.90	0.00	-11.03	14.57
	6	M(+)	1407.57	0.00	0.00	37.11	-49.01
		M(-)	-394.34	-6.40	0.00	-10.40	13.73
	7	M(+)	1307.96	79.69	0.00	34.48	-45.54
		M(-)	-418.46	12.90	0.00	-11.03	14.57
	8	M(+)	1009.12	159.38	0.00	26.60	-35.13
		M(-)	-473.34	39.23	0.00	-12.48	16.48
	9	M(+)	525.33	206.24	0.00	13.85	-18.29
		M(-)	-571.42	39.23	0.00	-15.06	19.89
	10	M(+)	115.14	-39.23	0.00	3.04	-4.01
		M(-)	-825.35	305.99	0.00	-21.76	28.74
	11	M(+)	213.22	-39.23	0.00	5.62	-7.42
		M(-)	-1725.11	431.28	0.00	-45.48	60.06
3	1	M(+)	213.22	10.66	0.00	5.62	-7.42
		M(-)	-1725.11	-353.02	0.00	-45.48	60.06
	2	M(+)	191.89	10.66	0.00	5.06	-6.68
		M(-)	-1072.43	-299.66	0.00	-28.27	37.34

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	478.06	-225.13	0.00	12.60	-16.64
		M(-)	-866.20	-54.14	0.00	-22.84	30.16
	4	M(+)	864.57	-161.38	0.00	22.79	-30.10
		M(-)	-757.92	-54.14	0.00	-19.98	26.39
	5	M(+)	1123.57	-97.63	0.00	29.62	-39.12
		M(-)	-649.65	-54.14	0.00	-17.13	22.62
	6	M(+)	1255.07	-33.87	0.00	33.09	-43.70
		M(-)	-541.37	-54.14	0.00	-14.27	18.85
	7	M(+)	1259.06	29.88	0.00	33.19	-43.84
		M(-)	-433.10	-54.14	0.00	-11.42	15.08
	8	M(+)	1135.55	93.63	0.00	29.94	-39.54
		M(-)	-324.82	-54.14	0.00	-8.56	11.31
	9	M(+)	884.54	157.38	0.00	23.32	-30.80
		M(-)	-216.55	-54.14	0.00	-5.71	7.54
	10	M(+)	506.02	221.13	0.00	13.34	-17.62
		M(-)	-108.27	-54.14	0.00	-2.85	3.77
	11	M(+)	0.00	197.27	0.00	0.00	0.00
		M(-)	0.00	-40.25	0.00	0.00	0.00

Cable Numero 1

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 31 (65.000) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.326	-.1611
2	1.150	-0.648	-.1611
3	8.000	-1.200	0.0000
4	18.000	-0.533	0.1333
5	20.000	-0.400	0.0000
6	22.500	-0.614	-.1712
7	32.500	-1.470	0.0000
8	42.500	-0.614	0.1712
9	45.000	-0.400	0.0000
10	47.000	-0.533	-.1333
11	57.000	-1.200	0.0000
12	63.850	-0.648	0.1611
13	65.850	-0.326	0.1611

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.463	1.187	-0.248	-0.1611
2	2.000	0.777	0.873	0.066	-0.1411
3	4.000	1.012	0.638	0.301	-0.0941
4	6.000	1.153	0.497	0.442	-0.0470
5	8.000	1.200	0.450	0.489	0.0000
6	10.000	1.173	0.477	0.462	0.0267
7	12.000	1.093	0.557	0.382	0.0533
8	14.000	0.960	0.690	0.249	0.0800
9	16.000	0.773	0.877	0.062	0.1067
10	18.000	0.533	1.117	-0.178	0.1333
11	20.000	0.400	1.250	-0.311	0.0000
12	22.500	0.614	1.036	-0.097	-0.1712
13	25.000	0.989	0.662	0.278	-0.1284
14	27.500	1.256	0.394	0.545	-0.0856
15	30.000	1.416	0.234	0.705	-0.0428
16	32.500	1.470	0.180	0.759	0.0000
17	35.000	1.417	0.234	0.706	0.0428
18	37.500	1.256	0.394	0.545	0.0856
19	40.000	0.989	0.662	0.278	0.1284
20	42.500	0.614	1.036	-0.097	0.1712
21	45.000	0.400	1.250	-0.311	0.0000
22	47.000	0.533	1.117	-0.178	-0.1333
23	49.000	0.773	0.877	0.062	-0.1067
24	51.000	0.960	0.690	0.249	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	53.000	1.093	0.557	0.382	-0.0533
26	55.000	1.173	0.477	0.462	-0.0267
27	57.000	1.200	0.450	0.489	0.0000
28	59.000	1.153	0.497	0.442	0.0470
29	61.000	1.012	0.638	0.301	0.0941
30	63.000	0.777	0.873	0.066	0.1411
31	65.000	0.463	1.187	-0.248	0.1611

Cable Numero 2

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 31 (65.000) Activa

Fuerza de Pretensado ..... = 2390.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.915	-.0525
2	1.150	-1.020	-.0525
3	8.000	-1.200	0.0000
4	18.000	-0.533	0.1333
5	20.000	-0.400	0.0000
6	22.500	-0.614	-.1712
7	32.500	-1.470	0.0000
8	42.500	-0.614	0.1712
9	45.000	-0.400	0.0000
10	47.000	-0.533	-.1333
11	57.000	-1.200	0.0000
12	63.850	-1.020	0.0525
13	65.850	-0.915	0.0525

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.960	0.690	0.249	-0.0524
2	2.000	1.062	0.588	0.351	-0.0460
3	4.000	1.139	0.511	0.428	-0.0306
4	6.000	1.185	0.465	0.474	-0.0153
5	8.000	1.200	0.450	0.489	0.0000
6	10.000	1.173	0.477	0.462	0.0267
7	12.000	1.093	0.557	0.382	0.0533
8	14.000	0.960	0.690	0.249	0.0800
9	16.000	0.773	0.877	0.062	0.1067
10	18.000	0.533	1.117	-0.178	0.1333
11	20.000	0.400	1.250	-0.311	0.0000
12	22.500	0.614	1.036	-0.097	-0.1712
13	25.000	0.989	0.662	0.278	-0.1284
14	27.500	1.256	0.394	0.545	-0.0856
15	30.000	1.416	0.234	0.705	-0.0428
16	32.500	1.470	0.180	0.759	0.0000
17	35.000	1.417	0.234	0.706	0.0428
18	37.500	1.256	0.394	0.545	0.0856
19	40.000	0.989	0.662	0.278	0.1284
20	42.500	0.614	1.036	-0.097	0.1712
21	45.000	0.400	1.250	-0.311	0.0000
22	47.000	0.533	1.117	-0.178	-0.1333
23	49.000	0.773	0.877	0.062	-0.1067
24	51.000	0.960	0.690	0.249	-0.0800

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Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	53.000	1.093	0.557	0.382	-0.0533
26	55.000	1.173	0.477	0.462	-0.0267
27	57.000	1.200	0.450	0.489	0.0000
28	59.000	1.185	0.465	0.474	0.0153
29	61.000	1.139	0.511	0.428	0.0306
30	63.000	1.062	0.588	0.351	0.0460
31	65.000	0.960	0.690	0.249	0.0524

Definicion esfuerzos unitarios cable : 1

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
1	2390.000	-380.128	2359.577	-585.093	-380.128	2359.577
				27.782	48.404	-8.648
2	2374.217	-331.723	2350.929			
				-3.304	112.099	-15.955
3	2345.280	-219.625	2334.974			
				-8.309	110.813	-21.029
4	2316.502	-108.812	2313.945			
				-12.700	108.812	-25.963
5	2287.983	0.000	2287.983			
				-9.448	60.526	-19.313
6	2269.477	60.526	2268.669			
				-9.032	59.399	-20.724
7	2251.143	119.925	2247.946			
				-7.261	58.165	-22.062
8	2232.997	178.090	2225.884			
				-3.943	56.833	-23.323
9	2215.053	234.923	2202.560			
				1.084	55.412	-24.499
10	2197.327	290.336	2178.062			
				14.436	-290.336	-46.419
11	2131.642	0.000	2131.642			
				34.347	-346.030	-110.442
12	2050.607	-346.030	2021.201			
				-1.337	87.975	-11.431
13	2026.269	-258.054	2009.770			
				-6.585	87.305	-15.035
14	2002.029	-170.749	1994.735			
				-12.123	86.170	-18.593
15	1977.951	-84.579	1976.142			
				-16.731	84.579	-22.043
16	1954.099	0.000	1954.099			
				16.731	84.579	22.043
17	1977.951	84.579	1976.142			
				12.122	86.170	18.593
18	2002.029	170.749	1994.735			
				6.586	87.305	15.035
19	2026.269	258.055	2009.770			
				1.337	87.975	11.431
20	2050.607	346.030	2021.201			
				-34.347	-346.030	110.441
21	2131.642	0.000	2131.642			
				-14.436	-290.336	46.419
22	2197.327	-290.336	2178.062			
				-1.084	55.412	24.499
23	2215.053	-234.923	2202.561			
				3.943	56.833	23.323
24	2232.997	-178.090	2225.884			
				7.261	58.165	22.063

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
25	2251.143	-119.925	2247.946			
				9.032	59.399	20.723
26	2269.477	-60.526	2268.669			
				9.448	60.526	19.313
27	2287.983	0.000	2287.983			
				12.699	108.812	25.963
28	2316.502	108.812	2313.945			
				8.309	110.813	21.029
29	2345.280	219.625	2334.974			
				3.304	112.099	15.955
30	2374.218	331.723	2350.929			
				-27.782	48.404	8.648
31	2390.000	380.128	2359.577	585.093	-380.128	-2359.577

Definicion esfuerzos unitarios cable : 2

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
1	2389.963	-125.126	2386.685	594.252	-125.126	2386.685
				6.399	15.788	-8.469
2	2380.728	-109.338	2378.216			
				-4.858	36.860	-12.217
3	2367.109	-72.478	2365.999			
				-5.831	36.453	-12.706
4	2353.569	-36.024	2353.293			
				-6.453	36.024	-13.182
5	2340.111	0.000	2340.111			
				-9.663	61.905	-19.753
6	2321.184	61.905	2320.358			
				-9.238	60.752	-21.196
7	2302.432	122.658	2299.162			
				-7.426	59.490	-22.565
8	2283.872	182.148	2276.597			
				-4.033	58.128	-23.854
9	2265.520	240.276	2252.743			
				1.109	56.675	-25.057
10	2247.390	296.951	2227.686			
				14.765	-296.951	-47.477
11	2180.209	0.000	2180.209			
				35.130	-353.913	-112.958
12	2097.327	-353.913	2067.251			
				-1.368	89.980	-11.691
13	2072.435	-263.934	2055.560			
				-6.736	89.294	-15.378
14	2047.643	-174.640	2040.182			
				-12.399	88.134	-19.016
15	2023.016	-86.506	2021.166			
				-17.112	86.506	-22.546
16	1998.620	0.000	1998.620			
				17.112	86.506	22.546
17	2023.016	86.506	2021.166			
				12.399	88.134	19.016
18	2047.643	174.640	2040.182			
				6.736	89.294	15.378
19	2072.435	263.934	2055.560			
				1.368	89.980	11.691
20	2097.327	353.913	2067.251			
				-35.130	-353.913	112.958
21	2180.209	0.000	2180.209			
				-14.765	-296.951	47.477
22	2247.390	-296.951	2227.686			
				-1.109	56.675	25.057
23	2265.520	-240.276	2252.743			
				4.033	58.128	23.854
24	2283.872	-182.148	2276.597			
				7.426	59.490	22.565
25	2302.432	-122.658	2299.162			
				9.237	60.752	21.196
26	2321.184	-61.905	2320.358			
				9.663	61.905	19.753
27	2340.111	0.000	2340.111			
				6.453	36.024	13.182
28	2353.569	36.024	2353.293			
				5.831	36.453	12.706
29	2367.109	72.478	2365.999			
				4.858	36.860	12.217
30	2380.728	109.338	2378.216			
				-6.376	15.792	8.543
31	2390.037	125.130	2386.759	-594.270	-125.130	-2386.759

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Coeficientes para perdidas de pretensado

Coef. de retraccion del hormigon ..... = 0.0003
Coef. de relajacion del acero ..... = 0.0600
Coef. de fluencia del hormigon ..... = 2.5000

Coef. medio de perdidas elasticas instantaneas ..... = 0.9906 (0.9%)
Coef. medio de perdidas en estado inicial ..... = 0.9593 (4.1%)
Coef. medio de perdidas diferidas inicial ..... = 0.9502 (5.0%)
Coef. medio de perdidas diferidas ..... = 0.8642 (13.6%)
Coef. medio de perdidas totales ..... = 0.8561 (14.4%)

Coef. de ponderacion maximo del pretensado ..... = 1.1000
Coef. de ponderacion minimo del pretensado ..... = 0.9000
Coef. de ponderacion para perdidas en estado inicial . = 0.3000

Comprobacion de tensiones

Estado 1 Pretensado de 2390. tn Familia 1
Estado 2 Pretensado de 2390. tn Familia 1

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9502

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-8.70	420.8	-4510.1	46.59	47.12
		2	-821.88	359.8	-4493.9	24.98	75.26
	2	2	-821.88	359.8	-4493.9	24.98	75.26
		3	-1392.27	218.3	-4467.1	9.66	94.84
	3	3	-1392.27	218.3	-4467.1	9.66	94.84
		4	-1675.49	78.4	-4435.0	1.86	104.37
	4	4	-1675.49	78.4	-4435.0	1.86	104.37
		5	-1676.38	-59.3	-4397.8	1.46	104.01
	5	5	-1676.38	-59.3	-4397.8	1.46	104.01
		6	-1423.34	-175.6	-4360.7	7.74	94.82
	6	6	-1423.34	-175.6	-4360.7	7.74	94.82
		7	-940.59	-289.8	-4320.9	20.05	77.60
	7	7	-940.59	-289.8	-4320.9	20.05	77.60
		8	-235.27	-401.6	-4278.5	38.21	52.60
	8	8	-235.27	-401.6	-4278.5	38.21	52.60
		9	684.72	-510.8	-4233.6	62.00	20.11
	9	9	684.72	-510.8	-4233.6	62.00	20.11
		10	1810.80	-617.3	-4186.6	91.19	-19.59
	10	10	1810.80	-617.3	-4186.6	91.19	-19.59
		11	2459.66	-59.3	-4097.3	107.37	-43.11
2	11	11	2459.66	0.0	-4097.3	107.37	-43.11
		12	1562.24	665.1	-3885.0	81.51	-14.07
	12	12	1562.24	665.1	-3885.0	81.51	-14.07
		13	113.39	496.0	-3863.1	43.09	36.15
	13	13	113.39	496.0	-3863.1	43.09	36.15
		14	-904.23	328.2	-3834.2	15.96	71.28
	14	14	-904.23	328.2	-3834.2	15.96	71.28
		15	-1494.40	162.6	-3798.4	0.03	91.46
	15	15	-1494.40	162.6	-3798.4	0.03	91.46
		16	-1665.46	0.0	-3756.1	-4.92	96.97
	16	16	-1665.46	0.0	-3756.1	-4.92	96.97
		17	-1494.40	-162.6	-3798.4	0.03	91.46
	17	17	-1494.40	-162.6	-3798.4	0.03	91.46
		18	-904.23	-328.2	-3834.2	15.96	71.28
	18	18	-904.23	-328.2	-3834.2	15.96	71.28
		19	113.39	-496.0	-3863.1	43.09	36.15
	19	19	113.39	-496.0	-3863.1	43.09	36.15
		20	1562.24	-665.1	-3885.0	81.51	-14.07
	20	20	1562.24	-665.1	-3885.0	81.51	-14.07
		21	2459.66	0.0	-4097.3	107.37	-43.11
3	21	21	2459.66	59.3	-4097.3	107.37	-43.11
		22	1810.80	617.3	-4186.6	91.19	-19.59
	22	22	1810.80	617.3	-4186.6	91.19	-19.59
		23	684.72	510.8	-4233.6	62.00	20.11
	23	23	684.72	510.8	-4233.6	62.00	20.11
		24	-235.27	401.6	-4278.5	38.21	52.60
	24	24	-235.27	401.6	-4278.5	38.21	52.60
		25	-940.59	289.8	-4320.9	20.05	77.60

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9502

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-940.59	289.8	-4320.9	20.05	77.60
		26	-1423.35	175.6	-4360.7	7.74	94.82
	26	26	-1423.35	175.6	-4360.7	7.74	94.82
		27	-1676.38	59.3	-4397.8	1.46	104.01
	27	27	-1676.38	59.3	-4397.8	1.46	104.01
		28	-1675.49	-78.4	-4435.0	1.86	104.37
	28	28	-1675.49	-78.4	-4435.0	1.86	104.37
		29	-1392.27	-218.3	-4467.1	9.66	94.84
	29	29	-1392.27	-218.3	-4467.1	9.66	94.84
		30	-821.88	-359.8	-4493.9	24.98	75.26
	30	30	-821.88	-359.8	-4493.9	24.98	75.26
		31	-8.72	-420.9	-4510.2	46.59	47.12

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8561

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-7.84	379.1	-4063.2	41.97	42.45
		2	-740.44	324.2	-4048.6	22.50	67.80
	2	2	-740.44	324.2	-4048.6	22.50	67.80
		3	-1254.31	196.7	-4024.5	8.71	85.44
	3	3	-1254.31	196.7	-4024.5	8.71	85.44
		4	-1509.47	70.6	-3995.6	1.68	94.03
	4	4	-1509.47	70.6	-3995.6	1.68	94.03
		5	-1510.27	-53.4	-3962.1	1.31	93.71
	5	5	-1510.27	-53.4	-3962.1	1.31	93.71
		6	-1282.31	-158.2	-3928.6	6.97	85.42
	6	6	-1282.31	-158.2	-3928.6	6.97	85.42
		7	-847.39	-261.1	-3892.7	18.07	69.91
	7	7	-847.39	-261.1	-3892.7	18.07	69.91
		8	-211.95	-361.8	-3854.5	34.42	47.39
	8	8	-211.95	-361.8	-3854.5	34.42	47.39
		9	616.87	-460.2	-3814.1	55.85	18.11
	9	9	616.87	-460.2	-3814.1	55.85	18.11
		10	1631.37	-556.2	-3771.7	82.16	-17.65
	10	10	1631.37	-556.2	-3771.7	82.16	-17.65
		11	2215.93	-53.4	-3691.3	96.73	-38.84
2	11	11	2215.93	0.0	-3691.3	96.73	-38.84
		12	1407.44	599.2	-3500.1	73.43	-12.67
	12	12	1407.44	599.2	-3500.1	73.43	-12.67
		13	102.15	446.9	-3480.3	38.82	32.57
	13	13	102.15	446.9	-3480.3	38.82	32.57
		14	-814.63	295.7	-3454.2	14.38	64.22
	14	14	-814.63	295.7	-3454.2	14.38	64.22
		15	-1346.32	146.5	-3422.0	0.03	82.39
	15	15	-1346.32	146.5	-3422.0	0.03	82.39
		16	-1500.43	0.0	-3383.9	-4.43	87.36
	16	16	-1500.43	0.0	-3383.9	-4.43	87.36
		17	-1346.33	-146.5	-3422.0	0.03	82.39
	17	17	-1346.33	-146.5	-3422.1	0.03	82.39
		18	-814.63	-295.7	-3454.2	14.38	64.22
	18	18	-814.63	-295.7	-3454.2	14.38	64.22
		19	102.15	-446.9	-3480.3	38.82	32.57
	19	19	102.15	-446.9	-3480.3	38.82	32.57
		20	1407.44	-599.2	-3500.1	73.43	-12.67
	20	20	1407.44	-599.2	-3500.1	73.43	-12.67
		21	2215.94	0.0	-3691.3	96.73	-38.84
3	21	21	2215.94	53.4	-3691.3	96.73	-38.84
		22	1631.37	556.2	-3771.7	82.16	-17.65
	22	22	1631.37	556.2	-3771.7	82.16	-17.65
		23	616.87	460.2	-3814.1	55.85	18.11
	23	23	616.87	460.2	-3814.1	55.85	18.11
		24	-211.96	361.8	-3854.5	34.42	47.39
	24	24	-211.96	361.8	-3854.5	34.42	47.39
		25	-847.39	261.1	-3892.7	18.07	69.91

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8561

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-847.39	261.1	-3892.7	18.07	69.91
		26	-1282.31	158.2	-3928.6	6.97	85.42
	26	26	-1282.31	158.2	-3928.6	6.97	85.42
		27	-1510.27	53.4	-3962.1	1.31	93.71
	27	27	-1510.27	53.4	-3962.1	1.31	93.71
		28	-1509.47	-70.6	-3995.6	1.68	94.03
	28	28	-1509.47	-70.6	-3995.6	1.68	94.03
		29	-1254.31	-196.7	-4024.4	8.71	85.44
	29	29	-1254.31	-196.7	-4024.4	8.71	85.44
		30	-740.44	-324.2	-4048.6	22.50	67.80
	30	30	-740.44	-324.2	-4048.6	22.50	67.80
		31	-7.86	-379.1	-4063.3	41.97	42.45

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO - I
E-2

FECHA

HOJA N.º

COMPROBACION DE TENSIONES

A las tensiones obtenidas mediante el programa de viga continua se sumaran las producidas por el gradiente térmico y las fuerzas longitudinales reológicas. Las tensiones pésimas se obtienen sobre pilas y en la sección central del vano intermedio, en estado final de servicio y en las pilas en construcción.

Las tensiones pésimas son inferiores a la resistencia a tracción del hormigón $0.45 \cdot \sqrt[3]{350^2} = 22.4$ kg/cm²

La armadura longitudinal dispuesta se obtiene añadiendo a la necesaria para anular el volumen de tracciones producido, la necesario para absorber la fuerza de frenado.

A continuación se adjuntan:

- Tensiones en construcción y en servicio producidas por las sobrecargas + Peso propio + C. permanente
- Tensiones producidas por el gradiente térmico, las fuerzas reológicas y los axiles producidos por el frenado
- Tensiones totales con los coeficientes mayorados al 75%
- Volúmenes de tracciones y armaduras resultantes

Tensiones en Construccion (kg/cm2) Estado 1

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	49.	49.	53.	54.	0.	0.	53.	54.
	2	26.	78.	29.	86.	8.	-11.	37.	76.
	3	10.	99.	11.	109.	14.	-18.	25.	91.
	4	2.	109.	2.	120.	17.	-22.	19.	98.
	5	2.	108.	2.	119.	17.	-23.	19.	96.
	6	8.	99.	9.	109.	15.	-20.	24.	89.
	7	21.	81.	23.	89.	11.	-14.	34.	75.
	8	40.	55.	44.	60.	4.	-5.	48.	55.
	9	65.	21.	71.	23.	-6.	8.	65.	31.
	10	95.	-20.	105.	-22.	-18.	23.	87.	1.
	11	112.	-45.	123.	-49.	-32.	43.	91.	-7.
2	1	112.	-45.	123.	-49.	-32.	43.	91.	-7.
	2	85.	-15.	93.	-16.	-15.	19.	79.	3.
	3	45.	38.	49.	41.	-1.	1.	49.	43.
	4	17.	74.	18.	82.	9.	-12.	27.	70.
	5	0.	95.	0.	105.	15.	-20.	15.	85.
	6	-5.	101.	-6.	111.	17.	-22.	11.	89.
	7	0.	95.	0.	105.	15.	-20.	15.	85.
	8	17.	74.	18.	82.	9.	-12.	27.	70.
	9	45.	38.	49.	41.	-1.	1.	49.	43.
	10	85.	-15.	93.	-16.	-15.	19.	79.	3.
	11	112.	-45.	123.	-49.	-32.	43.	91.	-7.
3	1	112.	-45.	123.	-49.	-32.	43.	91.	-7.
	2	95.	-20.	105.	-22.	-18.	23.	87.	1.
	3	65.	21.	71.	23.	-6.	8.	65.	31.
	4	40.	55.	44.	60.	4.	-5.	48.	55.
	5	21.	81.	23.	89.	11.	-14.	34.	75.
	6	8.	99.	9.	109.	15.	-20.	24.	89.
	7	2.	108.	2.	119.	17.	-23.	19.	96.
	8	2.	109.	2.	120.	17.	-22.	19.	98.
	9	10.	99.	11.	109.	14.	-18.	25.	91.
	10	26.	78.	29.	86.	8.	-11.	37.	76.
	11	49.	49.	53.	54.	0.	0.	53.	54.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	51.	52.	51.	52.	51.	52.	51.	52.	51.	52.
	2	39.	67.	53.	50.	36.	71.	45.	60.	38.	69.
	3	31.	78.	54.	47.	25.	86.	40.	66.	28.	81.
	4	26.	83.	56.	43.	18.	94.	38.	67.	23.	87.
	5	27.	81.	60.	37.	15.	96.	40.	64.	22.	87.
	6	31.	75.	64.	31.	17.	94.	44.	57.	25.	82.
	7	38.	65.	67.	25.	21.	87.	50.	49.	31.	74.
	8	48.	51.	70.	20.	28.	77.	57.	38.	40.	61.
	9	60.	33.	72.	16.	37.	63.	65.	26.	51.	45.
	10	74.	13.	80.	6.	46.	50.	76.	10.	63.	28.
	11	71.	15.	77.	7.	26.	75.	73.	12.	53.	39.
2	1	71.	15.	77.	7.	26.	75.	73.	12.	53.	39.
	2	68.	13.	71.	9.	47.	41.	70.	11.	60.	24.
	3	46.	41.	60.	23.	31.	61.	52.	34.	40.	49.
	4	31.	61.	57.	26.	18.	78.	41.	47.	26.	68.
	5	22.	72.	56.	26.	11.	87.	35.	54.	17.	78.
	6	19.	74.	56.	25.	9.	88.	34.	55.	15.	80.
	7	22.	72.	56.	26.	11.	87.	35.	54.	17.	78.
	8	31.	61.	57.	26.	18.	78.	41.	47.	26.	68.
	9	46.	41.	60.	23.	31.	61.	52.	34.	40.	49.
	10	68.	13.	71.	9.	47.	41.	70.	11.	60.	24.
	11	71.	15.	77.	7.	26.	75.	73.	12.	53.	39.
3	1	71.	15.	77.	7.	26.	75.	73.	12.	53.	39.
	2	74.	13.	80.	6.	46.	50.	76.	10.	63.	28.
	3	60.	33.	72.	16.	37.	63.	65.	26.	51.	45.
	4	48.	51.	70.	20.	28.	77.	57.	38.	40.	61.
	5	38.	65.	67.	25.	21.	87.	50.	49.	31.	74.
	6	31.	75.	64.	31.	17.	94.	44.	57.	25.	82.
	7	27.	81.	60.	37.	15.	96.	40.	64.	22.	87.
	8	26.	83.	56.	43.	18.	94.	38.	67.	23.	87.
	9	31.	78.	54.	47.	25.	86.	40.	66.	28.	81.
	10	39.	67.	53.	50.	36.	71.	45.	60.	38.	69.
	11	51.	52.	51.	52.	51.	52.	51.	52.	51.	52.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	46.	47.	46.	47.	46.	47.	46.	47.	46.	47.
	2	37.	59.	50.	41.	34.	63.	42.	52.	35.	61.
	3	29.	68.	53.	37.	24.	75.	39.	55.	27.	71.
	4	26.	71.	56.	32.	18.	83.	38.	55.	23.	76.
	5	27.	70.	60.	26.	15.	85.	40.	52.	22.	76.
	6	30.	65.	63.	21.	16.	83.	43.	47.	24.	72.
	7	36.	56.	65.	17.	18.	79.	47.	40.	29.	65.
	8	43.	45.	66.	15.	23.	71.	53.	33.	35.	55.
	9	53.	31.	66.	14.	30.	61.	58.	24.	44.	43.
	10	65.	15.	70.	8.	36.	52.	67.	12.	53.	30.
	11	59.	19.	65.	12.	14.	80.	62.	16.	41.	43.
2	1	59.	19.	65.	12.	14.	80.	62.	16.	41.	43.
	2	59.	14.	63.	10.	38.	43.	61.	13.	51.	26.
	3	41.	37.	55.	19.	26.	57.	47.	30.	35.	45.
	4	29.	53.	55.	18.	16.	70.	40.	39.	24.	60.
	5	22.	62.	56.	16.	11.	77.	35.	44.	17.	68.
	6	20.	64.	57.	15.	9.	77.	35.	44.	16.	69.
	7	22.	62.	56.	16.	11.	77.	35.	44.	17.	68.
	8	29.	53.	55.	18.	16.	70.	40.	39.	24.	60.
	9	41.	37.	55.	19.	26.	57.	47.	30.	35.	45.
	10	59.	14.	63.	10.	38.	43.	61.	13.	51.	26.
	11	59.	19.	65.	12.	14.	80.	62.	16.	41.	43.
3	1	59.	19.	65.	12.	14.	80.	62.	16.	41.	43.
	2	65.	15.	70.	8.	36.	52.	67.	12.	53.	30.
	3	53.	31.	66.	14.	30.	61.	58.	24.	44.	43.
	4	43.	45.	66.	15.	23.	71.	53.	33.	35.	55.
	5	36.	56.	65.	17.	18.	79.	47.	40.	29.	65.
	6	30.	65.	63.	21.	16.	83.	43.	47.	24.	72.
	7	27.	70.	60.	26.	15.	85.	40.	52.	22.	76.
	8	26.	71.	56.	32.	18.	83.	38.	55.	23.	76.
	9	29.	68.	53.	37.	24.	75.	39.	55.	27.	71.
	10	37.	59.	50.	41.	34.	63.	42.	52.	35.	61.
	11	46.	47.	46.	47.	46.	47.	46.	47.	46.	47.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.
	2	34.	52.	48.	35.	31.	56.	40.	45.	33.	54.
	3	29.	59.	52.	28.	23.	67.	38.	47.	26.	62.
	4	26.	62.	56.	22.	17.	73.	38.	46.	23.	66.
	5	26.	60.	60.	17.	15.	75.	40.	43.	22.	66.
	6	29.	56.	62.	12.	15.	75.	42.	38.	24.	63.
	7	34.	49.	63.	10.	17.	72.	46.	33.	27.	58.
	8	40.	40.	63.	10.	20.	66.	49.	28.	32.	51.
	9	47.	29.	60.	12.	25.	59.	53.	22.	38.	41.
	10	56.	17.	61.	10.	28.	54.	58.	14.	45.	31.
	11	50.	23.	55.	16.	4.	83.	52.	20.	31.	47.
2	1	50.	23.	55.	16.	4.	83.	52.	20.	31.	47.
	2	52.	15.	55.	11.	30.	44.	53.	14.	43.	27.
	3	38.	34.	51.	16.	22.	54.	43.	27.	32.	42.
	4	27.	47.	54.	12.	15.	63.	38.	33.	22.	53.
	5	22.	54.	56.	8.	11.	68.	35.	35.	17.	60.
	6	20.	55.	57.	6.	10.	69.	35.	35.	16.	60.
	7	22.	54.	56.	8.	11.	68.	35.	35.	17.	60.
	8	27.	47.	54.	12.	15.	63.	38.	33.	22.	53.
	9	38.	34.	51.	16.	22.	54.	43.	27.	32.	42.
	10	52.	15.	55.	11.	30.	44.	53.	14.	43.	27.
	11	50.	23.	55.	16.	4.	83.	52.	20.	31.	47.
3	1	50.	23.	55.	16.	4.	83.	52.	20.	31.	47.
	2	56.	17.	61.	10.	28.	54.	58.	14.	45.	31.
	3	47.	29.	60.	12.	25.	59.	53.	22.	38.	41.
	4	40.	40.	63.	10.	20.	66.	49.	28.	32.	51.
	5	34.	49.	63.	10.	17.	72.	46.	33.	27.	58.
	6	29.	56.	62.	12.	15.	75.	42.	38.	24.	63.
	7	26.	60.	60.	17.	15.	75.	40.	43.	22.	66.
	8	26.	62.	56.	22.	17.	73.	38.	46.	23.	66.
	9	29.	59.	52.	28.	23.	67.	38.	47.	26.	62.
	10	34.	52.	48.	35.	31.	56.	40.	45.	33.	54.
	11	42.	42.	42.	42.	42.	42.	42.	42.	42.	42.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4		Hipotesis 5	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	38.	38.	38.	38.	38.	38.	38.	38.	38.	38.
	2	32.	45.	45.	28.	29.	49.	37.	38.	31.	47.
	3	28.	51.	51.	20.	22.	58.	37.	38.	25.	54.
	4	26.	52.	56.	13.	17.	64.	38.	37.	22.	57.
	5	26.	51.	60.	7.	15.	66.	40.	34.	22.	57.
	6	29.	47.	62.	4.	14.	66.	42.	30.	23.	55.
	7	32.	42.	62.	3.	15.	65.	44.	26.	25.	51.
	8	37.	35.	59.	5.	17.	62.	46.	23.	29.	46.
	9	42.	27.	55.	11.	19.	57.	47.	21.	33.	39.
	10	48.	18.	53.	12.	20.	56.	50.	16.	37.	33.
	11	40.	27.	46.	20.	-5.	87.	42.	24.	22.	51.
2	1	40.	27.	46.	20.	-5.	87.	42.	24.	22.	51.
	2	45.	17.	48.	13.	23.	45.	46.	15.	36.	28.
	3	34.	31.	48.	13.	19.	51.	39.	24.	28.	39.
	4	26.	41.	53.	5.	14.	57.	37.	26.	21.	47.
	5	22.	46.	56.	0.	11.	60.	35.	27.	17.	51.
	6	21.	46.	58.	-3.	10.	60.	35.	27.	16.	52.
	7	22.	46.	56.	0.	11.	60.	35.	27.	17.	51.
	8	26.	41.	53.	5.	14.	57.	37.	26.	21.	47.
	9	34.	31.	48.	13.	19.	51.	39.	24.	28.	39.
	10	45.	17.	48.	13.	23.	45.	46.	15.	36.	28.
	11	40.	27.	46.	20.	-5.	87.	42.	24.	22.	51.
3	1	40.	27.	46.	20.	-5.	87.	42.	24.	22.	51.
	2	48.	18.	53.	12.	20.	56.	50.	16.	37.	33.
	3	42.	27.	55.	11.	19.	57.	47.	21.	33.	39.
	4	37.	35.	59.	5.	17.	62.	46.	23.	29.	46.
	5	32.	42.	62.	3.	15.	65.	44.	26.	25.	51.
	6	29.	47.	62.	4.	14.	66.	42.	30.	23.	55.
	7	26.	51.	60.	7.	15.	66.	40.	34.	22.	57.
	8	26.	52.	56.	13.	17.	64.	38.	37.	22.	57.
	9	28.	51.	51.	20.	22.	58.	37.	38.	25.	54.
	10	32.	45.	45.	28.	29.	49.	37.	38.	31.	47.
	11	38.	38.	38.	38.	38.	38.	38.	38.	38.	38.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

		TEMPERATURA		F. REOLOGICAS		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
0.00	1	0.0	0.0	77	-0.8	292	-2.8
2.00	2	0.9	-1.2	75	-0.7	283	-2.7
4.00	3	1.8	-2.4	72	-0.7	274	-2.6
6.00	4	2.7	-3.5	70	-0.7	265	-2.5
8.00	5	3.6	-4.7	68	-0.7	256	-2.5
10.00	6	4.5	-5.9	65	-0.7	247	-2.4
12.00	7	5.4	-7.1	63	-0.6	238	-2.3
14.00	8	6.2	-8.2	60	-0.6	229	-2.2
16.00	9	7.1	-9.4	58	-0.6	220	-2.1
18.00	10	8.0	-10.6	56	-0.6	211	-2.0
20.00	11	8.9	-11.8	53	-0.5	202	-1.9
20.00	11	8.9	-11.8	53	-0.5	202	-1.9
22.50	12	8.9	-11.8	50	-0.5	191	-1.8
25.00	13	8.9	-11.8	47	-0.5	180	-1.7
27.50	14	8.9	-11.8	44	-0.4	168	-1.6
30.00	15	8.9	-11.8	41	-0.4	157	-1.5
32.50	16	8.9	-11.8	39	-0.4	146	-1.4
35.00	17	8.9	-11.8	36	-0.4	135	-1.3
37.50	18	8.9	-11.8	33	-0.3	124	-1.2
40.00	19	8.9	-11.8	30	-0.3	112	-1.1
42.50	20	8.9	-11.8	27	-0.3	101	-1.0
45.00	21	8.9	-11.8	24	-0.2	90	-0.9
45.00	21	8.9	-11.8	24	-0.2	90	-0.9
47.00	22	8.0	-10.6	21	-0.2	81	-0.8
49.00	23	7.1	-9.4	19	-0.2	72	-0.7
51.00	24	6.2	-8.2	17	-0.2	63	-0.6
53.00	25	5.4	-7.1	14	-0.1	54	-0.5
55.00	26	4.5	-5.9	12	-0.1	45	-0.4
57.00	27	3.6	-4.7	9	-0.1	36	-0.3
59.00	28	2.7	-3.5	7	-0.1	27	-0.3
61.00	29	1.8	-2.4	5	-0.0	18	-0.2
63.00	30	0.9	-1.2	2	-0.0	9	-0.1
65.00	31	0.0	0.0	0	0.0	0	0.0

TOTAL FRENADO: 292 Af: 9.977 l. fr.= 22.3
TOTAL RETRACCIO 77 Ar: 10.4
L. TOTAL: 65 canto: 1.65

		M+ FINAL Pret°1.1 SIN TEMPERATURA		M+ FINAL Pret°1.1 CON TEMPERATURA		M- FINAL Pret°1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret°1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret°1.1 CON TEMPERATURA		M- FREQ. FINAL Pret°1.1 SIN TEMPERATURA		M+ FINAL Pret°0.9 SIN TEMPERATURA		M+ FINAL Pret°0.9 CON TEMPERATURA		M- FINAL Pret°0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret°0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret°0.9 CON TEMPERATURA		M- FREQ. FINAL Pret°0.9 SIN TEMPERATURA	
	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.00	1	46	47	46.0	47.0	46	47	46	47	46.0	47.0	46	47	38	38	38.0	38.0	38	38	38	38	38.0	38.0	38	38
2.00	2	50	41	50.9	39.8	34	63	42	52	42.9	50.8	35	61	45	28	45.9	26.8	29	49	37	38	37.9	36.8	31	47
4.00	3	53	37	54.8	34.7	24	75	39	55	40.8	52.7	27	71	51	20	52.8	17.7	22	58	37	38	38.8	35.7	25	54
6.00	4	56	32	58.7	28.5	16	83	38	55	40.7	51.5	23	76	56	13	58.7	9.5	17	64	38	37	40.7	33.5	22	57
8.00	5	60	26	63.6	21.3	15	85	40	52	43.6	47.3	22	76	60	7	63.6	2.3	15	66	40	34	43.6	29.3	22	57
10.00	6	63	21	67.5	15.1	16	83	43	47	47.5	41.1	24	72	62	4	66.5	-1.9	14	66	42	30	46.5	24.1	23	55
12.00	7	65	17	70.4	9.9	18	79	47	40	52.4	32.9	29	65	62	3	67.4	-4.1	15	65	44	26	49.4	18.9	25	51
14.00	8	66	15	72.2	6.8	23	71	53	33	59.2	24.8	35	55	59	5	65.2	-3.2	17	62	46	23	52.2	14.8	29	46
16.00	9	66	14	73.1	4.6	30	61	58	24	65.1	14.6	44	43	55	11	62.1	1.6	19	57	47	21	54.1	11.6	33	39
18.00	10	70	8	78.0	-2.6	36	52	67	12	75.0	1.4	53	30	53	12	61.0	1.4	20	56	50	16	56.0	5.4	37	33
20.00	11	65	12	73.9	0.2	14	80	62	16	70.9	4.2	41	43	46	20	54.9	8.2	-5	87	42	24	50.9	12.2	22	51
20.00	11	65	12	73.9	0.2	14	80	62	16	70.9	4.2	41	43	46	20	54.9	8.2	-5	87	42	24	50.9	12.2	22	51
22.50	12	63	10	71.9	-1.8	38	43	61	13	69.9	1.2	51	26	46	13	56.9	1.2	23	45	46	15	54.9	3.2	36	28
25.00	13	55	19	63.9	7.2	26	57	47	30	55.9	18.2	35	45	46	13	56.9	1.2	19	51	39	24	47.9	12.2	28	39
27.50	14	55	18	63.9	6.2	18	70	40	39	48.9	27.2	24	60	53	5	61.9	-6.8	14	57	37	26	45.9	14.2	21	47
30.00	15	56	16	64.9	4.2	11	77	35	44	43.9	32.2	17	68	56	0	64.9	-11.8	11	60	35	27	43.9	15.2	17	51
32.50	16	57	15	65.9	3.2	9	77	35	44	43.9	32.2	16	69	56	-3	68.9	-14.8	10	60	35	27	43.9	15.2	16	52
35.00	17	56	16	64.9	4.2	11	77	35	44	43.9	32.2	17	68	56	0	64.9	-11.8	11	60	35	27	43.9	15.2	17	51
37.50	18	55	18	63.9	6.2	18	70	40	39	48.9	27.2	24	60	53	5	61.9	-6.8	14	57	37	26	45.9	14.2	21	47
40.00	19	55	19	63.9	7.2	26	57	47	30	55.9	18.2	35	45	46	13	56.9	1.2	19	51	39	24	47.9	12.2	28	39
42.50	20	63	10	71.9	-1.8	38	43	61	13	69.9	1.2	51	26	46	13	56.9	1.2	23	45	46	15	54.9	3.2	36	28
45.00	21	65	12	73.9	0.2	14	80	62	16	70.9	4.2	41	43	46	20	54.9	8.2	-5	87	42	24	50.9	12.2	22	51
45.00	21	65	12	73.9	0.2	14	80	62	16	70.9	4.2	41	43	46	20	54.9	8.2	-5	87	42	24	50.9	12.2	22	51
47.00	22	70	8	78.0	-2.6	36	52	67	12	75.0	1.4	53	30	53	12	61.0	1.4	20	56	50	16	56.0	5.4	37	33
49.00	23	66	14	73.1	4.6	30	61	58	24	65.1	14.6	44	43	55	11	62.1	1.6	19	57	47	21	54.1	11.6	33	39
51.00	24	66	15	72.2	6.6	23	71	53	33	59.2	24.8	35	55	59	5	65.2	-3.2	17	62	46	23	52.2	14.8	29	46
53.00	25	65	17	70.4	9.9	18	79	47	40	52.4	32.9	29	65	62	3	67.4	-4.1	15	65	44	26	49.4	18.9	25	51
55.00	26	63	21	67.5	15.1	16	83	43	47	47.5	41.1	24	72	62	4	66.5	-1.9	14	66	42	30	46.5	24.1	23	55
57.00	27	60	26	63.6	21.3	15	85	40	52	43.6	47.3	22	76	60	7	63.6	2.3	15	66	40	34	43.6	29.3	22	57
59.00	28	56	32	58.7	28.5	16	83	38	55	40.7	51.5	23	76	56	13	58.7	9.5	17	64	38	37	40.7	33.5	22	57
61.00	29	53	37	54.8	34.7	24	75	39	55	40.8	52.7	27	71	51	20	52.8	17.7	22	58	37	38	38.8	35.7	25	54
63.00	30	50	41	50.9	39.8	34	63	42	52	42.9	50.8	35	61	45	28	45.9	26.8	29	49	37	38	37.9	36.8	31	47
65.00	31	46	47	46.0	47.0	46	47	46	47	46.0	47.0	46	47	38	38	38.0	38.0	38	38	38	38	38.0	38.0	38	38

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret°1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret°1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret°0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret°0.9 SIN TEMPERATURA				VALORES MAXIMOS			ARMADURAS	
																		Vt sup.	Vt inf.	frenado		
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	max(t/m)	max(t/m)	(t/m)	As cm2	Al cm2
0.00	1	45.2	46.2	0.0	0.0	45.2	46.2	0.0	0.0	37.2	37.2	0.0	0.0	37.2	37.2	0.0	0.0	0.0	0.0	13.1	4.25	4.25
2.00	2	50.1	39.1	0.0	0.0	33.3	62.3	0.0	0.0	45.1	26.1	0.0	0.0	28.3	46.3	0.0	0.0	0.0	0.0	12.7	4.12	4.12
4.00	3	54.1	33.9	0.0	0.0	23.3	74.3	0.0	0.0	52.1	16.9	0.0	0.0	21.3	57.3	0.0	0.0	0.0	0.0	12.3	3.99	3.99
6.00	4	58.0	27.8	0.0	0.0	17.3	82.3	0.0	0.0	58.0	8.8	0.0	0.0	16.3	63.3	0.0	0.0	0.0	0.0	11.9	3.86	3.86
8.00	5	62.9	20.8	0.0	0.0	14.3	84.3	0.0	0.0	62.9	1.6	0.0	0.0	14.3	65.3	0.0	0.0	0.0	0.0	11.5	3.73	3.73
10.00	6	66.8	14.5	0.0	0.0	15.3	82.3	0.0	0.0	65.8	-2.5	0.0	-0.8	13.3	65.3	0.0	0.0	0.0	-0.8	11.1	3.60	3.85
12.00	7	69.7	9.3	0.0	0.0	17.4	78.4	0.0	0.0	66.7	-4.7	0.0	-2.5	14.4	64.4	0.0	0.0	0.0	-2.5	10.7	3.47	4.29
14.00	8	71.6	6.2	0.0	0.0	22.4	70.4	0.0	0.0	64.6	-3.8	0.0	-1.8	16.4	61.4	0.0	0.0	0.0	-1.8	10.3	3.34	3.91
16.00	9	72.5	4.0	0.0	0.0	29.4	60.4	0.0	0.0	61.5	1.0	0.0	0.0	16.4	56.4	0.0	0.0	0.0	0.0	9.9	3.21	3.21
18.00	10	77.5	-3.1	0.0	-1.0	35.4	51.4	0.0	0.0	60.5	0.9	0.0	0.0	19.4	55.4	0.0	0.0	0.0	-1.0	9.5	3.07	3.40
20.00	11	73.4	-0.3	0.0	-0.0	13.5	79.5	0.0	0.0	54.4	7.7	0.0	0.0	-5.5	86.5	-2.7	0.0	-2.7	-0.0	9.1	3.64	2.95
20.00	11	73.4	-0.3	0.0	-0.0	13.5	79.5	0.0	0.0	54.4	7.7	0.0	0.0	-5.5	86.5	-2.7	0.0	-2.7	-0.0	9.1	3.64	2.95
22.50	12	71.4	-2.3	0.0	-0.6	37.5	42.5	0.0	0.0	56.4	0.7	0.0	0.0	22.5	44.5	0.0	0.0	0.0	-0.6	8.6	2.78	2.97
25.00	13	63.4	6.8	0.0	0.0	25.5	56.5	0.0	0.0	56.4	0.8	0.0	0.0	16.5	50.5	0.0	0.0	0.0	0.0	8.1	2.62	2.62
27.50	14	63.5	5.6	0.0	0.0	15.6	69.6	0.0	0.0	61.5	-7.2	0.0	-6.3	13.6	56.6	0.0	0.0	0.0	-6.3	7.6	2.45	4.46
30.00	15	64.5	3.6	0.0	0.0	10.6	76.6	0.0	0.0	64.5	-12.2	0.0	-16.0	10.6	59.6	0.0	0.0	0.0	-16.0	7.1	2.29	7.46
32.50	16	65.5	2.6	0.0	0.0	8.6	76.6	0.0	0.0	66.5	-15.2	0.0	-23.2	9.6	59.6	0.0	0.0	0.0	-23.2	6.5	2.13	9.66
35.00	17	64.6	3.9	0.0	0.0	10.6	76.6	0.0	0.0	64.6	-12.1	0.0	-15.6	10.6	59.6	0.0	0.0	0.0	-15.6	8.0	1.96	7.10
37.50	18	63.6	5.9	0.0	0.0	15.7	69.7	0.0	0.0	61.6	-7.1	0.0	-6.0	13.7	56.7	0.0	0.0	0.0	-6.0	5.5	1.60	3.76
40.00	19	63.6	6.9	0.0	0.0	25.7	56.7	0.0	0.0	56.6	0.9	0.0	0.0	18.7	50.7	0.0	0.0	0.0	0.0	5.0	1.64	1.64
42.50	20	71.6	-2.0	0.0	-0.5	37.7	42.7	0.0	0.0	56.6	1.0	0.0	0.0	22.7	44.7	0.0	0.0	0.0	-0.5	4.5	1.47	1.62
45.00	21	73.7	-0.0	0.0	-0.0	13.8	79.8	0.0	0.0	54.7	8.0	0.0	0.0	-5.2	86.8	-2.5	0.0	-2.5	-0.0	4.0	2.11	1.31
45.00	21	73.7	-0.0	0.0	-0.0	13.8	79.8	0.0	0.0	54.7	8.0	0.0	0.0	-5.2	86.8	-2.5	0.0	-2.5	-0.0	4.0	2.11	1.31
47.00	22	77.8	-2.6	0.0	-0.6	35.8	51.8	0.0	0.0	60.8	1.2	0.0	0.0	19.8	55.8	0.0	0.0	0.0	-0.6	3.6	1.18	1.44
49.00	23	72.9	4.4	0.0	0.0	29.8	60.8	0.0	0.0	61.9	1.4	0.0	0.0	16.8	56.8	0.0	0.0	0.0	0.0	3.2	1.05	1.05
51.00	24	72.1	8.8	0.0	0.0	22.8	70.8	0.0	0.0	65.1	-3.4	0.0	-1.4	16.8	61.8	0.0	0.0	0.0	-1.4	2.8	0.92	1.37
53.00	25	70.2	9.8	0.0	0.0	17.9	76.9	0.0	0.0	67.2	-4.2	0.0	-2.0	14.9	64.9	0.0	0.0	0.0	-2.0	2.4	0.78	1.45
55.00	26	67.3	15.0	0.0	0.0	15.9	82.9	0.0	0.0	66.3	-2.0	0.0	-0.5	13.9	65.9	0.0	0.0	0.0	-0.5	2.0	0.65	0.81
57.00	27	63.5	21.2	0.0	0.0	14.9	84.9	0.0	0.0	63.5	2.2	0.0	0.0	14.9	65.9	0.0	0.0	0.0	0.0	1.6	0.52	0.52
59.00	28	58.6	28.4	0.0	0.0	17.9	82.9	0.0	0.0	58.6	9.4	0.0	0.0	16.9	63.9	0.0	0.0	0.0	0.0	1.2	0.39	0.39
61.00	29	54.7	34.6	0.0	0.0	24.0	75.0	0.0	0.0	52.7	17.6	0.0	0.0	22.0	58.0	0.0	0.0	0.0	0.0	0.8	0.26	0.26
63.00	30	50.9	39.8	0.0	0.0	34.0	63.0	0.0	0.0	45.9	26.8	0.0	0.0	29.0	49.0	0.0	0.0	0.0	0.0	0.4	0.13	0.13
65.00	31	46.0	47.0	0.0	0.0	46.0	47.0	0.0	0.0	38.0	38.0	0.0	0.0	38.0	38.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO I E-2
COMPROBACION A ROTURA

FECHA

HOJA N.º

COMPROBACION A ROTURA POR FLEXION

A continuación se adjuntan para cada sección los momentos mayorados producidos por cargas exteriores, el momento hiperestático de pretensado, la suma de ambos, ponderando el pretensado por 0,9 ó 1.1 y los momentos últimos, tanto positivos como negativos.

En el siguiente cuadro se resumen las secciones de centro de vano y sobre pilas:

SECCION	Md f. exteriores	Md F. exteriores + hiperestático ponderado	Mu último
V-1; V-3	3542	4012	5872
P-1 y P-2	-5617	-4656	-5746
V-2	3741	4916	7274

El momento total es inferior al momento último en todas las secciones estudiadas => El coeficiente de seguridad a rotura es superior a 1.6


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                                                    TAV22      189 10/04/97   1

Calculo de Comprobacion a Rotura - Datos generales
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Limite elastico del acero pasivo ..... =   5100.00  kg/cm2
Coeficiente del acero pasivo ......... =      1.15
Limite elastico de acero activo ...... =    170.00  kg/cm2
Coeficiente del acero activo ......... =      1.10
Resistencia caracteristica del hormigon ..... =   350.00  kg/cm2
Coeficiente del hormigon ............. =      1.50

Coef. mayoracion Cargas muertas y Peso propio . =      1.60
Coef. mayoracion Sobrecargas ......... =      1.60
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Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
1	1	(H1)	0.00	0.00	0.00	3251.06	0.3	-4146.33	0.5
	1	(H2)	0.00	0.00	0.00	3251.06	0.3	-4146.33	0.5
	2	(H1)	1525.31	106.79	1642.79	4411.27	0.3	-3007.22	0.5
	2	(H2)	542.44	106.79	659.91	4411.27	0.3	-3007.22	0.5
	3	(H1)	2624.09	213.59	2859.03	5224.34	0.3	-2222.98	0.4
	3	(H2)	862.35	213.59	1097.29	5224.34	0.3	-2222.98	0.4
	4	(H1)	3296.32	320.38	3648.74	5709.86	0.3	-1791.59	0.4
	4	(H2)	959.72	320.38	1312.13	5709.86	0.3	-1791.59	0.4
	5	(H1)	3542.01	427.17	4011.90	5871.62	0.3	-1651.10	0.4
	5	(H2)	834.55	427.17	1304.44	5871.62	0.3	-1651.10	0.4
	6	(H1)	3361.16	533.96	3948.52	5732.97	0.3	-1767.36	0.4
	6	(H2)	486.86	533.96	1074.22	5732.97	0.3	-1767.36	0.4
	7	(H1)	2753.77	640.76	3458.60	5317.55	0.3	-2124.44	0.4
	7	(H2)	-83.37	640.76	493.31	5317.55	0.3	-2124.44	0.4
	8	(H1)	1719.84	747.55	2542.14	4624.84	0.3	-2751.60	0.5
	8	(H2)	-876.14	747.55	-203.35	4624.84	0.3	-2751.60	0.5
	9	(H1)	259.37	854.34	1199.14	3599.96	0.3	-3692.21	0.5
	9	(H2)	-1891.44	854.34	-1122.54	3599.96	0.3	-3692.21	0.5
	10	(H1)	-1263.09	961.13	-398.08	2209.26	0.3	-4995.52	0.5
	10	(H2)	-3286.01	961.13	-2421.00	2209.26	0.3	-4995.52	0.5
	11	(H1)	-2516.11	1067.92	-1554.98	1544.07	0.3	-5746.80	0.6
	11	(H2)	-5617.43	1067.92	-4656.30	1544.07	0.3	-5746.80	0.6
2	1	(H1)	-2516.11	1067.92	-1554.98	1544.07	0.3	-5746.80	0.6
	1	(H2)	-5617.43	1067.92	-4656.30	1544.07	0.3	-5746.80	0.6
	2	(H1)	-1108.35	1067.92	-147.22	2603.26	0.3	-4498.13	0.5
	2	(H2)	-2613.13	1067.92	-1652.00	2603.26	0.3	-4498.13	0.5
	3	(H1)	764.94	1067.92	1939.65	4773.35	0.3	-2579.60	0.4
	3	(H2)	-989.87	1067.92	-28.73	4773.35	0.3	-2579.60	0.4
	4	(H1)	2408.27	1067.93	3582.99	6162.41	0.3	-1381.62	0.4
	4	(H2)	36.33	1067.93	1211.05	6162.41	0.3	-1381.62	0.4
	5	(H1)	3407.97	1067.93	4582.69	6995.84	0.3	-812.62	0.3

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	5	(H2)	645.70	1067.93	1820.42	6995.84	0.3	-812.62	0.3
	6	(H1)	3741.20	1067.93	4915.92	7273.65	0.3	-661.72	0.3
	6	(H2)	858.15	1067.93	2032.88	7273.65	0.3	-661.72	0.3
	7	(H1)	3407.97	1067.93	4582.69	6995.84	0.3	-812.62	0.3
	7	(H2)	645.70	1067.93	1820.42	6995.84	0.3	-812.62	0.3
	8	(H1)	2408.27	1067.93	3582.99	6162.41	0.3	-1381.62	0.4
	8	(H2)	36.33	1067.93	1211.05	6162.41	0.3	-1381.62	0.4
	9	(H1)	764.94	1067.93	1939.66	4773.35	0.3	-2579.60	0.4
	9	(H2)	-989.87	1067.93	-28.73	4773.35	0.3	-2579.60	0.4
	10	(H1)	-1108.35	1067.93	-147.22	2603.26	0.3	-4498.13	0.5
	10	(H2)	-2613.13	1067.93	-1652.00	2603.26	0.3	-4498.13	0.5
	11	(H1)	-2516.11	1067.93	-1554.98	1544.07	0.3	-5746.80	0.6
	11	(H2)	-5617.43	1067.93	-4656.29	1544.07	0.3	-5746.80	0.6
3	1	(H1)	-2516.11	1067.93	-1554.98	1544.07	0.3	-5746.80	0.6
	1	(H2)	-5617.43	1067.93	-4656.29	1544.07	0.3	-5746.80	0.6
	2	(H1)	-1263.09	961.13	-398.07	2209.26	0.3	-4995.52	0.5
	2	(H2)	-3286.01	961.13	-2420.99	2209.26	0.3	-4995.52	0.5
	3	(H1)	259.37	854.34	1199.15	3599.96	0.3	-3692.21	0.5
	3	(H2)	-1891.44	854.34	-1122.53	3599.96	0.3	-3692.21	0.5
	4	(H1)	1719.84	747.55	2542.15	4624.84	0.3	-2751.60	0.5
	4	(H2)	-876.14	747.55	-203.34	4624.84	0.3	-2751.60	0.5
	5	(H1)	2753.77	640.76	3458.61	5317.55	0.3	-2124.44	0.4
	5	(H2)	-83.37	640.76	493.31	5317.55	0.3	-2124.44	0.4
	6	(H1)	3361.16	533.97	3948.53	5732.97	0.3	-1767.36	0.4
	6	(H2)	486.86	533.97	1074.22	5732.97	0.3	-1767.36	0.4
	7	(H1)	3542.01	427.18	4011.90	5871.62	0.3	-1651.10	0.4
	7	(H2)	834.55	427.18	1304.45	5871.62	0.3	-1651.10	0.4
	8	(H1)	3296.32	320.38	3648.74	5709.86	0.3	-1791.59	0.4
	8	(H2)	959.72	320.38	1312.14	5709.86	0.3	-1791.59	0.4
	9	(H1)	2624.09	213.59	2859.03	5224.34	0.3	-2222.98	0.4
	9	(H2)	862.35	213.59	1097.29	5224.34	0.3	-2222.98	0.4

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V. Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
10	(H1)	1525.31	106.79	1642.79	4411.27	0.3	-3007.22	0.5
10	(H2)	542.44	106.79	659.91	4411.27	0.3	-3007.22	0.5
11	(H1)	0.00	0.00	0.00	3251.06	0.3	-4146.33	0.5
11	(H2)	0.00	0.00	0.00	3251.06	0.3	-4146.33	0.5

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO I E-2
COMPROBACION A CORTANTE

FECHA

HOJA N.º

COMPROBACION A CORTANTE

Para el cálculo a cortante se ha tomado un ancho bruto de 2.85m y un ancho neto de 2.15m

Se ha dividido el tablero en dos zonas de armado:

- Zona de armadura mínima → 5c ϕ12/0.30
- Refuerzo en zonas próximas a riostras y pilas

$$A_{wc} = -\left(\frac{139-32}{2.5} \times 1.5\right) + 139 = 74{,}8\ m^2/m \Rightarrow 5c\ \phi 12/0.15$$

A continuación se adjunta un listado con la armadura necesaria en cada sección de cálculo.

Calculo de Comprobacion a Cortante - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio .	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-326.9	0.0	-7.84	379.1	-4063.2
	1	(H2)	0.00	-869.3	0.0	-7.84	379.1	-4063.2
	2	(H1)	542.44	-215.6	0.0	-740.44	324.2	-4048.6
	2	(H2)	1525.31	-656.0	0.0	-740.44	324.2	-4048.6
	3	(H1)	862.35	-104.3	0.0	-1254.31	196.7	-4024.4
	3	(H2)	2624.09	-442.8	0.0	-1254.31	196.7	-4024.4
	4	(H1)	959.72	6.9	0.0	-1509.47	70.6	-3995.6
	4	(H2)	3296.32	-229.5	0.0	-1509.47	70.6	-3995.6
	5	(H1)	834.55	118.2	0.0	-1510.27	-53.4	-3962.1
	5	(H2)	3542.01	-16.2	0.0	-1510.27	-53.4	-3962.1
	6	(H1)	2107.05	280.9	0.0	-1282.31	-158.2	-3928.6
	6	(H2)	1523.63	125.8	0.0	-1282.31	-158.2	-3928.6
	7	(H1)	1797.39	490.0	0.0	-847.39	-261.1	-3892.7
	7	(H2)	1160.75	237.1	0.0	-847.39	-261.1	-3892.7
	8	(H1)	604.06	703.3	0.0	-211.95	-361.8	-3854.5
	8	(H2)	575.33	348.3	0.0	-211.95	-361.8	-3854.5
	9	(H1)	-1015.80	916.6	0.0	616.87	-460.2	-3814.1
	9	(H2)	-232.61	459.6	0.0	616.87	-460.2	-3814.1
	10	(H1)	-3062.21	1129.8	0.0	1631.37	-556.2	-3771.7
	10	(H2)	-1263.09	570.9	0.0	1631.37	-556.2	-3771.7
	11	(H1)	-5535.16	1343.1	0.0	2215.93	-53.4	-3691.3
	11	(H2)	-2516.11	682.1	0.0	2215.93	-53.4	-3691.3
2	1	(H1)	-2516.11	-632.6	0.0	2215.93	0.0	-3691.3
	1	(H2)	-5617.43	-1385.5	0.0	2215.93	0.0	-3691.3
	2	(H1)	-1108.35	-493.6	0.0	1407.44	599.2	-3500.1
	2	(H2)	-2486.99	-1118.9	0.0	1407.44	599.2	-3500.1
	3	(H1)	-48.30	-354.5	0.0	102.15	446.9	-3480.3
	3	(H2)	-23.03	-852.3	0.0	102.15	446.9	-3480.3
	4	(H1)	664.04	-215.4	0.0	-814.63	295.7	-3454.2
	4	(H2)	1774.47	-585.7	0.0	-814.63	295.7	-3454.2
	5	(H1)	1028.68	-76.3	0.0	-1346.32	146.5	-3422.0

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
5	(H2)	2649.33	-347.8	0.0	-1346.32	146.5	-3422.0
6	(H1)	2930.32	62.8	0.0	-1500.43	0.0	-3383.9
6	(H2)	2930.32	-62.8	0.0	-1500.43	0.0	-3383.9
7	(H1)	2649.33	347.8	0.0	-1346.33	-146.5	-3422.0
7	(H2)	1028.68	76.3	0.0	-1346.33	-146.5	-3422.0
8	(H1)	1774.47	585.7	0.0	-814.63	-295.7	-3454.2
8	(H2)	664.04	215.4	0.0	-814.63	-295.7	-3454.2
9	(H1)	-23.03	852.3	0.0	102.15	-446.9	-3480.3
9	(H2)	-48.30	354.5	0.0	102.15	-446.9	-3480.3
10	(H1)	-2486.99	1118.9	0.0	1407.44	-599.2	-3500.1
10	(H2)	-1108.35	493.6	0.0	1407.44	-599.2	-3500.1
11	(H1)	-5617.43	1385.5	0.0	2215.94	0.0	-3691.3
11	(H2)	-2516.11	632.6	0.0	2215.94	0.0	-3691.3
3 1	(H1)	-2516.11	-682.1	0.0	2215.94	53.4	-3691.3
1	(H2)	-5535.16	-1343.1	0.0	2215.94	53.4	-3691.3
2	(H1)	-1263.09	-570.9	0.0	1631.37	556.2	-3771.7
2	(H2)	-3062.21	-1129.8	0.0	1631.37	556.2	-3771.7
3	(H1)	-232.61	-459.6	0.0	616.87	460.2	-3814.1
3	(H2)	-1015.80	-916.6	0.0	616.87	460.2	-3814.1
4	(H1)	575.33	-348.3	0.0	-211.96	361.8	-3854.5
4	(H2)	604.06	-703.3	0.0	-211.96	361.8	-3854.5
5	(H1)	1160.75	-237.1	0.0	-847.39	261.1	-3892.7
5	(H2)	1797.39	-490.0	0.0	-847.39	261.1	-3892.7
6	(H1)	1523.63	-125.8	0.0	-1282.31	158.2	-3928.6
6	(H2)	2107.05	-280.9	0.0	-1282.31	158.2	-3928.6
7	(H1)	3542.01	16.2	0.0	-1510.27	53.4	-3962.1
7	(H2)	834.55	-118.2	0.0	-1510.27	53.4	-3962.1
8	(H1)	3296.32	229.5	0.0	-1509.47	-70.6	-3995.6
8	(H2)	959.72	-6.9	0.0	-1509.47	-70.6	-3995.6
9	(H1)	2624.09	442.8	0.0	-1254.31	-196.7	-4024.4
9	(H2)	862.35	104.3	0.0	-1254.31	-196.7	-4024.4

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
10	(H1)	1525.31	656.0	0.0	-740.44	-324.2	-4048.6
10	(H2)	542.44	215.6	0.0	-740.44	-324.2	-4048.6
11	(H1)	0.00	869.3	0.0	-7.86	-379.1	-4063.3
11	(H2)	0.00	326.9	0.0	-7.86	-379.1	-4063.3

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1)	AB	1.6992	52.3	1664.6	0.03	207.74	--	25.00
	1	(H2)	AB	1.6992	-490.1	1664.6	0.29	207.74	27.48	25.00
	2	(H1)	AB	1.6972	108.6	1665.5	0.07	207.74	--	25.00
	2	(H2)	AB	1.6972	-331.8	1665.5	0.20	207.74	12.09	25.00
	3	(H1)	AB	1.6939	92.3	1667.1	0.06	207.74	--	25.00
	3	(H2)	AB	1.6939	-246.1	1667.1	0.15	207.74	3.74	25.00
	4	(H1)	AB	1.6899	77.5	1669.0	0.05	207.74	--	25.00
	4	(H2)	AB	1.6899	-158.9	1669.0	0.10	207.74	--	25.00
	5	(H1)	AB	1.6853	64.8	1671.2	0.04	207.74	--	25.00
	5	(H2)	C	1.6853	-69.6	1671.2	0.04	207.74	--	25.00
	6	(H1)	AB	1.6807	122.7	1673.4	0.07	207.74	--	25.00
	6	(H2)	AB	1.6807	-32.4	1673.4	0.02	207.74	--	25.00
	7	(H1)	AB	1.6757	229.0	1675.7	0.14	207.74	2.09	25.00
	7	(H2)	AB	1.6757	-24.0	1675.7	0.01	207.74	--	25.00
	8	(H1)	AB	1.6704	341.5	1678.2	0.20	207.74	13.24	25.00
	8	(H2)	AB	1.6704	-13.5	1678.2	0.01	207.74	--	25.00
	9	(H1)	AB	1.6648	456.4	1680.9	0.27	207.74	24.69	25.00
	9	(H2)	AB	1.6648	-0.6	1680.9	0.00	207.74	--	25.00
	10	(H1)	AB	1.6588	573.7	1683.7	0.34	207.74	36.47	25.00
	10	(H2)	AB	1.6588	14.7	1683.7	0.01	207.74	--	25.00
	11	(H1)	C	1.6476	1289.7	1689.1	0.76	0.00	129.43	25.00
	11	(H2)	AB	1.6476	628.7	1689.1	0.37	207.74	42.25	25.00
2	1	(H1)	AB	1.6476	-632.6	1689.1	0.37	207.74	42.64	25.00
	1	(H2)	C	1.6476	-1385.5	1689.1	0.82	0.00	139.04	25.00
	2	(H1)	AB	1.6204	105.6	1701.9	0.06	207.74	--	25.00
	2	(H2)	AB	1.6204	-519.7	1701.9	0.31	207.74	31.83	25.00
	3	(H1)	AB	1.6175	92.4	1703.2	0.05	207.74	--	25.00
	3	(H2)	AB	1.6175	-405.4	1703.2	0.24	207.74	20.21	25.00
	4	(H1)	AB	1.6138	80.3	1705.0	0.05	207.74	--	25.00
	4	(H2)	AB	1.6138	-290.0	1705.0	0.17	207.74	8.43	25.00
	5	(H1)	AB	1.6091	70.2	1707.2	0.04	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	5	(H2)	AB	1.6091	-201.4	1707.2	0.12	207.74	--	25.00
	6	(H1)	AB	1.6036	62.8	1709.8	0.04	207.74	--	25.00
	6	(H2)	AB	1.6036	-62.8	1709.8	0.04	207.74	--	25.00
	7	(H1)	AB	1.6091	201.4	1707.2	0.12	207.74	--	25.00
	7	(H2)	AB	1.6091	-70.1	1707.2	0.04	207.74	--	25.00
	8	(H1)	AB	1.6138	290.0	1705.0	0.17	207.74	8.43	25.00
	8	(H2)	AB	1.6138	-80.3	1705.0	0.05	207.74	--	25.00
	9	(H1)	AB	1.6175	405.4	1703.2	0.24	207.74	20.21	25.00
	9	(H2)	AB	1.6175	-92.4	1703.2	0.05	207.74	--	25.00
	10	(H1)	AB	1.6204	519.7	1701.9	0.31	207.74	31.83	25.00
	10	(H2)	AB	1.6204	-105.7	1701.9	0.06	207.74	--	25.00
	11	(H1)	C	1.6476	1385.5	1689.1	0.82	0.00	139.04	25.00
	11	(H2)	AB	1.6476	632.6	1689.1	0.37	207.74	42.64	25.00
3	1	(H1)	AB	1.6476	-628.7	1689.1	0.37	207.74	42.25	25.00
	1	(H2)	C	1.6476	-1289.7	1689.1	0.76	0.00	129.43	25.00
	2	(H1)	AB	1.6588	-14.7	1683.7	0.01	207.74	--	25.00
	2	(H2)	AB	1.6588	-573.7	1683.7	0.34	207.74	36.47	25.00
	3	(H1)	AB	1.6648	0.6	1680.9	0.00	207.74	--	25.00
	3	(H2)	AB	1.6648	-456.4	1680.9	0.27	207.74	24.69	25.00
	4	(H1)	AB	1.6704	13.5	1678.2	0.01	207.74	--	25.00
	4	(H2)	AB	1.6704	-341.5	1678.2	0.20	207.74	13.24	25.00
	5	(H1)	AB	1.6757	24.0	1675.7	0.01	207.74	--	25.00
	5	(H2)	AB	1.6757	-229.0	1675.7	0.14	207.74	2.09	25.00
	6	(H1)	AB	1.6807	32.4	1673.4	0.02	207.74	--	25.00
	6	(H2)	AB	1.6807	-122.7	1673.4	0.07	207.74	--	25.00
	7	(H1)	C	1.6853	69.6	1671.2	0.04	207.74	--	25.00
	7	(H2)	AB	1.6853	-64.8	1671.2	0.04	207.74	--	25.00
	8	(H1)	AB	1.6899	158.9	1669.0	0.10	207.74	--	25.00
	8	(H2)	AB	1.6899	-77.5	1669.0	0.05	207.74	--	25.00
	9	(H1)	AB	1.6939	246.1	1667.1	0.15	207.74	3.74	25.00
	9	(H2)	AB	1.6939	-92.3	1667.1	0.06	207.74	--	25.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
10	(H1)	AB	1.6972	331.8	1665.5	0.20	207.74	12.09	25.00
10	(H2)	AB	1.6972	-108.6	1665.5	0.07	207.74	--	25.00
11	(H1)	AB	1.6992	490.1	1664.6	0.29	207.74	27.48	25.00
11	(H2)	AB	1.6992	-52.3	1664.6	0.03	207.74	--	25.00

PROYECTO L.A.V ZARAGOZA- LLEIDA
SUBTRAMO 1. E-2
CALCULO A TORSION

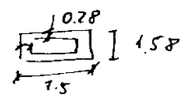
FECHA

HOJA N.°

CALCULO A TORSION

Empotramiento a torsión en pilas y estribos => Luz de calculo: 25,0 m

$$Td = 1.6 \times \left[(2.25 + 0.30) \times 12 + 0.4 \times 175 \times 5.99 \right] \times \frac{25}{2} = 634 \text{ mt}$$

Sección rectangular equivalente: 

$$he = \frac{1.58}{6} = 0.26 \qquad Ae = 1.32 \times 7.24 = 9.56 \text{ m}^2$$

$$\frac{At}{s} = \frac{634}{2 \times 9.56 \times 4.2} = 7.9 \text{ cm}^2/\text{m}$$

$$\frac{Al}{u} = 7.5 \text{ cm}^2/\text{m}$$

$$Tu_1 = 0.36 \times \frac{3500}{1.5} \times Ae \cdot he = 2088 \text{ mt}$$

COMPROBACION A CORTANTE Y TORSION

Sección pila: $\frac{Vrd}{Vu_1} + \frac{Td}{Tu_1} = 0.84 + 0.30$

↳ NO SON CONCOMITANTES (sección cortante - máximo torsor)

2 vías cargadas | 1 vía cargada

Con 2 vías cargadas $Td = 1.6 \times \left[0.3 \times 24 + 0.4 \times 175 \times 5.99 \right] \times \frac{25}{2} = 228$

$$\frac{Td}{Tu_1} = 0.11$$

PROYECTO L.A.V ZARAGOZA-LERIDA
SUBTRAMO 1 E-2 (3 VANOS)
ARMADURA ANCLAJES PRETENSADO

FECHA

HOJA N.º

ARMADURA ANCLAJES DE PRETENSADO

- CABLES DE CASCO

Fact: 77 t

Ffrenado: 292 t

$1.6 \times (77 + 292) = 590$ t

2 CABLES DE 12ϕ0.6" TESADOS A 220 t
650×650×56 (41)

Placa de anclaje: 0.27 × 0.27

$A_{nec} = 1.6 \times 220 \times 0.3 \times \frac{1.15}{5.1} \times \left(\frac{1.65 - 0.27}{1.65}\right) = 19.9\ cm^2$

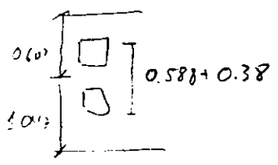
$\left(\frac{1.60 \cdot 0.27}{1.60}\right) = 19.8\ cm^2$

Neopreno 0,65×0.65 → 6.87 k/cm²

$A_{nec}: 1.6 - \left(220 + 292 - \frac{1}{2}\right) \times 0.3 \times \frac{1.15}{5.1} \times \left(\frac{1.65 - 0.65}{1.65}\right) = 24.0\ cm^2$

$\left(\frac{1.60 - 0.65}{1.60}\right) = 23.5\ cm^2$

- CABLES PRINCIPALES



$A_{vert}: 2 \times 478 \cdot 0.3 \times \frac{1.15}{5.1} \times 1.6 \times \left(\frac{1.047 \times 2 - (0.588 + 0.38)}{1.047 \times 2}\right)$

$\left(\frac{0.603 \times 2 - (.588 + .38)}{0.603 \times 2}\right)$

$= \begin{matrix} 55.6 \\ 20.4 \end{matrix} > 3\gamma \rightarrow \underline{3 \times 2c\phi 20}$

$A_{Horiz}: 478 \times 0.3 - \frac{1.15}{5.1} \times 1.6 - \left(\frac{1.6 - 0.27}{1.6}\right) = 89.4\ cm^2 \rightarrow \underline{3 \times 2c\phi 20}$

079

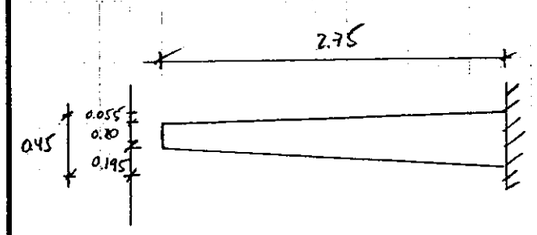
CALCULO TRANSVERSAL

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-2
ARMADURA DE VOLADIZO

FECHA

HOJA N.º

ARMADURA DE VOLADIZO



Peso propio $M = 0.20 \times \frac{2.75^2}{2} \times 2.5 + \frac{1}{2} 2.75 \times 0.25 \times 2.5 \times \frac{1}{3} 2.75 = 2.7 \text{ mt}$

Pasillos $M = 0.5 \times 1.75 \times 1.875 = 1.64 \text{ mt}$

Sobrecarga en pasillos $M = 0.4 \times 1.75 \times 1.875 = 1.31 \text{ mt}$

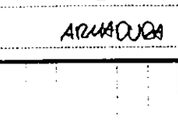
Barandilla : $0.05 \times 2.75 = 0.14 \text{ mt}$

Balasto $\frac{4.1}{9.92} \times 1 \times 0.50 = 0.21 \text{ mt}$

6 mt/m

$M_d = 1.6 \times 6 = 9.6 \text{ mt/m} \rightarrow U_c = \frac{3500}{15} \times 0.4 = 933$ $A_{nec} = 5.5 \text{ cm}^2/\text{m}$

Descentramiento :



Aa)

$M = 6 + 1.5 \times (2.25 + 2.8 - 4.10) = 7.43 \text{ mt/m}$

Ab) $M = 6 + \frac{10}{n} = 9,18 \text{ mt/m}$

Ba) $M = 6 + 5 \times 0.95 = 10.75 \text{ mt/m}$

Bb) $M = 6 + \frac{22}{n} = 13 \text{ mt/m}$

A_{nec} (13 mt/m) $\Rightarrow A_{nec} = 7.4$

$U_c = \frac{3500}{15} \times 1.0 \times 0.4 = 1273 \rightarrow A = 7.4 \text{ cm}^2/\text{m}$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-2
ARMADURA VOLADIZO

FECHA

HOJA N.º

CALCULO RASANTES

Mestribo: $0.20 \times 2.75 \times (0.71055 - 0.055 - 0.10) +$

$+ \frac{1}{2} 2.75 \times 0.25 \times \left(0.71055 - 0.255 - \frac{1}{3} 0.25\right) = 0.433502 \text{ m}^3$

Armadura: $V_{rd} - \frac{M_{est}}{6 \cdot 1} \times b_1 - \frac{1}{f_{yd}} = V_{rd} \times \frac{0.433502}{2.69706 \times 4.2} = 0.0383 \, V_{rd}$

Tomando valores medios por zonas:

	V_{rd} (t)	A (cm²/m)
Estribos:	411	15.7
2L/10 del estribo	246	9.4
2L/10 vano lateral	456	17.5
Pilas laterales	932	35.7
2L/10 vano intermedio	405	15.5

RIOSTRAS SOBRE PILAS

Reacciones a todo el ancho:

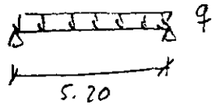
P. propio : 635 t

C. permanente : 268 t

Tren : 604 t

Pretensado : -53 t

TOTAL : 1454 t → $q = \frac{1454}{5{,}20} = 280$ t/m



Flexión:

$M_d = 1.6 \times 280 \times \frac{5.2^2}{8} = 1515$ mt

$U_c = \frac{3500}{1.5} \times 3{,}00 \times 155 = 10850$

$A_{nec} = \underline{\underline{232\ cm^2}}$

6 disponen $2 \times 26\ \phi 25$

Cortante $V_d = 1.6 \times 280 \times \frac{5.20}{2} = 1165$ t

$V_{u1} = 0.3 \times \frac{3500}{1.5} \times 3 \times 150 = 3150$ t

$V_{cu} = 5\sqrt{\frac{350}{1.5}} \times 3 \times 15 = 343$ t

$A_{nec} = \frac{1165 - 343}{0.9 \times 42 \times 15} = 145\ cm^2/m$

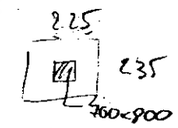
$A_{min} = 0.02 \times \frac{3500}{1.5} \times 3 \times \frac{1}{4.2} = 33\ cm^2/m$

Viga continua: $141\ cm^2 \times \frac{1}{68} \times 3 = 64\ cm^2$

Punzonamiento

$R_{max} = 760 \times 1.6$

Perímetro crítico:



$V_{cu} = 2 \times 5\sqrt{\frac{350}{1.5}} \times 9.20 \times 1.55 = 2225 >> 1216$ t

NO NECESITA ARMADURA DE PUNZONAMIENTO

Armadura reparto

$R_{max} = 1216$ t

$A = 0.3 \times 1216 \times \frac{1.15}{5.1} \times \left[1 - \frac{0.8}{1.60}\right] = 41\ cm^2$

$\times 10 = 82\ cm^2 \rightarrow \underline{\underline{3\ \#\ 10\ \phi 20}}$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-2
RIOSTRA SOBRE ESTRIBOS

FECHA

HOJA N.º

RIOSTRA SOBRE ESTRIBOS

Reacciones a todo el ancho:

P propio:	224 t
C permanente:	90 t
Tren:	219 t
Pretensado:	59 t
TOTAL:	592 t → $q = \frac{592}{5.8} = 102$ t/m

Flexión:

$$M_d = 1.6 \times 102 \cdot \frac{5.8^2}{8} = 686 \text{ m t}$$

$$U_c = \frac{3500}{1.5} \times 18.9 \cdot 1.55 = 6510$$

$$A_{nec} = 103.5 \text{ cm}^2$$

Cortante

$$V_d = 1.6 \cdot 102 \cdot \frac{5.8}{2} = 473 \text{ t}$$

$$V_{u1} = 0.3 \times \frac{3500}{1.5} \cdot 18 \cdot 15 = 1890 \text{ t}$$

$$V_{cu} = 5\sqrt{\frac{350}{1.5}} \times 18 \cdot 15 = 206 \text{ t}$$

$$A_{nec} = \frac{473 - 206}{0.9 \times 4.2 \times 1.5} \quad 47.0 \text{ cm}^2/\text{m} \qquad A_{min} = 25.4 \text{ cm}^2/\text{m}$$

Viga collivva: $\rightarrow 34 \cdot \frac{3}{68} = 15 \text{ cm}^2/\text{m}$

A. reparto: $R_{b,cu} = 323 \cdot 1.6 = 516$ $A = 0.3 \cdot 516 \cdot \frac{1.15}{51} \times \left[1 - \frac{a_0}{1.0}\right]$

$\times 1 \rightarrow 3085$

ALARGAMIENTOS TESADO

086

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-2. TRES VANOS. CABLE 1.

N° de puntos singulares en alzado = 13

PTO	----X----	----Y----	----P----
1	-0.8500	-0.3261	-0.16109
2	1.1500	-0.6483	-0.16109
3	8.0000	-1.2000	-0.00000
4	18.0000	-0.5333	0.13333
5	20.0000	-0.4000	-0.00000
6	22.5000	-0.6140	-0.17120
7	32.5000	-1.4700	-0.00000
8	42.5000	-0.6140	0.17120
9	45.0000	-0.4000	-0.00000
10	47.0000	-0.5333	-0.13333
11	57.0000	-1.2000	-0.00000
12	63.8500	-0.6483	0.16109
13	65.8500	-0.3261	0.16109

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
	-0.8500	0.0000	0.00000
2	65.8500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 478.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	-0.326	0.000	-0.1611	0.0000
2	0.000	-0.463	0.000	-0.1611	0.0000
3	1.000	-0.624	0.000	-0.1611	0.0000
4	2.000	-0.777	0.000	-0.1411	0.0000
5	3.000	-0.906	0.000	-0.1176	0.0000
6	4.000	-1.012	0.000	-0.0941	0.0000
7	5.000	-1.094	0.000	-0.0706	0.0000
8	6.000	-1.153	0.000	-0.0470	0.0000
9	7.000	-1.188	0.000	-0.0235	0.0000
10	8.000	-1.200	0.000	-0.0000	0.0000
11	9.000	-1.193	0.000	0.0133	0.0000
12	10.000	-1.173	0.000	0.0267	0.0000
13	11.000	-1.140	0.000	0.0400	0.0000
14	12.000	-1.093	0.000	0.0533	0.0000
15	13.000	-1.033	0.000	0.0667	0.0000
16	14.000	-0.960	0.000	0.0800	0.0000
17	15.000	-0.873	0.000	0.0933	0.0000
18	16.000	-0.773	0.000	0.1067	0.0000
19	17.000	-0.660	0.000	0.1200	0.0000
	18.000	-0.533	0.000	0.1333	0.0000
21	19.000	-0.433	0.000	0.0666	0.0000
22	20.000	-0.400	0.000	0.0000	0.0000
23	21.000	-0.434	0.000	-0.0685	0.0000
24	22.000	-0.537	0.000	-0.1370	0.0000
25	23.000	-0.697	0.000	-0.1626	0.0000
26	24.000	-0.852	0.000	-0.1455	0.0000
27	25.000	-0.988	0.000	-0.1284	0.0000
28	26.000	-1.108	0.000	-0.1113	0.0000
29	27.000	-1.211	0.000	-0.0942	0.0000
30	28.000	-1.297	0.000	-0.0770	0.0000
31	29.000	-1.365	0.000	-0.0599	0.0000
32	30.000	-1.416	0.000	-0.0428	0.0000
33	31.000	-1.451	0.000	-0.0257	0.0000
34	32.000	-1.468	0.000	-0.0086	0.0000
35	33.000	-1.468	0.000	0.0086	0.0000
36	34.000	-1.451	0.000	0.0257	0.0000
37	35.000	-1.416	0.000	0.0428	0.0000
38	36.000	-1.365	0.000	0.0599	0.0000
39	37.000	-1.297	0.000	0.0770	0.0000
	38.000	-1.211	0.000	0.0942	0.0000
41	39.000	-1.108	0.000	0.1113	0.0000
42	40.000	-0.988	0.000	0.1284	0.0000
43	41.000	-0.852	0.000	0.1455	0.0000
44	42.000	-0.697	0.000	0.1626	0.0000
45	43.000	-0.537	0.000	0.1370	0.0000
46	44.000	-0.434	0.000	0.0685	0.0000
47	45.000	-0.400	0.000	0.0000	0.0000
48	46.000	-0.433	0.000	-0.0666	0.0000
49	47.000	-0.533	0.000	-0.1333	0.0000
50	48.000	-0.660	0.000	-0.1200	0.0000
51	49.000	-0.773	0.000	-0.1067	0.0000
52	50.000	-0.873	0.000	-0.0933	0.0000
53	51.000	-0.960	0.000	-0.0800	0.0000
54	52.000	-1.033	0.000	-0.0667	0.0000
55	53.000	-1.093	0.000	-0.0533	0.0000
56	54.000	-1.140	0.000	-0.0400	0.0000
57	55.000	-1.173	0.000	-0.0267	0.0000
58	56.000	-1.193	0.000	-0.0133	0.0000
59	57.000	-1.200	0.000	-0.0000	0.0000
60	58.000	-1.188	0.000	0.0235	0.0000
61	59.000	-1.153	0.000	0.0470	0.0000
62	60.000	-1.094	0.000	0.0706	0.0000
63	61.000	-1.012	0.000	0.0941	0.0000
64	62.000	-0.906	0.000	0.1176	0.0000

65	63.000	-0.777	0.000	0.1411	0.0000
66	64.000	-0.624	0.000	0.1611	0.0000
67	65.000	-0.463	0.000	0.1611	0.0000
68	65.850	-0.326	0.000	0.1611	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	478.00	471.92	76.02
2	0.000	0.0000	0.0000	0.0000	477.49	471.41	75.94
3	1.000	0.0000	0.0000	0.0000	476.89	470.82	75.84
4	2.000	0.0195	0.0000	0.0195	474.34	469.68	66.27
5	3.000	0.0427	0.0000	0.0427	471.44	468.22	55.06
6	4.000	0.0659	0.0000	0.0659	468.56	466.50	43.88
7	5.000	0.0893	0.0000	0.0893	465.68	464.52	32.77
8	6.000	0.1127	0.0000	0.1127	462.81	462.30	21.74
9	7.000	0.1362	0.0000	0.1362	459.95	459.82	10.81
10	8.000	0.1597	0.0000	0.1597	457.11	457.11	0.00
11	9.000	0.1731	0.0000	0.1731	455.26	455.21	-6.07
12	10.000	0.1864	0.0000	0.1864	453.41	453.25	-12.09
13	11.000	0.1997	0.0000	0.1997	451.58	451.21	-18.05
14	12.000	0.2130	0.0000	0.2130	449.75	449.11	-23.96
15	13.000	0.2263	0.0000	0.2263	447.93	446.94	-29.80
16	14.000	0.2396	0.0000	0.2396	446.12	444.70	-35.58
17	15.000	0.2528	0.0000	0.2528	444.32	442.40	-41.29
18	16.000	0.2660	0.0000	0.2660	442.54	440.04	-46.94
19	17.000	0.2791	0.0000	0.2791	440.76	437.62	-52.51
	18.000	0.2923	0.0000	0.2923	438.99	435.14	-58.02
21	19.000	0.3583	0.0000	0.3583	432.41	431.45	-28.75
22	20.000	0.4248	0.0000	0.4248	425.87	425.87	-0.00
23	21.000	0.4932	0.0000	0.4932	419.27	418.29	28.64
24	22.000	0.5609	0.0000	0.5609	412.83	409.01	56.02
25	23.000	0.6027	0.0000	0.6027	408.70	403.40	65.61
26	24.000	0.6194	0.0000	0.6194	406.76	402.52	58.57
27	25.000	0.6362	0.0000	0.6362	404.82	401.52	51.56
28	26.000	0.6531	0.0000	0.6531	402.88	400.40	44.56
29	27.000	0.6700	0.0000	0.6700	400.94	399.17	37.59
30	28.000	0.6870	0.0000	0.6870	399.01	397.83	30.65
31	29.000	0.7041	0.0000	0.7041	397.08	396.37	23.75
32	30.000	0.7212	0.0000	0.7212	395.16	394.80	16.90
33	31.000	0.7383	0.0000	0.7383	393.25	393.12	10.10
34	32.000	0.7554	0.0000	0.7554	391.35	391.33	3.35
35	33.000	0.7554	0.0000	0.7554	391.35	391.33	-3.35
36	34.000	0.7383	0.0000	0.7383	393.25	393.12	-10.10
37	35.000	0.7212	0.0000	0.7212	395.16	394.80	-16.90
38	36.000	0.7041	0.0000	0.7041	397.08	396.37	-23.75
39	37.000	0.6870	0.0000	0.6870	399.01	397.83	-30.65
	38.000	0.6700	0.0000	0.6700	400.94	399.17	-37.59
41	39.000	0.6531	0.0000	0.6531	402.88	400.40	-44.56
42	40.000	0.6362	0.0000	0.6362	404.82	401.52	-51.56
43	41.000	0.6194	0.0000	0.6194	406.76	402.52	-58.57
44	42.000	0.6027	0.0000	0.6027	408.70	403.40	-65.61
45	43.000	0.5609	0.0000	0.5609	412.83	409.01	-56.02
46	44.000	0.4932	0.0000	0.4932	419.27	418.29	-28.64
47	45.000	0.4248	0.0000	0.4248	425.87	425.87	-0.00
48	46.000	0.3583	0.0000	0.3583	432.41	431.45	28.75
49	47.000	0.2923	0.0000	0.2923	438.99	435.14	58.02
50	48.000	0.2791	0.0000	0.2791	440.76	437.62	52.51
51	49.000	0.2660	0.0000	0.2660	442.54	440.04	46.94
52	50.000	0.2528	0.0000	0.2528	444.32	442.40	41.29
53	51.000	0.2396	0.0000	0.2396	446.12	444.70	35.58
54	52.000	0.2263	0.0000	0.2263	447.93	446.94	29.80
55	53.000	0.2130	0.0000	0.2130	449.75	449.11	23.96
56	54.000	0.1997	0.0000	0.1997	451.58	451.21	18.05
57	55.000	0.1864	0.0000	0.1864	453.41	453.25	12.09
58	56.000	0.1731	0.0000	0.1731	455.26	455.21	6.07
59	57.000	0.1597	0.0000	0.1597	457.11	457.11	0.00
60	58.000	0.1362	0.0000	0.1362	459.95	459.82	-10.81
61	59.000	0.1127	0.0000	0.1127	462.81	462.30	-21.74
62	60.000	0.0893	0.0000	0.0893	465.68	464.52	-32.77
63	61.000	0.0659	0.0000	0.0659	468.56	466.50	-43.88
64	62.000	0.0427	0.0000	0.0427	471.44	468.22	-55.06

65	63.000	0.0195	0.0000	0.0195	474.34	469.68	-66.27
66	64.000	0.0000	0.0000	0.0000	476.89	470.82	-75.84
67	65.000	0.0000	0.0000	0.0000	477.49	471.41	-75.94
68	65.850	0.0000	0.0000	0.0000	478.00	471.92	-76.02

Alarg. tesado ext. inicial = 411.2 mm. Retesado = 44.4 mm.
Alarg. tesado ext. final = 411.2 mm. Retesado = 44.4 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-2. TRES VANOS. CABLE 2.

N° de puntos singulares en alzado = 13

PTO	----X----	----Y----	----P----
1	-0.8500	-0.9154	-0.05246
2	1.1500	-1.0203	-0.05246
3	8.0000	-1.2000	-0.00000
4	18.0000	-0.5333	0.13333
5	20.0000	-0.4000	-0.00000
6	22.5000	-0.6140	-0.17120
7	32.5000	-1.4700	-0.00000
8	42.5000	-0.6140	0.17120
9	45.0000	-0.4000	-0.00000
10	47.0000	-0.5333	-0.13333
11	57.0000	-1.2000	-0.00000
12	63.8500	-1.0203	0.05246
13	65.8500	-0.9154	0.05246

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	65.8500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 478.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	-0.915	0.000	-0.0525	0.0000
2	0.000	-0.960	0.000	-0.0525	0.0000
3	1.000	-1.012	0.000	-0.0525	0.0000
4	2.000	-1.062	0.000	-0.0459	0.0000
5	3.000	-1.104	0.000	-0.0383	0.0000
6	4.000	-1.139	0.000	-0.0306	0.0000
7	5.000	-1.166	0.000	-0.0230	0.0000
8	6.000	-1.185	0.000	-0.0153	0.0000
9	7.000	-1.196	0.000	-0.0077	0.0000
10	8.000	-1.200	0.000	-0.0000	0.0000
11	9.000	-1.193	0.000	0.0133	0.0000
12	10.000	-1.173	0.000	0.0267	0.0000
13	11.000	-1.140	0.000	0.0400	0.0000
14	12.000	-1.093	0.000	0.0533	0.0000
15	13.000	-1.033	0.000	0.0667	0.0000
16	14.000	-0.960	0.000	0.0800	0.0000
17	15.000	-0.873	0.000	0.0933	0.0000
18	16.000	-0.773	0.000	0.1067	0.0000
19	17.000	-0.660	0.000	0.1200	0.0000
20	18.000	-0.533	0.000	0.1333	0.0000
21	19.000	-0.433	0.000	0.0666	0.0000
22	20.000	-0.400	0.000	0.0000	0.0000
23	21.000	-0.434	0.000	-0.0685	0.0000
24	22.000	-0.537	0.000	-0.1370	0.0000
25	23.000	-0.697	0.000	-0.1626	0.0000
26	24.000	-0.852	0.000	-0.1455	0.0000
27	25.000	-0.988	0.000	-0.1284	0.0000
28	26.000	-1.108	0.000	-0.1113	0.0000
29	27.000	-1.211	0.000	-0.0942	0.0000
30	28.000	-1.297	0.000	-0.0770	0.0000
31	29.000	-1.365	0.000	-0.0599	0.0000
32	30.000	-1.416	0.000	-0.0428	0.0000
33	31.000	-1.451	0.000	-0.0257	0.0000
34	32.000	-1.468	0.000	-0.0086	0.0000
35	33.000	-1.468	0.000	0.0086	0.0000
36	34.000	-1.451	0.000	0.0257	0.0000
37	35.000	-1.416	0.000	0.0428	0.0000
38	36.000	-1.365	0.000	0.0599	0.0000
39	37.000	-1.297	0.000	0.0770	0.0000
40	38.000	-1.211	0.000	0.0942	0.0000
41	39.000	-1.108	0.000	0.1113	0.0000
42	40.000	-0.988	0.000	0.1284	0.0000
43	41.000	-0.852	0.000	0.1455	0.0000
44	42.000	-0.697	0.000	0.1626	0.0000
45	43.000	-0.537	0.000	0.1370	0.0000
46	44.000	-0.434	0.000	0.0685	0.0000
47	45.000	-0.400	0.000	0.0000	0.0000
48	46.000	-0.433	0.000	-0.0666	0.0000
49	47.000	-0.533	0.000	-0.1333	0.0000
50	48.000	-0.660	0.000	-0.1200	0.0000
51	49.000	-0.773	0.000	-0.1067	0.0000
52	50.000	-0.873	0.000	-0.0933	0.0000
53	51.000	-0.960	0.000	-0.0800	0.0000
54	52.000	-1.033	0.000	-0.0667	0.0000
55	53.000	-1.093	0.000	-0.0533	0.0000
56	54.000	-1.140	0.000	-0.0400	0.0000
57	55.000	-1.173	0.000	-0.0267	0.0000
58	56.000	-1.193	0.000	-0.0133	0.0000
59	57.000	-1.200	0.000	-0.0000	0.0000
60	58.000	-1.196	0.000	0.0077	0.0000
61	59.000	-1.185	0.000	0.0153	0.0000
62	60.000	-1.166	0.000	0.0230	0.0000
63	61.000	-1.139	0.000	0.0306	0.0000
64	62.000	-1.104	0.000	0.0383	0.0000
65	63.000	-1.062	0.000	0.0459	0.0000
66	64.000	-1.012	0.000	0.0525	0.0000
67	65.000	-0.960	0.000	0.0525	0.0000
68	65.850	-0.915	0.000	0.0525	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	478.00	477.34	25.04
2	0.000	0.0000	0.0000	0.0000	477.49	476.83	25.01
3	1.000	0.0000	0.0000	0.0000	476.89	476.23	24.98
4	2.000	0.0065	0.0000	0.0065	475.64	475.14	21.83
5	3.000	0.0141	0.0000	0.0141	474.28	473.93	18.15
6	4.000	0.0218	0.0000	0.0218	472.92	472.70	14.48
7	5.000	0.0294	0.0000	0.0294	471.57	471.44	10.83
8	6.000	0.0371	0.0000	0.0371	470.21	470.16	7.20
9	7.000	0.0448	0.0000	0.0448	468.87	468.85	3.59
10	8.000	0.0524	0.0000	0.0524	467.53	467.53	0.00
11	9.000	0.0657	0.0000	0.0657	465.63	465.59	-6.21
12	10.000	0.0791	0.0000	0.0791	463.74	463.58	-12.36
13	11.000	0.0924	0.0000	0.0924	461.87	461.50	-18.46
14	12.000	0.1057	0.0000	0.1057	460.00	459.35	-24.50
15	13.000	0.1190	0.0000	0.1190	458.14	457.12	-30.48
16	14.000	0.1322	0.0000	0.1322	456.29	454.84	-36.39
17	15.000	0.1455	0.0000	0.1455	454.45	452.48	-42.23
18	16.000	0.1587	0.0000	0.1587	452.62	450.07	-48.01
19	17.000	0.1718	0.0000	0.1718	450.80	447.59	-53.71
	18.000	0.1850	0.0000	0.1850	449.00	445.06	-59.34
21	19.000	0.2510	0.0000	0.2510	442.26	441.28	-29.41
22	20.000	0.3175	0.0000	0.3175	435.57	435.57	-0.00
23	21.000	0.3859	0.0000	0.3859	428.82	427.82	29.30
24	22.000	0.4536	0.0000	0.4536	422.23	418.33	57.29
25	23.000	0.4954	0.0000	0.4954	418.02	412.60	67.10
26	24.000	0.5121	0.0000	0.5121	416.03	411.69	59.91
27	25.000	0.5289	0.0000	0.5289	414.04	410.67	52.73
28	26.000	0.5458	0.0000	0.5458	412.06	409.53	45.57
29	27.000	0.5627	0.0000	0.5627	410.08	408.27	38.44
30	28.000	0.5797	0.0000	0.5797	408.10	406.90	31.35
31	29.000	0.5968	0.0000	0.5968	406.13	405.40	24.29
32	30.000	0.6138	0.0000	0.6138	404.17	403.80	17.28
33	31.000	0.6309	0.0000	0.6309	402.21	402.08	10.33
34	32.000	0.6481	0.0000	0.6481	400.27	400.25	3.43
35	33.000	0.6481	0.0000	0.6481	400.27	400.25	-3.43
36	34.000	0.6309	0.0000	0.6309	402.21	402.08	-10.33
37	35.000	0.6138	0.0000	0.6138	404.17	403.80	-17.28
38	36.000	0.5968	0.0000	0.5968	406.13	405.40	-24.29
39	37.000	0.5797	0.0000	0.5797	408.10	406.90	-31.35
	38.000	0.5627	0.0000	0.5627	410.08	408.27	-38.44
41	39.000	0.5458	0.0000	0.5458	412.06	409.53	-45.57
42	40.000	0.5289	0.0000	0.5289	414.04	410.67	-52.73
43	41.000	0.5121	0.0000	0.5121	416.03	411.69	-59.91
44	42.000	0.4954	0.0000	0.4954	418.02	412.60	-67.10
45	43.000	0.4536	0.0000	0.4536	422.23	418.33	-57.29
46	44.000	0.3859	0.0000	0.3859	428.82	427.82	-29.30
47	45.000	0.3175	0.0000	0.3175	435.57	435.57	-0.00
48	46.000	0.2510	0.0000	0.2510	442.26	441.28	29.41
49	47.000	0.1850	0.0000	0.1850	449.00	445.06	59.34
50	48.000	0.1718	0.0000	0.1718	450.80	447.59	53.71
51	49.000	0.1587	0.0000	0.1587	452.62	450.07	48.01
52	50.000	0.1455	0.0000	0.1455	454.45	452.48	42.23
53	51.000	0.1322	0.0000	0.1322	456.29	454.84	36.39
54	52.000	0.1190	0.0000	0.1190	458.14	457.12	30.48
55	53.000	0.1057	0.0000	0.1057	460.00	459.35	24.50
56	54.000	0.0924	0.0000	0.0924	461.87	461.50	18.46
57	55.000	0.0791	0.0000	0.0791	463.74	463.58	12.36
58	56.000	0.0657	0.0000	0.0657	465.63	465.59	6.21
59	57.000	0.0524	0.0000	0.0524	467.53	467.53	0.00
60	58.000	0.0448	0.0000	0.0448	468.87	468.85	-3.59
61	59.000	0.0371	0.0000	0.0371	470.21	470.16	-7.20
62	60.000	0.0294	0.0000	0.0294	471.57	471.44	-10.83
63	61.000	0.0218	0.0000	0.0218	472.92	472.70	-14.48
64	62.000	0.0141	0.0000	0.0141	474.28	473.93	-18.15
65	63.000	0.0065	0.0000	0.0065	475.64	475.14	-21.83
66	64.000	0.0000	0.0000	0.0000	476.89	476.23	-24.98
67	65.000	0.0000	0.0000	0.0000	477.49	476.83	-25.01
68	65.850	0.0000	0.0000	0.0000	478.00	477.34	-25.04

Alarg. tesado ext. inicial = 420.2 mm. Retesado = 43.9 mm.
Alarg. tesado ext. final = 420.2 mm. Retesado = 43.9 mm.

095

096

2.- CALCULO REACCIONES Y APOYOS

Reacciones y giros acumulados por peso propio

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	179.00	-.000407
11	603.76	-.000023
21	603.76	0.000023
31	179.00	0.000407

$R_1 = 179.00 + 0.50 \times 9.63 \times 2.5 + 1.80 \times 4 \times \frac{\pi \times 1.11^2}{4} \times 2.5 = 716.96\,t$

$R_{31} = 179.00 + 1.00 \times 9.63 \times 2.5 + 2.00 \times 4 \times \frac{\pi \times 1.11^2}{4} \times 2.5 = 223,85\,t$

$R_{11} = R_{21} = 603.76 + 3.00 \times 4 \times \frac{\pi \times 1.11^2}{4} \times 2.5 = 634.92\,t$

Reacciones y giros debidos a cargas muertas

Apoyo	Reaccion (t)	Giro (gr)
1	79.42	-.000181
11	267.88	-.000010
21	267.88	0.000010
31	79.42	0.000181

$R_1 = 79.42 + 0.50 \times 13.70 \times 0.78 = 87,97\,t$

$R_{31} = 79.42 + 1.00 \times 13.70 \times 0,78 = 90.11\,t.$

Reacciones y giros debidos a temperatura

Apoyo	Reaccion (t)	Giro (gr)
1	16.90	0.000183
11	-16.90	-.000065
21	-16.90	0.000065
31	16.90	-.000183

Reacciones y giros por ferrocarril (RENFE)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	219.144	-41.644	0.0002896	-0.0006714
11	603.306	-38.379	0.0004902	-0.0005792
21	603.306	-38.379	0.0005792	-0.0004902
31	219.144	-41.644	0.0006714	-0.0002896

Reacciones y giros por ferrocarril (UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	180.985	-36.930	0.0002568	-0.0006098
11	492.222	-36.160	0.0004164	-0.0005136
21	492.222	-36.160	0.0005136	-0.0004164
31	180.985	-36.930	0.0006098	-0.0002568

Reacciones y giros por ferrocarril (RENFE/UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	219.144	-41.644	0.0002896	-0.0006714
11	603.306	-38.379	0.0004902	-0.0005792
21	603.306	-38.379	0.0005792	-0.0004902
31	219.144	-41.644	0.0006714	-0.0002896

Reacciones y giros por sobrecarga total

(sobrecarga repartida+carro)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro (gr) maximo	Giro (gr) minimo
1	219.144	-41.644	0.0002896	-0.0006714
11	603.306	-38.379	0.0004902	-0.0005792
21	603.306	-38.379	0.0005792	-0.0004902
31	219.144	-41.644	0.0006714	-0.0002896

Reacciones y giros por pretensado (sin ponderar)

0.9502

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	59.27	0.001037
11	-59.27	0.000085
21	-59.27	-.000085
31	59.27	-.001037

Reacciones y giros por pretensado (sin ponderar)

0.8561

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	53.40	0.000934
11	-53.40	0.000077
21	-53.40	-.000077
31	53.40	-.000934

PROYECTO L.A.V. ZARAGOZA-LERIDA
SUBTRAMO 1
E-2

FECHA 11-4-97

HOJA N.º 1

APOYOS.

- REACCIONES VERTICALES (A TODO ANCHO)

	PP	C.P.	TEMP.	FRECUENTE	PRET I.	PRET. F
E-1 (móvil)	216.96	87.97	16.90	238,34	59,3	53.4
P-1	634.92	267,88	-16.90	603,31	-59.3	-53.4
P. 2	634.92	267,88	-16.90	603.31	-59.3	-53.4
E-2 (fijo)	223,85	90,11	16.90	243,15	59,3	53,4

- REACCIONES MÁXIMAS POR APOYO.

E-1: $\frac{1}{2}(216,96+87,97+16,90+238,34+59,3)+\frac{238,34\times0,30}{5,80}=327,1$ t

P-1 y P-2: $\frac{1}{2}(634,92+267,88+603,31-53,4)+\frac{603,31\times1,30}{5,20}=761,2$ t

E-2: $\frac{1}{2}(223,85+90,11+16,90+243,15+59,3)+\frac{243,15\times0,30}{5,80}=329,2$ t.

Se disponen las siguientes pilas:

E-1 (móvil): 2 de 450 × 600 × 129 (93) → σ_{max} = 119,3 kp/cm²

P-1: 2 de 700 × 800 × 130 (95) → σ_{max} = 135,8 kp/cm²

P-2: 2 de 700 × 800 × 90 (65) → σ_{max} = 135,8 kp/cm²

E-2 (fijo): 2 de 450 × 600 × 54 (38) → σ_{max} = 121,8 kp/cm²

PROYECTO

FECHA

HOJA N.° 2

REACCIONES HORIZONTALES LONGITUDINALES

- FRENADA .- LONGITUD PUENTE : 66,60 m.

PUENTE: $\frac{1}{8}(36 \times 12.00 + 36.60 \times 10) \times 1.9 = 172.9$ t

U.I.C: $\frac{1}{4}(100 + 60.40 \times 8) \times 2 = \underline{291,6}$ t

Esta carga se la lleva integra el estribo 2.

- DEFORMACIONES DIFERIDAS..

- RETRACCION : $\varepsilon = -25 \times 10^{-5}$
- TEMPERATURA: $\varepsilon = \pm 20 \times 10^{-5}$
- FLUENCIA : $\sigma_{medio} = \frac{4133}{9.63} = 429$ kg/cm^2 = 42.9 kp/cm^2

$$\varepsilon = -\frac{42.9}{3.5 \times 10^5} \times 3.5 = -42.9 \times 10^{-5} \simeq -43 \times 10^{-5}$$

ε total $= -88 \times 10^{-5}$

Cada apoyo se lleva la correspondiente a su rigidez y desplazamiento (estribo 2 fijo)

Rigidez E-1: $\frac{2 \times 0.45 \times 0.60 \times 100}{0.093} = 580,6$ t

Rigidez P-1: $\frac{1}{\frac{0.095}{2 \times 0,70 \times 0,80 \times 100} + \frac{8,26^3}{3 \times 1,3 \times 10^6 \times 2 \times 0.15^4}} = 759,1$ t

Rigidez P-2: $\frac{1}{\frac{0,065}{2 \times 0,70 \times 0.80 \times 100} + \frac{9.50^3}{3 \times 1.3 \times 10^6 \times 2 \times 0.15^4}} = 772,7$ t

PROYECTO

FECHA

HOJA N.° 3

$F_{E-1} = 580.6 \times 65 \times 88 \times 10^{-5} = 33,2$ t

$F_{P-1} = 759.1 \times 45 \times 88 \times 10^{-5} = 30,1$ t

$F_{P-2} = 772.7 \times 20 \times 88 \times 10^{-5} = 13,6$ t

$F_{E-2} = -33,2 - 30,1 - 13,6 = -76,9$ t

$\delta_{HE-1} = 0.0572$ m

$\delta_{HP-1} = 0,0255$ m. $\quad \delta_{P-1} = 0,0141$ m.

$\delta_{HP-2} = 0,0079$ m $\quad \delta_{P-2} = 0,0097$ m.

- SISMO LONGITUDINAL

El puente es rígido al movimiento longitudinal por estar anulado en el estribo 2.

Por tanto: $S = 0.08$ (grado VII)

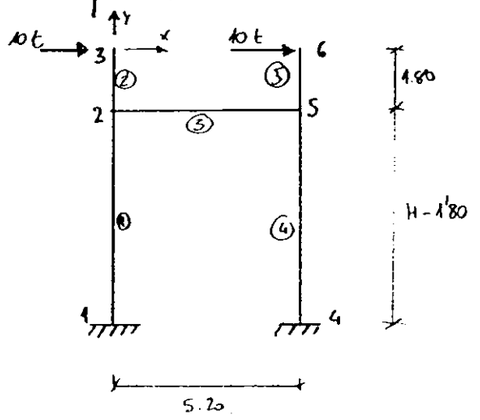
$F_{E-2} = 0.08(1710.65 + 713.84 + 0.6 \times 1456,00) = 263.9$ t

	PROYECTO L.A.V. ZARAGOZA - LÉRIDA SUBTRAMO 1 E-2	FECHA HOJA N.º 4

FUERZAS HORIZONTALES TRANSVERSALES

Se calculan previamente las rigideces transversales de las pilas, para poder hacer un reparto de las cargas de viento y sismo transversal de acuerdo con las rigideces de cada uno de los apoyos.

Para ello se calculan unos pórticos, que idealizan las pilas, de acuerdo con el siguiente esquema:



- Barras ①, ②, ④ y ⑤

$A = 1.39\ m^2$

$I = 0.154\ m^4$

- Barra ③

$A = 0.643\ m^2$

$I = 0.077\ m^4$

Se someten a dos cargas horizontales de 10 t en los nudos 3 y 6, hallando la rigidez por la relación:

$$1/R = \frac{\text{Desp. horizontal nudo 3}}{20}$$


```
PILA1                                                          pag.   1

L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. RIGIDEZ PILA 1
CONTROL
6 5 3 1
:
NUDOS
1 0 -8.26
2 0 -1.8
3 0 0
4 5.2 -8.26
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. RIGIDEZ PILA 1

Hip. n° 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.000848	0.000020	-0.000134
3	0.001125	0.000020	-0.000164
4	0.000000	-0.000000	-0.000000
5	0.000848	-0.000020	-0.000134
6	0.001125	-0.000020	-0.000164

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-15.06	43.45
4	-10.00	15.06	43.45

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	15.06	-43.45	-10.00
	2	15.06	21.15	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	39.15	15.06
	5	0.00	-39.15	15.06
4	4	-15.06	-43.45	-10.00
	5	-15.06	21.15	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00


```
L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. RIGIDEZ PILA 2
CONTROL
6 5 3 1
:
NUDOS
1 0 -9.50
2 0 -1.8
3 0 0
4 5.2 -9.50
5 5.2 -1.8
6 5.2 0
:
BARRAS TIPO
2
1.39 .154  3500000
.643 .077  3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 5 2
4 4 5 1
5 5 6 1
:
APOYOS
2
1 1 1 1
4 1 1 1
:
CARGAS
H-1 FUERZA DE 2X10 T
2
3 10 0 0
6 10 0 0
0
:
```

PILA2.001 pag. 1

L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. RIGIDEZ PILA 2

Hip. nº 1 H-1 FUERZA DE 2X10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001310	0.000028	-0.000157
3	0.001629	0.000028	-0.000187
4	0.000000	-0.000000	-0.000000
5	0.001310	-0.000028	-0.000157
6	0.001629	-0.000028	-0.000187

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-17.50	49.49
4	-10.00	17.50	49.49

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	17.50	-49.49	-10.00
	2	17.50	27.51	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	0.00	45.51	17.50
	5	0.00	-45.51	17.50
4	4	-17.50	-49.49	-10.00
	5	-17.50	27.51	-10.00
5	5	0.00	-18.00	-10.00
	6	0.00	0.00	-10.00

PROYECTO E-2 FECHA 11-4-97 HOJA N.º 9

RIGIDECES TRANSVERSALES

PILA	H	u	M_1	M_2	k_p	k_{cimp}	k	Frente
E-1	—	—	—	—	∞	1161,3	1161,3	12,9
P-1	8,26	0,001125	-43,45	39,15	17778	23579	2081,8	14,1
P-2	9,50	0,001629	-49,49	45,51	12277	3446,2	2691,9	26,5
E-2	—	—	—	—	∞	2842,1	2842,1	23,3

(a todo ancho)

Carga de viento

$q = 0,20(1,65 + 3,50 + 0,75) = 1,18$ t/m.

TAV2VIEN

L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. VIENTO

```
CONTROL
4 3 1 1
:
NUDOS
 1  0.00  0.00
 2 20.00  0.00
 3 45.00  0.00
 4 65.00  0.00
:
BARRAS TIPO
1
 9.630  90.54  4000000
:
BARRAS
 1  1  2  1
 2  2  3  1
 3  3  4  1
:
APOYOS
4
 1  1  1161.3  0
 4  0  2081.8  0
 2  0  2690.9  0
 3  0  2842.1  0
:
CARGAS
H-1 FUERZA DE VIENTO DE 1.18 t/m
0
3
   1  2  1.18  90
   2  2  1.18  90
   3  2  1.18  90
   :
:
```


TAV2VIEN.001

L.A.V. ZARAGOZA-LERIDA. ESTRUCTURA E-2. VIENTO

Hip. nº 1 H-1 FUERZA DE VIENTO DE 1.18 t/m

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.011068	-0.000060
2	-0.000000	0.009841	-0.000063
3	-0.000000	0.008192	-0.000069
4	-0.000000	0.006765	-0.000073

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.00	-12.85	-0.00
4	0.00	-14.08	0.00
2	-0.00	-26.48	-0.00
3	-0.00	-23.28	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	0.00	12.85
	2	-0.00	-21.07	-10.75
2	2	-0.00	-21.07	15.73
	3	-0.00	-45.68	-13.77
3	3	-0.00	-45.69	9.52
	4	0.00	0.00	-14.08

PROYECTO E-2 | FECHA | HOJA N.° 12

SISMO TRANSVERSAL

Carga debida al p.p + c.p + 0.6 sobrecarga:

$$p = 2.5 \times 9.63 + 9.N + 0.6 \times 2 \times 10.W = 45.6\ t_m$$

Por tanto, los desplazamientos "u" son los que da el cálculo de viento, multiplicados por $45.6/1.18$

$$T = 2\pi \sqrt{\frac{\Sigma m \cdot u^2}{g \Sigma m \cdot u}}$$ (Fórmula de Lord Rayleigh)

Los masas de los pilares intermedios son:

cada tablero 3 pilas:

estribos: $g \times 45.6 = 11\ W$

pila: $g = 3 \times 45.6 = 23.1\ W$

PILA	u	u^2	k·m·u	$k \cdot m \cdot u^2$
E-1	0.427713	0.182938	4.7948	2.0123
P-1	0.380296	0.144625	8.1567	3.2541
P-2	0.316572	0.100218	7.1229	2.2547
E-2	0.261427	0.068344	2.2757	0.7518
		Σ	23.2601	8.2731

$$T = 2\pi \sqrt{\frac{8.2731}{9.81 \times 23.2601}} = 1.20 \text{ segundos}$$

PROYECTO E-2 | FECHA | HOJA N.° 13

Coeficiente sísmico.

$$S = \alpha \times \eta \times \beta \times \delta$$

$$\alpha = CR = \frac{0.08}{2 \times 1.20} \times 1 = 0,033 \text{ (grado VII)}$$

$$\eta = \mu \times \frac{\Sigma Q \cdot u}{\Sigma Q \cdot u^2} = u \times \frac{23,2601}{8,2731}$$

$\beta = 1$

$\delta = 0,7$ (pilotes resistentes por el fuste).

PILA	η	S	F pila
E-1	1,203	0,028	14.1 t
P-1	1.069	0.025	25.7 t
P-2	0.890	0.021	21,6 t
E-2	0.735	0.017	8.6 t. (a todo ancho)

3.- CALCULO PILAS

3.1.- CALCULO FUSTES

PROYECTO TAV. ZARAGOZA - LÉRIDA
SUBTRAMO 1.
E-2

FECHA

HOJA N.° 1

FUSTES

Combinaciones de cargas.

H-1 : 1'60 × (P.propio + c. permanente + def. diferidas + sobrecarga + frenado + f. centrífuga + lazo).

H-2 : 1'44 × (p.propio + c.permanente + sobrecarga + def. diferidas + frenado + f centrífuga + lazo + viento).

H-3 : 1'28 (ppropio + c.permanente + sobrecarga + f.centrifuga + lazo + 0.25 viento + def diferida) + sismo transversal.

PILA	F_T(1.44 × viento)	F_T($\frac{1}{4}$ viento × 1'28 + s.transv.)
1	20,3 t	30,2 t
2	38.2 t	30,1 t

(a todo ancho)

F. centrifuga : $F_T = \phi \times \frac{V^2}{127 R_H}$ $\quad R_H = 7000$ m. $\quad V = 300$ km/h

$k = \frac{300}{V^2 + 300} = 0{,}032$

PILA	ϕ	F_T
E-1	264.0	26.7 t
P-1	540.0	54.7 t
P-2	540.0	54.7 t
E-2	264.0	28.7 t.

(a todo ancho)

PROYECTO L.A.V. ZARAGOZA - LÉRIDA
SUBTRAMO 1.
E-2

FECHA

HOJA N.° 2

Cálculo de las fuerzas transversales en cabeza de pilas, para calcular éstas como ménsulas libres, para tener en cuenta el efecto pórtico.

$F_{T,\,cálculo} = \frac{Mempotramiento}{h}$ (para $F = 10$ t).

Para $F = R \rightarrow F_T = \frac{F_{T\,cálculo}}{10} \times R$

Mempotramiento = momento de cálculo del pórtico cuando lo sometemos a fuerzas de 10 t en ambas cabezas de fustes.

PILA	Mempotramiento	h	$\frac{M/h}{10}$
1	43.45	8.24	0,526
2	49.49	9.50	0,521

Multiplicamos todas las fuerzas horizontales transversales por su valor $\frac{M/h}{10}$

PROYECTO .....

E.2

FECHA .....

HOJA N.º 3

FUERZAS MAYORADAS EN CABEZAS DE PILAS

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
P-1		24.1	25,1	1217,9	0	0
	8,26	21.7	28,0	1096.1	0	0
		19.5	28.1	986.5	0	0
P-2		10.9	24.9	1217.9	0	0
	9.50	9.8	32,3	1096.1	0	0
		8.8	27,8	986,5	0	0

TAV21 pag. 1

VIADUCTO 2 - PILA 1. (32 ⌀ 25 - 24 ⌀ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 8.26

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
157.08	157.08	157.08	157.08	157.08	117.84	117.84	117.84	117.84	117.84	117.84

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	24.10	25.10	1217.90	0.00	0.00	0	0.0	0	0.0	1.60
2	21.70	28.00	1096.10	0.00	0.00	0	0.4	0	0.4	1.44
3	19.50	28.10	986.50	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 2 - PILA 1. (32 ⌀ 25 - 24 ⌀ 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	345.77	234.11	1263.80	20.104	13.612
1	0.000	0.001	324.17	213.62	1259.21	17.711	11.671
2	0.002	0.003	301.05	192.13	1254.62	15.477	9.878
3	0.004	0.006	276.63	169.80	1250.03	13.440	8.250
4	0.006	0.009	251.07	146.78	1245.44	11.611	6.788
5	0.009	0.014	224.54	123.19	1240.85	11.074	6.075
6	0.012	0.019	197.10	99.10	1236.26	9.406	4.730
7	0.016	0.026	168.90	74.63	1231.67	7.951	3.514
8	0.020	0.032	140.05	49.89	1227.08	6.549	2.333
9	0.024	0.039	110.69	24.96	1222.49	5.147	1.161
10	0.028	0.047	80.93	-0.04	1217.90	3.750	1.161

Exc. totales result. cabeza -0.00003 0.06645
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

VIADUCTO 2 - PILA 1. (32 ⌀ 25 - 24 ⌀ 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	372.35	207.34	1137.41	22.289	12.411
1	0.000	0.001	345.77	188.93	1133.28	19.319	10.556
2	0.002	0.003	317.97	169.72	1129.15	16.582	8.850
3	0.003	0.006	289.17	149.82	1125.02	14.109	7.310
4	0.006	0.010	259.59	129.38	1120.89	11.920	5.941
5	0.008	0.015	229.38	108.48	1116.75	11.064	5.233
6	0.011	0.021	198.62	87.21	1112.62	9.164	4.023
7	0.015	0.027	167.47	65.64	1108.49	7.571	2.967
8	0.018	0.034	136.05	43.86	1104.36	6.116	1.972
9	0.022	0.041	104.46	21.94	1100.23	4.675	0.982
10	0.025	0.049	72.83	-0.03	1096.10	3.249	0.982

Exc. totales result. cabeza -0.00003 0.06644
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

VIADUCTO 2 - PILA 1. (32 ⌀ 25 - 24 ⌀ 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	344.67	182.31	1023.22	19.534	10.332
1	0.000	0.001	320.13	165.84	1019.55	17.065	8.840
2	0.001	0.002	294.48	148.76	1015.88	14.745	7.448
3	0.003	0.005	267.88	131.17	1012.20	12.606	6.172
4	0.005	0.009	240.49	113.16	1008.53	10.683	5.027
5	0.007	0.013	212.45	94.81	1004.86	9.864	4.402
6	0.009	0.019	183.82	76.16	1001.19	8.181	3.390
7	0.012	0.024	154.71	57.30	997.52	6.755	2.502
8	0.015	0.030	125.24	38.27	993.84	5.445	1.664
9	0.018	0.037	95.49	19.15	990.17	4.137	0.830
10	0.021	0.044	65.55	-0.02	986.50	2.833	0.830

Exc. totales result. cabeza -0.00002 0.06645
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

VIADUCTO 2 - PILA 2. (40 Ø 25 - 24 Ø 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 9.50

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
196.40	196.40	196.40	196.40	196.40	117.84	117.84	117.84	117.84	117.84	117.84

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	10.90	24.90	1217.90	0.00	0.00	0	0.0	0	0.0	1.60
2	9.80	32.30	1096.10	0.00	0.00	0	0.4	0	0.4	1.44
3	8.80	27.80	986.50	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 2 - PILA 2. (40 Ø 25 - 24 Ø 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	396.53	126.39	1270.69	19.815	6.316
1	0.000	0.001	371.74	115.68	1265.41	17.797	5.538
2	0.001	0.003	344.92	104.33	1260.13	15.810	4.782
3	0.002	0.007	316.33	92.44	1254.85	13.899	4.062
4	0.004	0.013	286.19	80.11	1249.57	12.101	3.387
5	0.006	0.019	254.71	67.40	1244.30	12.685	3.357
6	0.008	0.026	221.84	54.32	1239.02	10.649	2.608
7	0.010	0.035	187.83	40.96	1233.74	8.861	1.933
8	0.013	0.044	152.87	27.41	1228.46	7.157	1.283
9	0.016	0.054	117.17	13.72	1223.18	5.453	0.639
10	0.018	0.064	80.92	-0.02	1217.90	3.748	0.639

Exc. totales result. cabeza -0.00002 0.06645
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

VIADUCTO 2 - PILA 2. (40 Ø 25 - 24 Ø 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	492.73	113.77	1143.61	29.501	6.812
1	0.000	0.001	457.10	104.11	1138.86	25.296	5.762
2	0.001	0.005	419.24	93.86	1134.11	21.730	4.865
3	0.002	0.011	379.53	83.12	1129.36	18.376	4.024
4	0.004	0.018	338.35	71.97	1124.61	15.301	3.255
5	0.006	0.026	296.01	60.50	1119.86	15.625	3.194
6	0.008	0.036	252.50	48.72	1115.10	12.242	2.362
7	0.011	0.048	208.16	36.71	1110.35	9.556	1.685
8	0.013	0.060	163.29	24.55	1105.60	7.361	1.107
9	0.016	0.072	118.10	12.29	1100.85	5.290	0.550
10	0.019	0.085	72.81	-0.02	1096.10	3.247	0.550

Exc. totales result. cabeza -0.00002 0.06642
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

VIADUCTO 2 - PILA 2. (40 Ø 25 - 24 Ø 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	395.85	97.73	1028.73	20.187	4.984
1	0.000	0.001	367.65	89.14	1024.51	17.854	4.329
2	0.001	0.003	337.89	80.15	1020.29	15.578	3.695
3	0.002	0.007	306.81	70.82	1016.06	13.410	3.096
4	0.003	0.012	274.60	61.22	1011.84	11.396	2.541
5	0.004	0.019	241.47	51.39	1007.62	11.481	2.443
6	0.006	0.026	207.41	41.34	1003.39	9.354	1.864
7	0.008	0.034	172.62	31.13	999.17	7.565	1.364
8	0.010	0.043	137.28	20.81	994.95	5.974	0.905
9	0.012	0.052	101.53	10.41	990.72	4.401	0.451
10	0.014	0.062	65.52	-0.02	986.50	2.831	0.451

Exc. totales result. cabeza -0.00002 0.06642
Exc. reales 1er ord. cabeza 0.00000 0.06650

Convergencia del equilibrio sin agotamiento

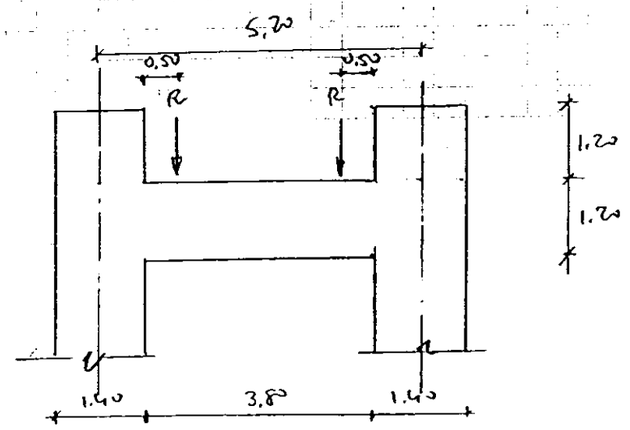
RIOSTRA SUPERIOR

PROYECTO TAV ZARAGOZA - LERIDA
TRAMO 1
E-2

FECHA

HOJA N.º 1

RIOSTRA SUPERIOR DE PILAS

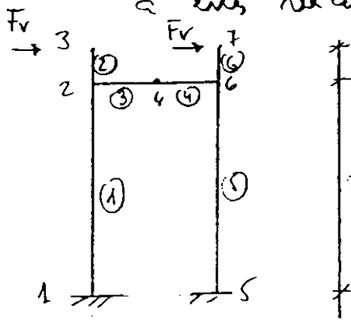


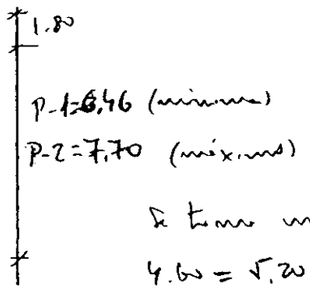
Se dimensiona para que pueda servir de apoyo a los gatos para levantar el puente y cambiar los aparatos de apoyo.

Se considera la reacción de peso propio + permanente + pretensado

$R_{máx} = 300 + 134 + 6 = 440$ t.

Se calcula la pila sometida a su peso propio y a estas reacciones + viento.





Fv = 7,05 t (P-2)

Fv = 13,25 t (P-1)

Se toma una luz de cálculo de

$4.60 = 5.20 - 2 \times 0.30$

TAV2P1 pag. 1

```
L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 1
CONTROL
7 6 2 3
:
NUDOS
1 0.0 -8.25
2 0.0 -1.80
3 0.0  0.00
4 2.3 -1.80
5 4.6 -8.25
6 4.6 -1.80
7 4.6  0.00
:
BARRAS TIPO
2
1.390 0.154 3.5E6
0.643 0.077 3.5E6
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1.PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2.VIENTO
2
3 7.05 0 0
7 7.05 0 0
4
1 2 0.28 0
2 2 0.28 0
5 2 0.28 0
6 2 0.28 0
H-3.LEVANTAMIENTO DEL TABLERO
0
2
3 1 452 0.90 270
4 1 452 0.90 270
:
```

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 1

Hip. n° 1 H-1.PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000000	-0.000028	-0.000006
3	0.000012	-0.000029	-0.000006
4	0.000000	-0.000042	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000000	-0.000028	0.000006
7	-0.000012	-0.000029	0.000006

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.48	32.41	-1.03
5	-0.48	32.41	1.03

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-32.41	1.03	0.48
	2	-9.97	-2.09	0.48
2	2	-6.26	-0.00	-0.00
	3	-0.00	0.00	-0.00
3	2	-0.48	-2.09	-3.70
	4	-0.48	2.17	0.00
4	4	-0.48	2.17	0.00
	6	-0.48	-2.09	3.70
5	5	-32.41	-1.03	-0.48
	6	-9.97	2.09	-0.48
6	6	-6.26	-0.00	-0.00
	7	0.00	0.00	0.00

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 1

Hip. n° 2 H-2.VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.000664	0.000018	-0.000097
3	0.000864	0.000018	-0.000119
4	0.000664	-0.000000	0.000037
5	0.000000	-0.000000	-0.000000
6	0.000664	-0.000018	-0.000097
7	0.000864	-0.000018	-0.000119

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-9.36	-13.63	36.35
5	-9.36	13.63	36.35

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	13.63	-36.35	-9.36
	2	13.63	18.20	-7.55
2	2	0.00	-13.14	-7.55
	3	0.00	0.00	-7.05
3	2	-0.00	31.34	13.63
	4	-0.00	0.00	13.63
4	4	0.00	0.00	13.63
	6	0.00	-31.34	13.63
5	5	-13.63	-36.35	-9.36
	6	-13.63	18.20	-7.55
6	6	-0.00	-13.14	-7.55
	7	-0.00	0.00	-7.05

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 1

Hip. n° 3 H-3.LEVANTAMIENTO DEL TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000092	-0.000665	-0.000869
3	0.001657	-0.000665	-0.000869
4	0.000026	-0.002440	-0.000011
5	0.000000	-0.000000	-0.000000
6	-0.000041	-0.000534	0.000854
7	-0.001578	-0.000534	0.000854

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	65.36	501.42	-138.13
5	-65.36	402.58	139.45

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-501.42	138.13	65.36
	2	-501.42	-283.43	65.36
2	2	0.00	0.00	-0.00
	3	0.00	0.00	-0.00
3	2	-65.36	-283.43	-501.42
	4	-65.36	237.03	-49.42
4	4	-65.36	237.03	-49.42
	6	-65.36	-282.11	402.58
5	5	-402.58	-139.45	-65.36
	6	-402.58	282.11	-65.36
6	6	0.00	0.00	-0.00
	7	0.00	0.00	-0.00


```
L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 2
CONTROL
7 6 2 3
:
NUDOS
1 0.0 -9.50
2 0.0 -1.80
3 0.0  0.00
4 2.3 -1.80
5 4.6 -9.50
6 4.6 -1.80
7 4.6  0.00
:
BARRAS TIPO
2
1.390 0.154 3.5E6
0.643 0.077 3.5E6
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1.PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2.VIENTO
2
3 13.25 0 0
7 13.25 0 0
4
1 2 0.28 0
2 2 0.28 0
5 2 0.28 0
6 2 0.28 0
H-3.LEVANTAMIENTO DEL TABLERO
0
2
3 1 452 0.90 270
4 1 452 0.90 270
:
```

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 2

Hip. n° 1 H-1.PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000000	-0.000037	-0.000007
3	0.000013	-0.000038	-0.000007
4	0.000000	-0.000052	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000000	-0.000037	0.000007
7	-0.000013	-0.000038	0.000007

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.39	36.76	-0.99
5	-0.39	36.76	0.99

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-36.76	0.99	0.39
	2	-9.97	-2.00	0.39
2	2	-6.26	-0.00	-0.00
	3	-0.00	0.00	-0.00
3	2	-0.39	-2.00	-3.70
	4	-0.39	2.26	0.00
4	4	-0.39	2.26	0.00
	6	-0.39	-2.00	3.70
5	5	-36.76	-0.99	-0.39
	6	-9.97	2.00	-0.39
6	6	-6.26	-0.00	-0.00
	7	0.00	-0.00	0.00

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 2

Hip. n° 2 H-2.VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001841	0.000045	-0.000206
3	0.002260	0.000045	-0.000247
4	0.001841	0.000000	0.000074
5	0.000000	-0.000000	-0.000000
6	0.001841	-0.000045	-0.000206
7	0.002260	-0.000045	-0.000247

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-15.91	-28.52	72.92
5	-15.91	28.52	72.92

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	28.52	-72.92	-15.91
	2	28.52	41.29	-13.75
2	2	-0.00	-24.30	-13.75
	3	-0.00	-0.00	-13.25
3	2	-0.00	65.59	28.52
	4	-0.00	-0.00	28.52
4	4	0.00	-0.00	28.52
	6	0.00	-65.59	28.52
5	5	-28.52	-72.92	-15.91
	6	-28.52	41.29	-13.75
6	6	0.00	-24.30	-13.75
	7	0.00	-0.00	-13.25

L.A.V. ZARAGOZA-LERIDA. E-2. RIOSTRA PILA 2

Hip. nº 3 H-3.LEVANTAMIENTO DEL TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000068	-0.000793	-0.000977
3	0.001826	-0.000793	-0.000977
4	0.000014	-0.002685	-0.000005
5	0.000000	-0.000000	-0.000000
6	-0.000039	-0.000637	0.000970
7	-0.001785	-0.000637	0.000970

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	52.34	501.24	-133.11
5	-52.34	402.76	133.62

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-501.24	133.11	52.34
	2	-501.24	-269.90	52.34
2	2	0.00	0.00	0.00
	3	0.00	-0.00	0.00
3	2	-52.34	-269.90	-501.24
	4	-52.34	250.15	-49.24
4	4	-52.34	250.15	-49.24
	6	-52.34	-269.39	402.76
5	5	-402.76	-133.62	-52.34
	6	-402.76	269.39	-52.34
6	6	0.00	0.00	0.00
	7	0.00	-0.00	0.00

PROYECTO ..... FECHA .....

HOJA N.º 10

ARMADURA

Flexión:

P-1
$M_d^- = -1.28\ (2.09 + 31.34 + 283.43) = -405.6$ mt
$M_d^+ = 1.28\ (2.17 + 0 + 237.03) = 306.2$ mt

P-2
$M_d^- = -1.28 \cdot (2.09 + 65.59 + 269.90) = -432.0$ mt
$M_d^+ = 1.28 \cdot (2.26 + 0 + 250.15) = 323.1$ mt

$$A = U_c \cdot \left[1 - \sqrt{1 - \frac{2M_d}{U_c \cdot 1.15}}\right] \cdot \frac{1.15}{5.1}$$

$U_c = \frac{3000}{1.5} \times 0.536 \cdot 1.15 = 1232.8$ t

$A_{sup} = 10.4$ cm²

$A_{inf} = 73$ cm² → 10 ϕ32 = 80 cm² $U_{s_2} = 354.8$ t

$$A_{sup} = U_c \left[1 - \sqrt{1 - 2\frac{432.0 - 354.8 \times 1.10}{U_c \cdot 1.15}}\right] \times \frac{1.15}{5.1} + 80.0 = 84.1\ cm^2$$

Cortante:

Al estar colocada la carga a menos de 0.75 h del soporte tomamos como valor de cálculo del cortante

distancia = 0.50 m

0.75 h = 0.90

$V = \frac{0.50}{0.90} \cdot V_{cálculo}$

$V_d = 1.28 \left(3.7 + 28.5 + \frac{0.50}{0.90} \times 501\right) = 397.5$ t

$V_{cu} = 5\sqrt{\frac{300}{15}} \cdot 0.536 \cdot 1.15 = 43.6$ t

2 c ϕ 16/0.10

$A_s = \frac{397.5 - 43.6}{0.9 \cdot 1.15 \cdot 42} = 8$ cm²/m

PROYECTO LAV ZARAGOZA - LÉRIDA
SUBTRAMO 1
E-2

FECHA

HOJA N.º 11

PARRILLAS DE APOYO:

Fustes: $N_{mdt} = 761,2\ t$

$$A = 0'30 \cdot 1'6 \cdot 761.2 \cdot \frac{1'33 - 0'70}{1'33} \cdot \frac{1'15}{5'1} = 39.0\ cm^2$$

→ 2 # 7 ∅20 /apoyo.

COMPROBACIÓN CORTANTE:

$V_{d1} = 1.44 \sqrt{15.05^2 + (0.48 + 9.36)^2} = 25.9\ t$; $V_{d2} = \sqrt{1,28^2 \times 15.05^2 + \left[1,28 \cdot (0.48 + 9.36) + 17.85\right]^2} = 25,3\ t$

$V_{u1} = 0'3 \cdot U_c = 1350\ bd > 25,9\ t$

$V_{cu} = 70'71\ t$

$V_{su} = V_d - V_{cu} < 0$

No necesita armadura de cortante

Cuantía mínima:

$A_\alpha = 0'07 \frac{300}{1'5} \cdot 1.40 \cdot \frac{1}{4'2} = 13,3\ cm^2/h$

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3.2.- CALCULO CIMENTACION

	PROYECTO TAV. ZARAGOZA – LÉRIDA TRAMO I ESTRUCTURA E-2	FECHA IV-97 HOJA N.º 1

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2{,}5(8{,}26 \times 1{,}39 + 1{,}90 \times 0{,}536 \times 1{,}20) = 31{,}8\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-1 h=8,26 m	PESO PROPIO	1	317,5	—	—	—	—
		2	317,5	—	—	—	—
	CARGA PERMANENTE	1	133,9	—	—	—	—
		2	133,9	—	—	—	—
	SOBRECARGA MÁXIMA	1	336,5	—	—	—	—
		2	266,8	—	—	—	—
	SOBRECARGA MÍNIMA	1	−17,0	—	—	—	—
		2	−21,4	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−8,5	15,1	—	124,7	—
		2	−8,5	15,1	—	124,7	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	−29,6	—	—	—	—
		2	−29,6	—	—	—	—
	PRETENSADO FINAL	1	−26,7	—	—	—	—
		2	−26,7	—	—	—	—
	VIENTO	1	13,6	—	9,4	—	36,4
		2	−13,6	—	9,4	—	36,4
	SISMO	1	24,8	—	12,9	—	66,4
		2	−24,8	—	12,9	—	66,4

	PROYECTO TAV. ZARAGOZA – LÉRIDA TRAMO I ESTRUCTURA E-2	FECHA IV-97 HOJA N.º 2

CIMENTACIÓN DE PILAS

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PESO PILA: $N_1 = N_2 = 2{,}5(9{,}50 \times 1{,}39 + 1{,}90 \times 0{,}536 \times 1{,}20) = 36\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-2 h=9,50 m	PESO PROPIO	1	317,5	—	—	—	—
		2	317,5	—	—	—	—
	CARGA PERMANENTE	1	133,9	—	—	—	—
		2	133,9	—	—	—	—
	SOBRECARGA MÁXIMA	1	336,5	—	—	—	—
		2	266,8	—	—	—	—
	SOBRECARGA MÍNIMA	1	−17,0	—	—	—	—
		2	−21,4	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−8,5	6,8	—	64,6	—
		2	−8,5	6,8	—	64,6	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	−29,6	—	—	—	—
		2	−29,6	—	—	—	—
	PRETENSADO FINAL	1	−26,7	—	—	—	—
		2	−26,7	—	—	—	—
	VIENTO	1	28,5	—	15,9	—	72,9
		2	−28,5	—	15,9	—	72,9
	SISMO	1	23,2	—	10,8	—	59,4
		2	−23,2	—	10,8	—	59,4

PROYECTO .....

FECHA .....

HOJA N.º 3

HIPÓTESIS COMBINADAS

H-1 - P. PROPIO + C. PERMANENTE + SOBRECARGA MÁXIMA + DEFORMACIONES DIFERIDAS + FRENADO + PRETENSADO

H-2 Como H-1 con sobrecarga mínima

H-3 Como H-1 con viento

H-4 Como H-2 con viento

H-5 - Como H-1 con 1/4 viento + sismo

H-6 Como H-2 con 1/4 viento + sismo

P-1

HIP	N	F_L	F_T	M_L	M_T
H-1	1484.5	30.2	—	249.4	181.2
H-2	820.0	30.2	—	249.4	11.5
H-3	1484.5	30.2	18.8	249.4	316.6
H-4	820.0	30.2	18.8	249.4	146.8
H-5	1484.5	30.2	30.5	249.4	454.5
H-6	820.0	30.2	30.5	249.4	284.7

P-2

HIP	N	F_L	F_T	M_L	M_T
H-1	1524.7	13.6	—	129.2	181.2
H-2	877.2	13.6	—	129.2	11.5
H-3	1524.7	13.6	31.8	129.2	458.1
H-4	877.2	13.6	31.8	129.2	288.3
H-5	1524.7	13.6	29.6	129.2	489.9
H-6	877.2	13.6	29.6	129.2	320.1

LAV ZARAGOZA-LERIDA.TRAMO 1.E-2.ENCEPADO P-1

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Reacc. pilote máx= 576.32 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 189.10 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1484.5	30.2	0.0	249.4	181.2
H- 2	820.0	30.2	0.0	249.4	11.5
H- 3	1484.5	30.2	18.8	249.4	316.6
H- 4	820.0	30.2	18.8	249.4	146.8
H- 5	1484.5	30.2	30.5	249.4	454.5
H- 6	820.0	30.2	30.5	249.4	284.7

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1830.4	30.2	0.0	324.9	181.2
H- 2	1165.9	30.2	0.0	324.9	11.5
H- 3	1830.4	30.2	18.8	324.9	363.6
H- 4	1165.9	30.2	18.8	324.9	193.8
H- 5	1830.4	30.2	30.5	324.9	530.8
H- 6	1165.9	30.2	30.5	324.9	361.0

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	532.4	497.6	417.6	382.8
H- 2	350.0	347.8	235.2	233.0
H- 3	556.3	473.7	441.5	358.9
H- 4	373.9	323.9	259.0	209.1
H- 5	576.3	453.7	461.5	338.9
H- 6	393.9	303.9	279.0	189.1

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	851.91	612.44	12.08	42.28	0.402	0.289	0.013	0.00
H- 2	560.01	372.74	12.08	42.28	0.264	0.176	0.013	0.00
H- 3	890.10	574.25	14.23	49.80	0.420	0.271	0.016	0.00
H- 4	598.17	334.58	14.23	49.80	0.282	0.158	0.016	0.00
H- 5	922.11	542.24	17.17	60.09	0.435	0.256	0.019	0.00
H- 6	630.19	302.56	17.17	60.09	0.297	0.143	0.019	0.00

DIMENSIONAMIENTO ARMADURAS ENCEPADO.

Fck=	2500	1.50	Vcu long=	3811.02	Uc banda= 10000.00
Fyk=	51000	1.15	Vcu tran=	3137.12	
Acciones		1.60	Vcu esqu=	1027.12	
Recubri=	0.10				
Banda=	2.50				

Flexión:

Mld=	1357.81	Ail en banda=	131.40	cm2
Mtd=	348.10	Ait en banda=	32.95	cm2
		Ail entre bandas=	13.14	cm2/m
		Ait entre bandas=	3.29	cm2/m
		A min mecánica=	36.08	cm2/m
		A min geométrica=	18.09	cm2/m

Cortante:

Vld=	1728.30	Astl=	0.00	cm2/m
Vtd=	0.00	Astt=	0.00	cm2/m

Resistencia local:
Vesqd= 922.11 comprobación válida.

Armadura de suspensión= 110.07 cm2

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.00
A necesaria = 0.00

LAV ZARAGOZA-LERIDA.TRAMO 1.E-2.ENCEPADO P-2

Dimensiones encepado
Canto = 2.50
Ancho L = 6.75
Ancho T = 8.20

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 4
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	1.875	2.600
2	1.875	-2.600
3	-1.875	2.600
4	-1.875	-2.600

Reacc. pilote máx= 559.95 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 229.82 Pilote: 4 Hipót.: 6

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1524.7	13.6	0.0	129.2	181.2
H- 2	877.2	13.6	0.0	129.2	11.5
H- 3	1524.7	13.6	31.8	129.2	458.1
H- 4	877.2	13.6	31.8	129.2	288.3
H- 5	1524.7	13.6	29.6	129.2	489.9
H- 6	877.2	13.6	29.6	129.2	320.1

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	1870.6	13.6	0.0	163.2	181.2
H- 2	1223.1	13.6	0.0	163.2	11.5
H- 3	1870.6	13.6	31.8	163.2	537.6
H- 4	1223.1	13.6	31.8	163.2	367.8
H- 5	1870.6	13.6	29.6	163.2	563.9
H- 6	1223.1	13.6	29.6	163.2	394.1

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4
H- 1	513.2	478.3	457.0	422.1
H- 2	335.0	332.8	278.8	276.6
H- 3	558.2	433.4	501.9	377.2
H- 4	380.0	287.8	323.7	231.6
H- 5	559.9	431.6	503.7	375.4
H- 6	381.7	286.0	325.5	229.8

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu= 84.27
Fyk=	51000	1.15	
Acciones		1.60	

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	821.10	675.41	5.44	19.04	0.387	0.319	0.006	0.00
H- 2	535.99	442.52	5.44	19.04	0.253	0.209	0.006	0.00
H- 3	893.06	603.45	13.83	48.42	0.421	0.285	0.015	0.00
H- 4	607.93	370.58	13.83	48.42	0.287	0.175	0.015	0.00
H- 5	895.92	600.59	13.03	45.60	0.423	0.283	0.014	0.00
H- 6	610.79	367.72	13.03	45.60	0.288	0.173	0.014	0.00

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.00
A necesaria = 0.00 cm2

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	3811.02	Uc banda= 10000.00
Fyk=	51000	1.15	Vcu tran=	3137.12	
Acciones		1.60	Vcu esqu=	1027.12	
Recubri=	0.10				
Banda=	2.50				

Flexión:

Mld=	1319.24	Ail en banda=	127.56 cm2
Mtd=	338.21	Ait en banda=	32.00 cm2
		Ail entre bandas=	12.76 cm2/m
		Ait entre bandas=	3.20 cm2/m
		A min mecánica=	36.08 cm2/m
		A min geométrica=	18.09 cm2/m

Cortante:

Vld=	1679.21	Astl=	0.00 cm2/m
Vtd=	0.00	Astt=	0.00 cm2/m

Resistencia local:
Vesqd= 895.92 comprobación válida.

Armadura de suspensión= 112.48 cm2

PROYECTO L.A.V. ZARAGOZA - LERIDA E-2 | FECHA | HOJA N.º 10

LONGITUD DE PILOTES

De acuerdo con el informe geotécnico se calculan las longitudes de pilote en cada pila:

Corte estratigráfico según informe geotécnico:

	P.1	P.2	Roz. (t/m²)
LIMOS YESIFEROS BLANDOS	0-5	0-3	3
GRAVAS DE YESO Y YESO ALTERADO	5-14	3-18	8
YESO SANO	14 ↦	18 ↦	40

Rozamiento negativo (flujo colapsable): $610 \cdot 4 \cdot 6.1 - 15 = 9.2$ t

PILA 1: $\frac{1}{3}[2\times3 + 9\times8]\times\pi\times1.5 + \frac{1}{2.5}\cdot\pi\cdot15\cdot40\times L - 9.2 = 576$ t

$L = 6.2$ m en yeso sano $L = 14 + 6.2 - 3.0 \approx \underline{18.0\ m}$

PILA 2: $\frac{1}{3}\ 15\times\pi\times15\times8 + \frac{1}{2.5}\times\pi\cdot1.5\times40\times L - 9.2 = 560$ t

$L = 5.1$ m en yeso $L = 18 + 5.1 - 3 \approx \underline{21.0\ m}$

4.- CALCULO ESTRIBOS

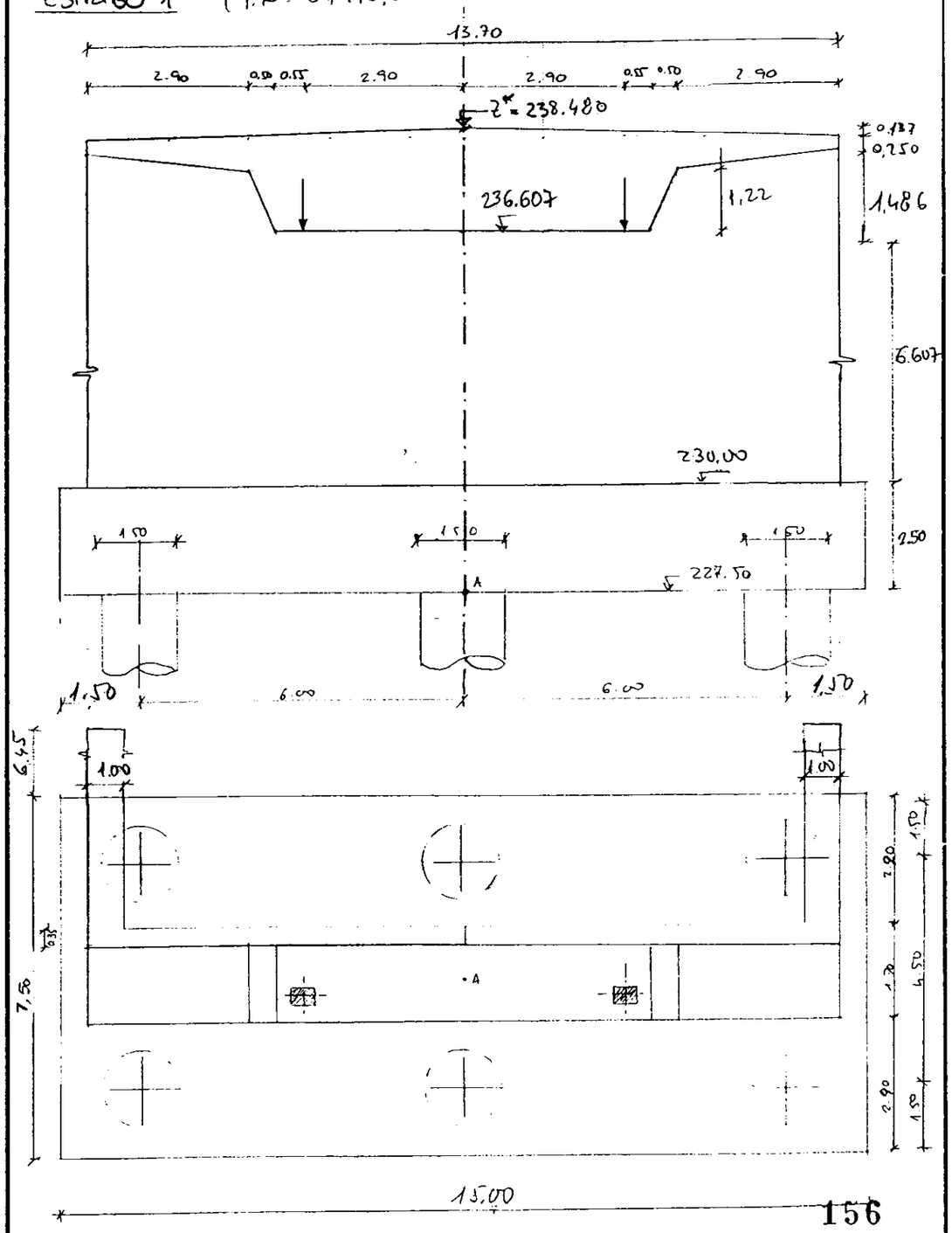
4.1.- ESTRIBO 1 (Móvil)

PROYECTO L.A.V. ZARAGOZA - LÉRIDA
SUBTRAMO 1.
E-2

FECHA IV-97

HOJA N.° 1

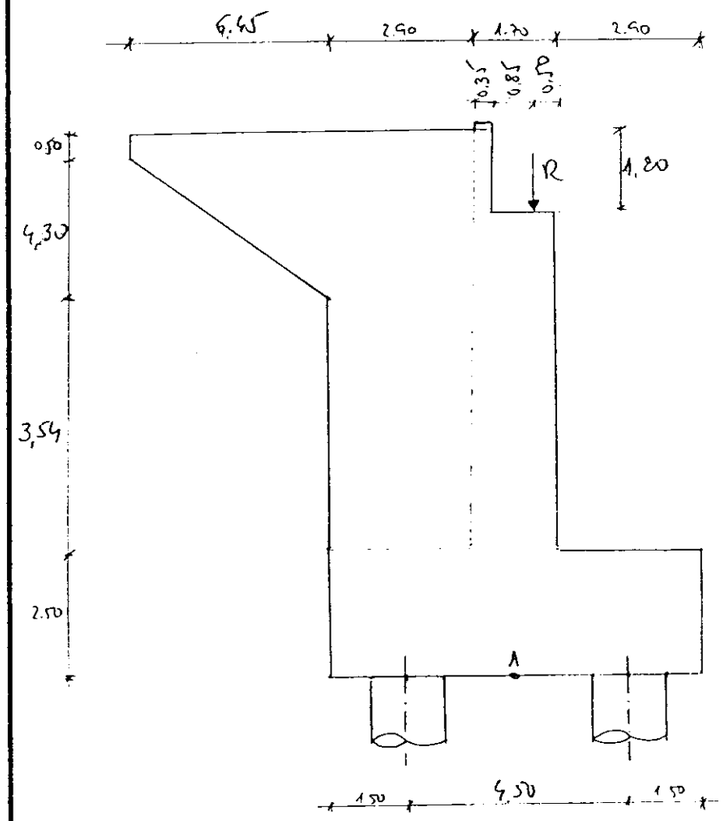
ESTRIBO 1 (P.K. 6+995,00)



PROYECTO L.A.V. ZARAGOZA-LÉRIDA
SUBTRAMO 1.
E-2

FECHA

HOJA N.° 2



	PROYECTO E-2	FECHA
		HOJA N.º 3

- REACCIONES DEL TABLERO:

P. propio + C perm + temp + ret. N = 381,2 t

Sobrecarga : N = 238,4 t M_T = 71,5 mt.

F_{HL} (frenada + def diferida) = 33,2 t

F_{HT} (viento + centr.) = 12,9 + 26,7 = 39,6 t.

F_{HT} (sism long) = 0

F_{HT} (sism transv.) = 14,1 t

E-2. ESTRIBO 1.

CARACTERISTICAS DEL RELLENO
==========

PESO ESPECIFICO (TN/M3)		=	2.00
ANGULO DE ROZAMIENTO FI		=	35.00
ANGULO ROZAMIENTO TERRENO-MURO		=	.00
SOBRECARGA (TN/M2)		=	3.00
COEFICIENTE SISMICO BASICO	C	=	.080
COEFICIENTE SISMICO	S	=	.080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		=	.293
COEFICIENTE DE EMPUJE ACTIVO		=	.271

CARACTERISTICAS DE LOS MATERIALES
==========

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250. KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.050 M

CARGAS SOBRE EL ESTRIBO
==========

CARGA VERTICAL DE TABLERO PESO PROPIO Y CARGA PERMANENTE	381.2 TN
CARGA VERTICAL DE SOBRECARGAS	238.4 TN
FUERZA LONGITUDINAL DE FRENADO RETRACCION Y TEMPERATURA	33.2 TN
FUERZA TRANSVERSAL DE VIENTO	39.6 TN
MOMENTO TRANSVERSAL DE SOBRECARGAS	71.5 MT
FUERZA LONGITUDINAL DE SISMO	.0 TN
FUERZA TRANSVERSAL DE SISMO	14.1 TN

GEOMETRIA DEL ESTRIBO
==========

ANCHURA DEL ESTRIBO	B	=	13.70
ESVIAJE (GRADOS SEXAGESIMALES)	BETA	=	.00

ALZADO DEL ESTRIBO

ESPESOR DEL FALDON	A3 =	.35
ALTURA DEL FALDON	A6 =	1.80
DISTANCIA DE APOYO A BORDE ESTRIBO	A5 =	.50
ESPESOR DEL ESTRIBO	A2 =	1.70
ESPESOR DE LAS ALETAS	A7 =	1.00
ALTURA TOTAL DEL ESTRIBO	H + C =	10.90
ALTURA DE TIERRAS	H =	8.40

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 24.8 CM2/M	(FI 20 A .125 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
	5.0 M. SUPERIORES	AV.= 12.4 CM2/M	(FI 20 A .250 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
INTRADOS		AV.= 5.5 CM2/M	(FI 12 A .200 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
FALDON	TRASDOS	AV.= 4.5 CM2/M	(FI 12 A .250 M)
		AH.= 4.1 CM2/M	(FI 12 A .250 M)
	INTRADOS	AV.= 4.5 CM2/M	(FI 12 A .250 M)
		AH.= 1.9 CM2/M	(FI 8 A .200 M)
ALETAS	TRASDOS	AV.= 14.3 CM2/M	(FI 20 A .200 M)
		AH.= 14.3 CM2/M	(FI 20 A .200 M)
	INTRADOS	AV.= 7.1 CM2/M	(FI 12 A .150 M)
		AH.= 7.1 CM2/M	(FI 12 A .150 M)

PROYECTO .....

FECHA .....

HOJA N.º 6

ESFUERZOS EN CARA SUPERIOR DE ENCEPADO

- P. PROPIO ESTRIBO

MURO FRONTAL: $N = 2.5\left[13.70\,(6.61\times1.70 + 1.80\times0.35) + 2\times3.15\times1.35\times1.35\right] = 384.9 + 21.6 + 28.7 = 435.2$ t.

$M_L = 384.9\,(3.75-3.75) + 21.6\,(3.75-4.425) + 28.7\,(3.75-3.575) = -9.6$ mt

ALETAS: $N = 2\times2.5\,(2.50\times8.34\times1.00 + 6.45\times0.30\times1.00 + \frac{1}{2}\,6.45\times4.30\times1.00) = 120.9 + 16.1 + 69.4 = 206.4$ t

$M_L = 120.9\,(3.75-6.05) + 16.1\,(3.75-10.725) + 69.4\,(3.75-9.65) = -799.7$ mt

- P PROPIO + TABLERO + C PERM. + TEMP + PRET.

$N = 381.2$ t

$M_L = 381.2\,(3.75-3.40) = 133.4$ mt

- SOBRECARGA: $N = 238.4$ t

$M_L = 238.4\,(3.75-3.40) = 83.5$ mt.

$M_T = 71.5$ mt

- FRENADO + REF. DIF.: $F_L = 33.2$ t

$M_L = 33.2\times6.70 = 222.5$ mt

- VIENTO + F. CENTR.: $F_T = 39.6$ t

$M_T = 39.6\times9.10 = 360.4$ mt.

PROYECTO

FECHA

HOJA N.° 7

- EMPUJE DE TIERRAS

$e = 0{,}27\,(3{,}00 + 2{,}0 \times 2)$

$z_0 = 0{,}81\ t/m^2 \rightarrow \quad E_0 = 0{,}81 \times 13{,}70 = 11{,}14\ t/m$

$z_{8{,}40} = 5{,}37\ t/m^2 \rightarrow \quad E_{8{,}40} = 5{,}37 \times 13{,}70 = 73{,}51\ t/m$

$$F_L = \frac{11{,}14 + 73{,}51}{2} \times 8{,}40 = 355{,}6\ t$$

$$M_L = 355{,}6 \times \frac{2 \times 11{,}14 + 73{,}51}{11{,}14 + 73{,}51} \times \frac{8{,}40}{3} = 1126{,}5\ mt$$

- PESO DE TIERRAS

$N = 13{,}00 \times 8{,}40 \times 2{,}90 \times 2{,}0 = 633{,}4\ t$

$M_L = 633{,}4\,(3{,}75 - 6{,}05) = -1456{,}7\ mt$

- SISMO TRANSVERSAL

$F_T = 14{,}1 + 0{,}08 \times (435{,}2 + 206{,}4) = 65{,}4\ t.$

$M_T = 14{,}1 \times 8{,}40 + 0{,}08\,(384{,}9 \times 3{,}30 + 216 \times 7{,}50 + 78{,}7 \times 7{,}28 +$

$+ 120{,}9 \times 4{,}17 + 16{,}1 \times 8{,}09 + 69{,}4 \times 6{,}41) = 216{,}5\ mt.$

PROYECTO

FECHA

HOJA N.° 8

Hipótesis combinadas

H1 - P. propio + C. perm + Temp. + Pret + Sobrecarga + def. dif. + viento + f. centrif. + emp. tierras + peso de tierras

$N = 435{,}2 + 206{,}4 + 381{,}2 + 238{,}4 + 633{,}4 = 1894{,}6\ t$

$F_L = 38{,}2 + 355{,}6 = 393{,}8\ t.$

$F_T = 39{,}6\ t$

$M_L = -9{,}6 - 799{,}7 + 133{,}4 + 83{,}5 + 222{,}5 + 1126{,}5 - 1456{,}7 = -700{,}1\ mt$

$M_T = 71{,}5 + 360{,}4 = 431{,}9\ mt$

H-2 Como H-1, sin empuje de tierras ni def. diferidas

$N = 1894{,}6\ t$

$F_L = 0\ t$

$F_T = 39{,}6\ t$

$M_L = -700{,}1 - 1126{,}5 - 222{,}5 = -2049{,}1\ mt$

$M_T = 431{,}9\ mt$

H-3 Como H-1 con sismo transversal

$N = 1894{,}6\ t \qquad F_L = 393{,}8\ t \qquad F_T = 39{,}6 + 65{,}4 = 105{,}0\ t$

$M_L = -700{,}1\ t \qquad M_T = 431{,}9 + 216{,}5 = 648{,}4\ mt$

H-4 Como H-2 con sismo transversal

$N = 1894{,}6\ t \qquad F_L = 0 \qquad F_T = 105{,}0\ t$

$M_L = -2049{,}1\ mt \qquad M_T = 648{,}4\ mt$

LAV ZARAGOZA-LERIDA.TRAMO 1.E-2.ENCEPADO ESTRIBO 1.

Dimensiones encepado
- Canto = 2.50
- Ancho L = 7.50
- Ancho T = 15.00

Reacc. pilote máx= 642.93 Pilote: 1 Hipót.: 3
Reacc. pilote mín= 222.98 Pilote: 6 Hipót.: 3

Dimensiones pila
- Ancho L = 1.70
- Ancho T = 13.70

Datos pilotes
- Número = 6
- Diámetro= 1.50
- Long emp= 9.00

Pilote	X-Long	Y-Trans
1	2.250	6.000
2	-2.250	6.000
3	2.250	0.000
4	-2.250	0.000
5	2.250	-6.000
6	-2.250	-6.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1894.6	393.8	39.6	-700.1	431.9
H- 2	1894.6	0.0	39.6	-2049.1	431.9
H- 3	1894.6	393.8	105.0	-700.1	648.4
H- 4	1894.6	0.0	105.0	-2049.1	648.4

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2597.7	393.8	39.6	284.4	530.9
H- 2	2597.7	0.0	39.6	-2049.1	530.9
H- 3	2597.7	393.8	105.0	284.4	910.9
H- 4	2597.7	0.0	105.0	-2049.1	910.9

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6
H- 1	614.8	310.2	585.3	280.6	555.7	251.1
H- 2	310.7	614.3	281.2	584.7	251.6	555.2
H- 3	642.9	338.3	585.3	280.6	527.6	223.0
H- 4	338.8	642.4	281.2	584.7	223.5	527.1

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu= 84.27
Fyk=	51000	1.15	
Acciones		1.60	
Acciones (con sismo)		1.28	

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	983.73	401.72	105.54	474.94	0.464	0.190	0.149	0.30
H- 2	982.86	402.60	10.56	47.52	0.464	0.190	0.015	0.00
H- 3	823.00	285.42	86.95	391.26	0.388	0.135	0.123	0.23
H- 4	822.25	286.11	22.40	100.80	0.388	0.135	0.032	0.00

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.30
A necesaria = 143.37 cm2
Ast = 4.58 cm2/m

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DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	6971.37	Uc banda= 12000.00
Fyk=	51000	1.15	Vcu tran=	3485.69	
Acciones		1.60	Vcu esqu=	1027.12	
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld= 1702.48 Ail en banda= 164.98 cm2
Mtd= 1239.57 Ait en banda= 119.08 cm2

Ail entre bandas= 13.75 cm2/m
Ait entre bandas= 9.92 cm2/m

A min mecánica= 36.08 cm2/m
A min geométrica= 18.09 cm2/m

Cortante:

Vld= 2875.21 Astl= 0.00 cm2/m
Vtd= 0.00 Astt= 0.00 cm2/m

Resistencia local:
Vesqd= 983.73 Comprobación válida

Armadura de suspensión= 104.14 cm2

)

)

PROYECTO L.A.V. ZARAGOZA - LÉRIDA
TRAMO 1
E-2

FECHA IV-97

HOJA N.º 12

PARRILLAS DE APOYO:

$R_{max} = 322.1\ t$

Apoyos: 450 × 600 × 129 (93)

$A_{sl} = 0'3 \cdot 1'6 \cdot 322.1 \times \frac{1'15}{5'1} \times \left(1 - \frac{450}{1000}\right) = 19,2\ cm^2$.

$A_{st} = 0'3 \cdot 1'6 \times 322.1 \times \frac{1'15}{5'1} = 34.9\ cm^2$

2 # 9Ø16 /apoyo.

LONGITUD DE PILOTES ($\phi = 1'50$ m)

De acuerdo con el informe geotécnico se calculan las longitudes de pilotes en el estribo:

Corte estratigráfico según plano geológico:

	ESTRIBO-1	ROZAMIENTO (t/m^2)
LIMOS YESÍFEROS BLANDOS	0 - 4.00	3.00
GRAVAS DE YESO	4 - 10.00	6.00
YESO ALTERADO	10 - 12.00	6.00
YESO SANO	12.00 →	40.00

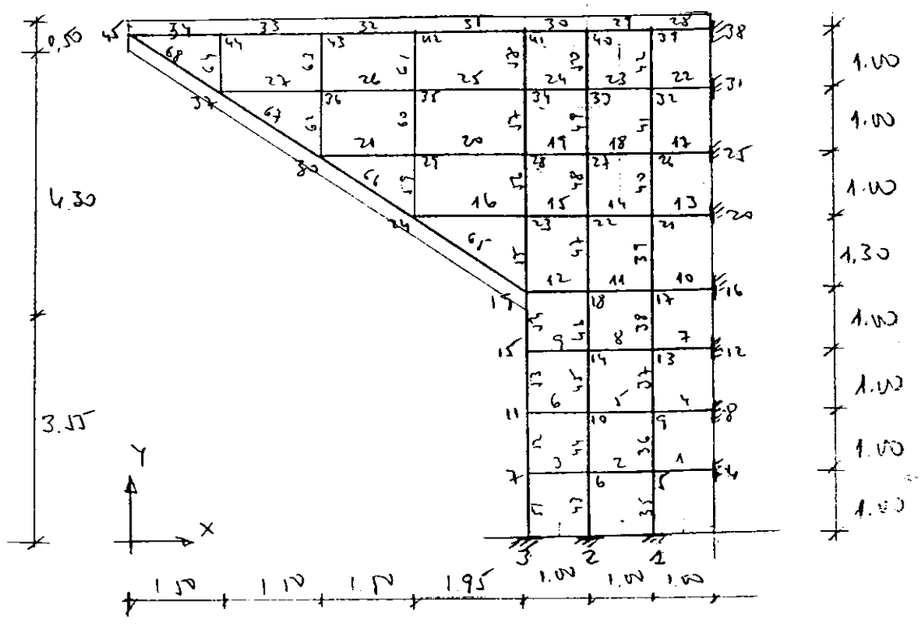
Rozamiento negativo (limos colapsables): $6'10 \times \phi = 9'12$ t

$$613{,}0 = \frac{1}{2{,}5}\,\pi \times 1.50\,(1.00 \times 3.0 + 6.00 \times 6.0 + 2{,}00 \times 6.00 + 2 \times 40) -$$

$$- 6.10 \times 1.10 \quad \rightarrow \quad z = 6\,98 \simeq 7{,}00\ m$$

Por tanto, longitud de pilotes = $1.00 + 6.00 + 2.00 + 7.00 = \underline{16.00\ m}$

ESTRIBO 1. MUROS EN VUELTA ($e = 1.00$ m)



Caracteristicas de barras

$$I = \frac{a \times 1.00^3}{12} \qquad J = 2I$$

Barras	a	I	J	Tipo
1 a 9, 11 a 27, 35 a 51	1.00	0.0833	0.1666	1
10 a 16	1.15	0.0758	0.1916	2
28 a 34	0.35	0.0458	0.0916	3
51 a 54	0.50	0.0417	0.0834	4
55 a 58	1.475	0.1229	0.2458	5
59 a 61	1.775	0.1438	0.2876	6
62 a 64	1.35	0.1250	0.2700	7
65 a 68	0.50	0.0417	0.0834	4

PROYECTO .....

FECHA .....

HOJA N.º 15

Empuje de tierras.

$e = 0{,}36\,(3.W + 2.0 \times z)$.

z	e	Barras	q (t/m)
0	1.08		
		28 a 34	0,704
0,55	1.48		
		22 a 27	1,840
1.35	2.20		
		17 a 21	2.560
2.35	2.92		
		13 a 16	3,830
3,70	3.74		
		10 a 12	4.778
4.85	4.57		
		7 a 9	5,210
5.85	5,29		
		4 a 6	5.650
6.85	6.01		
		1 a 3	6.370
7,85	6.73		

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```
L.A.V. ZARAGOZA-LÉRIDA. E-2. ESTRIBO 1. MUROS EN VUELTA.
CONTROL
45 68 8 1
:
NUDOS
 1  8.45  0.00
 2  7.45  0.00
 3  6.45  0.00
 4  9.45  1.00
 5  8.45  1.00
 6  7.45  1.00
 7  6.45  1.00
 8  9.45  2.00
 9  8.45  2.00
10  7.45  2.00
11  6.45  2.00
12  9.45  3.00
13  8.45  3.00
14  7.45  3.00
15  6.45  3.00
16  9.45  4.00
17  8.45  4.00
18  7.45  4.00
19  6.45  4.00
20  9.45  5.30
21  8.45  5.30
22  7.45  5.30
23  6.45  5.30
24  4.50  5.30
25  9.45  6.30
26  8.45  6.30
27  7.45  6.30
28  6.45  6.30
29  4.50  6.30
30  3.00  6.30
31  9.45  7.30
32  8.45  7.30
33  7.45  7.30
34  6.45  7.30
35  4.50  7.30
36  3.00  7.30
37  1.50  7.30
38  9.45  8.30
39  8.45  8.30
40  7.45  8.30
41  6.45  8.30
42  4.50  8.30
43  3.00  8.30
44  1.50  8.30
45  0.00  8.30
:
BARRAS TIPO
7
0.0833 0.1666 3E6 1.3E6
0.0958 0.1916 3E6 1.3E6
0.0458 0.0916 3E6 1.3E6
0.0417 0.0834 3E6 1.3E6
0.1229 0.2458 3E6 1.3E6
0.1438 0.2876 3E6 1.3E6
```

```
0.1250 0.2500 3E6 1.3E6
:
BARRAS
 1   4   5   1
 2   5   6   1
 3   6   7   1
 4   8   9   1
 5   9  10   1
 6  10  11   1
 7  12  13   1
 8  13  14   1
 9  14  15   1
10  16  17   2
11  17  18   2
12  18  19   2
13  20  21   2
14  21  22   2
15  22  23   2
16  23  24   2
17  25  26   1
18  26  27   1
19  27  28   1
20  28  29   1
21  29  30   1
22  31  32   1
23  32  33   1
24  33  34   1
25  34  35   1
26  35  36   1
27  36  37   1
28  38  39   3
29  39  40   3
30  40  41   3
31  41  42   3
32  42  43   3
33  43  44   3
34  44  45   3
35   1   5   1
36   5   9   1
37   9  13   1
38  13  17   1
39  17  21   1
40  21  26   1
41  26  32   1
42  32  39   1
43   2   6   1
44   6  10   1
45  10  14   1
46  14  18   1
47  18  22   1
48  22  27   1
49  27  33   1
50  33  40   1
51   3   7   4
52   7  11   4
53  11  15   4
54  15  19   4
55  19  23   5
56  23  28   5
```



```
57  28  34   5
58  34  41   5
59  24  29   6
60  29  35   6
61  35  42   6
62  30  36   7
63  36  43   7
64  37  44   7
65  19  24   4
66  24  30   4
67  30  37   4
68  37  45   4
:
APOYOS
11
 1  1  1  1
 2  1  1  1
 3  1  1  1
 4  1  1  1
 8  1  1  1
12  1  1  1
16  1  1  1
20  1  1  1
25  1  1  1
31  1  1  1
38  1  1  1
:
HIPOTESIS DE CARGA
H-1 EMPUJE DE TIERRAS
0
34
28  3  0.704  0.704
29  3  0.704  0.704
30  3  0.704  0.704
31  3  0.704  0.704
32  3  0.704  0.704
33  3  0.704  0.704
34  3  0.704  0.704
22  3  1.840  1.840
23  3  1.840  1.840
24  3  1.840  1.840
25  3  1.840  1.840
26  3  1.840  1.840
27  3  1.840  1.840
17  3  2.560  2.560
18  3  2.560  2.560
19  3  2.560  2.560
20  3  2.560  2.560
21  3  2.560  2.560
13  3  3.830  3.830
14  3  3.830  3.830
15  3  3.830  3.830
16  3  3.830  3.830
10  3  4.778  4.778
11  3  4.778  4.778
12  3  4.778  4.778
 7  3  5.210  5.210
 8  3  5.210  5.210
 9  3  5.210  5.210
```

4	3	5.650	5.650
5	3	5.650	5.650
6	3	5.650	5.650
1	3	6.370	6.370
2	3	6.370	6.370
3	3	6.370	6.370

:

L.A.V. ZARAGOZA-LÉRIDA. E-2. ESTRIBO 1. MUROS EN VUELTA.

Hip. n° 1 H-1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	-0.000000	0.000000
2	-0.000000	-0.000000	0.000000
3	-0.000000	-0.000000	0.000000
4	-0.000000	-0.000000	0.000000
5	-0.000014	-0.000014	0.000007
6	-0.000042	-0.000022	0.000025
7	-0.000072	-0.000024	0.000047
8	-0.000000	-0.000000	0.000000
9	-0.000016	-0.000039	0.000022
10	-0.000050	-0.000059	0.000072
11	-0.000088	-0.000065	0.000134
12	-0.000000	-0.000000	0.000000
13	-0.000013	-0.000064	0.000035
14	-0.000045	-0.000100	0.000119
15	-0.000088	-0.000116	0.000229
16	-0.000000	-0.000000	0.000000
17	-0.000011	-0.000084	0.000046
18	-0.000037	-0.000137	0.000158
19	-0.000073	-0.000184	0.000318
20	-0.000000	-0.000000	0.000000
21	-0.000008	-0.000105	0.000056
22	-0.000028	-0.000176	0.000199
23	-0.000053	-0.000229	0.000403
24	-0.000078	-0.000303	0.000932
25	-0.000000	-0.000000	0.000000
26	-0.000007	-0.000118	0.000063
27	-0.000022	-0.000197	0.000224
28	-0.000041	-0.000251	0.000450
29	-0.000071	-0.000314	0.001007
30	-0.000079	-0.000338	0.001500
31	-0.000000	-0.000000	0.000000
32	-0.000006	-0.000129	0.000069
33	-0.000019	-0.000214	0.000243
34	-0.000034	-0.000268	0.000487
35	-0.000064	-0.000325	0.001075
36	-0.000076	-0.000344	0.001578
37	-0.000080	-0.000351	0.002100
38	-0.000000	-0.000000	0.000000
39	-0.000007	-0.000138	0.000075
40	-0.000019	-0.000226	0.000262
41	-0.000033	-0.000280	0.000520
42	-0.000061	-0.000334	0.001138
43	-0.000074	-0.000348	0.001653
44	-0.000080	-0.000353	0.002181
45	-0.000081	-0.000354	0.002711

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	4.23	3.09	1.49
2	16.08	4.67	11.29
3	16.98	2.55	15.96

4	3.02	4.61	4.21
8	3.49	13.76	9.76
12	2.87	21.61	12.91
16	2.66	31.28	15.71
20	2.04	36.94	14.68
25	1.43	35.54	12.90
31	1.39	38.80	13.74
38	0.82	23.94	10.12

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	4	3.02	-4.61	4.21
	5	3.02	-3.58	-2.16
2	5	6.03	-1.24	0.95
	6	6.03	-3.48	-5.42
3	6	6.54	-0.13	1.42
	7	6.54	-1.90	-4.95
4	8	3.49	-13.76	9.76
	9	3.49	-6.83	4.11
5	9	7.33	-6.89	6.03
	10	7.33	-3.69	0.38
6	10	8.34	-2.80	4.50
	11	8.34	-1.13	-1.15
7	12	2.87	-21.61	12.91
	13	2.87	-11.30	7.70
8	13	6.77	-12.30	8.55
	14	6.77	-6.36	3.34
9	14	9.47	-7.27	8.09
	15	9.47	-1.78	2.88
10	16	2.66	-31.28	15.71
	17	2.66	-17.96	10.93
11	17	6.43	-18.85	9.23
	18	6.43	-12.01	4.45
12	18	9.19	-13.49	1.37
	19	9.19	-14.51	-3.40
13	20	2.04	-36.94	14.68
	21	2.04	-24.18	10.85
14	21	4.88	-24.87	10.52
	22	4.88	-16.26	6.69
15	22	6.35	-18.10	6.89
	23	6.35	-13.12	3.06
16	23	3.10	-17.21	8.99
	24	3.10	-6.95	1.52
17	25	1.43	-35.54	12.90
	26	1.43	-23.92	10.34
18	26	3.29	-24.36	10.03
	27	3.29	-15.62	7.47
19	27	4.08	-16.72	7.61
	28	4.08	-10.38	5.05
20	28	3.35	-11.77	5.38
	29	3.35	-6.15	0.39
21	29	1.23	-6.48	4.59
	30	1.23	-2.48	0.75
22	31	1.39	-38.80	13.74
	32	1.39	-25.98	11.90
23	32	2.76	-26.32	10.87
	33	2.76	-16.37	9.03
24	33	3.30	-17.21	7.90

	34	3.30	-10.22	6.06
25	34	3.29	-11.82	5.84
	35	3.29	-3.93	2.25
26	35	1.78	-4.68	3.03
	36	1.78	-2.21	0.27
27	36	0.59	-2.46	2.53
	37	0.59	-0.74	-0.23
28	38	0.82	-23.94	10.12
	39	0.82	-14.18	9.42
29	39	1.43	-16.19	8.40
	40	1.43	-8.14	7.70
30	40	1.64	-10.88	7.14
	41	1.64	-4.09	6.43
31	41	1.76	-8.06	4.88
	42	1.76	0.12	3.51
32	42	1.03	-3.14	2.79
	43	1.03	0.25	1.73
33	43	0.45	-1.21	1.41
	44	0.45	0.11	0.35
34	44	0.09	-0.40	0.76
	45	0.09	-0.05	-0.30
35	1	-3.09	-4.23	1.49
	5	-3.09	-2.74	1.49
36	5	-5.43	0.26	-1.62
	9	-5.43	-1.35	-1.62
37	9	-5.37	2.48	-3.54
	13	-5.37	-1.06	-3.54
38	13	-4.37	2.84	-4.39
	17	-4.37	-1.55	-4.39
39	17	-3.49	2.22	-2.69
	21	-3.49	-1.27	-2.69
40	21	-2.79	1.57	-2.36
	26	-2.79	-0.78	-2.36
41	26	-2.35	1.07	-2.05
	32	-2.35	-0.97	-2.05
42	32	-2.01	0.40	-1.01
	39	-2.01	-0.62	-1.01
43	2	-4.67	-16.08	11.29
	6	-4.67	-4.79	11.29
44	6	-8.02	-4.28	4.46
	10	-8.02	0.18	4.46
45	10	-8.90	1.19	0.34
	14	-8.90	1.52	0.34
46	14	-7.99	4.22	-4.42
	18	-7.99	-0.20	-4.42
47	18	-6.51	2.55	-1.34
	22	-6.51	0.80	-1.34
48	22	-4.68	2.27	-1.55
	27	-4.68	0.72	-1.55
49	27	-3.58	1.51	-1.69
	33	-3.58	-0.18	-1.69
50	33	-2.74	0.35	-0.56
	40	-2.74	-0.21	-0.56
51	3	-2.55	-16.98	15.96
	7	-2.55	-1.02	15.96
52	7	-4.45	-7.57	11.00
	11	-4.45	3.44	11.00
53	11	-5.58	-4.90	9.85
	15	-5.58	4.95	9.85

54	15	-7.36	-4.51	12.74
	19	-7.36	8.23	12.74
55	19	-11.05	2.79	4.49
	23	-11.05	8.62	4.49
56	23	-6.96	5.37	-1.44
	28	-6.96	3.93	-1.44
57	28	-5.57	3.20	-1.77
	34	-5.57	1.43	-1.77
58	34	-3.97	1.43	-1.55
	41	-3.97	-0.13	-1.55
59	24	-4.35	0.78	4.25
	29	-4.35	5.03	4.25
60	29	-4.01	2.91	0.05
	35	-4.01	2.96	0.05
61	35	-3.26	1.45	-0.72
	42	-3.26	0.74	-0.72
62	30	-1.72	0.15	1.94
	36	-1.72	2.09	1.94
63	36	-1.46	0.90	-0.32
	43	-1.46	0.58	-0.32
64	37	-0.50	-0.05	0.41
	44	-0.50	0.36	0.41
65	19	-2.88	-11.08	4.85
	24	-2.88	0.28	4.85
66	24	-1.10	-4.04	2.12
	30	-1.10	-0.22	2.12
67	30	-0.37	-1.62	0.93
	37	-0.37	0.06	0.93
68	37	-0.05	-0.44	0.30
	45	-0.05	0.09	0.30

PROYECTO

FECHA

HOJA N.º 24

ARMADURA

$$Md = \frac{1.6 \times (M+T)}{\text{ancho barra}} \quad mt_m.$$

$$Uc = \frac{25N \times 0.9}{1.5} \times 1.0N \times 0.5N = 130\ t_m$$

$$A = Uc\left[1 - \sqrt{1 - \frac{2\,Md}{Uc \times 0.5N}}\right] \times \frac{1.15}{5.1}\ cm^2/m$$

DIRECCION	NUDO	ANCHO	M	T	Md	Aext cm²/m	A int. (cm²/m)
VERTICAL	1	1 m	-4.23	-3.09	-11.71	—	3,0
	2	1.00	-16.98	-4,67	-33,20	—	8.5
	3	0,50	-16.98	-2.55	-62.50	—	16.1
	17	1.00	-1.55 2.22	-4.37 3.49	-9.47 9.14	— 2.3	2.4 —
	18	1.00	-0,20 2.55	-7.99 6.57	-13.10 14.50	— 3,7	3.3 —
	19	0,50	8.23 2.79	7.36 11.05	49.89 44.29	12 9	—
HORIZONTAL	8	1 m	-13.76	-3.49	-27.60	—	7.0
	12	1 m	-21.61	-2,87	-39,17	—	10.1
	16	1.5	-31,28	-2,66	-47.22	—	12.2
	20	1.5	-36.94	-2.04	-54.23	—	14 0
	25	1 m	-35.54	-1.43	-59,15	—	15.2
	31	1.00	-38,80	-1,39	-64.30	—	16 6
	38	0,55	-23.54	-0,82	-72.03	—	18.6
INCLINADO	19	0,50	-11.08	-2.88	-44.67	—	11 5

A min vertical = 4.5 cm²/m

A min horiz. = 8 cm²/m

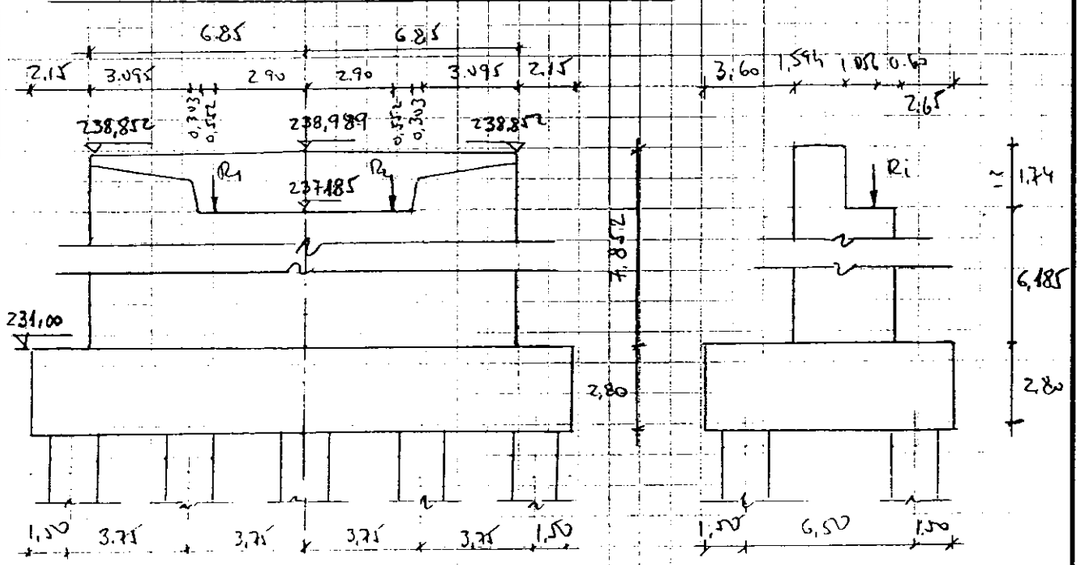
4.2.- ESTRIBO 2 (Fijo)

PROYECTO ZARAGOZA – LERIDA
SUBTRAMO 1
E-2

FECHA IV-97

HOJA N.º 1

ESTRIBO FIJO (E-2) (P.K 7+060,000)



PROYECTO
E-2

FECHA IV-97

HOJA N.º 2

— $R_1 + R_2$. $P_{prop} = 187.1 + 79.6 + 19.0 + 61.3 = 390.2$ t

Sobrec. = 243,2 t. $M_T = 243,2 \times 0,30 = 73.0$ mt

$F_{H_L\,frenado} = 291,6$ t

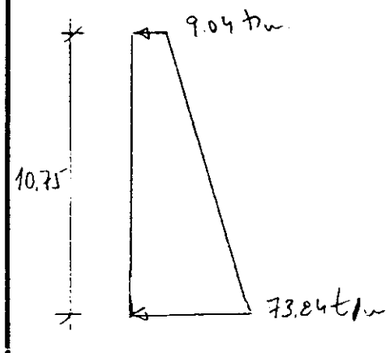
$F_{H_L\,del\,dif} = 76.9$ t

$F_{H_L\,Tramo} = 263,9$ t

$F_{H_T\,viento} = 23,3$ t

$F_{H_T\,giro} = 8,6 + 79.3 = 87.9$ t

Empuje de tierras



$\varphi = 40°$ $k_A = 0,22$ $\gamma = 3$ t/m³

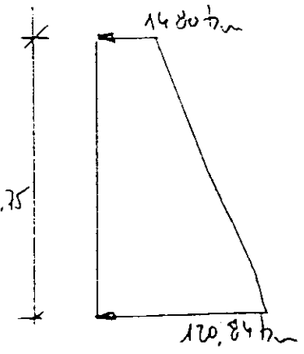
$e = 0,22\,(3,00 + 2,00 + h)$

$E = e \times 13,70$

$F_{H_L} = \frac{9,04 + 73,84}{2} \times 10,75 = 445,5$ t

$M_L = 445,5 \left[\frac{18,88 + 73,84}{9,04 + 73,84} \times \frac{10,75}{3} \right] = 1770,4$ mt

— Empuje de tierra al reposo.



$k_A = 1 - \sin 40° = 0,36$

$e = 0,36\,(3,00 + 2,00 + h)$ $E = e \times 13,70$

$F_{H_L} = \frac{14,80 + 120,84}{2} \times 10,75 = 729,0$ t

$M_L = 729,0 \left(\frac{29,60 + 120,84}{14,80 + 120,84} \times \frac{10,75}{3} \right) = 2897,5$ mt.

PROYECTO E-2 | FECHA 11-97 | HOJA N.° 3

Incremento de empuje de tierras por sismo.

$C = 0{,}07$

$k_A = 0{,}22$

$$k_{AH} = \left[\frac{\sec\alpha \cdot \cos(\psi - \alpha)}{\sqrt{\cos(\alpha+\delta)} + \sqrt{\frac{\sin(\psi+\delta)\sin(\psi+\beta)}{\cos(\beta-\alpha)}}} \right]^2 = 0{,}237$$

$\alpha = \psi$; $\psi = 41°$; $\beta = \psi$; $\delta = 0$; $\psi = \operatorname{arctg}(0{,}08) = 4{,}57°$

$$k_{AD} = \frac{k_{AH}}{\cos\psi} = \frac{0{,}237}{0{,}997} = 0{,}26$$

$$\Delta F_{HL} = \frac{1}{2}(0{,}26 - 0{,}22) \cdot 2{,}0 \times 10{,}75^2 \times 13{,}70 = 63{,}3\ t$$

$$\Delta M_L = 63{,}3 \times \frac{10{,}75}{2} = 340{,}5\ mt$$

ACCIONES RESPECTO AL CENTRO DEL ENCEPADO (CARA INFERIOR)

	N	F_{HL}	F_{HT}	M_L (→ +)	M_T
ENCEPADO: 18,00×9,50×2,50×2,5	1197,0	—	—	—	—
MURO FRON.: 13,70×6,185×3,45×2,5	688,5	—	—	327,0	—
MURETE: 13,70×1,74×1,594×2,5	95,0	—	—	−33,5	—
TAPES: 2×3,25×1,35×1,156×2,5	36,3	—	—	46,2	—
MUROS LAT.: 2×3,60×7,85×1,10×2,5	141,3	—	—	−416,8	—
ALETAS: 2×3,60×1,70×1,10×2,5	30,6	—	—	−187,5	—
PESO TIERRAS: 11,70×3,60×7,85×2,0	661,3	—	—	−1950,7	—
C.P. TABLERO:	390,2	—	—	585,3	—
SOB. TAB. MÁXIMA	243,2	—	—	364,8	73,0
SOB. TAB. MÍNIMA	−43,1	—	—	−65,4	—
EMPUJE TIERRAS	—	445,5	—	1770,4	—
EMPUJE TIERRAS REPOSO	—	729,0	—	2897,5	—
INCR. EMP. TIERRAS SISMO	—	63,3	—	340,5	—
FRENADO	—	±291,6	—	±2911,6	—
REF. DIFERIDAS	—	76,9	—	768,2	—
VIENTO	—	—	233	—	278,2
SISMO LONGITUDINAL	—	±263,9	—	±2636,4	—
SISMO TRANSVERSAL	—	—	87,9	—	613,2

PROYECTO E-2 | FECHA | HOJA N.° 4

CARGAS MÁXIMAS SOBRE PILOTES.

H-1 P. propio + C. permanente + Sobrec. máxima + Def. Di) + frenado + emp. tierras + viento.

$N = 3483{,}4\ t$

$F_{HL} = 814{,}0\ t$

$F_{HT} = 23{,}3\ t$

$M_L = 4185{,}0\ mt$

$M_T = 351{,}2\ mt$

Long. empotramiento pilotes = $6\phi = 9{,}00\ m$

$$R_{máx} = \frac{3483{,}4}{10} \pm \frac{4185{,}0 + 814{,}0 \times 4{,}50}{5 \times 6{,}50} \pm \frac{(351{,}2 + 23{,}3 \times 4{,}50) \times 7{,}50}{281{,}25}$$

$$= 348{,}4 \pm 241{,}5 \pm 12{,}2 = \begin{cases} 602{,}0\ t \\ 94{,}8\ t \end{cases}$$

H-2 P. propio + C. permanente + Sobrec. mínima + calentamiento − frenado + emp. el reposo + viento.

$N = 3196{,}6\ t$

$F_{HL} = 419{,}9\ t$

$F_{HT} = 23{,}3\ t$

$M_L = -1884{,}1\ mt$

$M_T = 351{,}2\ mt$

$$R_{mín} = \frac{3196{,}6}{10} \pm \frac{-1884{,}1 + 419{,}9 \times 4{,}50}{5 \times 6{,}50} \pm 12{,}2 = 319{,}7 \pm 0{,}2 \pm 12{,}2 = \begin{cases} 332{,}0\ t \\ 307{,}4\ t \end{cases}$$

PROYECTO

E-2

FECHA

HOJA N.º 5

H-3 Comb H-1, 2 m + muerto

$N = 3483,4$ t

$F_{HL} = 522,4$ t

$F_{HT} = 43,3$ t

$M_L = 1273,4$ mt

$M_T = 351,2$ mt

$R_{máx} = \frac{3483,4}{10} \pm \frac{1273,4 + 522,4 \times 4,50}{5 \times 6,50} \pm 12,2 = 348,4 \pm 111,5 \pm 12,2 =$

$= \begin{cases} 472,1\ t \\ 224,7\ t \end{cases}$

H-4 P. propio + c. perm. + 0,6 sobrec. + def. dif. + amp. térm. al reposo + sismo longitudinal

$N = 3386,1$ t

$F_{HL} = 1133,1$ t

$F_{HT} = 0$

$M_L = 4891,0$ mt

$M_T = 43,8$ mt

$R_{máx} = \frac{3386,1}{10} \pm \frac{4891,0 + 1133,1 \times 4,50}{5 \times 6,50} \pm \frac{43,8 \times 7,50}{281,25} =$

$= 338,6 \pm 307,4 \pm 1,2 = \begin{cases} 647,2\ t \\ 30,1\ t \end{cases}$

Por tanto, la hipótesis más desfavorable es la H-1 >

$R_{máx} = 602,0\ t < \frac{\pi \cdot 1,5^2}{4} \times 400 = 707\ t$ (tope estructural).

(Rmáx = 647,2 t con sismo)

Valen, por tanto, los pilotes dispuestos.

LAV ZARAGOZA-LERIDA.TRAMO 1.E-2.ENCEPADO ESTRIBO 2.

Dimensiones encepado
- Canto = 2.80
- Ancho L = 9.50
- Ancho T = 18.00

Reacc. pilote máx= 647.16 Pilote: 1 Hipót.: 4
Reacc. pilote mín= 30.06 Pilote: 10 Hipót.: 4

Dimensiones pila
- Ancho L = 3.25
- Ancho T = 13.70

Datos pilotes
- Número = 10
- Diámetro= 1.50
- Long emp= 9.00

Pilote	X-Long	Y-Trans
1	3.250	7.500
2	-3.250	7.500
3	3.250	3.750
4	-3.250	3.750
5	3.250	0.000
6	-3.250	0.000
7	3.250	-3.750
8	-3.250	-3.750
9	3.250	-7.500
10	-3.250	-7.500

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2286.4	814.0	23.3	1905.9	286.0
H- 2	1999.6	419.9	23.3	-3059.8	286.0
H- 3	2286.4	522.4	23.3	-189.3	286.0
H- 4	2189.1	1133.1	0.0	1718.3	43.8

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	3483.4	814.0	23.3	4185.1	351.2
H- 2	3196.6	419.9	23.3	-1884.1	351.2
H- 3	3483.4	522.4	23.3	1273.4	351.2
H- 4	3386.1	1133.1	0.0	4891.0	43.8

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	P-9	P-10
H- 1	602.0	119.0	595.9	112.9	589.8	106.9	583.7	100.8	577.7	94.7
H- 2	332.0	331.7	325.9	325.6	319.8	319.5	313.7	313.4	307.7	307.3
H- 3	472.0	249.0	465.9	242.9	459.9	236.8	453.8	230.7	447.7	224.7
H- 4	647.2	32.4	646.6	31.8	646.0	31.2	645.4	30.6	644.8	30.1

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		
Acciones (sismo)		1.28		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	963.17	151.52	130.29	586.32	0.454	0.071	0.184	0.48
H- 2	531.19	491.73	67.29	302.79	0.251	0.232	0.095	0.09
H- 3	755.23	359.46	83.67	376.50	0.356	0.170	0.118	0.20
H- 4	838.72	39.00	146.85	660.82	0.396	0.018	0.208	0.59

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.59
A necesaria = 281.98 cm2
Ast = 13.51 cm2/m

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	9411.35 Uc banda= 13500.00
Fyk=	51000	1.15	Vcu tran=	4967.10
Acciones		1.60	Vcu esqu=	1244.39
Recubri=	0.10			
Banda=	3.00			

Flexión:

Mld=	2187.40	Ail en banda=	188.52 cm2
Mtd=	2800.91	Ait en banda=	243.67 cm2
		Ail entre bandas=	15.71 cm2/m
		Ait entre bandas=	20.31 cm2/m
		A min mecánica=	40.59 cm2/m
		A min geométrica=	20.26 cm2/m

Cortante:

Vld=	5682.38	Astl=	0.00 cm2/m
Vtd=	0.00	Astt=	0.00 cm2/m

Resistencia local:
Vesqd= 1035.46 comprobación válida.

Armadura de suspensión= 83.78 cm2

PROYECTO E-2 FECHA HOJA N.° 9

ARMADURA DE CUERPO DEL ESTRIBO, BIELTAS

$$Md = \frac{1}{13.7} \times 1.6 \left[9.04 \times \frac{7.95^2}{2} + 47.92 \times \frac{7.95^2}{6} + 368.5 \times 7.17 \right] = 401 \text{ mt/m}$$

$A = 30 \text{ cm}^2/\text{m} \rightarrow \phi 25/0.15$

Mínima: $49 \text{ cm}^2/\text{m} \rightarrow \phi 25/0.10$

$$Vd = \frac{1}{13.7} \times 1.6 \left[9.04 \times 7.95 + \frac{1}{2} 47.92 \times 7.95 + 368.5 \right] = 73.7 \text{ tn}$$

$$Vcu = 0.50 \times 64.55 \times 3.15 \times 1.00 \left[1 + 50 \times 0.002 \right] = 111.2 \text{ tn}$$

No necesita armadura de cortante

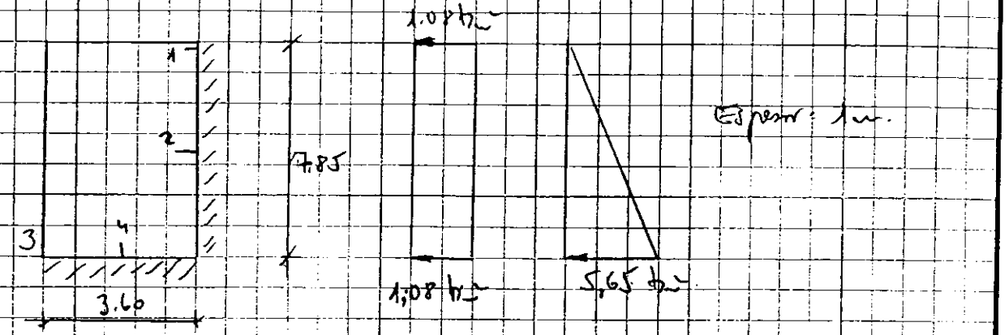
Armadura delantera

$$Md = \frac{1}{13.7} \times 1.6 \left[47.92 \times \frac{7.95^2}{6} - 309.1 \times 5.48 \right] = -138.9 \text{ mt/m}$$

$A = 10 \text{ cm}^2/\text{m}$. (mínima: $37.7 \text{ cm}^2/\text{m} \rightarrow \phi 25/0.125$)

PROYECTO E-2 FECHA HOJA N.° 10

ARMADURA DE BIELTAS



Pieza N	UNIFORME Ic = 30,52	TRIANGULAR Ic = 79,83	TOTAL	ARMADURA (cm²/m)
1	7,3 mt/m	7,8 mt/m	15,1 mt/m	3,8
2	5,2 mt/m	11,8 mt/m	17,0 mt/m	4,3
3	6,3 mt/m	16,8 mt/m	23,1 mt/m	5,9
4	2,5 mt/m	7,7 mt/m	10,2 mt/m	2,6

Amín vertical: 4.5 cm²/m

Amín horizontal: 8,0 cm²/m

PROYECTO ..... FECHA .....

E-2 HOJA N.º 11

Longitud de pilotes:

El estudio 2 se encuentra situado en el PK 7+060, no que se encuentra próximo a la pila P-3 del proyecto original (catcata PD-1+3. Sondeo SR-152)

El corte del terreno es, aproximadamente:

Limos y arcillas blandas : de 0 - 4 metros
Grava de yeso : de 4 a 16 metros
Yeso alterado : de 15 a 21 metros
Yeso sano : a partir de 21 metros.

Los valores de las resistencias unitarias por rozamiento fuste-terreno son:

Limos y arcillas blandas: 3 t/m²
Grava de yeso : 6 t/m²
Yeso sano : 40 t/m²

Rozamiento negativo . 6.10 t/m² tomaldén.

$$Q_{admisible} = \frac{Q_{hundimiento}}{2.5} - Q_{roz.\ negativo}$$

$$647.2 = \frac{1}{2.5}\ \pi \times 1.50\ (12.00 \times 5 + 5.00 \times 6 + 2 \times 40) - 6.10 \times 1.50$$

$$2 = 6.08 \simeq 6.00 \text{ metros}.$$

Por tanto, longitud de pilotes = 12.00 + 5.00 + 6.00 = 23.00 metros

ESTRUCTURA E-3

ESTRUCTURA E-3

ÍNDICE

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- Generalidades
- Programa general de puentes continuos

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3. CÁLCULO DE PILAS
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L.A.V. ZARAGOZA-LLEIDA

SUBTRAMO-I

E-3

GENERALIDADES

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Union Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril" de 25 de junio de 1975.
- "L.A.V. Zaragoza-Lérida. Proyecto de Estructuras de Puentes de Ferrocarril. Bases del Cálculo" de 29 de julio de 1993.
- "Instrucción EP-93, para el proyecto y ejecución de obras de hormigón pretensado".
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

. Encepados y zapatas..... $fck \geq 250$ Kp/cm^2
. Pilotes..... $fck \geq 200$ Kp/cm^2
. Alzados de estribos ..... $fck \geq 250$ kp/cm^2
. Alzados de pilas ..... $fck \geq 300$ Kp/cm^2
. Tablero postesado..... $fck \geq 350$ kp/cm^2
. Coeficiente de seguridad ..... $\gamma_c = 1,5$

Armaduras activas

. Tensión de rotura ≥ 190 Kp/mm^2
. Límite elástico ≥ 170 Kp/mm^2
. Coeficiente de seguridad $\gamma_s = 1,1$

Armaduras pasivas

. Límite elástico ≥ 5100 Kp/cm^2
. Coeficiente de seguridad $\gamma_s = 1,15$

Cargas

Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

3.- Criterios generales de cálculo

Para el cálculo de la estructura se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

El cálculo del viaducto se ha realizado básicamente en las siguientes fases:

- Tablero:
  - Cálculo longitudinal
  - Cálculo transversal
- Reacciones y aparatos de apoyo
- Pilas
- Estribos

La obtención de esfuerzos que permiten realizar el análisis longitudinal del tablero, se ha realizado con la ayuda de un programa de cálculo matricial basado en el método de la rigidez, discretizándose el tablero como viga contínua, sometida a las acciones de peso propio, carga permanente, sobrecarga, gradiente térmico y pretensado, tanto inicial como final, con sus correspondientes coeficientes de ponderación. De este cálculo como viga se obtienen los estados tensionales en servicio y la comprobación a rotura por flexión y cortante.

En el análisis transversal, se ha estudiado la flexión transversal, la armadura necesaria en el voladizo, el rasante y las costillas sobre pilas y estribos, en particular el anclaje del tablero al estribo.

En cuanto al cálculo de pilas y estribos se han tenido en cuenta, además de las acciones verticales, las horizontales debidas a los acortamientos por retracción, fluencia y temperatura, frenado, viento, empuje de tierras y efectos sísmicos.

En la distribución de acciones horizontales en los distintos elementos se han tenido en cuenta las distintas rigideces de éstos, tanto para cargas rápidas como de larga duración.

En la comprobación de las pilas se ha empleado un programa que tiene en cuenta los efectos de 2° orden, considerando la no linealidad, tanto geométrica como del material.

En la comprobación de los elementos de hormigón armado y pretensado, se ha tenido en cuenta lo prescrito en las Instrucciones correspondientes EH-91 y EP-93, respectivamente.

4.- Equipo redactor del proyecto

El cálculo del proyecto ha sido realizado por la oficina **SIEGRIST Y MORENO, S.L.**

Madrid, 25 de junio de 1997

Fdo.: Carlos Siegrist Fernández

PROGRAMA GENERAL DE PUENTES CONTINUOS (VI-0)

- Objeto del programa y campo de aplicación: El programa está diseñado para el cálculo matricial en teoría de primer orden de una viga contínua recta, teniendo en cuenta el proceso constructivo de la estructura. Se aplica a estructuras de varios vanos cuyo comportamiento pueda considerarse tipo viga. Permite la introducción de un coeficiente de excentricidad para tener en cuenta los efectos de cargas locales que hagan que el comportamiento tipo viga no se real.

- Identificación: Este programa ha sido desarrollado en la oficina SIEGRIST Y MORENO S.L. por Juan Moreno Torres y Miguel Angel Utrilla Arroyo. La última revisión del mismo, utilizada en estos calculos, se realizó en enero de 1994.

- Datos de entrada:

  - Definición de **vanos, cargas y características de los materiales** que componen la estructura.
  - Definición de **secciones de cálculo** en la estructura final con sus características geométricas.
  - Definición de **estados** de la estructura. (Proceso constructivo).
  - Definición de los **cables de pretensado** con los puntos singulares del trazado y fuerzas de tesado.

- Resultados:

  - **Esfuerzos en las secciones de cálculo en las hipótesis:**

    . Peso propio estructura en cada uno de los estados constructivos y peso propio de la estructura completa en los estados inicial y final (teniendo en cuenta el reajuste por fluencia). En todos los casos se tiene en cuenta la construcción por fases.
    . Cargas muertas
    . Temperatura
    . Descenso de apoyos
    . Envolvente de cortantes y momentos para sobrecarga tipo renfe y tipo UIC.

  - Definición general de los **cables de pretensado**, con su replanteo.

  - **Esfuerzos unitarios producidos por los cables de pretensado**, tanto en las estructuras parciales como en la completa.

  - **Coeficientes de pérdidas de pretensado** y resumen de familias de cables.

  - **Esfuerzos de pretensado** en estado inicial y final.

  . **Tensiones en construcción** en cada uno de los estados evolutivos. En

cada fase se calculan cuatro hipótesis: Pretensado con pérdidas instantáneas ponderado y sin ponderar; peso propio; y la suma de peso propio y pretensado ponderado.

- **Tensiones en servicio** en estados inicial y final, ponderando el pretensado con 0,9 y 1,1 y considerando las diferentes envolventes de sobrecarga, así como la sobrecarga frecuente.

- **Reacciones y giros** en cada una de las hipótesis en que se han dado esfuerzos.

- **Comprobación a cortante**. En este apartado se detallan inicialmente los esfuerzos, tanto de cargas exteriores (envolvente de esfuerzos máximos y mínimos ponderados) como de pretensado, en cada una de las secciones de cálculo. A partir de estos esfuerzos el programa obtiene de acuerdo con la EP-93 el esfuerzo cortante reducido, así como la armadura necesaria en cada sección. También se obtiene la armadura mínima de las secciones y se comprueba la compresión en el hormigón (Vrd/Vu1).

- **Comprobación a rotura**. Se calcula el momento de cálculo, (envolventes de momentos máximos y mínimos), el momento hiperestático de pretensado y el momento último de cada sección. En este cálculo se tiene en cuenta tanto el pretensado como la armadura pasiva del tablero. En los momentos totales se suma a los momentos de cálculo el momento hiperestático ponderado por 1.1 o por 0.9 según sea desfavorable o favorable.

1.- CALCULO TABLERO

CALCULO DEL TABLERO

Para el cálculo del tablero se han seguido los siguientes pasos:

- Sección transversal del tablero

- Cálculo longitudinal

    - Cálculo como viga contínua
    - Comprobación de tensiones
    - Comprobación a rotura por flexión
    - Combrobación a cortante
    - Cálculo armadura anclajes pretensado

- Cálculo transversal

    - Flexión transversal y torsión de la losa
    - Armadura de rasante
    - Cálculo a torsión
    - Costilla sobre pilas
    - Costilla apoyo en estribo fijo
    - Costilla apoyo en estribo móvil

- Cálculo de alargamientos de tesado

SECCION TRANSVERSAL

PROYECTO LAV ZARAGOZA - LERIDA
SUBTRAMO 1
PUENTES CAJON (E-3, E-4 y E-5)

FECHA

HOJA N.º

CALCULO DE VIENTO

Según la instrucción de acciones en puentes de ferrocarril.

presión básica: $q_w = 154 (2 - 0.7\lambda) = 200 \text{ kp/m}^2$

$\lambda = \frac{A_u}{A_{lat}} = 1$

Superficie a considerar: $S = 2.45$ (canto tablero) $+ 0.70$ (balasto + carril) $+ 3.50$ (tren) $= 6.65 \text{ m}^2/\text{m}$

Presión sobre el dintel: $0.2 \text{ T/m}^2 \times 6.65 \text{ m}^2/\text{m} = \underline{1.33 \text{ T/m}}$

fustes → E-3 y E-5 $S = 2.40 \text{ m}^2/\text{m}$ ⇒ Presión = 0.48 T/m

E-4 $S = 1.40 \text{ m}^2/\text{m}$ ⇒ Presión = 0.28 T/m

COEFICIENTE DE IMPACTO

- RENFE Según la instrucción:

Tramos apoyados continuos. $I = 65 \frac{\mu}{1 - \mu + \mu^2} = 23.5$ de tanto 24% ⇒ $I = 1.24$

$\mu = \frac{V \cdot T}{2L} = 0.2874$

$V = 200 \text{ km/h} = 55.56 \text{ m/s}$ $L = 33 \text{ m}$

$T = \frac{2\pi}{\omega}$ $\omega = \sqrt{\frac{EJ\pi^4}{m l^4}}$ $EI = 3.5 \cdot 10^6 \times 6.828$

$T = 0.3414$

$m = \frac{1}{9.8} \left(\underbrace{8.84 \times 2.5}_{\text{p. propio}} + \underbrace{10.686}_{\text{c. perm}} + \underbrace{24}_{\text{sobrecarga}} \right) = 5.8$

UIC

$L_m = \frac{1}{7} (27 \times 2 + 33 \times 5) = 31.3 \text{ m}$ $L_\phi = 1.5 \cdot 31.3 = 46.95$

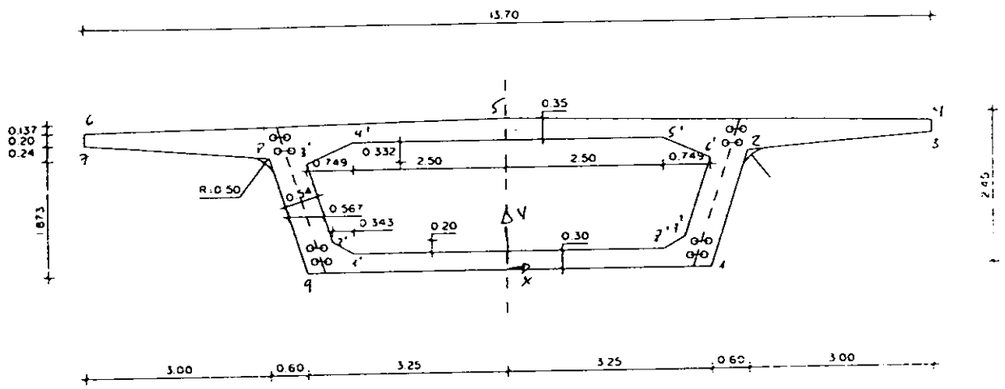
Tomando ϕ_2 para 40-50 ⇒ IMPACTO = 1,06

PROYECTO LAV ZARAGOZA - LLEIDA
SUBTRAMO - 1. SECCION CAJÓN

FECHA

HOJA N.º 1/5

SECCION TIPO
ESCALA 1:50
1:100



PUNTO	X	Y
1	3,25	0,0
2	3,85	1.873
3	6,85	2.113
4	6,85	2.313
5	0,0	2.45
6	-6,85	2.313
7	-6,85	2.113
8	-3.85	1.873
9	-3.25	0,0

PUNTO	X	Y
1'	-2.50	0.30
2'	-2.843	0.50
3'	-3.249	1.768
4'	-2.50	2.10
5'	2.50	2.10
6'	3.249	1.768
7'	2.843	0.50
8'	2.50	0.30

Area: 8,843 m^2

I_L: 6,828 m^4

I_T: 100,99 m^4

Y_i: 1.499 m

Y_s: 0.951 m

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION ALIGERADA.

NUM. CONTORNOS	NUM. CIRCULOS
2	0

CONTORNO 1 PUNTOS 9

	COORD. X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

CONTORNO 2 PUNTOS 8

	COORD. X	Y
1	-2.500	0.300
2	-2.843	0.500
3	-3.249	1.768
4	-2.500	2.100
5	2.500	2.100
6	3.249	1.768
7	2.843	0.500
8	2.500	0.300

FIBRA INFERIOR X	FIBRA INFERIOR Y	FIBRA SUPERIOR X	FIBRA SUPERIOR Y
0.000	0.000	0.000	2.450

RESULTADOS

AREA = 8.84283 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.49870

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 13.2527186	Ixx = 26.6898422	ANG. FI = 0.0000
My = 0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.49870 Ds = 0.95130
Wi = 4.55598 Ws = 7.17756
Radio Giro X-X = 0.87872 Radio Giro Y-Y= 3.37943

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION MACIZA.

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 9

	COORD. X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
0.000	0.000	0.000	2.450

RESULTADOS

AREA = 19.54475 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.34198

```
****************** EJES ORIGINALES *************************
MOMENTOS ESTATICOS        INERCIAS            EJES PRINCIPALES

Mx =  26.2286056      Ixx =  45.1849251      ANG. FI =   0.0000
My =   0.0000000      Iyy = 132.8847198
                      Ixy =  -0.0000006

****************** EJES PARALELOS POR G ********************
MOMENTOS ESTATICOS        INERCIAS            EJES PRINCIPALES

Mx =   0.0000000      Ixx =   9.9867392      ANG. FI =   0.0000
My =  -0.0000000      Iyy = 132.8847198
                      Ixy =  -0.0000006

****************** EJES PRINCIPALES ************************
MOMENTOS ESTATICOS        INERCIAS            EJES PRINCIPALES

Mx =   0.0000000      Ixx =   9.9867392      ANG. FI =   0.0000
My =  -0.0000000      Iyy = 132.8847198
                      Ixy =  -0.0000006
```

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G
==========

```
Di =   1.34198          Ds =   1.10802
Wi =   7.44181          Ws =   9.01312
Radio Giro X-X =  0.71482      Radio Giro Y-Y=   2.60749
```

CALCULO LONGITUDINAL

014

CALCULO COMO VIGA CONTINUA

Los datos introducidos en el cálculo como viga continua son:

- Definición de vanos de la estructura y estados de la misma.
- Hipótesis de cargas actuantes.
- Características de los materiales empleados.
- Características geométricas de las secciones en que se divide el tablero.
- Definición del pretensado (se introduce el cable medio).

A partir de estos datos se obtiene:

- Esfuerzos en las secciones de la viga para las distintas hipótesis de carga consideradas.
- Definición del pretensado, acciones unitarias de los cables y esfuerzos de pretensado.
- Reacciones en las distintas hipótesis de cargas.
- Tensiones ponderadas en los distintos estados de la estructura.
- Cálculo a cortante.
- Comprobación a rotura.

Programa general de puentes continuos (V1-0)

Proyecto : ZARAGOZA-LERIDA. T-1. E-3

Definicion geometrica de vanos

	Longitud
Vano 1	27.0000 m
Vano 2	33.0000 m
Vano 3	33.0000 m
Vano 4	27.0000 m

Definicion de cargas

Cargas muertas (t.I) ..... = 0.780 t/m2
Cargas muertas (t.II)..... = 0.000 t/m

Sobrecarga repartida ..... = 0.000 t/m2

Tanque :

	Coeficientes de excentricidad			
	Flexion		Cortante	
	C.Vano	Apoyos	C.Vano	Apoyos
Vano 1	1.00	1.00	1.00	1.00
Vano 2	1.00	1.00	1.00	1.00
Vano 3	1.00	1.00	1.00	1.00
Vano 4	1.00	1.00	1.00	1.00

Ancho de aceras 1.300 m
Coef. de impacto para tren de RENFE 1.240
Coef. de impacto para tren de U.I.C. 1.060
Numero de vias 2

Temperatura :

Coef. de dilatacion termica de 1E-04
Gradiente lineal termico de ..... 5.000 grad

Caracteristicas de los materiales

Resistencia caracteristica del hormigon ..... = 350.00 kg/cm2
Densidad del hormigon ..... = 2.50 t/m3

Modulo de elasticidad del acero de pretensar .. = 19000.00 kg/mm2
Tension de rotura de los cables ..... = 190.00 kg/mm2
Porcentaje a que se tesan los cables ..... = 75./80 %

Retraccion del hormigon .... = 0.00025
Coeficiente de relajacion del acero ..... = 0.06000
Coeficiente de fluencia del hormigon ..... = 2.50000

Coef. de ponderacion maximo del pretensado .... = 1.1000
Coef. de ponderacion minimo del pretensado .... = 0.9000
Coef. de perdidas finales en estado inicial ... = 0.3000

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
1	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.700	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.400	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.100	0.951	1.499	2.45	8.84	6.8280	13.70
	5	10.800	0.951	1.499	2.45	8.84	6.8280	13.70
	6	13.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	16.200	0.951	1.499	2.45	8.84	6.8280	13.70
	8	18.900	0.951	1.499	2.45	8.84	6.8280	13.70
	9	21.600	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.300	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70
2	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
3	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
4	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	4.125	0.951	1.499	2.45	8.84	6.8280	13.70
	3	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	4	10.594	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.938	0.951	1.499	2.45	8.84	6.8280	13.70
	6	15.282	0.951	1.499	2.45	8.84	6.8280	13.70
	7	17.626	0.951	1.499	2.45	8.84	6.8280	13.70
	8	19.970	0.951	1.499	2.45	8.84	6.8280	13.70
	9	22.314	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.658	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70

Definicion de estados de la estructura

	Numero de secciones	Numero de secciones activas
Estado 1	14	de 1 a 14
Estado 2	24	de 14 a 24
Estado 3	33	de 24 a 33
Estado 4	41	de 33 a 41

Cable Numero 1 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Cable Numero 2 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Cable Numero 3 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Cable Numero 4 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Cable Numero 5 (Pertenece a familia 1)

efinicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Cable Numero 6 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Cable Numero 7 (Pertenece a familia 3)

efinicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Cable Numero 8 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Cable Numero 9 (Pertenece a familia 1)

efinicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Cable Numero 10 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Cable Numero 11 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Cable Numero 12 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Cable Numero 13 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Cable Numero 14 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Cable Numero 15 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Cable Numero 16 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Cable Fase Final Numero 1

efinicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	120.000	-2.300	0.0000

Cable Fase Final Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	120.000	-2.300	0.0000

Esfuerzos acumulados por peso propio

Estado 1

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-270.58	0.00	0.00	0.00
	2	650.00	-210.90	0.00	9.05	-14.27
	3	1138.83	-151.21	0.00	15.86	-25.00
	4	1466.51	-91.51	0.00	20.43	-32.20
	5	1633.02	-31.82	0.00	22.74	-35.85
	6	1638.37	27.86	0.00	22.82	-35.97
	7	1482.55	87.56	0.00	20.65	-32.55
	8	1165.57	147.24	0.00	16.23	-25.59
	9	687.43	206.93	0.00	9.57	-15.09
	10	48.13	266.63	0.00	0.67	-1.06
	11	-752.34	326.32	0.00	-10.48	16.52
2	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 2

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-228.68	0.00	0.00	0.00
	2	536.85	-168.99	0.00	7.48	-11.79
	3	912.54	-109.30	0.00	12.71	-20.03
	4	1127.07	-49.61	0.00	15.70	-24.74
	5	1180.44	10.08	0.00	16.44	-25.91
	6	1072.64	69.77	0.00	14.94	-23.55
	7	803.68	129.46	0.00	11.19	-17.64
	8	373.55	189.15	0.00	5.20	-8.20
	9	-217.73	248.84	0.00	-3.03	4.78
	10	-970.18	308.53	0.00	-13.51	21.30
	11	-1883.80	368.22	0.00	-26.24	41.36
2	1	-1883.80	-399.06	0.00	-26.24	41.36
	2	-827.87	-335.50	0.00	-11.53	18.17
	3	45.33	-271.94	0.00	0.63	-1.00
	4	656.10	-216.67	0.00	9.14	-14.40
	5	1361.79	-125.48	0.00	18.97	-29.90
	6	1691.30	-34.29	0.00	23.56	-37.13
	7	1644.65	56.91	0.00	22.91	-36.11
	8	1221.82	148.10	0.00	17.02	-26.82
	9	782.49	203.37	0.00	10.90	-17.18
	10	106.44	266.93	0.00	1.48	-2.34
	11	-752.34	330.49	0.00	-10.48	16.52
3	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

stado 3

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-239.93	0.00	0.00	0.00
	2	567.23	-180.24	0.00	7.90	-12.45
	3	973.29	-120.55	0.00	13.56	-21.37
	4	1218.20	-60.86	0.00	16.97	-26.74
	5	1301.93	-1.17	0.00	18.13	-28.58
	6	1224.51	58.52	0.00	17.05	-26.88
	7	985.92	118.21	0.00	13.73	-21.64
	8	586.17	177.90	0.00	8.16	-12.87
	9	25.26	237.59	0.00	0.35	-0.55
	10	-696.81	297.28	0.00	-9.71	15.30
	11	-1580.05	356.97	0.00	-22.01	34.69
2	1	-1580.05	-356.39	0.00	-22.01	34.69
	2	-646.82	-292.83	0.00	-9.01	14.20
	3	103.69	-229.27	0.00	1.44	-2.28
	4	607.77	-174.00	0.00	8.47	-13.34
	5	1137.43	-82.80	0.00	15.84	-24.97
	6	1290.91	8.39	0.00	17.98	-28.34
	7	1068.22	99.58	0.00	14.88	-23.45
	8	469.36	190.77	0.00	6.54	-10.30
	9	-76.66	246.04	0.00	-1.07	1.68
	10	-875.40	309.60	0.00	-12.19	19.22
	11	-1856.88	373.16	0.00	-25.86	40.77
3	1	-1856.88	-398.24	0.00	-25.86	40.77
	2	-803.29	-334.68	0.00	-11.19	17.64
	3	67.56	-271.13	0.00	0.94	-1.48
	4	676.29	-215.86	0.00	9.42	-14.85
	5	1378.61	-124.66	0.00	19.20	-30.27
	6	1704.76	-33.47	0.00	23.74	-37.43
	7	1654.74	57.72	0.00	23.05	-36.33
	8	1228.55	148.92	0.00	17.11	-26.97
	9	787.18	204.18	0.00	10.96	-17.28
	10	108.78	267.74	0.00	1.52	-2.39
	11	-752.35	331.30	0.00	-10.48	16.52
4	1	-752.35	-182.39	0.00	-10.48	16.52
	2	-188.09	-91.19	0.00	-2.62	4.13
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.97	0.00	0.00	0.00
	2	561.94	-178.28	0.00	7.83	-12.34
	3	962.71	-118.59	0.00	13.41	-21.14
	4	1202.33	-58.90	0.00	16.75	-26.40
	5	1280.78	0.79	0.00	17.84	-28.12
	6	1198.07	60.48	0.00	16.69	-26.30
	7	954.19	120.17	0.00	13.29	-20.95
	8	549.15	179.86	0.00	7.65	-12.06
	9	-17.05	239.55	0.00	-0.24	0.37
	10	-744.42	299.24	0.00	-10.37	16.34
	11	-1632.94	358.93	0.00	-22.74	35.85
2	1	-1632.94	-363.82	0.00	-22.74	35.85
	2	-678.34	-300.26	0.00	-9.45	14.89
	3	93.53	-236.70	0.00	1.30	-2.05
	4	616.19	-181.43	0.00	8.58	-13.53
	5	1176.49	-90.24	0.00	16.39	-25.83
	6	1360.63	0.96	0.00	18.95	-29.87
	7	1168.59	92.15	0.00	16.28	-25.65
	8	600.39	183.34	0.00	8.36	-13.18
	9	72.94	238.61	0.00	1.02	-1.60
	10	-704.44	302.17	0.00	-9.81	15.47
	11	-1664.55	365.73	0.00	-23.18	36.54
3	1	-1664.55	-370.71	0.00	-23.18	36.54
	2	-690.14	-307.15	0.00	-9.61	15.15
	3	101.55	-243.59	0.00	1.41	-2.23
	4	641.43	-188.32	0.00	8.93	-14.08
	5	1230.16	-97.13	0.00	17.13	-27.01
	6	1442.72	-5.93	0.00	20.09	-31.67
	7	1279.10	85.26	0.00	17.82	-28.08
	8	739.32	176.45	0.00	10.30	-16.23
	9	229.10	231.72	0.00	3.19	-5.03
	10	-528.47	295.28	0.00	-7.36	11.60
	11	-1468.77	358.84	0.00	-20.46	32.24
4	1	-1468.77	-352.85	0.00	-20.46	32.24
	2	-201.35	-261.66	0.00	-2.80	4.42
	3	689.90	-170.46	0.00	9.61	-15.15
	4	1028.73	-118.64	0.00	14.33	-22.58
	5	1246.10	-66.82	0.00	17.36	-27.36
	6	1342.00	-15.00	0.00	18.69	-29.46
	7	1316.43	36.82	0.00	18.34	-28.90
	8	1169.40	88.64	0.00	16.29	-25.67
	9	900.90	140.46	0.00	12.55	-19.78
	10	510.94	192.28	0.00	7.12	-11.22
	11	0.00	244.05	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

,structura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.97	0.00	0.00	0.00
	2	561.94	-178.28	0.00	7.83	-12.34
	3	962.71	-118.59	0.00	13.41	-21.14
	4	1202.33	-58.90	0.00	16.75	-26.40
	5	1280.78	0.79	0.00	17.84	-28.12
	6	1198.07	60.48	0.00	16.69	-26.30
	7	954.19	120.17	0.00	13.29	-20.95
	8	549.15	179.86	0.00	7.65	-12.06
	9	-17.05	239.55	0.00	-0.24	0.37
	10	-744.42	299.24	0.00	-10.37	16.34
	11	-1632.94	358.93	0.00	-22.74	35.85
2	1	-1632.94	-363.82	0.00	-22.74	35.85
	2	-678.34	-300.26	0.00	-9.45	14.89
	3	93.53	-236.70	0.00	1.30	-2.05
	4	616.19	-181.43	0.00	8.58	-13.53
	5	1176.49	-90.24	0.00	16.39	-25.83
	6	1360.63	0.96	0.00	18.95	-29.87
	7	1168.59	92.15	0.00	16.28	-25.65
	8	600.39	183.34	0.00	8.36	-13.18
	9	72.94	238.61	0.00	1.02	-1.60
	10	-704.44	302.17	0.00	-9.81	15.47
	11	-1664.55	365.73	0.00	-23.18	36.54
3	1	-1664.55	-370.71	0.00	-23.18	36.54
	2	-690.14	-307.15	0.00	-9.61	15.15
	3	101.55	-243.59	0.00	1.41	-2.23
	4	641.43	-188.32	0.00	8.93	-14.08
	5	1230.16	-97.13	0.00	17.13	-27.01
	6	1442.72	-5.93	0.00	20.09	-31.67
	7	1279.10	85.26	0.00	17.82	-28.08
	8	739.32	176.45	0.00	10.30	-16.23
	9	229.10	231.72	0.00	3.19	-5.03
	10	-528.47	295.28	0.00	-7.36	11.60
	11	-1468.77	358.84	0.00	-20.46	32.24
4	1	-1468.77	-352.85	0.00	-20.46	32.24
	2	-201.35	-261.66	0.00	-2.80	4.42
	3	689.90	-170.46	0.00	9.61	-15.15
	4	1028.73	-118.64	0.00	14.33	-22.58
	5	1246.10	-66.82	0.00	17.36	-27.36
	6	1342.00	-15.00	0.00	18.69	-29.46
	7	1316.43	36.82	0.00	18.34	-28.90
	8	1169.40	88.64	0.00	16.29	-25.67
	9	900.90	140.46	0.00	12.55	-19.78
	10	510.94	192.28	0.00	7.12	-11.22
	11	0.00	244.05	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-225.13	0.00	0.00	0.00
	2	527.28	-165.44	0.00	7.34	-11.58
	3	893.39	-105.75	0.00	12.44	-19.61
	4	1098.34	-46.06	0.00	15.30	-24.11
	5	1142.13	13.63	0.00	15.91	-25.07
	6	1024.75	73.32	0.00	14.27	-22.50
	7	746.21	133.01	0.00	10.39	-16.38
	8	306.51	192.70	0.00	4.27	-6.73
	9	-294.35	252.39	0.00	-4.10	6.46
	10	-1056.38	312.08	0.00	-14.71	23.19
	11	-1979.57	371.77	0.00	-27.57	43.46
2	1	-1979.57	-364.88	0.00	-27.57	43.46
	2	-1021.93	-301.32	0.00	-14.23	22.44
	3	-247.01	-237.76	0.00	-3.44	5.42
	4	278.30	-182.49	0.00	3.88	-6.11
	5	842.97	-91.29	0.00	11.74	-18.51
	6	1031.48	-0.10	0.00	14.37	-22.64
	7	843.81	91.09	0.00	11.75	-18.52
	8	279.98	182.28	0.00	3.90	-6.15
	9	-244.82	237.55	0.00	-3.41	5.37
	10	-1019.15	301.11	0.00	-14.19	22.37
	11	-1976.22	364.67	0.00	-27.52	43.39
3	1	-1976.22	-365.08	0.00	-27.52	43.39
	2	-1017.98	-301.52	0.00	-14.18	22.35
	3	-242.47	-237.96	0.00	-3.38	5.32
	4	283.34	-182.69	0.00	3.95	-6.22
	5	848.86	-91.50	0.00	11.82	-18.64
	6	1038.21	-0.31	0.00	14.46	-22.79
	7	851.39	90.89	0.00	11.86	-18.69
	8	288.40	182.08	0.00	4.02	-6.33
	9	-235.88	237.35	0.00	-3.29	5.18
	10	-1009.63	300.91	0.00	-14.06	22.17
	11	-1966.10	364.47	0.00	-27.38	43.16
4	1	-1966.10	-371.27	0.00	-27.38	43.16
	2	-622.70	-280.08	0.00	-8.67	13.67
	3	344.53	-188.88	0.00	4.80	-7.56
	4	726.54	-137.06	0.00	10.12	-15.95
	5	987.08	-85.24	0.00	13.75	-21.67
	6	1126.16	-33.42	0.00	15.69	-24.72
	7	1143.77	18.40	0.00	15.93	-25.11
	8	1039.91	70.22	0.00	14.48	-22.83
	9	814.59	122.04	0.00	11.35	-17.88
	10	467.80	173.86	0.00	6.52	-10.27
	11	0.00	225.63	0.00	0.00	0.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-108.27	0.00	0.00	0.00
	2	253.37	-79.41	0.00	3.53	-5.56
	3	428.83	-50.56	0.00	5.97	-9.41
	4	526.40	-21.71	0.00	7.33	-11.56
	5	546.07	7.14	0.00	7.61	-11.99
	6	487.83	35.99	0.00	6.79	-10.71
	7	351.70	64.85	0.00	4.90	-7.72
	8	137.66	93.70	0.00	1.92	-3.02
	9	-154.27	122.55	0.00	-2.15	3.39
	10	-524.11	151.40	0.00	-7.30	11.51
	11	-971.84	180.25	0.00	-13.54	21.34
2	1	-971.84	-176.41	0.00	-13.54	21.34
	2	-508.82	-145.69	0.00	-7.09	11.17
	3	-134.11	-114.97	0.00	-1.87	2.94
	4	119.92	-88.25	0.00	1.67	-2.63
	5	393.05	-44.17	0.00	5.47	-8.63
	6	484.36	-0.10	0.00	6.75	-10.63
	7	393.83	43.99	0.00	5.49	-8.65
	8	121.48	88.06	0.00	1.69	-2.67
	9	-132.08	114.78	0.00	-1.84	2.90
	10	-506.23	145.50	0.00	-7.05	11.11
	11	-968.71	176.22	0.00	-13.49	21.27
3	1	-968.71	-176.22	0.00	-13.49	21.27
	2	-506.23	-145.50	0.00	-7.05	11.11
	3	-132.08	-114.78	0.00	-1.84	2.90
	4	121.48	-88.06	0.00	1.69	-2.67
	5	393.83	-43.99	0.00	5.49	-8.65
	6	484.36	0.10	0.00	6.75	-10.63
	7	393.05	44.17	0.00	5.47	-8.63
	8	119.91	88.25	0.00	1.67	-2.63
	9	-134.12	114.97	0.00	-1.87	2.94
	10	-508.82	145.69	0.00	-7.09	11.17
	11	-971.85	176.41	0.00	-13.54	21.34
4	1	-971.84	-180.26	0.00	-13.54	21.34
	2	-319.21	-136.18	0.00	-4.45	7.01
	3	151.60	-92.10	0.00	2.11	-3.33
	4	338.12	-67.05	0.00	4.71	-7.42
	5	465.92	-42.00	0.00	6.49	-10.23
	6	535.01	-16.95	0.00	7.45	-11.75
	7	545.39	8.10	0.00	7.60	-11.97
	8	497.06	33.14	0.00	6.92	-10.91
	9	390.01	58.19	0.00	5.43	-8.56
	10	224.25	83.24	0.00	3.12	-4.92
	11	0.00	108.27	0.00	0.00	0.00

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-22.97	0.00	0.00	0.00
	2	62.02	-22.97	0.00	0.86	-1.36
	3	124.05	-22.97	0.00	1.73	-2.72
	4	186.07	-22.97	0.00	2.59	-4.09
	5	248.10	-22.97	0.00	3.46	-5.45
	6	310.12	-22.97	0.00	4.32	-6.81
	7	372.15	-22.97	0.00	5.18	-8.17
	8	434.17	-22.97	0.00	6.05	-9.53
	9	496.20	-22.97	0.00	6.91	-10.89
	10	558.22	-22.97	0.00	7.77	-12.26
	11	620.25	-22.97	0.00	8.64	-13.62
2	1	620.25	5.82	0.00	8.64	-13.62
	2	603.52	5.82	0.00	8.41	-13.25
	3	586.80	5.82	0.00	8.17	-12.88
	4	572.26	5.82	0.00	7.97	-12.56
	5	548.26	5.82	0.00	7.64	-12.04
	6	524.27	5.82	0.00	7.30	-11.51
	7	500.27	5.82	0.00	6.97	-10.98
	8	476.28	5.82	0.00	6.63	-10.46
	9	461.73	5.82	0.00	6.43	-10.14
	10	445.01	5.82	0.00	6.20	-9.77
	11	428.29	5.82	0.00	5.97	-9.40
3	1	428.29	-5.82	0.00	5.97	-9.40
	2	445.03	-5.82	0.00	6.20	-9.77
	3	461.78	-5.82	0.00	6.43	-10.14
	4	476.34	-5.82	0.00	6.63	-10.46
	5	500.37	-5.82	0.00	6.97	-10.98
	6	524.40	-5.82	0.00	7.30	-11.51
	7	548.42	-5.82	0.00	7.64	-12.04
	8	572.45	-5.82	0.00	7.97	-12.57
	9	587.01	-5.82	0.00	8.18	-12.89
	10	603.76	-5.82	0.00	8.41	-13.25
	11	620.51	-5.82	0.00	8.64	-13.62
4	1	620.51	22.98	0.00	8.64	-13.62
	2	525.71	22.98	0.00	7.32	-11.54
	3	430.91	22.98	0.00	6.00	-9.46
	4	377.04	22.98	0.00	5.25	-8.28
	5	323.17	22.98	0.00	4.50	-7.09
	6	269.30	22.98	0.00	3.75	-5.91
	7	215.43	22.98	0.00	3.00	-4.73
	8	161.56	22.98	0.00	2.25	-3.55
	9	107.69	22.98	0.00	1.50	-2.36
	10	53.82	22.98	0.00	0.75	-1.18
	11	0.00	22.98	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.11	0.00	0.00	0.00	0.00
		Q(-)	-369.70	0.00	0.00	0.00	0.00
	2	Q(+)	68.11	-183.88	0.00	2.56	-4.04
		Q(-)	-287.61	887.37	0.00	-12.36	19.48
	3	Q(+)	68.11	-367.77	0.00	5.12	-8.07
		Q(-)	-205.52	1553.09	0.00	-21.63	34.10
	4	Q(+)	68.11	-551.65	0.00	7.68	-12.11
		Q(-)	-123.42	1997.16	0.00	-27.82	43.85
	5	Q(+)	68.11	-735.53	0.00	10.24	-16.15
		Q(-)	-41.33	2219.57	0.00	-30.91	48.73
	6	Q(+)	107.93	861.56	0.00	-12.00	18.91
		Q(-)	-17.68	238.75	0.00	-3.33	5.24
	7	Q(+)	189.32	922.81	0.00	-12.85	20.26
		Q(-)	-17.68	286.50	0.00	-3.99	6.29
	8	Q(+)	271.41	300.83	0.00	-4.19	6.60
		Q(-)	-17.68	334.25	0.00	-4.66	7.34
	9	Q(+)	353.50	-542.80	0.00	7.56	-11.92
		Q(-)	-17.68	381.99	0.00	-5.32	8.39
	10	Q(+)	435.60	-1608.08	0.00	22.40	-35.30
		Q(-)	-17.68	429.74	0.00	-5.99	9.43
	11	Q(+)	517.69	-2895.01	0.00	40.32	-63.56
		Q(-)	-17.68	477.49	0.00	-6.65	10.48
2	1	Q(+)	67.09	477.49	0.00	-6.65	10.48
		Q(-)	-543.84	-2903.94	0.00	40.45	-63.75
	2	Q(+)	67.09	284.62	0.00	-3.96	6.25
		Q(-)	-459.19	-1488.87	0.00	20.74	-32.69
	3	Q(+)	67.09	91.75	0.00	-1.28	2.01
		Q(-)	-372.39	-292.83	0.00	4.08	-6.43
	4	Q(+)	67.09	-75.97	0.00	1.06	-1.67
		Q(-)	-296.38	543.14	0.00	-7.56	11.92
	5	Q(+)	67.09	-352.70	0.00	4.91	-7.74
		Q(-)	-170.96	1507.03	0.00	-20.99	33.08
	6	Q(+)	67.09	-629.43	0.00	8.77	-13.82
		Q(-)	-59.43	1549.27	0.00	-21.58	34.01
	7	Q(+)	179.22	1368.03	0.00	-19.05	30.03
		Q(-)	-51.74	-278.95	0.00	3.89	-6.12
	8	Q(+)	304.64	370.06	0.00	-5.15	8.12
		Q(-)	-51.74	-65.50	0.00	0.91	-1.44
	9	Q(+)	380.65	-486.56	0.00	6.78	-10.68
		Q(-)	-51.74	63.86	0.00	-0.89	1.40
	10	Q(+)	467.45	-1706.75	0.00	23.77	-37.47
		Q(-)	-51.74	212.62	0.00	-2.96	4.67
	11	Q(+)	553.32	-3175.61	0.00	44.23	-69.72
		Q(-)	-51.74	361.38	0.00	-5.03	7.93
3	1	Q(+)	51.74	361.38	0.00	-5.03	7.93
		Q(-)	-553.32	-3175.61	0.00	44.23	-69.72
	2	Q(+)	51.74	212.62	0.00	-2.96	4.67
		Q(-)	-467.46	-1706.60	0.00	23.77	-37.47

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	51.74	63.86	0.00	-0.89	1.40
		Q(-)	-380.67	-486.78	0.00	6.78	-10.69
	4	Q(+)	51.74	-65.50	0.00	0.91	-1.44
		Q(-)	-304.65	369.87	0.00	-5.15	8.12
	5	Q(+)	51.74	-278.95	0.00	3.89	-6.12
		Q(-)	-179.24	1367.88	0.00	-19.05	30.03
	6	Q(+)	59.43	1549.27	0.00	-21.58	34.01
		Q(-)	-67.08	-629.40	0.00	8.77	-13.82
	7	Q(+)	170.95	1507.18	0.00	-20.99	33.09
		Q(-)	-67.08	-352.68	0.00	4.91	-7.74
	8	Q(+)	296.37	543.33	0.00	-7.57	11.93
		Q(-)	-67.08	-75.96	0.00	1.06	-1.67
	9	Q(+)	372.38	-292.62	0.00	4.08	-6.42
		Q(-)	-67.08	91.74	0.00	-1.28	2.01
	10	Q(+)	459.18	-1489.02	0.00	20.74	-32.69
		Q(-)	-67.08	284.61	0.00	-3.96	6.25
	11	Q(+)	543.84	-2903.94	0.00	40.45	-63.75
		Q(-)	-67.08	477.47	0.00	-6.65	10.48
4	1	Q(+)	17.68	477.47	0.00	-6.65	10.48
		Q(-)	-517.69	-2895.01	0.00	40.32	-63.56
	2	Q(+)	17.68	404.53	0.00	-5.63	8.88
		Q(-)	-392.27	-1018.23	0.00	14.18	-22.35
	3	Q(+)	17.68	331.58	0.00	-4.62	7.28
		Q(-)	-266.85	341.20	0.00	-4.75	7.49
	4	Q(+)	17.68	290.13	0.00	-4.04	6.37
		Q(-)	-195.58	883.16	0.00	-12.30	19.39
	5	Q(+)	17.68	248.68	0.00	-3.46	5.46
		Q(-)	-124.31	1258.07	0.00	-17.52	27.62
	6	Q(+)	17.68	207.22	0.00	-2.89	4.55
		Q(-)	-68.10	-798.02	0.00	11.11	-17.52
	7	Q(+)	84.69	2129.73	0.00	-29.66	46.76
		Q(-)	-68.10	-638.39	0.00	8.89	-14.02
	8	Q(+)	155.96	1847.69	0.00	-25.73	40.56
		Q(-)	-68.10	-478.76	0.00	6.67	-10.51
	9	Q(+)	227.23	1398.60	0.00	-19.48	30.70
		Q(-)	-68.10	-319.13	0.00	4.44	-7.01
	10	Q(+)	298.49	782.46	0.00	-10.90	17.18
		Q(-)	-68.10	-159.49	0.00	2.22	-3.50
	11	Q(+)	369.70	0.00	0.00	0.00	0.00
		Q(-)	-68.10	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-369.70	0.00	0.00	0.00
		M(-)	0.00	68.11	0.00	0.00	0.00
	2	M(+)	887.37	-287.61	0.00	12.36	-19.48
		M(-)	-183.88	68.11	0.00	-2.56	4.04
	3	M(+)	1553.09	-205.52	0.00	21.63	-34.10
		M(-)	-367.77	68.11	0.00	-5.12	8.07
	4	M(+)	1997.16	-123.42	0.00	27.82	-43.85
		M(-)	-551.65	68.11	0.00	-7.68	12.11
	5	M(+)	2219.57	-41.33	0.00	30.91	-48.73
		M(-)	-735.53	68.11	0.00	-10.24	16.15
	6	M(+)	2220.34	40.76	0.00	30.92	-48.74
		M(-)	-919.41	68.11	0.00	-12.81	20.18
	7	M(+)	1999.45	122.86	0.00	27.85	-43.90
		M(-)	-1103.30	68.11	0.00	-15.37	24.22
	8	M(+)	1556.92	204.95	0.00	21.68	-34.18
		M(-)	-1287.18	68.11	0.00	-17.93	28.26
	9	M(+)	892.73	287.04	0.00	12.43	-19.60
		M(-)	-1471.06	68.11	0.00	-20.49	32.30
	10	M(+)	429.74	-17.68	0.00	5.99	-9.43
		M(-)	-1788.06	382.74	0.00	-24.90	39.25
	11	M(+)	477.49	-17.68	0.00	6.65	-10.48
		M(-)	-2914.20	451.44	0.00	-40.59	63.98
2	1	M(+)	477.49	67.09	0.00	6.65	-10.48
		M(-)	-2914.20	-532.34	0.00	-40.59	63.98
	2	M(+)	284.62	67.09	0.00	3.96	-6.25
		M(-)	-1622.26	-406.12	0.00	-22.59	35.61
	3	M(+)	670.21	-273.05	0.00	9.33	-14.71
		M(-)	-1048.64	-51.74	0.00	-14.61	23.02
	4	M(+)	1327.24	-258.35	0.00	18.49	-29.14
		M(-)	-919.28	-51.74	0.00	-12.80	20.18
	5	M(+)	2134.24	-132.92	0.00	29.73	-46.85
		M(-)	-823.92	-7.01	0.00	-11.48	18.09
	6	M(+)	2423.87	-7.50	0.00	33.76	-53.21
		M(-)	-845.67	23.37	0.00	-11.78	18.57
	7	M(+)	2198.39	116.57	0.00	30.62	-48.26
		M(-)	-963.18	33.60	0.00	-13.42	21.15
	8	M(+)	1458.85	241.99	0.00	20.32	-32.03
		M(-)	-1182.89	67.09	0.00	-16.48	25.97
	9	M(+)	758.86	318.00	0.00	10.57	-16.66
		M(-)	-1350.60	67.09	0.00	-18.81	29.65
	10	M(+)	321.24	-13.96	0.00	4.47	-7.05
		M(-)	-1886.95	411.65	0.00	-26.28	41.43
	11	M(+)	361.38	-13.96	0.00	5.03	-7.93
		M(-)	-3175.61	484.81	0.00	-44.23	69.72
3	1	M(+)	361.38	51.74	0.00	5.03	-7.93
		M(-)	-3175.61	-484.81	0.00	-44.23	69.72
	2	M(+)	321.24	13.96	0.00	4.47	-7.05
		M(-)	-1886.95	-411.65	0.00	-26.28	41.43

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	752.45	-318.32	0.00	10.48	-16.52
		M(-)	-1350.55	-67.08	0.00	-18.81	29.65
	4	M(+)	1453.23	-242.31	0.00	20.24	-31.90
		M(-)	-1182.84	-67.08	0.00	-16.47	25.97
	5	M(+)	2196.00	-117.92	0.00	30.59	-48.21
		M(-)	-965.46	-33.77	0.00	-13.45	21.20
	6	M(+)	2423.77	7.50	0.00	33.76	-53.21
		M(-)	-847.26	-23.54	0.00	-11.80	18.60
	7	M(+)	2134.17	132.92	0.00	29.72	-46.85
		M(-)	-823.92	7.01	0.00	-11.48	18.09
	8	M(+)	1327.22	258.33	0.00	18.49	-29.14
		M(-)	-919.28	51.74	0.00	-12.80	20.18
	9	M(+)	670.22	273.04	0.00	9.33	-14.71
		M(-)	-1048.64	51.74	0.00	-14.61	23.02
	10	M(+)	284.61	-67.08	0.00	3.96	-6.25
		M(-)	-1622.27	406.12	0.00	-22.59	35.61
	11	M(+)	477.47	-67.08	0.00	6.65	-10.48
		M(-)	-2918.57	538.42	0.00	-40.65	64.07
4	1	M(+)	477.47	17.68	0.00	6.65	-10.48
		M(-)	-2918.57	-451.60	0.00	-40.65	64.07
	2	M(+)	525.73	-268.04	0.00	7.32	-11.54
		M(-)	-1557.84	-68.10	0.00	-21.70	34.20
	3	M(+)	1587.32	-200.39	0.00	22.11	-34.85
		M(-)	-1276.92	-68.10	0.00	-17.78	28.03
	4	M(+)	1973.50	-129.12	0.00	27.49	-43.33
		M(-)	-1117.28	-68.10	0.00	-15.56	24.53
	5	M(+)	2192.63	-57.85	0.00	30.54	-48.14
		M(-)	-957.65	-68.10	0.00	-13.34	21.02
	6	M(+)	2244.71	13.42	0.00	31.26	-49.28
		M(-)	-798.02	-68.10	0.00	-11.11	17.52
	7	M(+)	2129.73	84.69	0.00	29.66	-46.76
		M(-)	-638.39	-68.10	0.00	-8.89	14.02
	8	M(+)	1847.69	155.96	0.00	25.73	-40.56
		M(-)	-478.76	-68.10	0.00	-6.67	10.51
	9	M(+)	1398.60	227.23	0.00	19.48	-30.70
		M(-)	-319.13	-68.10	0.00	-4.44	7.01
	10	M(+)	782.46	298.49	0.00	10.90	-17.18
		M(-)	-159.49	-68.10	0.00	-2.22	3.50
	11	M(+)	0.00	369.70	0.00	0.00	0.00
		M(-)	0.00	-68.10	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	47.33	0.00	0.00	0.00	0.00
		Q(-)	-243.61	0.00	0.00	0.00	0.00
	2	Q(+)	47.33	-127.80	0.00	1.78	-2.81
		Q(-)	-197.81	595.92	0.00	-8.30	13.08
	3	Q(+)	47.33	-255.60	0.00	3.56	-5.61
		Q(-)	-152.02	1068.19	0.00	-14.88	23.45
	4	Q(+)	47.33	-383.39	0.00	5.34	-8.42
		Q(-)	-106.23	1416.83	0.00	-19.73	31.10
	5	Q(+)	47.33	-511.19	0.00	7.12	-11.22
		Q(-)	-68.92	1643.96	0.00	-22.90	36.09
	6	Q(+)	75.14	531.04	0.00	-7.40	11.66
		Q(-)	-12.59	170.01	0.00	-2.37	3.73
	7	Q(+)	180.23	841.95	0.00	-11.73	18.48
		Q(-)	-12.59	204.01	0.00	-2.84	4.48
	8	Q(+)	217.54	314.29	0.00	-4.38	6.90
		Q(-)	-12.59	238.01	0.00	-3.31	5.23
	9	Q(+)	263.33	-334.88	0.00	4.66	-7.35
		Q(-)	-12.59	272.01	0.00	-3.79	5.97
	10	Q(+)	309.12	-1107.70	0.00	15.43	-24.32
		Q(-)	-12.59	306.01	0.00	-4.26	6.72
	11	Q(+)	354.92	-2004.15	0.00	27.91	-44.00
		Q(-)	-12.59	340.01	0.00	-4.74	7.46
2	1	Q(+)	47.77	340.01	0.00	-4.74	7.46
		Q(-)	-361.69	-2028.88	0.00	28.26	-44.54
	2	Q(+)	47.77	202.67	0.00	-2.82	4.45
		Q(-)	-312.93	-1059.11	0.00	14.75	-23.25
	3	Q(+)	47.77	65.33	0.00	-0.91	1.43
		Q(-)	-264.17	-229.53	0.00	3.20	-5.04
	4	Q(+)	47.77	-54.10	0.00	0.75	-1.19
		Q(-)	-221.77	377.90	0.00	-5.26	8.30
	5	Q(+)	47.77	-251.15	0.00	3.50	-5.51
		Q(-)	-151.81	1148.41	0.00	-15.99	25.21
	6	Q(+)	47.77	-448.20	0.00	6.24	-9.84
		Q(-)	-39.47	955.84	0.00	-13.31	20.98
	7	Q(+)	157.92	1046.14	0.00	-14.57	22.97
		Q(-)	-38.48	-207.47	0.00	2.89	-4.55
	8	Q(+)	227.88	250.43	0.00	-3.49	5.50
		Q(-)	-38.48	-48.72	0.00	0.68	-1.07
	9	Q(+)	270.28	-372.26	0.00	5.18	-8.17
		Q(-)	-38.48	47.49	0.00	-0.66	1.04
	10	Q(+)	319.04	-1219.40	0.00	16.98	-26.77
		Q(-)	-38.48	158.14	0.00	-2.20	3.47
	11	Q(+)	367.80	-2206.73	0.00	30.74	-48.45
		Q(-)	-38.48	268.78	0.00	-3.74	5.90
3	1	Q(+)	38.48	268.78	0.00	-3.74	5.90
		Q(-)	-367.80	-2206.73	0.00	30.74	-48.45
	2	Q(+)	38.48	158.14	0.00	-2.20	3.47
		Q(-)	-319.04	-1219.40	0.00	16.98	-26.77

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	38.48	47.49	0.00	-0.66	1.04
		Q(-)	-270.28	-372.26	0.00	5.18	-8.17
	4	Q(+)	38.48	-48.72	0.00	0.68	-1.07
		Q(-)	-227.88	250.43	0.00	-3.49	5.50
	5	Q(+)	38.48	-207.47	0.00	2.89	-4.55
		Q(-)	-157.92	1046.14	0.00	-14.57	22.97
	6	Q(+)	39.47	955.84	0.00	-13.31	20.98
		Q(-)	-47.77	-448.20	0.00	6.24	-9.84
	7	Q(+)	151.81	1148.41	0.00	-15.99	25.21
		Q(-)	-47.77	-251.15	0.00	3.50	-5.51
	8	Q(+)	221.77	377.89	0.00	-5.26	8.30
		Q(-)	-47.77	-54.10	0.00	0.75	-1.19
	9	Q(+)	264.17	-229.53	0.00	3.20	-5.04
		Q(-)	-47.77	65.33	0.00	-0.91	1.43
	10	Q(+)	312.93	-1059.11	0.00	14.75	-23.25
		Q(-)	-47.77	202.67	0.00	-2.82	4.45
	11	Q(+)	361.69	-2028.88	0.00	28.26	-44.54
		Q(-)	-47.77	340.01	0.00	-4.74	7.46
4	1	Q(+)	12.59	340.01	0.00	-4.74	7.46
		Q(-)	-354.92	-2004.15	0.00	27.91	-44.00
	2	Q(+)	12.59	288.07	0.00	-4.01	6.32
		Q(-)	-284.96	-684.42	0.00	9.53	-15.03
	3	Q(+)	12.59	236.12	0.00	-3.29	5.18
		Q(-)	-215.00	346.74	0.00	-4.83	7.61
	4	Q(+)	12.59	206.60	0.00	-2.88	4.54
		Q(-)	-180.23	804.83	0.00	-11.21	17.67
	5	Q(+)	12.59	177.08	0.00	-2.47	3.89
		Q(-)	-84.68	486.13	0.00	-6.77	10.67
	6	Q(+)	15.92	1674.47	0.00	-23.32	36.76
		Q(-)	-47.33	-554.65	0.00	7.73	-12.18
	7	Q(+)	84.62	1538.41	0.00	-21.43	33.77
		Q(-)	-47.33	-443.70	0.00	6.18	-9.74
	8	Q(+)	124.38	1293.46	0.00	-18.02	28.40
		Q(-)	-47.33	-332.75	0.00	4.63	-7.31
	9	Q(+)	164.13	955.33	0.00	-13.31	20.97
		Q(-)	-47.33	-221.80	0.00	3.09	-4.87
	10	Q(+)	203.89	524.01	0.00	-7.30	11.50
		Q(-)	-47.33	-110.85	0.00	1.54	-2.43
	11	Q(+)	243.61	0.00	0.00	0.00	0.00
		Q(-)	-47.33	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.33	0.00	0.00	0.00
	2	M(+)	595.92	-197.81	0.00	8.30	-13.08
		M(-)	-127.80	47.33	0.00	-1.78	2.81
	3	M(+)	1068.19	-152.02	0.00	14.88	-23.45
		M(-)	-255.60	47.33	0.00	-3.56	5.61
	4	M(+)	1416.83	-106.23	0.00	19.73	-31.10
		M(-)	-383.39	47.33	0.00	-5.34	8.42
	5	M(+)	1643.96	-68.92	0.00	22.90	-36.09
		M(-)	-511.19	47.33	0.00	-7.12	11.22
	6	M(+)	1660.44	37.08	0.00	23.13	-36.45
		M(-)	-638.99	47.33	0.00	-8.90	14.03
	7	M(+)	1443.71	143.08	0.00	20.11	-31.69
		M(-)	-766.79	47.33	0.00	-10.68	16.83
	8	M(+)	1016.35	180.39	0.00	14.16	-22.31
		M(-)	-894.59	47.33	0.00	-12.46	19.64
	9	M(+)	467.47	226.19	0.00	6.51	-10.26
		M(-)	-1022.39	47.33	0.00	-14.24	22.45
	10	M(+)	306.01	-12.59	0.00	4.26	-6.72
		M(-)	-1269.62	258.31	0.00	-17.68	27.87
	11	M(+)	340.01	-12.59	0.00	4.74	-7.46
		M(-)	-2028.88	304.10	0.00	-28.26	44.54
2	1	M(+)	340.01	47.77	0.00	4.74	-7.46
		M(-)	-2028.88	-361.69	0.00	-28.26	44.54
	2	M(+)	202.67	47.77	0.00	2.82	-4.45
		M(-)	-1156.22	-270.55	0.00	-16.10	25.38
	3	M(+)	406.68	-197.82	0.00	5.66	-8.93
		M(-)	-779.93	-38.48	0.00	-10.86	17.12
	4	M(+)	890.68	-192.91	0.00	12.41	-19.55
		M(-)	-683.72	-38.48	0.00	-9.52	15.01
	5	M(+)	1542.13	-122.95	0.00	21.48	-33.86
		M(-)	-524.97	-38.48	0.00	-7.31	11.52
	6	M(+)	1822.23	-1.26	0.00	25.38	-40.00
		M(-)	-448.20	47.77	0.00	-6.24	9.84
	7	M(+)	1552.52	120.43	0.00	21.62	-34.08
		M(-)	-645.25	47.77	0.00	-8.99	14.17
	8	M(+)	911.46	190.39	0.00	12.69	-20.01
		M(-)	-842.31	47.77	0.00	-11.73	18.49
	9	M(+)	418.11	203.93	0.00	5.82	-9.18
		M(-)	-961.73	47.77	0.00	-13.39	21.11
	10	M(+)	238.93	-10.39	0.00	3.33	-5.25
		M(-)	-1337.78	277.86	0.00	-18.63	29.37
	11	M(+)	268.78	-10.39	0.00	3.74	-5.90
		M(-)	-2206.73	367.80	0.00	-30.74	48.45
3	1	M(+)	268.78	38.48	0.00	3.74	-5.90
		M(-)	-2206.73	-326.62	0.00	-30.74	48.45
	2	M(+)	238.93	10.39	0.00	3.33	-5.25
		M(-)	-1337.78	-277.86	0.00	-18.63	29.37

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	418.11	-203.93	0.00	5.82	-9.18
		M(-)	-961.73	-47.77	0.00	-13.39	21.11
	4	M(+)	911.46	-190.39	0.00	12.69	-20.01
		M(-)	-842.31	-47.77	0.00	-11.73	18.49
	5	M(+)	1552.52	-120.43	0.00	21.62	-34.08
		M(-)	-645.25	-47.77	0.00	-8.99	14.17
	6	M(+)	1822.23	1.26	0.00	25.38	-40.00
		M(-)	-448.20	-47.77	0.00	-6.24	9.84
	7	M(+)	1542.13	122.95	0.00	21.48	-33.86
		M(-)	-524.97	38.48	0.00	-7.31	11.53
	8	M(+)	890.68	192.91	0.00	12.41	-19.55
		M(-)	-683.72	38.48	0.00	-9.52	15.01
	9	M(+)	406.68	197.82	0.00	5.66	-8.93
		M(-)	-779.93	38.48	0.00	-10.86	17.12
	10	M(+)	202.67	-47.77	0.00	2.82	-4.45
		M(-)	-1156.22	270.55	0.00	-16.10	25.38
	11	M(+)	340.01	-47.77	0.00	4.74	-7.46
		M(-)	-2028.88	361.69	0.00	-28.26	44.54
4	1	M(+)	340.01	12.59	0.00	4.74	-7.46
		M(-)	-2028.88	-304.10	0.00	-28.26	44.54
	2	M(+)	288.07	12.59	0.00	4.01	-6.32
		M(-)	-1082.74	-47.33	0.00	-15.08	23.77
	3	M(+)	1043.22	-177.85	0.00	14.53	-22.90
		M(-)	-887.49	-47.33	0.00	-12.36	19.48
	4	M(+)	1414.24	-143.08	0.00	19.70	-31.05
		M(-)	-776.54	-47.33	0.00	-10.82	17.05
	5	M(+)	1639.60	-37.08	0.00	22.84	-36.00
		M(-)	-665.59	-47.33	0.00	-9.27	14.61
	6	M(+)	1674.47	15.92	0.00	23.32	-36.76
		M(-)	-554.65	-47.33	0.00	-7.73	12.18
	7	M(+)	1538.41	84.62	0.00	21.43	-33.77
		M(-)	-443.70	-47.33	0.00	-6.18	9.74
	8	M(+)	1293.46	124.38	0.00	18.02	-28.40
		M(-)	-332.75	-47.33	0.00	-4.63	7.31
	9	M(+)	955.33	164.13	0.00	13.31	-20.97
		M(-)	-221.80	-47.33	0.00	-3.09	4.87
	10	M(+)	524.01	203.89	0.00	7.30	-11.50
		M(-)	-110.85	-47.33	0.00	-1.54	2.43
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.33	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.11	0.00	0.00	0.00	0.00
		Q(-)	-369.70	0.00	0.00	0.00	0.00
	2	Q(+)	68.11	-183.88	0.00	2.56	-4.04
		Q(-)	-287.61	887.37	0.00	-12.36	19.48
	3	Q(+)	68.11	-367.77	0.00	5.12	-8.07
		Q(-)	-205.52	1553.09	0.00	-21.63	34.10
	4	Q(+)	68.11	-551.65	0.00	7.68	-12.11
		Q(-)	-123.42	1997.16	0.00	-27.82	43.85
	5	Q(+)	68.11	-735.53	0.00	10.24	-16.15
		Q(-)	-68.92	1643.96	0.00	-22.90	36.09
	6	Q(+)	107.93	861.56	0.00	-12.00	18.91
		Q(-)	-17.68	238.75	0.00	-3.33	5.24
	7	Q(+)	189.32	922.81	0.00	-12.85	20.26
		Q(-)	-17.68	286.50	0.00	-3.99	6.29
	8	Q(+)	271.41	300.83	0.00	-4.19	6.60
		Q(-)	-17.68	334.25	0.00	-4.66	7.34
	9	Q(+)	353.50	-542.80	0.00	7.56	-11.92
		Q(-)	-17.68	381.99	0.00	-5.32	8.39
	10	Q(+)	435.60	-1608.08	0.00	22.40	-35.30
		Q(-)	-17.68	429.74	0.00	-5.99	9.43
	11	Q(+)	517.69	-2895.01	0.00	40.32	-63.56
		Q(-)	-17.68	477.49	0.00	-6.65	10.48
2	1	Q(+)	67.09	477.49	0.00	-6.65	10.48
		Q(-)	-543.84	-2903.94	0.00	40.45	-63.75
	2	Q(+)	67.09	284.62	0.00	-3.96	6.25
		Q(-)	-459.19	-1488.87	0.00	20.74	-32.69
	3	Q(+)	67.09	91.75	0.00	-1.28	2.01
		Q(-)	-372.39	-292.83	0.00	4.08	-6.43
	4	Q(+)	67.09	-75.97	0.00	1.06	-1.67
		Q(-)	-296.38	543.14	0.00	-7.56	11.92
	5	Q(+)	67.09	-352.70	0.00	4.91	-7.74
		Q(-)	-170.96	1507.03	0.00	-20.99	33.08
	6	Q(+)	67.09	-629.43	0.00	8.77	-13.82
		Q(-)	-59.43	1549.27	0.00	-21.58	34.01
	7	Q(+)	179.22	1368.03	0.00	-19.05	30.03
		Q(-)	-51.74	-278.95	0.00	3.89	-6.12
	8	Q(+)	304.64	370.06	0.00	-5.15	8.12
		Q(-)	-51.74	-65.50	0.00	0.91	-1.44
	9	Q(+)	380.65	-486.56	0.00	6.78	-10.68
		Q(-)	-51.74	63.86	0.00	-0.89	1.40
	10	Q(+)	467.45	-1706.75	0.00	23.77	-37.47
		Q(-)	-51.74	212.62	0.00	-2.96	4.67
	11	Q(+)	553.32	-3175.61	0.00	44.23	-69.72
		Q(-)	-51.74	361.38	0.00	-5.03	7.93
3	1	Q(+)	51.74	361.38	0.00	-5.03	7.93
		Q(-)	-553.32	-3175.61	0.00	44.23	-69.72
	2	Q(+)	51.74	212.62	0.00	-2.96	4.67
		Q(-)	-467.46	-1706.60	0.00	23.77	-37.47

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	51.74	63.86	0.00	-0.89	1.40
		Q(-)	-380.67	-486.78	0.00	6.78	-10.69
	4	Q(+)	51.74	-65.50	0.00	0.91	-1.44
		Q(-)	-304.65	369.87	0.00	-5.15	8.12
	5	Q(+)	51.74	-278.95	0.00	3.89	-6.12
		Q(-)	-179.24	1367.88	0.00	-19.05	30.03
	6	Q(+)	59.43	1549.27	0.00	-21.58	34.01
		Q(-)	-67.08	-629.40	0.00	8.77	-13.82
	7	Q(+)	170.95	1507.18	0.00	-20.99	33.09
		Q(-)	-67.08	-352.68	0.00	4.91	-7.74
	8	Q(+)	296.37	543.33	0.00	-7.57	11.93
		Q(-)	-67.08	-75.96	0.00	1.06	-1.67
	9	Q(+)	372.38	-292.62	0.00	4.08	-6.42
		Q(-)	-67.08	91.74	0.00	-1.28	2.01
	10	Q(+)	459.18	-1489.02	0.00	20.74	-32.69
		Q(-)	-67.08	284.61	0.00	-3.96	6.25
	11	Q(+)	543.84	-2903.94	0.00	40.45	-63.75
		Q(-)	-67.08	477.47	0.00	-6.65	10.48
4	1	Q(+)	17.68	477.47	0.00	-6.65	10.48
		Q(-)	-517.69	-2895.01	0.00	40.32	-63.56
	2	Q(+)	17.68	404.53	0.00	-5.63	8.88
		Q(-)	-392.27	-1018.23	0.00	14.18	-22.35
	3	Q(+)	17.68	331.58	0.00	-4.62	7.28
		Q(-)	-266.85	341.20	0.00	-4.75	7.49
	4	Q(+)	17.68	290.13	0.00	-4.04	6.37
		Q(-)	-195.58	883.16	0.00	-12.30	19.39
	5	Q(+)	17.68	248.68	0.00	-3.46	5.46
		Q(-)	-124.31	1258.07	0.00	-17.52	27.62
	6	Q(+)	17.68	207.22	0.00	-2.89	4.55
		Q(-)	-68.10	-798.02	0.00	11.11	-17.52
	7	Q(+)	84.69	2129.73	0.00	-29.66	46.76
		Q(-)	-68.10	-638.39	0.00	8.89	-14.02
	8	Q(+)	155.96	1847.69	0.00	-25.73	40.56
		Q(-)	-68.10	-478.76	0.00	6.67	-10.51
	9	Q(+)	227.23	1398.60	0.00	-19.48	30.70
		Q(-)	-68.10	-319.13	0.00	4.44	-7.01
	10	Q(+)	298.49	782.46	0.00	-10.90	17.18
		Q(-)	-68.10	-159.49	0.00	2.22	-3.50
	11	Q(+)	369.70	0.00	0.00	0.00	0.00
		Q(-)	-68.10	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	752.45	-318.32	0.00	10.48	-16.52
		M(-)	-1350.55	-67.08	0.00	-18.81	29.65
	4	M(+)	1453.23	-242.31	0.00	20.24	-31.90
		M(-)	-1182.84	-67.08	0.00	-16.47	25.97
	5	M(+)	2196.00	-117.92	0.00	30.59	-48.21
		M(-)	-965.46	-33.77	0.00	-13.45	21.20
	6	M(+)	2423.77	7.50	0.00	33.76	-53.21
		M(-)	-847.26	-23.54	0.00	-11.80	18.60
	7	M(+)	2134.17	132.92	0.00	29.72	-46.85
		M(-)	-823.92	7.01	0.00	-11.48	18.09
	8	M(+)	1327.22	258.33	0.00	18.49	-29.14
		M(-)	-919.28	51.74	0.00	-12.80	20.18
	9	M(+)	670.22	273.04	0.00	9.33	-14.71
		M(-)	-1048.64	51.74	0.00	-14.61	23.02
	10	M(+)	284.61	-67.08	0.00	3.96	-6.25
		M(-)	-1622.27	406.12	0.00	-22.59	35.61
	11	M(+)	477.47	-67.08	0.00	6.65	-10.48
		M(-)	-2918.57	538.42	0.00	-40.65	64.07
4	1	M(+)	477.47	17.68	0.00	6.65	-10.48
		M(-)	-2918.57	-451.60	0.00	-40.65	64.07
	2	M(+)	525.73	-268.04	0.00	7.32	-11.54
		M(-)	-1557.84	-68.10	0.00	-21.70	34.20
	3	M(+)	1587.32	-200.39	0.00	22.11	-34.85
		M(-)	-1276.92	-68.10	0.00	-17.78	28.03
	4	M(+)	1973.50	-129.12	0.00	27.49	-43.33
		M(-)	-1117.28	-68.10	0.00	-15.56	24.53
	5	M(+)	2192.63	-57.85	0.00	30.54	-48.14
		M(-)	-957.65	-68.10	0.00	-13.34	21.02
	6	M(+)	2244.71	13.42	0.00	31.26	-49.28
		M(-)	-798.02	-68.10	0.00	-11.11	17.52
	7	M(+)	2129.73	84.69	0.00	29.66	-46.76
		M(-)	-638.39	-68.10	0.00	-8.89	14.02
	8	M(+)	1847.69	155.96	0.00	25.73	-40.56
		M(-)	-478.76	-68.10	0.00	-6.67	10.51
	9	M(+)	1398.60	227.23	0.00	19.48	-30.70
		M(-)	-319.13	-68.10	0.00	-4.44	7.01
	10	M(+)	782.46	298.49	0.00	10.90	-17.18
		M(-)	-159.49	-68.10	0.00	-2.22	3.50
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.33	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.33	0.00	0.00	0.00
	2	M(+)	887.37	-287.61	0.00	12.36	-19.48
		M(-)	-183.88	68.11	0.00	-2.56	4.04
	3	M(+)	1553.09	-205.52	0.00	21.63	-34.10
		M(-)	-367.77	68.11	0.00	-5.12	8.07
	4	M(+)	1997.16	-123.42	0.00	27.82	-43.85
		M(-)	-551.65	68.11	0.00	-7.68	12.11
	5	M(+)	2219.57	-41.33	0.00	30.91	-48.73
		M(-)	-735.53	68.11	0.00	-10.24	16.15
	6	M(+)	2220.34	40.76	0.00	30.92	-48.74
		M(-)	-919.41	68.11	0.00	-12.81	20.18
	7	M(+)	1999.45	122.86	0.00	27.85	-43.90
		M(-)	-1103.30	68.11	0.00	-15.37	24.22
	8	M(+)	1556.92	204.95	0.00	21.68	-34.18
		M(-)	-1287.18	68.11	0.00	-17.93	28.26
	9	M(+)	892.73	287.04	0.00	12.43	-19.60
		M(-)	-1471.06	68.11	0.00	-20.49	32.30
	10	M(+)	429.74	-17.68	0.00	5.99	-9.43
		M(-)	-1788.06	382.74	0.00	-24.90	39.25
	11	M(+)	477.49	-17.68	0.00	6.65	-10.48
		M(-)	-2914.20	451.44	0.00	-40.59	63.98
2	1	M(+)	477.49	67.09	0.00	6.65	-10.48
		M(-)	-2914.20	-532.34	0.00	-40.59	63.98
	2	M(+)	284.62	67.09	0.00	3.96	-6.25
		M(-)	-1622.26	-406.12	0.00	-22.59	35.61
	3	M(+)	670.21	-273.05	0.00	9.33	-14.71
		M(-)	-1048.64	-51.74	0.00	-14.61	23.02
	4	M(+)	1327.24	-258.35	0.00	18.49	-29.14
		M(-)	-919.28	-51.74	0.00	-12.80	20.18
	5	M(+)	2134.24	-132.92	0.00	29.73	-46.85
		M(-)	-823.92	-7.01	0.00	-11.48	18.09
	6	M(+)	2423.87	-7.50	0.00	33.76	-53.21
		M(-)	-845.67	23.37	0.00	-11.78	18.57
	7	M(+)	2198.39	116.57	0.00	30.62	-48.26
		M(-)	-963.18	33.60	0.00	-13.42	21.15
	8	M(+)	1458.85	241.99	0.00	20.32	-32.03
		M(-)	-1182.89	67.09	0.00	-16.48	25.97
	9	M(+)	758.86	318.00	0.00	10.57	-16.66
		M(-)	-1350.60	67.09	0.00	-18.81	29.65
	10	M(+)	321.24	-13.96	0.00	4.47	-7.05
		M(-)	-1886.95	411.65	0.00	-26.28	41.43
	11	M(+)	361.38	-13.96	0.00	5.03	-7.93
		M(-)	-3175.61	484.81	0.00	-44.23	69.72
3	1	M(+)	361.38	51.74	0.00	5.03	-7.93
		M(-)	-3175.61	-484.81	0.00	-44.23	69.72
	2	M(+)	321.24	13.96	0.00	4.47	-7.05
		M(-)	-1886.95	-411.65	0.00	-26.28	41.43

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.11	0.00	0.00	0.00	0.00
		Q(-)	-369.70	0.00	0.00	0.00	0.00
	2	Q(+)	68.11	-183.88	0.00	-2.56	4.04
		Q(-)	-287.61	887.37	0.00	12.36	-19.48
	3	Q(+)	68.11	-367.77	0.00	-5.12	8.07
		Q(-)	-205.52	1553.09	0.00	21.63	-34.10
	4	Q(+)	68.11	-551.65	0.00	-7.68	12.11
		Q(-)	-123.42	1997.16	0.00	27.82	-43.85
	5	Q(+)	68.11	-735.53	0.00	-10.24	16.15
		Q(-)	-68.92	1643.96	0.00	22.90	-36.09
	6	Q(+)	107.93	861.56	0.00	12.00	-18.91
		Q(-)	-17.68	238.75	0.00	3.33	-5.24
	7	Q(+)	189.32	922.81	0.00	12.85	-20.26
		Q(-)	-17.68	286.50	0.00	3.99	-6.29
	8	Q(+)	271.41	300.83	0.00	4.19	-6.60
		Q(-)	-17.68	334.25	0.00	4.66	-7.34
	9	Q(+)	353.50	-542.80	0.00	-7.56	11.92
		Q(-)	-17.68	381.99	0.00	5.32	-8.39
	10	Q(+)	435.60	-1608.08	0.00	-22.40	35.30
		Q(-)	-17.68	429.74	0.00	5.99	-9.43
	11	Q(+)	517.69	-2895.01	0.00	-40.32	63.56
		Q(-)	-17.68	477.49	0.00	6.65	-10.48
2	1	Q(+)	67.09	477.49	0.00	6.65	-10.48
		Q(-)	-543.84	-2903.94	0.00	-40.45	63.75
	2	Q(+)	67.09	284.62	0.00	3.96	-6.25
		Q(-)	-459.19	-1488.87	0.00	-20.74	32.69
	3	Q(+)	67.09	91.75	0.00	1.28	-2.01
		Q(-)	-372.39	-292.83	0.00	-4.08	6.43
	4	Q(+)	67.09	-75.97	0.00	-1.06	1.67
		Q(-)	-296.38	543.14	0.00	7.56	-11.92
	5	Q(+)	67.09	-352.70	0.00	-4.91	7.74
		Q(-)	-170.96	1507.03	0.00	20.99	-33.08
	6	Q(+)	67.09	-629.43	0.00	-8.77	13.82
		Q(-)	-59.43	1549.27	0.00	21.58	-34.01
	7	Q(+)	179.22	1368.03	0.00	19.05	-30.03
		Q(-)	-51.74	-278.95	0.00	-3.89	6.12
	8	Q(+)	304.64	370.06	0.00	5.15	-8.12
		Q(-)	-51.74	-65.50	0.00	-0.91	1.44
	9	Q(+)	380.65	-486.56	0.00	-6.78	10.68
		Q(-)	-51.74	63.86	0.00	0.89	-1.40
	10	Q(+)	467.45	-1706.75	0.00	-23.77	37.47
		Q(-)	-51.74	212.62	0.00	2.96	-4.67
	11	Q(+)	553.32	-3175.61	0.00	-44.23	69.72
		Q(-)	-51.74	361.38	0.00	5.03	-7.93
3	1	Q(+)	51.74	361.38	0.00	5.03	-7.93
		Q(-)	-553.32	-3175.61	0.00	-44.23	69.72
	2	Q(+)	51.74	212.62	0.00	2.96	-4.67
		Q(-)	-467.46	-1706.60	0.00	-23.77	37.47

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	51.74	63.86	0.00	0.89	-1.40
		Q(-)	-380.67	-486.78	0.00	-6.78	10.69
	4	Q(+)	51.74	-65.50	0.00	-0.91	1.44
		Q(-)	-304.65	369.87	0.00	5.15	-8.12
	5	Q(+)	51.74	-278.95	0.00	-3.89	6.12
		Q(-)	-179.24	1367.88	0.00	19.05	-30.03
	6	Q(+)	59.43	1549.27	0.00	21.58	-34.01
		Q(-)	-67.08	-629.40	0.00	-8.77	13.82
	7	Q(+)	170.95	1507.18	0.00	20.99	-33.09
		Q(-)	-67.08	-352.68	0.00	-4.91	7.74
	8	Q(+)	296.37	543.33	0.00	7.57	-11.93
		Q(-)	-67.08	-75.96	0.00	-1.06	1.67
	9	Q(+)	372.38	-292.62	0.00	-4.08	6.42
		Q(-)	-67.08	91.74	0.00	1.28	-2.01
	10	Q(+)	459.18	-1489.02	0.00	-20.74	32.69
		Q(-)	-67.08	284.61	0.00	3.96	-6.25
	11	Q(+)	543.84	-2903.94	0.00	-40.45	63.75
		Q(-)	-67.08	477.47	0.00	6.65	-10.48
4	1	Q(+)	17.68	477.47	0.00	6.65	-10.48
		Q(-)	-517.69	-2895.01	0.00	-40.32	63.56
	2	Q(+)	17.68	404.53	0.00	5.63	-8.88
		Q(-)	-392.27	-1018.23	0.00	-14.18	22.35
	3	Q(+)	17.68	331.58	0.00	4.62	-7.28
		Q(-)	-266.85	341.20	0.00	4.75	-7.49
	4	Q(+)	17.68	290.13	0.00	4.04	-6.37
		Q(-)	-195.58	883.16	0.00	12.30	-19.39
	5	Q(+)	17.68	248.68	0.00	3.46	-5.46
		Q(-)	-124.31	1258.07	0.00	17.52	-27.62
	6	Q(+)	17.68	207.22	0.00	2.89	-4.55
		Q(-)	-68.10	-798.02	0.00	-11.11	17.52
	7	Q(+)	84.69	2129.73	0.00	29.66	-46.76
		Q(-)	-68.10	-638.39	0.00	-8.89	14.02
	8	Q(+)	155.96	1847.69	0.00	25.73	-40.56
		Q(-)	-68.10	-478.76	0.00	-6.67	10.51
	9	Q(+)	227.23	1398.60	0.00	19.48	-30.70
		Q(-)	-68.10	-319.13	0.00	-4.44	7.01
	10	Q(+)	298.49	782.46	0.00	10.90	-17.18
		Q(-)	-68.10	-159.49	0.00	-2.22	3.50
	11	Q(+)	369.70	0.00	0.00	0.00	0.00
		Q(-)	-68.10	0.00	0.00	0.00	0.00

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.33	0.00	0.00	0.00
	2	M(+)	887.37	-287.61	0.00	12.36	-19.48
		M(-)	-183.88	68.11	0.00	-2.56	4.04
	3	M(+)	1553.09	-205.52	0.00	21.63	-34.10
		M(-)	-367.77	68.11	0.00	-5.12	8.07
	4	M(+)	1997.16	-123.42	0.00	27.82	-43.85
		M(-)	-551.65	68.11	0.00	-7.68	12.11
	5	M(+)	2219.57	-41.33	0.00	30.91	-48.73
		M(-)	-735.53	68.11	0.00	-10.24	16.15
	6	M(+)	2220.34	40.76	0.00	30.92	-48.74
		M(-)	-919.41	68.11	0.00	-12.81	20.18
	7	M(+)	1999.45	122.86	0.00	27.85	-43.90
		M(-)	-1103.30	68.11	0.00	-15.37	24.22
	8	M(+)	1556.92	204.95	0.00	21.68	-34.18
		M(-)	-1287.18	68.11	0.00	-17.93	28.26
	9	M(+)	892.73	287.04	0.00	12.43	-19.60
		M(-)	-1471.06	68.11	0.00	-20.49	32.30
	10	M(+)	429.74	-17.68	0.00	5.99	-9.43
		M(-)	-1788.06	382.74	0.00	-24.90	39.25
	11	M(+)	477.49	-17.68	0.00	6.65	-10.48
		M(-)	-2914.20	451.44	0.00	-40.59	63.98
2	1	M(+)	477.49	67.09	0.00	6.65	-10.48
		M(-)	-2914.20	-532.34	0.00	-40.59	63.98
	2	M(+)	284.62	67.09	0.00	3.96	-6.25
		M(-)	-1622.26	-406.12	0.00	-22.59	35.61
	3	M(+)	670.21	-273.05	0.00	9.33	-14.71
		M(-)	-1048.64	-51.74	0.00	-14.61	23.02
	4	M(+)	1327.24	-258.35	0.00	18.49	-29.14
		M(-)	-919.28	-51.74	0.00	-12.80	20.18
	5	M(+)	2134.24	-132.92	0.00	29.73	-46.85
		M(-)	-823.92	-7.01	0.00	-11.48	18.09
	6	M(+)	2423.87	-7.50	0.00	33.76	-53.21
		M(-)	-845.67	23.37	0.00	-11.78	18.57
	7	M(+)	2198.39	116.57	0.00	30.62	-48.26
		M(-)	-963.18	33.60	0.00	-13.42	21.15
	8	M(+)	1458.85	241.99	0.00	20.32	-32.03
		M(-)	-1182.89	67.09	0.00	-16.48	25.97
	9	M(+)	758.86	318.00	0.00	10.57	-16.66
		M(-)	-1350.60	67.09	0.00	-18.81	29.65
	10	M(+)	321.24	-13.96	0.00	4.47	-7.05
		M(-)	-1886.95	411.65	0.00	-26.28	41.43
	11	M(+)	361.38	-13.96	0.00	5.03	-7.93
		M(-)	-3175.61	484.81	0.00	-44.23	69.72
3	1	M(+)	361.38	51.74	0.00	5.03	-7.93
		M(-)	-3175.61	-484.81	0.00	-44.23	69.72
	2	M(+)	321.24	13.96	0.00	4.47	-7.05
		M(-)	-1886.95	-411.65	0.00	-26.28	41.43

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	752.45	-318.32	0.00	10.48	-16.52
		M(-)	-1350.55	-67.08	0.00	-18.81	29.65
	4	M(+)	1453.23	-242.31	0.00	20.24	-31.90
		M(-)	-1182.84	-67.08	0.00	-16.47	25.97
	5	M(+)	2196.00	-117.92	0.00	30.59	-48.21
		M(-)	-965.46	-33.77	0.00	-13.45	21.20
	6	M(+)	2423.77	7.50	0.00	33.76	-53.21
		M(-)	-847.26	-23.54	0.00	-11.80	18.60
	7	M(+)	2134.17	132.92	0.00	29.72	-46.85
		M(-)	-823.92	7.01	0.00	-11.48	18.09
	8	M(+)	1327.22	258.33	0.00	18.49	-29.14
		M(-)	-919.28	51.74	0.00	-12.80	20.18
	9	M(+)	670.22	273.04	0.00	9.33	-14.71
		M(-)	-1048.64	51.74	0.00	-14.61	23.02
	10	M(+)	284.61	-67.08	0.00	3.96	-6.25
		M(-)	-1622.27	406.12	0.00	-22.59	35.61
	11	M(+)	477.47	-67.08	0.00	6.65	-10.48
		M(-)	-2918.57	538.42	0.00	-40.65	64.07
4	1	M(+)	477.47	17.68	0.00	6.65	-10.48
		M(-)	-2918.57	-451.60	0.00	-40.65	64.07
	2	M(+)	525.73	-268.04	0.00	7.32	-11.54
		M(-)	-1557.84	-68.10	0.00	-21.70	34.20
	3	M(+)	1587.32	-200.39	0.00	22.11	-34.85
		M(-)	-1276.92	-68.10	0.00	-17.78	28.03
	4	M(+)	1973.50	-129.12	0.00	27.49	-43.33
		M(-)	-1117.28	-68.10	0.00	-15.56	24.53
	5	M(+)	2192.63	-57.85	0.00	30.54	-48.14
		M(-)	-957.65	-68.10	0.00	-13.34	21.02
	6	M(+)	2244.71	13.42	0.00	31.26	-49.28
		M(-)	-798.02	-68.10	0.00	-11.11	17.52
	7	M(+)	2129.73	84.69	0.00	29.66	-46.76
		M(-)	-638.39	-68.10	0.00	-8.89	14.02
	8	M(+)	1847.69	155.96	0.00	25.73	-40.56
		M(-)	-478.76	-68.10	0.00	-6.67	10.51
	9	M(+)	1398.60	227.23	0.00	19.48	-30.70
		M(-)	-319.13	-68.10	0.00	-4.44	7.01
	10	M(+)	782.46	298.49	0.00	10.90	-17.18
		M(-)	-159.49	-68.10	0.00	-2.22	3.50
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.33	0.00	0.00	0.00

Cable Numero 1

finicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	2.050	0.400	1.099	-0.0352
2	2.700	2.140	0.310	1.189	-0.0295
3	5.400	2.207	0.243	1.256	-0.0197
4	8.100	2.247	0.203	1.296	-0.0099
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333

Se.	X	Y (s)	Y (i)	Exce.	Pend.
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000
12	29.875	1.037	1.413	0.086	-0.3206
13	32.750	1.840	0.610	0.889	-0.1577
14	35.250	2.060	0.390	1.109	-0.0800

Cable Numero 2

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	2.060	0.390	1.109	-0.0800
15	39.375	2.260	0.190	1.309	0.0000
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
22	62.875	1.037	1.413	0.086	-0.3206
23	65.750	1.840	0.610	0.889	-0.1577
24	68.250	2.060	0.390	1.109	-0.0800

Cable Numero 3

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	2.060	0.390	1.109	-0.0800
25	72.375	2.260	0.190	1.309	0.0000
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
32	97.125	1.440	1.010	0.489	-0.3091
33	101.250	2.060	0.390	1.109	-0.0800

Cable Numero 4

finicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.200	-2.260	0.0000
28	118.650	-2.097	0.0346
29	120.650	-2.027	0.0346

Replanteo del cable : 4

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	101.250	2.060	0.390	1.109	-0.0800
34	103.594	2.242	0.208	1.291	-0.0484
35	105.938	2.260	0.190	1.309	0.0000
36	108.282	2.260	0.190	1.309	0.0000
37	110.626	2.256	0.194	1.305	0.0052
38	112.970	2.234	0.216	1.283	0.0137
39	115.314	2.192	0.258	1.241	0.0223
40	117.658	2.130	0.320	1.179	0.0309

Se.	X	Y (s)	Y (i)	Exce.	Pend.
41	120.000	2.050	0.400	1.099	0.0348

Cable Numero 5

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Replanteo del cable : 5

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.550	0.900	0.599	-0.1191
2	2.700	1.856	0.594	0.905	-0.0997
3	5.400	2.081	0.369	1.130	-0.0664
4	8.100	2.215	0.235	1.264	-0.0332
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
12	29.875	0.748	1.702	-0.203	-0.1684
13	32.750	1.244	1.206	0.293	-0.1440
14	35.250	1.550	0.900	0.599	-0.1200

Cable Numero 6

efinicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Replanteo del cable : 6

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.550	0.900	0.599	-0.1200
15	39.375	2.027	0.423	1.076	-0.0997
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000
22	62.875	0.748	1.702	-0.203	-0.1684
23	65.750	1.244	1.206	0.293	-0.1440
24	68.250	1.550	0.900	0.599	-0.1200

Cable Numero 7

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Replanteo del cable : 7

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.550	0.900	0.599	-0.1200
25	72.375	2.027	0.423	1.076	-0.0997
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000
32	97.125	0.971	1.479	0.020	-0.1816
33	101.250	1.550	0.900	0.599	-0.1200

Cable Numero 8

efinicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.200	-2.260	0.0000
25	118.650	-1.708	0.1169
26	120.650	-1.474	0.1169

Replanteo del cable : 8

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	101.250	1.550	0.900	0.599	-0.1200
34	103.594	1.831	0.619	0.880	-0.1193
35	105.938	2.088	0.362	1.137	-0.0940
36	108.282	2.244	0.206	1.293	-0.0334
37	110.626	2.247	0.203	1.296	0.0176
38	112.970	2.172	0.278	1.221	0.0466
39	115.314	2.029	0.421	1.078	0.0756
40	117.658	1.818	0.632	0.867	0.1046
41	120.000	1.550	0.900	0.599	0.1170

Cable Numero 9

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Replanteo del cable : 9

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.050	1.400	0.099	-0.1661
2	2.700	1.477	0.973	0.526	-0.1390
3	5.400	1.790	0.660	0.839	-0.0926
4	8.100	1.978	0.472	1.027	-0.0463
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.325	2.125	-0.626	-0.0636
13	32.750	0.630	1.820	-0.321	-0.1521
14	35.250	1.050	1.400	0.099	-0.1700

Cable Numero 10

:finicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Replanteo del cable : 10

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.050	1.400	0.099	-0.1700
15	39.375	1.722	0.728	0.771	-0.1378
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000
22	62.875	0.325	2.125	-0.626	-0.0636
23	65.750	0.630	1.820	-0.321	-0.1521
24	68.250	1.050	1.400	0.099	-0.1700

Cable Numero 11

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Replanteo del cable : 11

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.050	1.400	0.099	-0.1700
25	72.375	1.722	0.728	0.771	-0.1378
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000
32	97.125	0.427	2.023	-0.524	-0.0990
33	101.250	1.050	1.400	0.099	-0.1700

Cable Numero 12

Definicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.200	-2.040	0.0000
22	118.650	-1.270	0.1630
23	120.650	-0.944	0.1630

Replanteo del cable : 12

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	101.250	1.050	1.400	0.099	-0.1700
34	103.594	1.448	1.002	0.497	-0.1681
35	105.938	1.805	0.645	0.854	-0.1292
36	108.282	2.019	0.431	1.068	-0.0452
37	110.626	2.022	0.428	1.071	0.0246
38	112.970	1.917	0.533	0.966	0.0650
39	115.314	1.718	0.732	0.767	0.1054
40	117.658	1.423	1.027	0.472	0.1459
41	120.000	1.050	1.400	0.099	0.1630

Cable Numero 13

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Replanteo del cable : 13

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.590	1.860	-0.361	-0.2424
2	2.700	1.215	1.235	0.264	-0.2037
3	5.400	1.673	0.777	0.722	-0.1358
4	8.100	1.948	0.502	0.997	-0.0679
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333

Se.	X	Y (s)	Y (i)	Exce.	Pend.
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.240	2.210	-0.711	0.0000
13	32.750	0.264	2.186	-0.687	-0.0662
14	35.250	0.550	1.900	-0.401	-0.1200

Cable Numero 14

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Replanteo del cable : 14

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	0.550	1.900	-0.401	-0.1200
15	39.375	1.236	1.214	0.285	-0.2678
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
22	62.875	0.240	2.210	-0.711	0.0000
23	65.750	0.264	2.186	-0.687	-0.0662
24	68.250	0.550	1.900	-0.401	-0.1200

Cable Numero 15

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 33 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Replanteo del cable : 15

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	0.550	1.900	-0.401	-0.1200
25	72.375	1.236	1.214	0.285	-0.2678
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000

Cable Numero 16

efinicion general

Seccion inicial ..... = 33 (101.250) Pasiva
Seccion final ..... = 41 (120.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.850	-1.396	-.2891
27	109.200	-2.040	0.0000
28	118.650	-0.912	0.2387
29	120.650	-0.435	0.2387

Replanteo del cable : 16

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	101.250	0.550	1.900	-0.401	-0.1200
34	103.594	0.839	1.611	-0.112	-0.1620
35	105.938	1.421	1.029	0.470	-0.2888
36	108.282	1.974	0.476	1.023	-0.1361
37	110.626	2.014	0.436	1.063	0.0360
38	112.970	1.860	0.590	0.909	0.0952
39	115.314	1.568	0.882	0.617	0.1545
40	117.658	1.136	1.314	0.185	0.2137

Se.	X	Y (s)	Y (i)	Exce.	Pend.
32	97.125	0.240	2.210	-0.711	0.0000
33	101.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
41	120.000	0.590	1.860	-0.361	0.2384

Definicion esfuerzos unitarios cable : 1

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	1075.984	-37.822	1075.319	1181.747	-37.822	1075.319
---				-1.971	6.258	-4.701
2	1071.083	-31.564	1070.618			
---				-6.844	10.606	-5.573
3	1065.251	-20.959	1065.045			
---				-7.242	10.522	-5.651
4	1059.445	-10.436	1059.394			
---				-7.493	10.436	-5.729
5	1053.665	0.000	1053.665			
---				-18.792	46.198	-14.355
6	1040.336	46.198	1039.310			
---				-19.179	44.759	-16.130
7	1027.215	90.957	1023.180			
---				-16.840	43.104	-17.744
8	1014.334	134.061	1005.436			
---				-11.295	41.267	-19.177
9	1001.722	175.328	986.259			
---				-2.225	39.284	-20.410
10	989.405	214.612	965.849			
---				8.603	-214.612	-17.580
11	948.269	0.000	948.269			
---				102.719	-310.091	19.018
12	1015.776	-310.091	967.287			
---				161.922	145.697	75.342
13	1055.510	-164.394	1042.629			
---				-50.135	78.588	29.944
14	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 2

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	824.566	-65.755	821.940	911.531	-65.755	821.940
---				56.172	65.755	20.935
15	842.875	0.000	842.875			
---				5.749	0.000	4.392
16	847.267	0.000	847.267			
---				19.040	62.709	15.219
17	864.763	62.709	862.486			
---				9.834	61.661	10.641
18	881.940	124.370	873.127			
---				2.155	36.445	4.400
19	892.140	160.814	877.526			
---				-53.019	0.415	18.237
20	910.158	161.229	895.764			
---				13.687	-161.229	52.505
21	948.269	0.000	948.269			
---				102.719	-310.092	19.018
22	1015.777	-310.092	967.288			
---				161.921	145.698	75.342
23	1055.510	-164.394	1042.629			
---				-50.135	78.588	29.944
24	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

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Definicion esfuerzos unitarios cable : 3

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	824.566	-65.755	821.940	911.531	-65.755	821.940
---				56.172	65.755	20.935
25	842.875	0.000	842.875			
---				5.749	0.000	4.392
26	847.267	0.000	847.267			
---				19.040	62.709	15.219
27	864.763	62.709	862.486			
---				9.834	61.661	10.641
28	881.940	124.370	873.127			
---				2.155	36.445	4.400
29	892.140	160.814	877.527			
---				-53.019	0.414	18.237
30	910.158	161.229	895.764			
---				13.687	-161.229	52.505
31	948.269	0.000	948.269			
---				320.264	-301.878	28.228
32	1022.095	-301.878	976.497			
---				-87.401	216.072	96.076
33	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 4

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	33	911.513	-72.689	908.610	1007.648	-72.689	908.610
---					41.574	28.191	10.582
	34	920.268	-44.498	919.192			
---					-18.186	44.498	13.222
	35	932.414	0.000	932.414			
---					3.610	0.000	2.758
	36	935.172	0.000	935.172			
---					7.176	4.865	3.775
	37	938.959	4.865	938.946			
---					5.714	8.086	4.393
	38	943.428	12.952	943.339			
---					5.519	8.196	4.350
	39	947.925	21.148	947.690			
---					5.238	8.306	4.306
	40	952.451	29.454	951.996			
---					1.603	3.794	3.465
	41	956.040	33.248	955.461	-1050.113	-33.248	-955.461

Definicion esfuerzos unitarios cable : 5

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.935	-127.237	1068.385	640.107	-127.237	1068.385
---					7.293	21.272	-5.550
	2	1068.104	-105.965	1062.835			
---					-8.367	35.878	-8.041
	3	1057.120	-70.087	1054.794			
---					-11.160	35.358	-9.149
	4	1046.221	-34.729	1045.645			
---					-13.384	34.729	-10.221
	5	1035.424	0.000	1035.424			
---					-18.466	45.398	-14.106
	6	1022.326	45.398	1021.317			
---					-18.847	43.984	-15.851
	7	1009.432	89.382	1005.467			
---					-16.549	42.358	-17.437
	8	996.774	131.740	988.030			
---					-11.100	40.553	-18.844
	9	984.380	172.293	969.185			
---					-2.187	38.604	-20.057
	10	972.276	210.896	949.128			
---					-31.115	-210.896	63.313
	11	1012.441	0.000	1012.441			
---					35.496	-174.782	25.295
	12	1052.351	-174.782	1037.735			
---					49.661	22.631	18.674
	13	1067.310	-152.151	1056.410			
---					-19.768	23.950	11.926
	14	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 6

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	873.075	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.134
15	881.336	-87.406	876.991			
				60.098	87.406	27.613
16	904.604	0.000	904.604			
				20.329	66.952	16.249
17	923.283	66.952	920.853			
				10.500	65.834	11.361
18	941.623	132.786	932.213			
				2.301	38.911	4.697
19	952.513	171.697	936.911			
				-56.607	0.443	19.471
20	971.750	172.140	956.382			
				14.613	-172.140	56.058
21	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
22	1052.351	-174.782	1037.735			
				49.661	22.631	18.674
23	1067.310	-152.151	1056.410			
				-19.768	23.950	11.926
24	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 7

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	873.076	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.135
25	881.336	-87.406	876.991			
				60.098	87.406	27.613
26	904.604	0.000	904.604			
				20.329	66.953	16.249
27	923.283	66.953	920.853			
				10.500	65.834	11.361
28	941.623	132.786	932.213			
				2.301	38.911	4.697
29	952.513	171.697	936.911			
				-56.607	0.442	19.472
30	971.750	172.140	956.382			
				14.613	-172.140	56.058
31	1012.441	0.000	1012.441			
				128.281	-188.816	27.539
32	1056.981	-188.816	1039.980			
				-34.519	60.616	28.356
33	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 8

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	33	888.571	-105.869	882.242	528.463	-105.869	882.242
---					2.752	0.308	2.820
	34	891.334	-105.561	885.061			
---					16.039	21.447	9.665
	35	898.671	-84.114	894.726			
---					28.246	53.658	17.593
	36	912.828	-30.456	912.320			
---					3.055	46.750	12.919
	37	925.382	16.295	925.238			
---					9.608	27.156	7.527
	38	933.777	43.451	932.765			
---					7.929	27.562	6.792
	39	942.238	71.013	939.558			
---					5.979	27.903	6.038
	40	950.755	98.916	945.596			
---					-4.935	12.210	3.950
	41	956.026	111.127	949.546	-568.811	-111.127	-949.546

Definicion esfuerzos unitarios cable : 9

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.903	-176.333	1061.355	105.157	-176.333	1061.355
---					14.326	29.458	-5.022
	2	1066.495	-146.876	1056.333			
---					-5.806	49.762	-8.117
	3	1052.705	-97.113	1048.216			
---					-9.950	49.060	-10.309
	4	1039.019	-48.054	1037.907			
---					-13.546	48.054	-12.429
	5	1025.478	0.000	1025.478			
---					-15.216	44.962	-13.971
	6	1012.506	44.962	1011.507			
---					-15.213	43.561	-15.698
	7	999.736	88.523	995.809			
---					-12.590	41.951	-17.270
	8	987.199	130.474	978.539			
---					-6.887	40.163	-18.663
	9	974.925	170.638	959.875			
---					0.527	41.589	-4.758
	10	978.412	212.227	955.118			
---					-51.759	-212.227	72.757
	11	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	12	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	13	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	14	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 10

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	877.318	-147.035	864.909	85.626	-147.035	864.909
				38.967	25.865	14.520
15	887.738	-121.169	879.429			
				72.457	121.169	38.965
16	918.394	0.000	918.394			
				17.010	67.973	16.497
17	937.359	67.973	934.891			
				8.122	66.837	11.534
18	955.978	134.810	946.425			
				1.287	39.504	4.769
19	967.034	174.314	951.194			
				-61.819	0.450	19.768
20	986.565	174.764	970.962			
				2.315	-174.764	56.913
21	1027.875	0.000	1027.875			
				-17.222	-66.351	15.473
22	1045.456	-66.351	1043.348			
				-13.345	-94.320	13.192
23	1068.687	-160.671	1056.540			
				18.427	-19.662	4.241
24	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 11

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	877.318	-147.035	864.909	85.626	-147.035	864.909
				38.967	25.865	14.520
25	887.738	-121.169	879.429			
				72.457	121.169	38.965
26	918.394	0.000	918.394			
				17.010	67.973	16.497
27	937.359	67.973	934.891			
				8.122	66.837	11.534
28	955.978	134.810	946.425			
				1.287	39.504	4.769
29	967.034	174.315	951.194			
				-61.819	0.449	19.768
30	986.565	174.764	970.962			
				2.315	-174.764	56.913
31	1027.875	0.000	1027.875			
				-34.027	-103.929	21.860
32	1054.867	-103.929	1049.735			
				69.219	-76.403	11.046
33	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 12

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	33	871.172	-146.005	858.850	85.026	-146.005	858.850
---					2.604	1.107	3.145
	34	874.089	-144.897	861.995			
---					17.739	31.641	14.419
	35	883.702	-113.256	876.415			
---					32.721	72.521	24.629
	36	901.964	-40.735	901.043			
---					-0.069	63.294	16.660
	37	917.981	22.559	917.703			
---					9.249	37.669	8.868
	38	928.527	60.228	926.572			
---					6.597	38.244	7.407
	39	939.156	98.472	933.979			
---					3.807	38.638	5.915
	40	949.842	137.111	939.894			
---					-9.803	16.688	3.654
	41	956.000	153.798	943.548	-93.364	-153.798	-943.548

Definicion esfuerzos unitarios cable : 13

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.937	-253.474	1045.654	-377.335	-253.474	1045.654
---					23.632	41.080	-3.052
	2	1064.016	-212.394	1042.603			
---					-3.399	71.657	-6.305
	3	1045.811	-140.737	1036.298			
---					-9.964	71.117	-11.001
	4	1027.657	-69.620	1025.296			
---					-16.997	69.620	-15.608
	5	1009.689	0.000	1009.689			
---					-14.981	44.270	-13.756
	6	996.916	44.270	995.933			
---					-14.978	42.891	-15.457
	7	984.343	87.160	980.476			
---					-12.396	41.305	-17.004
	8	971.999	128.466	963.473			
---					-0.804	42.425	-2.175
	9	976.369	170.891	961.297			
---					-0.411	43.530	3.691
	10	988.524	214.420	964.989			
---					-52.294	-214.420	73.509
	11	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	12	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	13	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	14	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 14

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	14	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.361
	15	871.498	-225.421	841.840			
---					305.216	225.421	86.046
	16	927.886	0.000	927.886			
---					17.185	68.676	16.667
	17	947.046	68.676	944.553			
---					8.206	67.528	11.653
	18	965.858	136.204	956.206			
---					1.300	39.912	4.818
	19	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	20	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	21	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	22	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	23	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	24	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 15

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.362
	25	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	26	927.886	0.000	927.886			
---					17.185	68.676	16.667
	27	947.046	68.676	944.553			
---					8.206	67.528	11.653
	28	965.858	136.204	956.206			
---					1.300	39.912	4.818
	29	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	30	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	31	1038.498	0.000	1038.498			
---					-3.848	0.000	5.412
	32	1043.910	0.000	1043.910			
---					49.404	-128.200	24.426
	33	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 16

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
33	809.816	-96.486	804.048	-322.423	-96.486	804.048
				-35.063	-34.546	4.675
34	819.269	-131.032	808.723			
				44.097	-102.844	1.028
35	842.849	-233.876	809.750			
				90.881	116.292	53.918
36	871.635	-117.584	863.668			
				-20.300	150.216	41.984
37	906.240	32.632	905.652			
				10.661	54.625	10.443
38	920.241	87.257	916.095			
				5.810	55.364	7.284
39	934.329	142.621	923.380			
				1.790	55.539	4.113
40	948.425	198.160	927.493			
				-15.892	23.581	2.487
41	956.050	221.741	929.980	335.671	-221.741	-929.980

Cable Numero 1

Definicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	120.000	-2.300	0.0000

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
13	32.750	2.300	0.150	1.349	0.0000
14	35.250	2.300	0.150	1.349	0.0000
15	39.375	2.300	0.150	1.349	0.0000
16	43.500	2.300	0.150	1.349	0.0000
17	47.625	2.300	0.150	1.349	0.0000
18	51.750	2.300	0.150	1.349	0.0000
19	54.250	2.300	0.150	1.349	0.0000

Cable Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	120.000	-2.300	0.0000

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
23	65.750	2.300	0.150	1.349	0.0000
24	68.250	2.300	0.150	1.349	0.0000
25	72.375	2.300	0.150	1.349	0.0000
26	76.500	2.300	0.150	1.349	0.0000
27	80.625	2.300	0.150	1.349	0.0000
28	84.750	2.300	0.150	1.349	0.0000
29	87.250	2.300	0.150	1.349	0.0000

Definicion esfuerzos unitarios cable : 1

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
13	598.000	0.000	598.000	806.702	0.000	598.000
14	596.119	0.000	596.119	-2.537	0.000	-1.881
15	593.029	0.000	593.029	-4.169	0.000	-3.090
16	589.955	0.000	589.955	-4.147	0.000	-3.074
17	593.029	0.000	593.029	4.147	0.000	3.074
18	596.119	0.000	596.119	4.169	0.000	3.090
19	598.000	0.000	598.000	2.537	0.000	1.881
				-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 2

Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
23	598.000	0.000	598.000	806.702	0.000	598.000
---				-2.537	0.000	-1.881
24	596.119	0.000	596.119			
---				-4.169	0.000	-3.090
25	593.029	0.000	593.029			
---				-4.147	0.000	-3.074
26	589.955	0.000	589.955			
---				4.147	0.000	3.074
27	593.029	0.000	593.029			
---				4.169	0.000	3.090
28	596.119	0.000	596.119			
---				2.537	0.000	1.881
29	598.000	0.000	598.000	-806.702	0.000	-598.000

Coeficientes para perdidas de pretensado

Coef. de retraccion del hormigon ..... = 0.0003
Coef. de relajacion del acero ..... = 0.0600
Coef. de fluencia del hormigon ..... = 2.5000

Coef. medio de perdidas elasticas instantaneas ..... = 0.9904 (1.0%)
Coef. medio de perdidas en estado inicial ..... = 0.9581 (4.2%)
Coef. medio de perdidas diferidas inicial ..... = 0.9490 (5.1%)
Coef. medio de perdidas diferidas ..... = 0.8605 (14.0%)
Coef. medio de perdidas totales ..... = 0.8522 (14.8%)

Coef. de ponderacion maximo del pretensado ..... = 1.1000
Coef. de ponderacion minimo del pretensado ..... = 0.9000
Coef. de ponderacion para perdidas en estado inicial . = 0.3000

Comprobacion de tensiones

Estado 1 Pretensado de 1076. tn Familia 1
Estado 2 Pretensado de 1076. tn Familia 2
Estado 3 Pretensado de 1076. tn Familia 3
Estado 4 Pretensado de 956. tn Familia 4
Estado 5 Pretensado de 1076. tn Familia 1
Estado 6 Pretensado de 1076. tn Familia 2
Estado 7 Pretensado de 1076. tn Familia 3
Estado 8 Pretensado de 956. tn Familia 4
Estado 9 Pretensado de 1076. tn Familia 1
Estado 10 Pretensado de 1076. tn Familia 2
Estado 11 Pretensado de 1076. tn Familia 3
Estado 12 Pretensado de 956. tn Familia 4
Estado 13 Pretensado de 1076. tn Familia 1
Estado 14 Pretensado de 1076. tn Familia 2
Estado 15 Pretensado de 1076. tn Familia 3
Estado 16 Pretensado de 956. tn Familia 4
Estado 1 Pretensado de 598. tn (Refuerzo)
Estado 2 Pretensado de 598. tn (Refuerzo)

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9490

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1470.60	518.2	-4033.8	25.13	77.90
		2	-2785.25	425.2	-4016.4	6.63	106.57
	2	2	-2785.25	425.2	-4016.4	6.63	106.57
		3	-3694.93	265.8	-3989.8	-6.34	126.24
	3	3	-3694.93	265.8	-3989.8	-6.34	126.24
		4	-4163.57	108.2	-3955.5	-13.26	136.14
	4	4	-4163.57	108.2	-3955.5	-13.26	136.14
		5	-4198.43	-46.3	-3913.8	-14.22	136.43
	5	5	-4198.43	-46.3	-3913.8	-14.22	136.43
		6	-3777.79	-217.9	-3860.5	-8.96	126.59
	6	6	-3777.79	-217.9	-3860.5	-8.96	126.59
		7	-2900.33	-384.1	-3800.6	2.58	106.65
	7	7	-2900.33	-384.1	-3800.6	2.58	106.65
		8	-1591.62	-544.2	-3734.6	20.06	77.17
	8	8	-1591.62	-544.2	-3734.7	20.06	77.17
		9	117.02	-700.3	-3678.8	43.23	39.03
	9	9	117.02	-700.3	-3678.8	43.23	39.03
		10	2220.64	-855.0	-3639.4	72.08	-7.60
	10	10	2220.64	-855.0	-3639.4	72.08	-7.60
		11	3557.41	-46.3	-3821.6	92.76	-34.88
2	11	11	3557.42	-10.1	-3821.6	92.76	-34.88
		12	2722.14	513.0	-3881.9	81.81	-15.86
	12	12	2722.14	513.0	-3881.9	81.81	-15.86
		13	1147.03	509.3	-3998.9	61.20	20.04
	13	13	381.50	509.3	-4566.4	56.95	43.26
		14	-859.60	485.8	-4617.8	40.25	71.09
	14	14	-551.52	385.7	-3781.9	35.09	54.88
		15	-2198.77	401.8	-3828.3	12.67	91.56
	15	15	-2198.77	401.8	-3828.3	12.67	91.56
		16	-3423.62	-10.1	-3974.4	-2.74	120.11
	16	16	-3423.62	-10.1	-3974.4	-2.74	120.11
		17	-2934.58	-262.8	-4038.6	4.80	110.10
	17	17	-2934.58	-262.8	-4038.6	4.80	110.10
		18	-1376.78	-511.3	-4084.5	27.01	76.41
	18	18	-1376.78	-511.3	-4084.5	27.01	76.41
		19	75.94	-658.2	-4104.0	47.47	44.74
	19	19	841.48	-658.2	-3536.5	51.71	21.52
		20	2958.07	-659.8	-3610.0	82.02	-24.12
	20	20	2958.07	-659.8	-3610.0	82.02	-24.12
		21	3889.79	-10.1	-3821.6	97.39	-42.18
3	21	21	3889.79	8.2	-3821.6	97.39	-42.18
		22	3001.92	531.3	-3881.9	85.71	-22.01
	22	22	3001.92	531.3	-3881.9	85.71	-22.01
		23	1374.21	527.6	-3998.9	64.36	15.05
	23	23	608.67	527.6	-4566.4	60.12	38.28
		24	-678.17	504.1	-4617.8	42.77	67.11
	24	24	-370.08	404.0	-3781.9	37.61	50.89
		25	-2092.81	420.1	-3828.3	14.14	89.24

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9490

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-2092.81	420.1	-3828.3	14.14	89.24
		26	-3393.12	8.2	-3974.4	-2.32	119.44
	26	26	-3393.12	8.2	-3974.4	-2.32	119.44
		27	-2979.56	-244.5	-4038.6	4.17	111.08
	27	27	-2979.56	-244.5	-4038.6	4.17	111.08
		28	-1497.23	-493.0	-4084.5	25.34	79.06
	28	28	-1497.23	-493.0	-4084.5	25.34	79.06
		29	-90.24	-639.9	-4104.0	45.15	48.39
	29	29	675.30	-639.9	-3536.5	49.40	25.17
		30	2739.29	-641.5	-3610.0	78.98	-19.31
	30	30	2739.29	-641.5	-3610.0	78.98	-19.31
		31	3618.41	8.2	-3821.6	93.61	-36.22
4	31	31	3618.41	48.5	-3821.6	93.61	-36.22
		32	1864.64	612.8	-3900.4	70.08	3.17
	32	32	1864.64	612.8	-3900.4	70.08	3.17
		33	-519.03	544.4	-4052.1	38.59	57.22
	33	33	-322.29	448.1	-3277.5	32.57	44.14
		34	-1389.40	452.8	-3297.6	17.94	67.79
	34	34	-1389.40	452.8	-3297.6	17.94	67.79
		35	-2513.24	457.8	-3334.0	2.70	92.88
	35	35	-2513.24	457.8	-3334.0	2.70	92.88
		36	-3464.13	227.7	-3427.9	-9.48	114.81
	36	36	-3464.13	227.7	-3427.9	-9.48	114.81
		37	-3693.32	-23.9	-3499.4	-11.87	120.65
	37	37	-3693.32	-23.9	-3499.4	-11.87	120.65
		38	-3528.86	-144.9	-3529.0	-9.24	117.38
	38	38	-3528.86	-144.9	-3529.0	-9.24	117.38
		39	-3069.77	-267.7	-3553.5	-2.57	107.58
	39	39	-3069.77	-267.7	-3553.5	-2.57	107.58
		40	-2313.20	-391.4	-3572.9	8.19	91.19
	40	40	-2313.20	-391.4	-3572.9	8.19	91.19
		41	-1306.37	-444.8	-3585.7	22.35	69.23

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8522

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1320.67	438.7	-3622.6	22.57	69.96
		2	-2429.21	355.1	-3606.9	6.95	94.12
	2	2	-2429.21	355.1	-3606.9	6.95	94.12
		3	-3174.05	212.0	-3583.1	-3.69	110.20
	3	3	-3174.05	212.0	-3583.1	-3.69	110.20
		4	-3522.82	70.5	-3552.3	-8.90	117.51
	4	4	-3522.82	70.5	-3552.3	-8.90	117.51
		5	-3482.02	-68.3	-3514.8	-8.75	116.19
	5	5	-3482.02	-68.3	-3514.8	-8.75	116.19
		6	-3032.17	-222.4	-3466.9	-3.03	105.77
	6	6	-3032.17	-222.4	-3466.9	-3.03	105.77
		7	-2172.07	-371.7	-3413.1	8.34	86.28
	7	7	-2172.07	-371.7	-3413.1	8.34	86.28
		8	-924.68	-515.5	-3353.9	25.05	58.23
	8	8	-924.68	-515.5	-3353.9	25.05	58.23
		9	681.87	-655.6	-3303.8	46.86	22.39
	9	9	681.87	-655.6	-3303.8	46.86	22.39
		10	2643.13	-794.5	-3268.4	73.77	-21.07
	10	10	2643.13	-794.5	-3268.4	73.77	-21.07
		11	3915.72	-68.3	-3432.0	93.35	-47.15
2	11	11	3915.72	11.1	-3432.0	93.35	-47.15
		12	3107.65	480.9	-3486.1	82.71	-28.80
	12	12	3107.65	480.9	-3486.1	82.71	-28.80
		13	1635.16	477.6	-3591.2	63.39	4.71
	13	13	1004.10	477.6	-4059.0	59.89	23.86
		14	-161.05	456.4	-4105.4	44.18	49.96
	14	14	115.63	366.6	-3354.7	39.55	35.40
		15	-1447.13	381.0	-3396.5	18.25	70.18
	15	15	-1447.13	381.0	-3396.5	18.25	70.18
		16	-2630.55	11.1	-3527.9	3.26	97.65
	16	16	-2630.55	11.1	-3527.9	3.26	97.65
		17	-2274.23	-215.8	-3585.4	8.87	90.47
	17	17	-2274.23	-215.8	-3585.4	8.87	90.47
		18	-958.11	-439.0	-3626.4	27.66	62.04
	18	18	-958.11	-439.0	-3626.4	27.66	62.04
		19	296.30	-570.9	-3643.7	45.33	34.70
	19	19	927.36	-570.9	-3175.9	48.83	15.56
		20	2770.21	-572.4	-3242.0	75.24	-24.16
	20	20	2770.21	-572.4	-3242.0	75.24	-24.16
		21	3548.99	11.1	-3432.0	88.24	-39.10
3	21	21	3548.99	-2.3	-3432.0	88.24	-39.10
		22	2779.62	467.4	-3486.1	78.14	-21.60
	22	22	2779.62	467.4	-3486.1	78.14	-21.60
		23	1345.83	464.1	-3591.2	59.36	11.07
	23	23	714.77	464.1	-4059.0	55.86	30.21
		24	-416.73	443.0	-4105.4	40.62	55.57
	24	24	-140.05	353.1	-3354.7	35.99	41.01
		25	-1647.30	367.5	-3396.5	15.47	74.57

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8522

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-1647.30	367.5	-3396.5	15.47	74.57
		26	-2775.19	-2.3	-3527.9	1.24	100.82
	26	26	-2775.19	-2.3	-3527.9	1.24	100.82
		27	-2363.35	-229.3	-3585.4	7.63	92.43
	27	27	-2363.35	-229.3	-3585.4	7.63	92.43
		28	-991.71	-452.5	-3626.4	27.20	62.78
	28	28	-991.70	-452.5	-3626.4	27.20	62.78
		29	296.35	-584.4	-3643.7	45.33	34.70
	29	29	927.41	-584.4	-3176.0	48.83	15.55
		30	2808.97	-585.9	-3242.0	75.78	-25.01
	30	30	2808.97	-585.9	-3242.0	75.78	-25.01
		31	3626.44	-2.3	-3432.0	89.32	-40.80
4	31	31	3626.44	57.6	-3432.0	89.32	-40.80
		32	1993.88	564.3	-3502.8	67.38	-4.16
	32	32	1993.88	564.3	-3502.8	67.38	-4.16
		33	-204.37	502.9	-3639.0	38.31	45.64
	33	33	-27.69	416.4	-2943.4	32.90	33.89
		34	-1018.73	420.6	-2961.5	19.30	55.85
	34	34	-1018.73	420.6	-2961.5	19.30	55.85
		35	-2060.71	425.1	-2994.1	5.16	79.10
	35	35	-2060.71	425.1	-2994.1	5.16	79.10
		36	-2947.39	218.4	-3078.4	-6.24	99.52
	36	36	-2947.39	218.4	-3078.4	-6.24	99.52
		37	-3185.94	-7.5	-3142.6	-8.84	105.48
	37	37	-3185.94	-7.5	-3142.6	-8.84	105.48
		38	-3070.96	-116.2	-3169.2	-6.93	103.26
	38	38	-3070.96	-116.2	-3169.2	-6.93	103.26
		39	-2691.40	-226.5	-3191.3	-1.40	95.17
	39	39	-2691.40	-226.5	-3191.3	-1.40	95.17
		40	-2044.68	-337.6	-3208.6	7.81	81.17
	40	40	-2044.68	-337.6	-3208.6	7.81	81.17
		41	-1173.19	-385.5	-3220.2	20.07	62.17

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO-I E-3

FECHA

HOJA N.º

COMPROBACION DE TENSIONES

A las tensiones obtenidas mediante el programa de viga continua se sumau las producidas por el gradiente térmico y las fuerzas longitudinales reológicas

Las tensiones pésiuas se obtienen en las juntas de construcciou en las fases intermedias. Para reducir las tracciones en la zona del anclaje pasivo se tesau los cables al 80% y se anclau al 75%, consiguiendo reducir las pérdidas en esta zona.

Las tracciones son inferiores a la resistencia a tracción del hormigón : $0.45 * \sqrt[3]{350^2} = 22.4 kg/cm^2$ en todas las secciones en estudio

A continuación se adjunta :

- Tensiones en construcción y servicio producidas por las sobrecargas + peso propio + c.permanente
- Tensiones producidas por el gradiente térmico, fuerzas longitudinales reológicas y axiles producidas por el frenado.
- Tensiones totales, obtenidas a tracciones y armaduras resultantes con los cables tesados y anclados al 75%
- Tensiones totales, obtenidas a tracciones y armaduras resultantes con los cables tesados al 80%

Tensiones en Construccion (kg/cm2) Estado 1

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	5.	114.	6.	125.	9.	-14.	15.	111.
	3	-10.	137.	-11.	151.	16.	-25.	4.	126.
	4	-19.	151.	-21.	166.	20.	-32.	-1.	134.
	5	-22.	154.	-24.	169.	23.	-36.	-2.	134.
	6	-18.	146.	-20.	161.	23.	-36.	2.	125.
	7	-8.	128.	-9.	141.	20.	-32.	11.	109.
	8	8.	101.	9.	111.	16.	-25.	25.	85.
	9	31.	64.	34.	70.	9.	-15.	43.	55.
	10	59.	18.	65.	20.	1.	-1.	65.	19.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
2	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 2

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	7.	-12.	15.	111.
	3	-7.	132.	-7.	145.	13.	-20.	5.	125.
	4	-14.	142.	-15.	156.	16.	-25.	0.	132.
	5	-15.	142.	-16.	156.	16.	-26.	0.	131.
	6	-9.	132.	-10.	145.	15.	-23.	5.	122.
	7	3.	111.	3.	122.	11.	-17.	14.	105.
	8	21.	80.	23.	88.	5.	-8.	28.	80.
	9	45.	40.	50.	44.	-3.	5.	47.	49.
	10	76.	-8.	83.	-9.	-13.	21.	70.	12.
	11	97.	-37.	107.	-41.	-26.	41.	81.	0.
2	1	97.	-37.	107.	-41.	-26.	41.	81.	0.
	2	84.	-14.	92.	-15.	-11.	18.	81.	3.
	3	60.	27.	66.	29.	1.	-1.	67.	28.
	4	38.	50.	42.	55.	9.	-14.	51.	41.
	5	9.	85.	10.	93.	19.	-30.	29.	64.
	6	-10.	119.	-11.	131.	23.	-37.	13.	94.
	7	-5.	113.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	39.	58.	11.	-17.	49.	40.
	10	65.	8.	71.	9.	1.	-2.	73.	6.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
3	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 3

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	6.	112.	7.	123.	8.	-12.	15.	111.
	3	-8.	133.	-8.	147.	13.	-21.	5.	125.
	4	-15.	144.	-17.	159.	17.	-26.	0.	132.
	5	-17.	145.	-18.	160.	18.	-28.	0.	132.
	6	-12.	136.	-13.	149.	17.	-27.	4.	123.
	7	0.	116.	0.	127.	14.	-21.	14.	106.
	8	18.	86.	19.	94.	8.	-13.	28.	81.
	9	41.	47.	46.	51.	0.	-1.	46.	51.
	10	71.	-1.	78.	-2.	-10.	15.	69.	14.
	11	92.	-29.	101.	-32.	-22.	34.	80.	2.
2	1	92.	-29.	101.	-32.	-22.	34.	80.	2.
	2	81.	-9.	89.	-10.	-9.	14.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	8.	-13.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	5.	98.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	31.	70.	6.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-18.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
3	1	97.	-36.	106.	-40.	-26.	40.	81.	0.
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-1.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	95.
	7	-5.	114.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
4	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	57.	29.	63.	32.	-3.	4.	60.	36.
	3AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	17.	-26.	0.	132.
	5	-16.	145.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	17.	-26.	4.	122.
	7	1.	115.	1.	126.	13.	-21.	14.	105.
	8	19.	84.	20.	93.	8.	-12.	28.	81.
	9	42.	45.	47.	50.	0.	0.	46.	50.
	10	72.	-3.	79.	-3.	-10.	16.	69.	13.
	11	93.	-31.	103.	-34.	-23.	36.	80.	1.
2	1	93.	-31.	103.	-34.	-23.	36.	80.	1.
	2	81.	-10.	90.	-11.	-9.	15.	80.	3.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	88.	16.	-26.	29.	63.
	6	-5.	111.	-5.	122.	19.	-30.	14.	93.
	7	2.	102.	3.	112.	16.	-25.	19.	87.
	8	25.	68.	27.	74.	8.	-13.	36.	61.
	9	46.	35.	50.	39.	1.	-2.	51.	37.
	10	77.	-12.	85.	-13.	-10.	15.	75.	3.
	11	93.	-30.	102.	-33.	-23.	36.	79.	4.
3	1	93.	-30.	102.	-33.	-23.	36.	79.	4.
	2	81.	-9.	89.	-10.	-10.	15.	79.	5.
	3	59.	28.	65.	31.	1.	-2.	66.	29.
	4	39.	50.	43.	54.	9.	-14.	51.	41.
	5	12.	80.	13.	88.	17.	-27.	30.	61.
	6	-4.	111.	-5.	122.	20.	-31.	15.	90.
	7	3.	101.	4.	111.	18.	-28.	21.	83.
	8	26.	66.	29.	73.	10.	-16.	39.	57.
	9	47.	33.	52.	37.	3.	-5.	55.	32.
	10	78.	-14.	86.	-15.	-7.	11.	79.	-4.
	11	94.	-32.	104.	-36.	-20.	32.	83.	-4.
4	1	94.	-32.	104.	-36.	-20.	32.	83.	-4.
	2	70.	8.	77.	9.	-3.	4.	74.	13.
	3	35.	57.	38.	62.	10.	-15.	48.	47.
	4	17.	74.	18.	81.	14.	-22.	32.	59.
	5	1.	100.	1.	110.	17.	-27.	18.	83.
	6	-11.	122.	-13.	134.	19.	-29.	6.	105.
	7	-14.	128.	-15.	141.	18.	-29.	3.	112.
	8	-11.	124.	-12.	136.	16.	-25.	5.	111.
	9	-3.	113.	-4.	125.	12.	-20.	9.	105.
	10	8.	96.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado ultimo

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	8.	-12.	15.	110.
	3	-7.	132.	-7.	145.	13.	-21.	6.	124.
	4	-14.	142.	-15.	156.	17.	-26.	1.	130.
	5	-15.	142.	-16.	157.	18.	-28.	1.	129.
	6	-9.	132.	-10.	145.	17.	-26.	6.	119.
	7	3.	111.	3.	122.	13.	-21.	16.	102.
	8	21.	81.	23.	89.	8.	-12.	31.	77.
	9	45.	41.	50.	45.	0.	0.	49.	45.
	10	75.	-8.	83.	-9.	-10.	16.	72.	7.
	11	97.	-36.	106.	-40.	-23.	36.	84.	-5.
2	1	97.	-36.	106.	-40.	-23.	36.	84.	-5.
	2	85.	-17.	94.	-18.	-9.	15.	85.	-3.
	3	62.	33.	68.	36.	1.	-2.	69.	34.
	4	39.	66.	43.	72.	9.	-13.	52.	59.
	5	13.	96.	15.	105.	16.	-26.	31.	80.
	6	-3.	125.	-3.	138.	19.	-30.	16.	108.
	7	5.	115.	6.	126.	16.	-25.	22.	101.
	8	28.	80.	31.	88.	8.	-13.	39.	75.
	9	52.	35.	57.	38.	1.	-2.	58.	36.
	10	86.	-25.	94.	-28.	-10.	15.	84.	-12.
	11	102.	-44.	112.	-48.	-23.	36.	89.	-12.
3	1	102.	-44.	112.	-48.	-23.	36.	89.	-12.
	2	89.	-23.	98.	-25.	-10.	15.	89.	-10.
	3	65.	28.	71.	31.	1.	-2.	73.	28.
	4	42.	62.	46.	68.	9.	-14.	55.	54.
	5	15.	93.	16.	102.	17.	-27.	33.	76.
	6	-2.	125.	-3.	137.	20.	-31.	17.	106.
	7	4.	116.	5.	128.	18.	-28.	22.	100.
	8	26.	83.	29.	91.	10.	-16.	39.	75.
	9	49.	38.	54.	42.	3.	-5.	57.	37.
	10	82.	-20.	91.	-22.	-7.	11.	83.	-11.
	11	98.	-38.	107.	-42.	-20.	32.	87.	-10.
4	1	98.	-38.	107.	-42.	-20.	32.	87.	-10.
	2	73.	3.	80.	4.	-3.	4.	78.	8.
	3	37.	53.	41.	58.	10.	-15.	50.	43.
	4	19.	71.	21.	78.	14.	-22.	35.	55.
	5	3.	97.	3.	107.	17.	-27.	20.	80.
	6	-10.	120.	-11.	132.	19.	-29.	8.	103.
	7	-12.	126.	-14.	139.	18.	-29.	5.	110.
	8	-10.	123.	-11.	135.	16.	-25.	6.	109.
	9	-3.	112.	-3.	124.	12.	-20.	9.	104.
	10	9.	95.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	28.	86.	28.	86.	28.	86.	28.	86.	28.	86.
	2	19.	99.	31.	80.	16.	103.	24.	92.	18.	101.
	3	12.	108.	34.	74.	7.	116.	21.	95.	10.	112.
	4	9.	112.	37.	68.	2.	124.	21.	94.	6.	117.
	5	10.	110.	41.	61.	0.	126.	22.	90.	6.	116.
	6	14.	102.	45.	53.	1.	122.	26.	83.	9.	110.
	7	21.	89.	49.	45.	6.	113.	32.	71.	15.	98.
	8	32.	70.	53.	36.	14.	98.	40.	56.	24.	81.
	9	45.	47.	58.	27.	25.	79.	50.	39.	37.	60.
	10	62.	19.	68.	10.	37.	59.	64.	16.	52.	35.
	11	66.	19.	72.	8.	25.	83.	68.	15.	50.	44.
2	1	66.	19.	72.	8.	25.	83.	68.	15.	50.	44.
	2	73.	9.	77.	2.	51.	44.	75.	6.	64.	23.
	3	64.	36.	74.	21.	50.	59.	68.	30.	59.	45.
	4AI	55.	62.	73.	33.	42.	82.	62.	50.	49.	70.
	4AD	49.	44.	67.	15.	36.	64.	56.	33.	44.	52.
	5	36.	66.	66.	19.	24.	84.	48.	48.	31.	73.
	6	23.	92.	56.	38.	11.	110.	36.	70.	18.	99.
	7	27.	87.	58.	39.	14.	108.	39.	67.	22.	95.
	8	40.	68.	60.	36.	23.	94.	48.	55.	33.	79.
	9	54.	38.	64.	21.	35.	67.	58.	31.	46.	50.
	10	73.	0.	78.	-7.	47.	41.	75.	-3.	63.	17.
	11	70.	11.	75.	3.	26.	81.	72.	8.	53.	39.
3	1	70.	11.	75.	3.	26.	81.	72.	8.	53.	39.
	2	78.	2.	82.	-5.	51.	43.	79.	-1.	67.	19.
	3	68.	30.	79.	13.	49.	60.	72.	23.	61.	42.
	4AI	58.	57.	78.	25.	41.	83.	66.	44.	51.	67.
	4AD	52.	39.	72.	7.	36.	65.	60.	26.	45.	50.
	5	38.	63.	69.	14.	25.	84.	50.	43.	33.	71.
	6	24.	89.	58.	36.	12.	108.	38.	68.	20.	97.
	7	28.	85.	58.	39.	16.	104.	40.	67.	23.	93.
	8	40.	68.	58.	39.	27.	88.	47.	56.	35.	76.
	9	53.	38.	63.	24.	39.	61.	57.	32.	47.	48.
	10	72.	2.	76.	-5.	50.	37.	74.	-1.	63.	16.
	11	69.	14.	76.	3.	28.	78.	72.	10.	53.	39.
4	1	69.	14.	76.	3.	28.	78.	72.	10.	53.	39.
	2	70.	15.	77.	3.	48.	49.	73.	10.	61.	29.
	3AI	54.	44.	76.	10.	36.	72.	63.	31.	47.	56.
	3AD	48.	30.	70.	-5.	30.	58.	56.	16.	40.	41.
	4	39.	45.	66.	1.	23.	69.	50.	27.	33.	54.
	5	27.	65.	57.	16.	13.	86.	39.	45.	21.	73.
	6	16.	85.	47.	36.	5.	103.	28.	65.	11.	92.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	13.	92.	43.	45.	4.	106.	25.	73.	9.	97.
	8	13.	93.	39.	52.	6.	103.	23.	76.	10.	97.
	9	15.	90.	35.	59.	11.	97.	23.	78.	13.	93.
	10	19.	84.	30.	67.	17.	88.	24.	77.	18.	86.
	11	25.	76.	25.	76.	25.	76.	25.	76.	25.	76.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	25.	77.	25.	77.	25.	77.	25.	77.	25.	77.
	2	19.	86.	31.	67.	16.	90.	23.	79.	17.	88.
	3	14.	92.	36.	58.	9.	100.	23.	79.	12.	95.
	4	13.	94.	41.	50.	5.	106.	24.	76.	10.	98.
	5	14.	91.	45.	42.	4.	107.	26.	71.	10.	97.
	6	18.	83.	49.	34.	5.	103.	30.	64.	13.	91.
	7	24.	71.	52.	27.	9.	95.	36.	53.	18.	80.
	8	34.	54.	55.	20.	16.	83.	42.	41.	27.	66.
	9	45.	34.	58.	15.	25.	67.	50.	27.	37.	47.
	10	59.	12.	65.	2.	34.	51.	62.	8.	49.	27.
	11	62.	13.	68.	2.	21.	77.	64.	9.	45.	39.
2	1	62.	13.	68.	2.	21.	77.	64.	9.	45.	39.
	2	70.	2.	74.	-4.	47.	38.	71.	-1.	61.	16.
	3	62.	24.	72.	9.	48.	47.	66.	18.	57.	33.
	4AI	54.	46.	73.	17.	41.	66.	62.	35.	49.	54.
	4AD	49.	30.	68.	1.	36.	50.	56.	19.	44.	38.
	5	37.	50.	67.	3.	26.	68.	49.	31.	33.	57.
	6	25.	74.	58.	21.	13.	93.	38.	53.	20.	82.
	7	27.	72.	58.	24.	14.	93.	39.	53.	22.	81.
	8	36.	59.	56.	27.	20.	85.	44.	47.	29.	70.
	9	47.	36.	57.	19.	28.	66.	51.	29.	39.	48.
	10	62.	7.	66.	0.	35.	48.	63.	4.	51.	23.
	11	56.	22.	61.	14.	12.	91.	58.	18.	38.	50.
3	1	56.	22.	61.	14.	12.	91.	58.	18.	38.	50.
	2	65.	10.	69.	3.	38.	51.	67.	7.	54.	26.
	3	58.	31.	69.	14.	39.	61.	62.	24.	51.	43.
	4AI	50.	52.	71.	20.	34.	78.	58.	39.	44.	63.
	4AD	45.	36.	65.	4.	29.	62.	53.	23.	39.	47.
	5	34.	55.	65.	7.	21.	76.	47.	35.	29.	63.
	6	23.	77.	56.	24.	11.	96.	36.	56.	18.	85.
	7	26.	74.	55.	27.	14.	92.	38.	56.	21.	82.
	8	36.	60.	54.	31.	23.	80.	43.	48.	30.	68.
	9	47.	36.	56.	21.	32.	59.	50.	30.	41.	45.
	10	62.	6.	66.	0.	40.	41.	64.	3.	53.	20.
	11	57.	20.	64.	9.	17.	84.	60.	15.	41.	45.
4	1	57.	20.	64.	9.	17.	84.	60.	15.	41.	45.
	2	61.	16.	68.	5.	39.	50.	64.	11.	52.	30.
	3AI	49.	39.	71.	4.	31.	67.	58.	25.	42.	51.
	3AD	43.	26.	65.	-8.	25.	54.	52.	12.	36.	38.
	4	36.	38.	64.	-5.	20.	63.	47.	21.	30.	48.
	5	26.	55.	56.	7.	13.	76.	38.	36.	21.	64.
	6	16.	73.	48.	24.	5.	91.	29.	53.	12.	80.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	14.	79.	43.	32.	5.	93.	26.	60.	10.	85.
	8	14.	80.	40.	39.	7.	90.	24.	64.	11.	84.
	9	15.	78.	35.	48.	11.	85.	23.	66.	13.	81.
	10	18.	74.	29.	57.	16.	78.	23.	67.	17.	75.
	11	22.	68.	22.	68.	22.	68.	22.	68.	22.	68.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	23.	70.	23.	70.	23.	70.	23.	70.	23.	70.
	2	17.	78.	30.	59.	15.	82.	22.	70.	16.	80.
	3	14.	83.	35.	49.	9.	91.	22.	69.	12.	86.
	4	12.	85.	40.	41.	4.	97.	23.	67.	9.	89.
	5	13.	83.	44.	34.	2.	99.	25.	63.	9.	89.
	6	15.	77.	46.	28.	3.	97.	28.	57.	10.	85.
	7	21.	67.	48.	23.	5.	92.	32.	50.	14.	77.
	8	28.	54.	49.	20.	10.	83.	36.	41.	20.	66.
	9	37.	39.	49.	19.	16.	71.	41.	31.	28.	52.
	10	47.	21.	53.	12.	22.	60.	50.	17.	37.	37.
	11	47.	26.	54.	15.	7.	90.	50.	22.	31.	51.
2	1	47.	26.	54.	15.	7.	90.	50.	22.	31.	51.
	2	57.	12.	61.	6.	35.	47.	59.	9.	48.	26.
	3	53.	29.	62.	15.	38.	52.	56.	23.	47.	39.
	4AI	46.	48.	65.	19.	34.	68.	54.	36.	41.	56.
	4AD	42.	33.	60.	4.	29.	53.	49.	22.	37.	41.
	5	33.	48.	63.	1.	22.	66.	45.	29.	29.	55.
	6	23.	68.	57.	14.	11.	86.	37.	46.	19.	75.
	7	26.	65.	57.	17.	13.	86.	38.	45.	21.	73.
	8	34.	53.	55.	21.	18.	79.	42.	40.	28.	63.
	9	44.	31.	54.	14.	25.	61.	48.	24.	36.	43.
	10	57.	5.	61.	-2.	31.	46.	59.	2.	46.	21.
	11	51.	20.	56.	12.	7.	90.	53.	17.	33.	48.
3	1	51.	20.	56.	12.	7.	90.	53.	17.	33.	48.
	2	60.	6.	65.	-1.	34.	48.	62.	4.	50.	23.
	3	56.	25.	66.	8.	37.	54.	60.	18.	48.	37.
	4AI	49.	44.	69.	12.	33.	70.	57.	31.	43.	54.
	4AD	44.	29.	65.	-3.	28.	55.	53.	16.	38.	39.
	5	35.	45.	66.	-4.	22.	66.	48.	25.	30.	53.
	6	25.	65.	59.	12.	13.	84.	38.	44.	20.	73.
	7	27.	63.	57.	16.	16.	81.	39.	45.	22.	70.
	8	35.	52.	53.	23.	22.	72.	42.	41.	30.	60.
	9	44.	31.	53.	16.	29.	54.	48.	25.	38.	40.
	10	57.	5.	61.	-1.	34.	41.	58.	3.	48.	20.
	11	50.	21.	57.	10.	10.	85.	53.	17.	34.	47.
4	1	50.	21.	57.	10.	10.	85.	53.	17.	34.	47.
	2	56.	14.	63.	3.	34.	48.	59.	10.	47.	28.
	3AI	46.	33.	69.	-2.	29.	61.	55.	19.	39.	44.
	3AD	41.	21.	63.	-14.	23.	49.	50.	7.	34.	32.
	4	35.	31.	63.	-12.	20.	56.	46.	14.	29.	41.
	5	26.	46.	57.	-2.	13.	67.	38.	27.	21.	54.
	6	18.	62.	49.	13.	6.	80.	30.	42.	13.	69.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	15.	68.	45.	21.	6.	82.	27.	49.	12.	73.
	8	15.	69.	41.	28.	8.	80.	25.	53.	12.	73.
	9	16.	68.	35.	38.	11.	75.	23.	56.	14.	71.
	10	18.	66.	29.	49.	15.	69.	22.	59.	17.	67.
	11	20.	62.	20.	62.	20.	62.	20.	62.	20.	62.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4		Hipotesis 5	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	20.	63.	20.	63.	20.	63.	20.	63.	20.	63.
	2	17.	68.	29.	48.	15.	72.	22.	60.	16.	69.
	3	15.	70.	37.	36.	10.	78.	24.	57.	13.	73.
	4	15.	70.	42.	26.	7.	82.	26.	53.	12.	75.
	5	16.	68.	47.	19.	5.	84.	28.	48.	12.	74.
	6	18.	62.	49.	13.	6.	82.	31.	42.	13.	70.
	7	23.	54.	51.	10.	7.	78.	34.	36.	17.	63.
	8	29.	43.	50.	8.	11.	71.	37.	29.	22.	54.
	9	36.	30.	48.	10.	15.	62.	41.	22.	28.	43.
	10	44.	16.	50.	6.	19.	55.	47.	12.	34.	31.
	11	43.	22.	50.	12.	2.	86.	46.	18.	27.	48.
2	1	43.	22.	50.	12.	2.	86.	46.	18.	27.	48.
	2	53.	8.	57.	1.	31.	43.	55.	5.	44.	22.
	3	50.	21.	59.	7.	36.	44.	54.	15.	44.	30.
	4AI	45.	36.	64.	7.	33.	56.	53.	25.	40.	44.
	4AD	41.	23.	60.	-6.	28.	43.	49.	11.	36.	31.
	5	34.	36.	63.	-11.	22.	54.	46.	17.	29.	43.
	6	24.	55.	58.	1.	12.	73.	38.	33.	19.	62.
	7	25.	54.	56.	6.	12.	75.	37.	35.	20.	63.
	8	30.	47.	51.	15.	14.	73.	39.	34.	24.	57.
	9	37.	31.	48.	14.	18.	61.	41.	24.	30.	43.
	10	46.	12.	51.	5.	20.	53.	48.	9.	36.	28.
	11	38.	29.	43.	22.	-6.	99.	40.	26.	21.	57.
3	1	38.	29.	43.	22.	-6.	99.	40.	26.	21.	57.
	2	49.	14.	54.	7.	23.	55.	51.	11.	39.	31.
	3	47.	27.	57.	10.	28.	56.	51.	20.	39.	39.
	4AI	42.	41.	62.	9.	26.	67.	50.	28.	36.	52.
	4AD	38.	28.	58.	-4.	22.	54.	46.	15.	31.	38.
	5	31.	40.	62.	-8.	18.	61.	43.	21.	26.	48.
	6	22.	57.	56.	4.	11.	76.	36.	36.	18.	65.
	7	24.	56.	54.	9.	13.	74.	36.	37.	20.	63.
	8	30.	48.	49.	18.	17.	68.	38.	36.	25.	56.
	9	37.	31.	47.	16.	23.	54.	41.	25.	31.	40.
	10	47.	11.	51.	5.	24.	46.	49.	8.	38.	25.
	11	39.	28.	46.	17.	-1.	92.	42.	24.	23.	53.
4	1	39.	28.	46.	17.	-1.	92.	42.	24.	23.	53.
	2	48.	17.	55.	5.	26.	51.	50.	12.	39.	31.
	3AI	41.	30.	63.	-5.	24.	58.	50.	16.	34.	41.
	3AD	37.	20.	59.	-15.	19.	48.	45.	6.	29.	31.
	4	32.	27.	60.	-16.	17.	51.	43.	10.	26.	37.
	5	25.	39.	55.	-9.	12.	60.	37.	20.	20.	48.
	6	18.	53.	49.	4.	6.	71.	30.	33.	13.	60.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4		Hipotesis 5	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
	7	16.	58.	45.	11.	7.	72.	27.	39.	12.	63.
	8	15.	59.	41.	19.	8.	70.	25.	43.	12.	63.
	9	16.	59.	35.	29.	11.	66.	23.	47.	14.	62.
	10	17.	58.	28.	41.	14.	61.	21.	51.	16.	59.
	11	18.	56.	18.	56.	18.	56.	18.	56.	18.	56.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

LINEA A. VELOCIDAD ZARAGOZA-LLEIDA
SUBTRAMO 1. E-3
F. LONG. REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
0.000	1	0	0	134	-1.4	513	-5.7
2.700	2	0.92	-1.46	131	-1.4	501	-5.6
5.400	3	1.85	-2.91	128	-1.4	490	-5.4
8.100	4	2.77	-4.37	125	-1.4	478	-5.3
10.800	5	3.69	-5.82	122	-1.3	467	-5.2
13.500	6	4.62	-7.28	119	-1.3	455	-5.1
16.200	7	5.54	-8.73	116	-1.3	444	-4.9
18.900	8	6.46	-10.19	113	-1.2	432	-4.8
21.600	9	7.39	-11.65	110	-1.2	421	-4.7
24.300	10	8.31	-13.1	107	-1.2	409	-4.5
27.000	11	9.24	-14.56	104	-1.1	398	-4.4
27.000	11	9.24	-14.56	104	-1.1	398	-4.4
29.875	12	8.99	-14.16	101	-1.1	385	-4.3
32.750	13	8.74	-13.77	97	-1.1	373	-4.1
35.250	14	8.52	-13.43	95	-1.0	362	-4.0
35.250	14	8.52	-13.43	95	-1.0	362	-4.0
39.375	15	8.16	-12.87	90	-1.0	345	-3.8
43.500	16	7.81	-12.3	85	-0.9	327	-3.6
47.625	17	7.45	-11.74	81	-0.9	309	-3.4
51.750	18	7.09	-11.18	76	-0.8	292	-3.2
54.250	19	6.88	-10.84	73	-0.8	281	-3.1
57.125	20	6.63	-10.44	70	-0.8	269	-3.0
60.000	21	6.38	-10.05	67	-0.7	257	-2.9
60.000	21	6.38	-10.05	67	-0.7	257	-2.9
62.875	22	6.63	-10.44	64	-0.7	244	-2.7
65.750	23	6.88	-10.84	61	-0.7	232	-2.6
68.250	24	7.09	-11.18	58	-0.6	221	-2.5
68.250	24	7.09	-11.18	58	-0.6	221	-2.5
72.375	25	7.45	-11.74	53	-0.6	204	-2.3
76.500	26	7.81	-12.31	49	-0.5	186	-2.1
80.625	27	8.17	-12.87	44	-0.5	168	-1.9
84.750	28	8.52	-13.44	39	-0.4	151	-1.7
87.250	29	8.74	-13.78	37	-0.4	140	-1.6
90.125	30	8.99	-14.17	33	-0.4	126	-1.4
93.000	31	9.24	-14.56	30	-0.3	115	-1.3
93.000	31	9.24	-14.56	30	-0.3	115	-1.3
97.125	32	7.83	-12.34	26	-0.3	98	-1.1
101.250	33	6.42	-10.11	21	-0.2	80	-0.9
101.250	33	6.42	-10.11	21	-0.2	80	-0.9
103.594	34	5.61	-8.85	18	-0.2	70	-0.8
105.938	35	4.81	-7.58	16	-0.2	60	-0.7
108.282	36	4.01	-6.32	13	-0.1	50	-0.6
110.626	37	3.21	-5.06	10	-0.1	40	-0.4
112.970	38	2.41	-3.79	8	-0.1	30	-0.3
115.314	39	1.6	-2.53	5	-0.1	20	-0.2
117.658	40	0.8	-1.26	3	-0.0	10	-0.1
120.000	41	0	0	0	0.0	0	0.0

TOTAL FRENADO 513
TOTAL RETRACCIO 134
L. TOTAL 1.20

At: 9.25 l. h. = 23.7
At: 9
canto: 2.45

L. A. V. ZARAGOZA-LLEIDA
SUBTRAMO 1 E-3

		M+ FINAL Pref*1.1 SIN TEMPERATURA		M+ FINAL Pref*1.1 CON TEMPERATUR		M- FINAL Pref*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pref*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pref*1.1 CON TEMPERATUR		M- FREQ. FINAL Pref*1.1 SIN TEMPERATURA		M+ FINAL Pref*0.9 SIN TEMPERATURA		M+ FINAL Pref*0.9 CON TEMPERATUR		M- FINAL Pref*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pref*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pref*0.9 CON TEMPERATUR		M- FREQ. FINAL Pref*0.9 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	25	77	25.0	77.0	25	77	25	77	25.0	77.0	25	77	25	77	25.0	77.0	25	77	25	77	25.0	77.0	25	77
2.700	2	31	87	31.0	85.5	16	91	23	78	23.6	77.5	16	91	31	87	31.0	85.5	16	91	23	78	23.6	77.5	16	91
5.400	3	38	97	37.9	93.1	9	101	28	79	24.9	78.1	12	98	38	97	37.9	93.1	9	101	28	79	24.9	78.1	12	98
6.100	4	41	50	43.6	45.8	5	106	24	77	26.6	72.6	10	99	42	47	43.6	45.8	5	106	24	77	26.6	72.6	10	99
10.800	5	45	42	46.7	38.2	4	107	26	72	29.7	66.2	10	98	46	19	46.7	38.2	4	107	26	72	29.7	66.2	10	98
13.500	6	49	35	53.8	27.7	5	104	30	64	34.8	56.7	13	92	49	14	53.8	27.7	5	104	30	64	34.8	56.7	13	92
16.200	7	52	27	57.5	18.3	9	93	34	54	41.5	45.3	18	81	51	10	58.5	18.3	9	93	34	54	41.5	45.3	18	81
18.900	8	56	20	62.5	9.8	16	83	43	41	49.5	30.8	27	68	50	9	62.5	9.8	16	83	43	41	49.5	30.8	27	68
21.600	9	58	15	65.4	3.4	25	67	50	27	57.4	15.4	37	47	55	6	65.4	3.4	25	67	50	27	57.4	15.4	37	47
24.300	10	65	2	73.3	-11.1	35	51	62	8	70.3	-5.1	49	27	63	2	73.3	-11.1	35	51	62	8	70.3	-5.1	49	27
27.000	11	69	2	78.2	-12.8	21	77	65	9	74.2	-5.6	46	38	69	2	78.2	-12.8	21	77	65	9	74.2	-5.6	46	38
27.000	11	69	2	78.2	-12.8	21	77	65	9	74.2	-5.6	46	38	69	2	78.2	-12.8	21	77	65	9	74.2	-5.6	46	38
29.875	12	74	-4	83.0	-18.2	47	37	72	-1	81.0	-15.2	57	16	74	-4	83.0	-18.2	47	37	72	-1	81.0	-15.2	57	16
32.750	13	72	9	80.7	-4.8	48	47	66	16	74.7	4.2	57	33	72	9	80.7	-4.8	48	47	66	16	74.7	4.2	57	33
35.250	14	73	17	81.5	3.6	42	57	62	35	70.5	21.6	49	54	73	17	81.5	3.6	42	57	62	35	70.5	21.6	49	54
35.250	14	68	1	76.5	-12.4	36	51	57	19	65.5	5.6	44	38	68	1	76.5	-12.4	36	51	57	19	65.5	5.6	44	38
39.375	15	67	3	75.2	-9.9	28	68	49	32	57.2	19.1	33	58	67	3	75.2	-9.9	28	68	49	32	57.2	19.1	33	58
43.500	16	58	21	65.9	8.7	13	93	38	53	45.8	40.7	20	62	58	21	65.9	8.7	13	93	38	53	45.8	40.7	20	62
47.625	17	58	24	65.5	12.3	14	94	39	53	46.5	41.3	22	61	58	24	65.5	12.3	14	94	39	53	46.5	41.3	22	61
51.750	18	58	28	63.1	16.8	20	88	44	47	51.1	35.8	30	70	58	28	63.1	16.8	20	88	44	47	51.1	35.8	30	70
54.250	19	57	19	63.9	8.2	28	68	51	20	57.9	18.2	30	46	57	19	63.9	8.2	28	68	51	20	57.9	18.2	30	46
57.125	20	56	0	72.6	-10.4	38	48	64	4	70.6	-6.4	51	23	56	0	72.6	-10.4	38	48	64	4	70.6	-6.4	51	23
60.000	21	61	14	67.4	3.9	12	91	58	18	64.4	6.0	39	49	61	14	67.4	3.9	12	91	58	18	64.4	6.0	39	49
60.000	21	61	14	67.4	3.9	12	91	58	18	64.4	6.0	39	49	61	14	67.4	3.9	12	91	58	18	64.4	6.0	39	49
62.875	22	69	3	75.6	-7.4	39	51	67	7	73.6	-3.4	55	28	69	3	75.6	-7.4	39	51	67	7	73.6	-3.4	55	28
65.750	23	69	14	75.9	3.2	40	61	63	24	69.9	13.2	51	43	69	14	75.9	3.2	40	61	63	24	69.9	13.2	51	43
68.250	24	71	21	78.1	9.8	34	78	59	40	66.1	28.8	44	63	71	21	78.1	9.8	34	78	59	40	66.1	28.8	44	63
68.250	24	66	4	73.1	-7.2	29	82	53	24	60.1	12.8	30	47	66	4	73.1	-7.2	29	82	53	24	60.1	12.8	30	47
72.375	25	65	7	72.5	-4.7	21	76	47	36	54.5	24.3	28	64	65	7	72.5	-4.7	21	76	47	36	54.5	24.3	28	64
76.500	26	56	25	63.8	12.7	11	96	36	57	43.8	44.7	16	85	56	25	63.8	12.7	11	96	36	57	43.8	44.7	16	85
80.625	27	55	28	63.2	15.1	14	93	38	56	46.2	43.1	21	82	55	28	63.2	15.1	14	93	38	56	46.2	43.1	21	82
84.750	28	54	31	62.5	17.6	23	81	43	48	51.5	35.6	31	66	54	31	62.5	17.6	23	81	43	48	51.5	35.6	31	66
87.250	29	55	21	64.7	7.2	32	59	51	30	59.7	16.2	41	45	55	21	64.7	7.2	32	59	51	30	59.7	16.2	41	45
90.125	30	56	-1	75.0	-15.2	40	41	64	3	73.0	-11.2	53	20	56	-1	75.0	-15.2	40	41	64	3	73.0	-11.2	53	20
93.000	31	64	9	73.2	-5.6	17	64	60	15	69.2	0.4	41	45	64	9	73.2	-5.6	17	64	60	15	69.2	0.4	41	45
93.000	31	64	9	73.2	-5.6	17	64	60	15	69.2	0.4	41	45	64	9	73.2	-5.6	17	64	60	15	69.2	0.4	41	45
97.125	32	69	5	76.8	-7.3	40	50	64	11	71.8	-1.3	53	30	69	5	76.8	-7.3	40	50	64	11	71.8	-1.3	53	30
101.250	33	71	5	77.4	-5.1	31	66	58	26	64.4	15.9	42	51	71	5	77.4	-5.1	31	66	58	26	64.4	15.9	42	51
101.250	33	65	-6	71.4	-16.1	25	55	52	13	58.4	2.9	36	38	65	-6	71.4	-16.1	25	55	52	13	58.4	2.9	36	38
103.594	34	64	-5	69.6	-13.9	21	63	47	21	52.6	12.2	30	46	64	-5	69.6	-13.9	21	63	47	21	52.6	12.2	30	46
105.938	35	56	7	60.8	-0.6	13	76	38	36	42.8	28.4	21	64	56	7	60.8	-0.6	13	76	38	36	42.8	28.4	21	64
108.282	36	48	24	52.0	17.7	5	91	29	54	33.0	47.7	12	80	48	24	52.0	17.7	5	91	29	54	33.0	47.7	12	80
110.626	37	43	33	46.2	27.9	5	93	26	61	29.2	55.9	10	85	43	33	46.2	27.9	5	93	26	61	29.2	55.9	10	85
112.970	38	39	40	41.4	36.2	7	91	24	64	26.4	60.2	11	84	39	40	41.4	36.2	7	91	24	64	26.4	60.2	11	84
115.314	39	35	46	36.6	45.5	11	86	23	66	24.6	63.5	13	81	35	46	36.6	45.5	11	86	23	66	24.6	63.5	13	81
117.658	40	29	57	29.8	55.7	16	78	23	68	23.6	66.7	17	76	29	57	29.8	55.7	16	78	23	68	23.6	66.7	17	76
120.000	41	22	69	22.0	69.0	22	69	22	69	22.0	69.0	22	69	22	69	22.0	69.0	22	69	22	69	22.0	69.0	22	69

		M+ FINAL Pref*0.9 SIN TEMPERATURA		M+ FINAL Pref*0.9 CON TEMPERATUR		M- FINAL Pref*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pref*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pref*0.9 CON TEMPERATUR		M- FREQ. FINAL Pref*0.9 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	20	63	20.0	63.0	20	63	20	63	20.0	63.0	20	63
2.700	2	30	48	30.9	48.5	15	72	23	60	22.9	58.5	16	69
5.400	3	38	33	38.9	33.1	10	78	24	57	25.9	54.1	13	74
8.100	4	47	19	50.7	13.2	7	83	28	49	31.7	42.2	12	74
10.800	5	47	19	53.6	6.7	6	83	31	43	35.6	35.7	13	70
13.500	6	51	10	58.5	1.3	7	78	34	30	39.5	27.3	17	64
16.200	7	50	9	58.5	-1.2	11	71	37	29	43.5	18.8	22	54
18.900	8	51	6	59.3	-1.7	20	55	46	12	55.3	-1.1	35	31
21.600	9	50	12	59.2	-2.6	3	66	46	18	55.2	3.4	27	48
24.300	10	50	12	59.2	-2.6	3	66	46	18	55.2	3.4	27	48
27.000	11	50	12	59.2	-2.6	3	66	46	18	55.2	3.4	27	48
27.000	11	50	12	59.2	-2.6	3	66	46	18	55.2	3.4	27	48
29.875	12	54	7	66.7	-6.8	36	44	54	15	62.7	1.2	45	30
32.750	13	60	1	66.0	-13.2	31	43	55	5	64.0	-9.2	44	22
35.250	14	64	7	72.5	-6.4	33	57	53	25	61.5	11.6	40	44
35.250	14	60	-6	68.5	-19.4	28	43	49	12	57.5	-1.4	36	31
39.375	15	63	-11	71.2	-23.9	22	54	46	16	54.2	5.1	29	43
43.500	16	58	2	65.8	-10.3	12	73	38	34	45.8	21.7	19	62
47.625	17	56	6	63.5	-5.7	12	76	37	35	44.5	20.3	20	63
51.750	18	51	15	58.1	3.8	14	73	39	34	46.1	22.8	24	58
54.250	19	48	14	54.9	3.2	16	61	41	24	47.9	13.2	30	43
57.125	20	51	5	57.6	-5.4	20	53	48	9	54.6	-1.4	38	28
60.000	21	44	21	50.4	11.0	-6	99	41	28	47.4	16.0	21	57
60.000	21	44	21	50.4	11.0	-6	99	41	28	47.4	16.0	21	57
62.875	22	54	7	60.6	-3.4	23	55	51	11	57.6	0.6	39	31
65.750	23	57	10	63.9	-0.8	28	57	51	20	57.9	9.2	39	39
68.250	24	63	9	70.1	-2.2	26	67	50	29	57.1	17.8	36	52
68.250	24	58	-4	65.1	-15.2	22	54	46	15	53.1	3.8	32	39
72.375	25	62	-3	69.5	-19.7	16	61	44	21	51.5	9.3	28	49
76.500	26	56	4	63.8	-9.3	11	76	36	36	43.8	23.7	16	65
80.625	27	54	9	62.2	-3.9	13	74	36	37	44.2	24.1	20	63
84.750	28	49	19	57.5	5.6	17	68	38	36	46.5	22.8	25	58
87.250	29	47	16	55.7	2.2	23	54	41	25	49.7	11.2	32	40
90.125	30	51	5	60.0	-9.2	25	46	49	6	56.0	-6.2	38	25
93.000	31	46	17	55.2	2.4	-1	62	42	23	51.2	6.4	23	53
93.000	31	46	17	55.2	2.4	-1	62	42	23	51.2	6.4	23	53
97.125	32	55	9	62.8	-7.3	20	51	51	12	58.8	-3.3	39	31
101.250	33	64	-5	70.4	-15.1	24	58	50	18	58.4	5.9	34	42
101.250	33	59	-15	65.4	-25.1	18	48	45	6	51.4	-4.1	30	31
103.594	34	60	-16	65.8	-24.9	17	52	43	10	48.8	1.2	28	37
105.938	35	55	-9	59.8	-16.6	12	61	37	20	41.8	12.4	20	48
108.282	36	48	4	53.0	-2.3	6	71	30	34	34.0	27.7	13	60
110.626	37	45	11	48.2	5.9	7	72	27	39	30.2	33.9	12	64
112.970	38	41	19	43.4	15.2	8	70	25	43	27.4	39.2	12	64
115.314	39	35	29	36.6	26.5	11	67	23	47	24.6	44.5	14	62
117.658	40	28	41	28.8	39.7	14	62	21	51	21.8	49.7	16	60
120.000	41	18	56	16.0	56.0	18	56	18	56	16.0	56.0	18	56

TOTAL FRENADO: 513 Af 9.25 I fr.= 23.7
TOTAL RETRACCIO 134 Ar 9
L TOTAL: 120 canto: 2.45

L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 C.3

		M+ FINAL Pret°1.1 SIN TEMPERATURA		M+ FINAL Pret°1.1 CON TEMPERATUR		M- FINAL Pret°1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret°1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret°1.1 CON TEMPERATUR		M- FREQ. FINAL Pret°1.1 SIN TEMPERATURA		M+ FINAL Pret°0.9 SIN TEMPERATURA		M+ FINAL Pret°0.9 CON TEMPERATUR		M- FINAL Pret°0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret°0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret°0.9 CON TEMPERATUR		M- FREQ. FINAL Pret°0.9 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	27	83	27.0	83.0	27	83	27	83	27.0	83.0	27	83	22	66	22.0	66.0	22	66	22	66	22.0	66.0	22	66
2.700	2	31	75	31.9	73.5	17	98	24	86	24.9	84.5	18	96	30	54	30.9	52.5	15	78	23	66	23.9	64.5	17	75
5.400	3	36	67	37.9	64.1	9	109	23	88	24.9	85.1	12	104	36	43	37.9	40.1	10	88	23	64	24.9	61.1	13	81
8.100	4	40	59	42.8	54.6	4	115	23	86	25.8	81.6	9	108	42	34	44.8	29.6	6	90	25	60	27.8	55.6	11	83
10.800	5	44	52	47.7	46.2	3	116	25	81	26.7	75.2	9	107	46	27	49.7	21.2	5	91	27	58	30.7	50.2	11	82
13.500	6	48	43	52.6	35.7	5	112	30	72	34.6	64.7	12	100	49	20	53.6	12.7	5	89	30	50	34.6	42.7	13	77
16.200	7	53	34	58.5	25.3	10	102	36	60	41.5	51.3	19	88	51	16	58.5	7.3	8	84	34	42	39.5	33.3	17	69
18.900	8	57	25	63.5	14.8	16	87	44	46	50.5	35.8	28	71	52	12	58.5	1.8	12	75	39	33	45.5	22.8	23	58
21.600	9	61	17	68.4	5.4	26	69	54	29	61.4	17.4	41	49	51	12	58.4	0.3	18	64	44	24	51.4	12.4	31	45
24.300	10	71	1	79.3	-12.1	40	49	67	6	75.3	-7.1	55	26	55	5	63.3	-8.1	24	54	51	11	59.3	-2.1	39	30
27.000	11	76	-1	85.2	-15.6	28	73	72	5	81.2	-9.6	53	35	56	9	65.2	-5.6	8	83	52	15	61.2	0.4	33	45
27.000	11	76	-1	85.2	-15.6	28	73	72	5	81.2	-9.6	53	35	56	9	65.2	-5.6	8	83	52	15	61.2	0.4	33	45
29.875	12	80	-6	89.0	-20.2	54	36	78	-3	87.0	-17.2	67	14	62	0	71.0	-14.2	36	42	60	4	69.0	-10.2	49	20
32.750	13	77	10	85.7	-3.6	53	48	71	19	79.7	5.2	61	34	63	7	71.7	-6.6	40	45	58	16	66.7	2.2	46	31
35.250	14	76	20	84.5	6.6	45	69	65	35	73.5	24.6	53	57	67	10	75.5	-3.4	35	59	56	27	64.5	13.6	43	47
35.250	14	71	3	79.5	-10.4	39	52	60	20	68.5	6.6	47	40	62	-4	70.5	-17.4	31	45	51	13	59.5	-0.4	39	33
39.375	15	66	8	76.2	-4.9	27	73	51	36	59.2	23.1	34	62	65	-7	73.2	-19.9	23	58	47	21	55.2	8.1	30	47
43.500	16	59	28	66.8	15.7	13	100	38	60	45.8	47.7	20	89	58	7	65.8	-5.3	12	79	38	39	45.8	26.7	19	68
47.625	17	58	31	65.5	19.3	14	100	40	60	47.5	46.3	22	87	56	11	63.5	-0.7	12	81	38	40	45.5	28.3	20	68
51.750	18	58	32	65.1	20.8	22	90	46	51	53.1	39.8	31	74	52	19	59.1	7.8	16	77	40	38	47.1	26.8	26	61
54.250	19	61	21	67.9	10.2	31	68	54	31	60.9	20.2	42	50	51	16	57.9	5.2	21	62	44	26	50.9	15.2	32	44
57.125	20	72	-1	78.6	-11.4	41	47	69	3	75.6	-7.4	57	22	56	4	62.6	-6.4	25	52	53	8	59.6	-2.4	41	27
60.000	21	68	11	74.4	0.9	18	89	65	16	71.4	6.0	45	47	49	20	55.4	10.0	0	97	46	24	52.4	14.0	26	55
60.000	21	68	11	74.4	0.9	18	89	65	16	71.4	6.0	45	47	49	20	55.4	10.0	0	97	46	24	52.4	14.0	26	55
62.875	22	75	2	81.6	-8.4	44	50	72	6	78.6	-4.4	60	25	58	6	64.6	-4.4	28	55	56	10	62.6	-0.4	43	30
65.750	23	73	16	79.9	5.2	44	62	67	26	73.9	15.2	55	44	61	12	67.9	1.2	31	58	54	22	60.9	11.2	43	40
68.250	24	74	24	81.1	12.8	37	82	62	43	69.1	31.8	47	66	65	12	72.1	0.8	28	70	53	31	60.1	19.8	38	55
68.250	24	68	7	75.1	-4.2	31	65	56	26	63.1	14.8	41	49	60	-2	67.1	-13.2	24	56	48	17	55.1	5.8	34	41
72.375	25	66	12	73.5	0.3	22	61	48	41	55.5	29.3	30	66	63	-4	70.5	-15.7	19	65	44	25	51.5	13.3	27	53
76.500	26	56	32	63.8	19.7	11	103	36	64	43.8	51.7	16	92	56	10	63.8	-2.3	11	82	36	42	43.8	29.7	16	71
80.625	27	56	34	64.2	21.1	15	99	38	62	46.2	49.1	22	88	54	14	62.2	1.1	13	79	37	42	45.2	29.1	20	66
84.750	28	56	35	64.5	21.6	25	84	45	53	53.5	39.6	33	72	50	22	58.5	8.6	19	71	39	39	47.5	25.6	27	59
87.250	29	60	23	68.7	9.2	36	61	54	32	62.7	18.2	44	47	50	17	58.7	3.2	26	55	44	26	52.7	12.2	34	41
90.125	30	72	-2	81.0	-16.2	46	40	70	2	79.0	-12.2	59	18	56	3	65.0	-11.2	29	45	53	7	62.0	-7.2	43	24
93.000	31	71	6	80.2	-8.8	24	81	67	12	76.2	-2.6	48	42	52	15	61.2	0.4	5	89	48	21	57.2	8.4	29	51
93.000	31	71	6	80.2	-8.8	24	81	67	12	76.2	-2.6	48	42	52	15	61.2	0.4	5	89	48	21	57.2	8.4	29	51
97.125	32	74	4	81.8	-8.3	45	50	69	11	76.8	-1.3	58	30	59	5	66.8	-7.3	30	51	55	12	62.8	-0.3	43	31
101.250	33	74	8	80.4	-2.1	34	71	61	29	67.4	18.9	45	54	66	-1	72.4	-11.1	26	81	53	19	59.4	8.9	37	45
101.250	33	68	-6	74.4	-16.1	28	57	54	15	60.4	4.9	39	41	61	-13	67.4	-23.1	21	50	47	8	53.4	-2.1	31	33
103.594	34	65	-1	70.6	-9.9	22	67	48	25	53.6	16.2	31	53	61	-13	66.6	-21.9	18	55	44	13	49.6	4.2	27	41
105.938	35	57	14	61.8	6.4	13	83	38	42	42.8	34.4	21	70	56	-3	60.8	-10.6	12	86	37	25	41.8	17.4	20	53
108.282	36	47	32	51.0	25.7	5	99	28	61	32.0	54.7	11	86	46	11	52.0	4.7	6	77	30	40	34.0	33.7	13	67
110.626	37	43	41	46.2	35.9	4	102	25	69	28.2	63.9	9	93	45	18	48.2	12.9	6	79	27	46	30.2	40.9	11	71
112.970	38	39	46	41.4	44.2	6	99	23	72	25.4	66.2	11	92	40	26	42.4	22.2	8	77	25	50	27.4	46.2	12	70
115.314	39	35	55	36.6	52.5	11	93	23	74	24.6	71.5	13	89	35	35	36.6	32.5	11	73	23	53	24.6	50.5	14	66
117.658	40	30	63	30.8	61.7	17	84	23	74	23.8	72.7	16	82	28	46	28.8	44.7	15	67	22	56	22.8	54.7	16	65
120.000	41	24	73	24.0	73.0	24	73	24	73	24.0	73.0	24	73	19	60	19.0	60.0	19	60	19	60	19.0	60.0	19	60

L.A.V ZARAGOZA-LLEIDA. SUBTRAMO 1. C-3 CABLES TESADOS AL 75 %

		FUERZAS LONGITUDINALES REOLOGICA M+ FINAL Pret°1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICA M- FINAL Pret°1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret°0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret°0.9 SIN TEMPERATURA				VALORES MAXIMOS			ARMADURAS	
																				Vt sup.	Vt inf.	frenado		
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
0.000	1	23.6	75.6	0.0	0.0	23.6	75.6	0.0	0.0	18.6	61.6	0.0	0.0	18.6	61.6	0.0	0.0	0.0	0.0	21.6	7.03	7.03
2.700	2	30.5	64.1	0.0	0.0	14.6	89.6	0.0	0.0	29.5	45.1	0.0	0.0	13.6	70.6	0.0	0.0	0.0	0.0	21.2	6.87	6.87
5.400	3	36.5	54.7	0.0	0.0	7.6	99.6	0.0	0.0	37.5	31.7	0.0	0.0	8.6	77.6	0.0	0.0	0.0	0.0	20.7	6.71	6.71
8.100	4	42.4	44.3	0.0	0.0	3.6	104.6	0.0	0.0	43.4	21.3	0.0	0.0	5.6	81.6	0.0	0.0	0.0	0.0	20.2	6.55	6.55
10.800	5	47.4	34.9	0.0	0.0	2.7	105.7	0.0	0.0	49.4	11.9	0.0	0.0	3.7	82.7	0.0	0.0	0.0	0.0	19.7	6.40	6.40
13.500	6	52.3	26.4	0.0	0.0	3.7	102.7	0.0	0.0	52.3	5.4	0.0	0.0	4.7	81.7	0.0	0.0	0.0	0.0	19.2	6.24	6.24
16.200	7	56.3	17.0	0.0	0.0	7.7	93.7	0.0	0.0	55.3	0.0	0.0	0.0	5.7	76.7	0.0	0.0	0.0	0.0	18.7	6.08	6.08
18.900	8	61.2	8.6	0.0	0.0	14.8	81.8	0.0	0.0	55.2	-2.4	0.0	-1.2	9.8	69.8	0.0	0.0	0.0	-1.2	18.2	5.92	6.32
21.600	9	64.2	2.2	0.0	0.0	23.8	65.8	0.0	0.0	55.2	-2.8	0.0	-1.7	14.8	60.8	0.0	0.0	0.0	-1.7	17.7	5.76	6.32
24.300	10	72.2	-12.3	0.0	-21.8	33.8	49.8	0.0	0.0	58.2	-8.3	0.0	-12.6	18.8	53.8	0.0	0.0	0.0	-21.8	17.3	5.61	12.68
27.000	11	77.1	-13.7	0.0	-25.3	19.9	75.9	0.0	0.0	58.1	-3.7	0.0	-2.7	1.9	84.9	0.0	0.0	0.0	-25.3	16.8	5.45	13.65
27.000	11	77.1	-13.7	0.0	-25.3	19.9	75.9	0.0	0.0	58.1	-3.7	0.0	-2.7	1.9	84.9	0.0	0.0	0.0	-25.3	16.8	5.45	13.65
29.875	12	81.9	-19.2	0.0	-44.9	45.9	35.9	0.0	0.0	64.9	-14.2	0.0	-31.4	29.9	41.9	0.0	0.0	0.0	-44.9	16.3	5.28	19.85
32.750	13	79.7	-5.8	0.0	-4.9	46.9	45.9	0.0	0.0	67.7	-7.8	0.0	-9.9	34.9	42.9	0.0	0.0	0.0	-9.9	15.7	5.11	8.33
35.250	14	80.5	2.5	0.0	0.0	41.0	66.0	0.0	0.0	71.5	-7.5	0.0	-8.6	32.0	66.0	0.0	0.0	0.0	-8.6	15.3	4.96	7.76
35.250	14	75.5	-13.5	0.0	-24.9	35.0	50.0	0.0	0.0	67.5	-20.5	0.0	-58.3	27.0	42.0	0.0	0.0	0.0	-58.3	15.3	4.96	23.88
39.375	15	74.2	-10.8	0.0	-16.9	25.0	67.0	0.0	0.0	70.2	-24.8	0.0	-79.6	21.0	53.0	0.0	0.0	0.0	-79.6	14.5	4.72	30.56
43.500	16	64.9	7.8	0.0	0.0	12.1	92.1	0.0	0.0	64.9	-11.2	0.0	-20.3	11.1	72.1	0.0	0.0	0.0	-20.3	13.8	4.48	11.06
47.625	17	64.6	11.4	0.0	0.0	13.1	93.1	0.0	0.0	62.6	-6.6	0.0	-7.7	11.1	75.1	0.0	0.0	0.0	-7.7	13.1	4.24	6.75
51.750	18	62.3	16.0	0.0	0.0	19.2	85.2	0.0	0.0	57.3	3.0	0.0	0.0	13.2	72.2	0.0	0.0	0.0	0.0	12.3	4.00	4.00
54.250	19	63.1	7.4	0.0	0.0	27.2	65.2	0.0	0.0	54.1	2.4	0.0	0.0	17.2	60.2	0.0	0.0	0.0	0.0	11.9	3.85	3.85
57.125	20	71.9	-11.2	0.0	-18.5	35.2	47.2	0.0	0.0	58.9	-6.2	0.0	-7.5	19.2	52.2	0.0	0.0	0.0	-18.5	11.3	3.68	9.69
60.000	21	66.7	3.2	0.0	0.0	11.3	90.3	0.0	0.0	49.7	10.2	0.0	0.0	-6.7	98.3	-5.3	0.0	-5.3	0.0	10.8	5.23	3.51
60.000	21	66.7	3.2	0.0	0.0	11.3	90.3	0.0	0.0	49.7	10.2	0.0	0.0	-6.7	98.3	-5.3	0.0	-5.3	0.0	10.8	5.23	3.51
62.875	22	74.9	-8.1	0.0	-9.7	38.3	50.3	0.0	0.0	59.9	-4.1	0.0	-3.3	22.3	54.3	0.0	0.0	0.0	-9.7	10.3	3.35	6.51
65.750	23	75.2	2.5	0.0	0.0	39.3	60.3	0.0	0.0	63.2	-1.5	0.0	-0.4	27.3	56.3	0.0	0.0	0.0	-0.4	9.8	3.18	3.31
68.250	24	77.5	9.2	0.0	0.0	33.4	77.4	0.0	0.0	69.5	-2.8	0.0	-1.3	25.4	66.4	0.0	0.0	0.0	-1.3	9.3	3.03	3.46
68.250	24	72.5	-7.8	0.0	-9.3	26.4	61.4	0.0	0.0	64.5	-15.6	0.0	-38.1	21.4	53.4	0.0	0.0	0.0	-38.1	9.3	3.03	15.41
72.375	25	71.9	-5.3	0.0	-4.5	20.4	75.4	0.0	0.0	68.9	-20.3	0.0	-56.7	17.4	60.4	0.0	0.0	0.0	-56.7	8.8	2.79	21.19
76.500	26	63.3	12.2	0.0	0.0	10.5	95.5	0.0	0.0	63.3	-8.8	0.0	-13.3	10.5	75.5	0.0	0.0	0.0	-13.3	7.8	2.55	8.85
80.625	27	62.7	14.7	0.0	0.0	13.5	92.5	0.0	0.0	61.7	-4.3	0.0	-3.5	12.5	73.5	0.0	0.0	0.0	-3.5	7.1	2.31	3.44
84.750	28	62.1	17.1	0.0	0.0	22.6	80.6	0.0	0.0	57.1	5.1	0.0	0.0	16.6	67.6	0.0	0.0	0.0	0.0	6.4	2.06	2.06
87.250	29	64.3	6.8	0.0	0.0	31.6	58.6	0.0	0.0	55.3	1.8	0.0	0.0	22.6	53.6	0.0	0.0	0.0	0.0	5.9	1.92	1.92
90.125	30	74.6	-15.5	0.0	-32.8	39.6	40.6	0.0	0.0	59.6	-9.5	0.0	-16.1	24.6	45.6	0.0	0.0	0.0	-32.8	5.4	1.75	12.39
93.000	31	72.9	-5.9	0.0	-5.4	16.7	83.7	0.0	0.0	54.9	2.1	0.0	0.0	-1.3	91.7	-0.2	0.0	-0.2	-5.4	4.9	1.66	3.33
93.000	31	72.9	-5.9	0.0	-5.4	16.7	83.7	0.0	0.0	54.9	2.1	0.0	0.0	-1.3	91.7	-0.2	0.0	-0.2	-5.4	4.9	1.66	3.33
97.125	32	76.6	-7.6	0.0	-8.4	39.7	49.7	0.0	0.0	62.6	-7.6	0.0	-10.1	25.7	50.7	0.0	0.0	0.0	-10.1	4.1	1.34	4.63
101.250	33	77.2	-5.3	0.0	-4.2	30.8	67.8	0.0	0.0	70.2	-15.3	0.0	-33.7	23.8	57.8	0.0	0.0	0.0	-33.7	3.4	1.10	12.04
101.250	33	71.2	-18.3	0.0	-46.0	24.8	54.8	0.0	0.0	65.2	-25.3	0.0	-86.9	16.8	47.8	0.0	0.0	0.0	-86.9	3.4	1.10	29.30
103.594	34	69.4	-14.0	0.0	-29.0	20.8	62.8	0.0	0.0	65.4	-25.0	0.0	-85.0	16.8	51.8	0.0	0.0	0.0	-85.0	3.0	0.96	28.55
105.938	35	60.6	-0.7	0.0	-0.1	12.8	75.8	0.0	0.0	59.6	-16.7	0.0	-45.0	11.8	60.8	0.0	0.0	0.0	-45.0	2.5	0.82	15.43
108.282	36	51.9	17.5	0.0	0.0	4.9	90.9	0.0	0.0	52.9	-2.5	0.0	-1.3	5.9	70.9	0.0	0.0	0.0	-1.3	2.1	0.69	1.12
110.626	37	46.1	27.8	0.0	0.0	4.9	92.9	0.0	0.0	46.1	5.8	0.0	0.0	6.9	71.9	0.0	0.0	0.0	0.0	1.7	0.55	0.55
112.970	38	41.3	36.1	0.0	0.0	6.9	90.9	0.0	0.0	43.3	15.1	0.0	0.0	7.9	69.9	0.0	0.0	0.0	0.0	1.3	0.41	0.41
115.314	39	36.5	45.4	0.0	0.0	10.9	85.9	0.0	0.0	36.5	26.4	0.0	0.0	10.9	66.9	0.0	0.0	0.0	0.0	0.8	0.27	0.27
117.658	40	29.8	55.7	0.0	0.0	16.0	78.0	0.0	0.0	28.8	39.7	0.0	0.0	14.0	62.0	0.0	0.0	0.0	0.0	0.4	0.14	0.14
120.000	41	22.0	69.0	0.0	0.0	22.0	69.0	0.0	0.0	18.0	56.0	0.0	0.0	18.0	56.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00

NUDO	X	FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA F. Sup.	F. Inf.	Vi sup.	Vi inf.	FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA F. Sup.	F. Inf.	Vi sup.	Vi inf.	FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA F. Sup.	F. Inf.	Vi sup.	Vi inf.	FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA F. Sup.	F. Inf.	Vi sup.	Vi inf.	VALORES MAXIMOS max(t/m) Vi sup.	Vi inf.	transito (t/m)	ARMADURAS Ar cm2	Ai cm2
1	0.000	25.6	81.8	0.0	0.0	25.6	81.8	0.0	0.0	20.6	66.6	0.0	0.0	20.6	66.6	0.0	0.0	0.0	0.0	21.6	7.03	7.03
2	2.700	30.5	72.1	0.0	0.0	15.6	86.6	0.0	0.0	28.5	51.1	0.0	0.0	28.5	51.1	0.0	0.0	0.0	0.0	21.2	6.87	6.87
3	5.400	36.5	62.7	0.0	0.0	7.6	107.6	0.0	0.0	36.5	35.7	0.0	0.0	36.5	35.7	0.0	0.0	0.0	0.0	20.7	6.71	6.71
4	8.100	41.4	53.3	0.0	0.0	2.8	113.8	0.0	0.0	43.4	28.3	0.0	0.0	43.4	28.3	0.0	0.0	0.0	0.0	20.2	6.55	6.55
5	10.800	46.4	44.9	0.0	0.0	1.7	114.7	0.0	0.0	48.4	19.9	0.0	0.0	48.4	19.9	0.0	0.0	0.0	0.0	19.7	6.40	6.40
6	13.500	51.3	34.4	0.0	0.0	3.7	110.7	0.0	0.0	52.3	11.4	0.0	0.0	52.3	11.4	0.0	0.0	0.0	0.0	19.2	6.24	6.24
7	16.200	57.3	24.0	0.0	0.0	5.7	100.7	0.0	0.0	55.3	6.0	0.0	0.0	55.3	6.0	0.0	0.0	0.0	0.0	18.7	6.08	6.08
8	18.900	62.2	13.6	0.0	0.0	16.9	89.6	0.0	0.0	57.2	0.8	0.0	0.0	57.2	0.8	0.0	0.0	0.0	0.0	18.2	5.92	5.92
9	21.600	67.2	4.2	0.0	0.0	28.6	67.8	0.0	0.0	57.2	-0.8	0.0	0.0	57.2	-0.8	0.0	0.0	0.0	0.0	17.7	5.78	5.81
10	24.300	78.2	-13.3	0.0	-23.5	38.8	47.8	0.0	0.0	62.2	-9.3	0.0	0.0	62.2	-9.3	0.0	0.0	0.0	-23.5	17.3	5.61	13.25
11	27.000	84.1	-16.7	0.0	-33.8	26.9	71.9	0.0	0.0	64.1	-8.7	0.0	0.0	64.1	-8.7	0.0	0.0	0.0	-33.8	16.8	5.45	16.43
12	29.875	87.9	-21.2	0.0	-50.7	52.9	34.9	0.0	0.0	69.9	-15.2	0.0	0.0	69.9	-15.2	0.0	0.0	0.0	-50.7	16.3	5.28	21.73
13	32.750	84.7	-4.8	0.0	-3.2	51.9	48.9	0.0	0.0	70.7	-7.8	0.0	0.0	70.7	-7.8	0.0	0.0	0.0	-9.5	15.7	5.11	8.21
14	35.250	83.5	5.5	0.0	0.0	44.0	68.0	0.0	0.0	74.5	-4.5	0.0	0.0	74.5	-4.5	0.0	0.0	0.0	-3.1	15.3	4.96	5.96
15	37.625	78.5	-11.5	0.0	-17.9	38.0	51.0	0.0	0.0	69.5	-16.5	0.0	0.0	69.5	-16.5	0.0	0.0	0.0	-47.4	15.3	4.98	20.38
16	39.375	75.2	-5.8	0.0	-5.2	28.0	72.0	0.0	0.0	72.2	-20.8	0.0	0.0	72.2	-20.8	0.0	0.0	0.0	-57.2	14.5	4.72	23.30
17	43.500	65.9	14.8	0.0	0.0	12.1	98.1	0.0	0.0	64.9	-6.2	0.0	0.0	64.9	-6.2	0.0	0.0	0.0	-6.7	13.6	4.48	6.85
18	47.625	64.8	18.4	0.0	0.0	13.1	99.1	0.0	0.0	62.9	-1.6	0.0	0.0	62.9	-1.6	0.0	0.0	0.0	-0.5	13.1	4.24	4.40
19	51.750	64.3	20.0	0.0	0.0	21.2	89.2	0.0	0.0	58.3	7.0	0.0	0.0	58.3	7.0	0.0	0.0	0.0	12.3	12.3	4.00	4.00
20	54.250	67.1	9.4	0.0	0.0	30.2	67.2	0.0	0.0	57.1	4.4	0.0	0.0	57.1	4.4	0.0	0.0	0.0	11.9	11.9	3.85	3.85
21	57.125	77.9	-12.2	0.0	-20.2	40.2	48.2	0.0	0.0	61.9	-7.2	0.0	0.0	61.9	-7.2	0.0	0.0	0.0	-20.2	11.3	3.68	10.26
22	60.000	73.7	0.2	0.0	0.0	17.3	88.3	0.0	0.0	54.7	9.2	0.0	0.0	54.7	9.2	0.0	0.0	0.0	-0.1	10.8	3.54	3.54
23	62.875	80.9	-9.1	0.0	-11.3	43.3	49.3	0.0	0.0	53.9	-5.1	0.0	0.0	53.9	-5.1	0.0	0.0	0.0	-11.3	10.3	3.35	7.03
24	65.750	79.2	4.5	0.0	0.0	43.3	81.3	0.0	0.0	57.2	0.5	0.0	0.0	57.2	0.5	0.0	0.0	0.0	0.0	9.8	3.18	3.18
25	68.250	80.5	12.2	0.0	0.0	38.4	81.4	0.0	0.0	71.5	0.2	0.0	0.0	71.5	0.2	0.0	0.0	0.0	-29.1	9.3	3.03	3.03
26	72.375	72.9	-0.3	0.0	-0.0	21.4	80.4	0.0	0.0	69.9	-16.3	0.0	0.0	69.9	-16.3	0.0	0.0	0.0	-37.6	8.6	2.79	15.07
27	76.500	63.3	19.2	0.0	0.0	10.5	102.5	0.0	0.0	60.3	-2.6	0.0	0.0	60.3	-2.6	0.0	0.0	0.0	-1.5	7.8	2.55	3.03
28	80.625	63.7	20.7	0.0	0.0	14.5	98.5	0.0	0.0	61.7	0.7	0.0	0.0	61.7	0.7	0.0	0.0	0.0	-10.1	7.1	2.31	2.31
29	84.750	64.1	21.1	0.0	0.0	24.6	83.8	0.0	0.0	59.1	6.1	0.0	0.0	59.1	6.1	0.0	0.0	0.0	0.0	6.4	2.08	2.08
30	87.250	60.8	-16.5	0.0	-34.5	35.6	60.6	0.0	0.0	58.3	2.8	0.0	0.0	58.3	2.8	0.0	0.0	0.0	0.0	5.9	1.92	1.92
31	90.125	79.9	-8.9	0.0	-10.9	23.7	80.7	0.0	0.0	80.9	0.1	0.0	0.0	80.9	0.1	0.0	0.0	0.0	-10.9	4.9	1.58	5.12
32	93.000	81.6	-8.6	0.0	-10.1	44.7	49.7	0.0	0.0	66.6	-7.6	0.0	0.0	66.6	-7.6	0.0	0.0	0.0	-10.1	4.1	1.34	4.61
33	97.125	80.2	-2.3	0.0	-0.6	33.8	70.8	0.0	0.0	72.2	-11.3	0.0	0.0	72.2	-11.3	0.0	0.0	0.0	-18.8	3.4	1.10	7.22
34	101.250	74.2	-16.3	0.0	-36.1	50.8	0.0	0.0	0.0	67.2	-23.3	0.0	0.0	67.2	-23.3	0.0	0.0	0.0	-73.7	3.4	1.10	25.03
35	103.594	70.4	-10.0	0.0	-15.4	27.8	69.8	0.0	0.0	66.4	-22.0	0.0	0.0	66.4	-22.0	0.0	0.0	0.0	-67.3	3.0	0.96	22.82
36	105.938	61.8	6.3	0.0	0.0	12.8	82.8	0.0	0.0	60.6	-10.7	0.0	0.0	60.6	-10.7	0.0	0.0	0.0	-19.8	2.5	0.82	7.26
37	108.282	50.9	25.5	0.0	0.0	4.9	98.9	0.0	0.0	51.9	4.5	0.0	0.0	51.9	4.5	0.0	0.0	0.0	-19.8	2.1	0.69	0.69
38	110.626	46.1	35.8	0.0	0.0	3.9	101.9	0.0	0.0	48.1	-12.8	0.0	0.0	48.1	-12.8	0.0	0.0	0.0	-19.8	1.7	0.55	0.55
39	112.970	41.3	44.1	0.0	0.0	5.9	99.8	0.0	0.0	42.3	22.1	0.0	0.0	42.3	22.1	0.0	0.0	0.0	-19.8	1.3	0.41	0.41
40	115.314	38.5	52.4	0.0	0.0	10.8	92.9	0.0	0.0	38.5	32.4	0.0	0.0	38.5	32.4	0.0	0.0	0.0	-19.8	0.8	0.27	0.27
41	117.658	30.8	61.7	0.0	0.0	17.0	84.0	0.0	0.0	28.8	44.7	0.0	0.0	28.8	44.7	0.0	0.0	0.0	-19.8	0.4	0.14	0.14
42	120.000	24.0	73.0	0.0	0.0	24.0	73.0	0.0	0.0	19.0	60.0	0.0	0.0	19.0	60.0	0.0	0.0	0.0	-19.8	0.0	0.00	0.00

COMPROBACION A ROTURA POR FLEXION

A continuación se adjuntan para cada sección los momentos mayorados producidos por las cargas exteriores, el momento hiperestático de pretensado, la suma de ambos, ponderando el pretensado por 0,9 ó 1.1 y los momentos últimos, tanto positivos como negativos

En el siguiente cuadro se resumen las secciones de centro de vano y sobre pilas.

SECCION	Md F. exteriores	Md. F.exteriores + hiperestático ponderado	Último
V-1	6252	7064	9895
P-1	-9385	-7726	-9612
P-2,	-9793	-8464	-9612
V-2 y V-3	6304	8191	11279
P-3	-9370	-7972	-9613
V-4	6249	6994	8794

El momento total es inferior al momento último en todas las secciones estudiadas => El coeficiente de seguridad a rotura es superior a 1.6.

Calculo de Comprobacion a Rotura - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio .	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
1	1	(H1)	0.00	0.01	0.01	5896.45	0.4	-5125.31	0.6
	1	(H2)	0.00	0.01	0.01	5896.45	0.4	-5125.31	0.6
	2	(H1)	2668.82	184.33	2871.59	7662.86	0.4	-3430.25	0.5
	2	(H2)	954.82	184.33	1157.58	7662.86	0.4	-3430.25	0.5
	3	(H1)	4600.50	368.66	5006.03	8903.20	0.4	-2171.83	0.4
	3	(H2)	1527.13	368.66	1932.66	8903.20	0.4	-2171.83	0.4
	4	(H1)	5795.04	552.98	6403.32	9647.56	0.4	-1521.73	0.4
	4	(H2)	1716.95	552.98	2325.23	9647.56	0.4	-1521.73	0.4
	5	(H1)	6252.43	737.31	7063.47	9895.61	0.4	-1312.86	0.4
	5	(H2)	1524.26	737.31	2335.30	9895.61	0.4	-1312.86	0.4
	6	(H1)	5972.68	921.63	6986.47	9615.20	0.4	-1519.72	0.4
	6	(H2)	949.07	921.63	1962.86	9615.20	0.4	-1519.72	0.4
	7	(H1)	4955.78	1105.94	6172.32	8773.98	0.4	-2206.08	0.5
	7	(H2)	-8.62	1105.94	986.73	8773.98	0.4	-2206.08	0.5
	8	(H1)	3201.75	1290.26	4621.03	7371.94	0.4	-3514.73	0.5
	8	(H2)	-1348.81	1290.26	-187.57	7371.94	0.4	-3514.73	0.5
	9	(H1)	710.57	1474.58	2332.60	5339.21	0.4	-5479.19	0.6
	9	(H2)	-3071.50	1474.58	-1744.38	5339.21	0.4	-5479.19	0.6
	10	(H1)	-1841.19	1658.89	-348.19	2598.10	0.3	-8133.73	0.8
	10	(H2)	-5389.68	1658.89	-3896.68	2598.10	0.3	-8133.73	0.8
	11	(H1)	-3958.28	1843.20	-2299.39	1362.19	0.3	-9612.65	0.8
	11	(H2)	-9384.98	1843.20	-7726.09	1362.19	0.3	-9612.65	0.8
2	1	(H1)	-3958.28	1843.20	-2299.39	1362.19	0.3	-9612.65	0.8
	1	(H2)	-9384.98	1843.20	-7726.10	1362.19	0.3	-9612.65	0.8
	2	(H1)	-1993.79	1811.26	-363.66	2462.90	0.3	-8423.15	0.7
	2	(H2)	-5044.81	1811.26	-3414.67	2462.90	0.3	-8423.15	0.7
	3	(H1)	462.54	1807.53	2450.82	5759.68	0.4	-6397.11	0.7
	3	(H2)	-2287.62	1807.53	-660.83	5759.68	0.4	-6397.11	0.7
	4AI	(H1)	2760.72	1807.80	4749.30	5866.27	0.4	-5165.50	0.5
	4AI	(H2)	-833.70	1807.80	793.31	5866.27	0.4	-5165.50	0.5
	4AD	(H1)	2760.72	1807.80	4749.30	7100.27	0.4	-5042.27	0.6

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	4AD	(H2)	-833.70	1807.80	793.31	7100.27	0.4	-5042.27	0.6
	5	(H1)	5392.42	1761.67	7330.26	9610.55	0.4	-2713.43	0.5
	5	(H2)	659.36	1761.67	2597.21	9610.55	0.4	-2713.43	0.5
	6	(H1)	6303.54	1715.55	8190.64	11229.09	0.4	-1264.29	0.4
	6	(H2)	1072.27	1715.55	2959.37	11229.09	0.4	-1264.29	0.4
	7	(H1)	5497.66	1670.00	7334.65	10523.40	0.4	-1774.58	0.4
	7	(H2)	439.15	1670.00	2276.15	10523.40	0.4	-1774.58	0.4
	8	(H1)	2976.49	1624.44	4763.38	8445.12	0.4	-3614.79	0.6
	8	(H2)	-1250.29	1624.44	211.70	8445.12	0.4	-3614.79	0.6
	9	(H1)	611.14	1568.61	2336.61	6426.67	0.4	-5431.70	0.7
	9	(H2)	-2764.00	1568.61	-1352.25	6426.67	0.4	-5431.70	0.7
	10	(H1)	-1926.63	1508.44	-569.04	2213.15	0.3	-8542.14	0.8
	10	(H2)	-5459.73	1508.44	-4102.14	2213.15	0.3	-8542.14	0.8
	11	(H1)	-4133.68	1476.48	-2804.84	1362.19	0.3	-9612.65	0.8
	11	(H2)	-9792.86	1476.48	-8464.03	1362.19	0.3	-9612.65	0.8
3	1	(H1)	-4133.68	1476.48	-2804.84	1362.19	0.3	-9612.65	0.8
	1	(H2)	-9792.86	1476.48	-8464.03	1362.19	0.3	-9612.65	0.8
	2	(H1)	-1924.75	1483.23	-589.84	2462.90	0.3	-8423.15	0.7
	2	(H2)	-5457.86	1483.23	-4122.95	2462.90	0.3	-8423.15	0.7
	3	(H1)	604.64	1518.21	2274.66	5759.68	0.4	-6397.11	0.7
	3	(H2)	-2760.16	1518.21	-1393.78	5759.68	0.4	-6397.11	0.7
	4AI	(H1)	2972.89	1552.12	4680.22	5866.27	0.4	-5165.50	0.5
	4AI	(H2)	-1244.83	1552.12	152.08	5866.27	0.4	-5165.50	0.5
	4AD	(H1)	2972.89	1552.12	4680.22	7100.27	0.4	-5042.27	0.6
	4AD	(H2)	-1244.83	1552.12	152.08	7100.27	0.4	-5042.27	0.6
	5	(H1)	5501.92	1561.51	7219.59	9610.55	0.4	-2713.43	0.5
	5	(H2)	443.58	1561.51	2161.24	9610.55	0.4	-2713.43	0.5
	6	(H1)	6314.14	1570.91	8042.14	11229.09	0.4	-1264.29	0.4
	6	(H2)	1080.51	1570.91	2808.50	11229.09	0.4	-1264.29	0.4
	7	(H1)	5405.79	1580.88	7144.75	10523.40	0.4	-1774.58	0.4
	7	(H2)	672.83	1580.88	2411.79	10523.40	0.4	-1774.58	0.4

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Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	8	(H1)	2776.86	1590.84	4526.78	8445.12	0.4	-3614.79	0.6
	8	(H2)	-817.54	1590.84	614.21	8445.12	0.4	-3614.79	0.6
	9	(H1)	480.35	1568.66	2205.87	6426.67	0.4	-5431.70	0.7
	9	(H2)	-2269.82	1568.66	-858.03	6426.67	0.4	-5431.70	0.7
	10	(H1)	-1974.13	1547.18	-581.67	2213.15	0.3	-8542.14	0.8
	10	(H2)	-5025.13	1547.18	-3632.67	2213.15	0.3	-8542.14	0.8
	11	(H1)	-3936.76	1553.92	-2538.23	1362.19	0.3	-9612.65	0.8
	11	(H2)	-9370.43	1553.92	-7971.90	1362.19	0.3	-9612.65	0.8
4	1	(H1)	-3936.76	1553.92	-2538.23	1362.19	0.3	-9612.65	0.8
	1	(H2)	-9370.43	1553.92	-7971.90	1362.19	0.3	-9612.65	0.8
	2	(H1)	-665.88	1316.52	518.99	3363.42	0.3	-7556.24	0.7
	2	(H2)	-3999.59	1316.52	-2814.72	3363.42	0.3	-7556.24	0.7
	3AI	(H1)	3333.53	1079.13	4520.56	5866.27	0.4	-5165.50	0.5
	3AI	(H2)	-1249.25	1079.13	-278.03	5866.27	0.4	-5165.50	0.5
	3AD	(H1)	3333.52	1079.13	4520.56	5280.13	0.3	-4744.28	0.5
	3AD	(H2)	-1249.25	1079.13	-278.04	5280.13	0.3	-4744.28	0.5
	4	(H1)	4861.06	944.22	5899.70	6500.04	0.3	-3557.37	0.4
	4	(H2)	-84.20	944.22	765.60	6500.04	0.3	-3557.37	0.4
	5	(H1)	5833.02	809.33	6723.27	7836.02	0.4	-2255.60	0.4
	5	(H2)	792.56	809.33	1682.82	7836.02	0.4	-2255.60	0.4
	6	(H1)	6249.40	674.42	6991.27	8793.76	0.4	-1367.89	0.4
	6	(H2)	1381.04	674.42	2122.91	8793.76	0.4	-1367.89	0.4
	7	(H1)	6110.22	539.52	6703.69	8838.73	0.4	-1336.45	0.4
	7	(H2)	1681.24	539.52	2274.71	8838.73	0.4	-1336.45	0.4
	8	(H1)	5415.46	404.62	5860.54	8468.70	0.4	-1650.25	0.4
	8	(H2)	1693.14	404.62	2138.22	8468.70	0.4	-1650.25	0.4
	9	(H1)	4165.13	269.71	4461.81	7764.77	0.4	-2310.92	0.4
	9	(H2)	1416.76	269.71	1713.44	7764.77	0.4	-2310.92	0.4
	10	(H1)	2359.22	134.80	2507.50	6726.85	0.4	-3394.45	0.5
	10	(H2)	852.10	134.80	1000.38	6726.85	0.4	-3394.45	0.5
	11	(H1)	0.00	0.01	0.00	5348.71	0.3	-4728.27	0.5
	11	(H2)	0.00	0.01	0.00	5348.71	0.3	-4728.27	0.5

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-3
COMPROBACION A CORTANTE

FECHA

HOJA N.º

COMPROBACION A CORTANTE

Para el cálculo a cortante se ha tomado un ancho bruto de 1,08 m y un ancho neto de 0,86 m en secciones sobre pilas → nervios.

Se ha dividido el tablero en dos zonas de armado:

- Zona de armadura mínima → 2c Φ16/0.20
- Refuerzo en zonas próximas a nervios de pilas

$A_{nec}: 120 - \frac{120 - 56.2}{2.875} \times 1 = 97.2 cm^2/m$ 2c Φ20/0125

A continuación se adjunta un listado con la armadura necesaria en cada sección de cálculo.

Calculo de Comprobacion a Cortante - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-424.5	0.0	-1320.67	438.7	-3622.6
	1	(H2)	0.00	-1125.0	0.0	-1320.67	438.7	-3622.6
	2	(H1)	954.82	-282.8	0.0	-2429.21	355.1	-3606.9
	2	(H2)	2668.82	-851.9	0.0	-2429.21	355.1	-3606.9
	3	(H1)	1527.13	-141.1	0.0	-3174.04	212.0	-3583.1
	3	(H2)	4600.50	-578.9	0.0	-3174.04	212.0	-3583.1
	4	(H1)	1716.95	0.5	0.0	-3522.82	70.5	-3552.3
	4	(H2)	5795.04	-305.9	0.0	-3522.82	70.5	-3552.3
	5	(H1)	1524.26	142.2	0.0	-3482.02	-68.3	-3514.8
	5	(H2)	5331.44	-77.0	0.0	-3482.02	-68.3	-3514.8
	6	(H1)	3798.63	347.6	0.0	-3032.17	-222.4	-3466.9
	6	(H2)	2802.13	146.6	0.0	-3032.17	-222.4	-3466.9
	7	(H1)	3233.15	619.5	0.0	-2172.07	-371.7	-3413.1
	7	(H2)	2215.05	288.3	0.0	-2172.07	-371.7	-3413.1
	8	(H1)	1192.01	892.5	0.0	-924.68	-515.5	-3353.9
	8	(H2)	1245.47	429.9	0.0	-924.68	-515.5	-3353.9
	9	(H1)	-1586.28	1165.5	0.0	681.87	-655.6	-3303.8
	9	(H2)	-106.61	571.6	0.0	681.87	-655.6	-3303.8
	10	(H1)	-5101.70	1438.5	0.0	2643.13	-794.5	-3268.4
	10	(H2)	-1841.19	713.3	0.0	2643.13	-794.5	-3268.4
	11	(H1)	-9354.28	1711.5	0.0	3915.72	-68.3	-3432.0
	11	(H2)	-3958.28	854.9	0.0	3915.72	-68.3	-3432.0
2	1	(H1)	-3958.28	-758.7	0.0	3915.72	11.1	-3432.0
	1	(H2)	-9368.57	-1736.2	0.0	3915.72	11.1	-3432.0
	2	(H1)	-1993.79	-607.9	0.0	3107.65	480.9	-3486.1
	2	(H2)	-4831.38	-1449.9	0.0	3107.65	480.9	-3486.1
	3	(H1)	-463.00	-457.0	0.0	1319.63	477.6	-3825.1
	3	(H2)	-1078.33	-1160.2	0.0	1319.63	477.6	-3825.1
	4AI	(H1)	515.59	-325.8	0.0	-161.05	456.4	-4105.4
	4AI	(H2)	1506.16	-907.4	0.0	-161.05	456.4	-4105.4
	4AD	(H1)	515.59	-325.9	0.0	115.63	366.6	-3354.7

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	4AD	(H2)	1506.16	-907.4	0.0	115.63	366.6	-3354.7
	5	(H1)	1413.32	-109.4	0.0	-1447.13	381.0	-3396.5
	5	(H2)	4388.89	-490.3	0.0	-1447.13	381.0	-3396.5
	6	(H1)	1418.25	107.0	0.0	-2630.55	11.1	-3527.9
	6	(H2)	4904.17	-95.4	0.0	-2630.55	11.1	-3527.9
	7	(H1)	4169.09	502.9	0.0	-2274.23	-215.8	-3585.4
	7	(H2)	1533.92	133.3	0.0	-2274.23	-215.8	-3585.4
	8	(H1)	1234.42	920.0	0.0	-958.11	-439.0	-3626.4
	8	(H2)	537.52	349.8	0.0	-958.11	-439.0	-3626.4
	9	(H1)	-1381.54	1172.8	0.0	611.83	-570.9	-3409.8
	9	(H2)	-500.87	480.9	0.0	611.83	-570.9	-3409.8
	10	(H1)	-5171.42	1462.5	0.0	2770.22	-572.4	-3242.0
	10	(H2)	-2100.42	631.8	0.0	2770.22	-572.4	-3242.0
	11	(H1)	-9792.86	1750.7	0.0	3548.99	11.1	-3432.0
	11	(H2)	-4133.68	782.6	0.0	3548.99	11.1	-3432.0
3	1	(H1)	-4133.68	-783.3	0.0	3548.99	-2.3	-3432.0
	1	(H2)	-9792.86	-1751.4	0.0	3548.99	-2.3	-3432.0
	2	(H1)	-2098.55	-632.4	0.0	2779.62	467.4	-3486.1
	2	(H2)	-5169.30	-1463.2	0.0	2779.62	467.4	-3486.1
	3	(H1)	-497.11	-481.6	0.0	1030.30	464.1	-3825.1
	3	(H2)	-1378.14	-1173.5	0.0	1030.30	464.1	-3825.1
	4AI	(H1)	542.91	-350.4	0.0	-416.73	443.0	-4105.4
	4AI	(H2)	1239.50	-920.7	0.0	-416.73	443.0	-4105.4
	4AD	(H1)	542.91	-350.4	0.0	-140.05	353.1	-3354.7
	4AD	(H2)	1239.50	-920.7	0.0	-140.05	353.1	-3354.7
	5	(H1)	1542.00	-134.0	0.0	-1647.30	367.5	-3396.5
	5	(H2)	4176.93	-503.6	0.0	-1647.30	367.5	-3396.5
	6	(H1)	4914.94	94.8	0.0	-2775.19	-2.3	-3527.9
	6	(H2)	1429.07	-107.7	0.0	-2775.19	-2.3	-3527.9
	7	(H1)	4402.59	489.6	0.0	-2363.35	-229.3	-3585.4
	7	(H2)	1426.82	108.8	0.0	-2363.35	-229.3	-3585.4

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	8	(H1)	1522.63	906.7	0.0	-991.71	-452.5	-3626.4
	8	(H2)	531.76	325.2	0.0	-991.71	-452.5	-3626.4
	9	(H1)	-1060.19	1159.5	0.0	611.88	-584.4	-3409.9
	9	(H2)	-445.21	456.4	0.0	611.88	-584.4	-3409.9
	10	(H1)	-4811.95	1449.2	0.0	2808.97	-585.9	-3242.0
	10	(H2)	-1974.13	607.2	0.0	2808.97	-585.9	-3242.0
	11	(H1)	-9347.03	1735.6	0.0	3626.44	-2.3	-3432.0
	11	(H2)	-3936.76	758.1	0.0	3626.44	-2.3	-3432.0
4	1	(H1)	-3936.76	-854.1	0.0	3626.44	57.6	-3432.0
	1	(H2)	-9332.73	-1710.7	0.0	3626.44	57.6	-3432.0
	2	(H1)	-859.81	-637.7	0.0	1993.88	564.3	-3502.8
	2	(H2)	-3136.21	-1293.6	0.0	1993.88	564.3	-3502.8
	3AI	(H1)	1324.34	-421.3	0.0	-204.37	502.9	-3639.0
	3AI	(H2)	1339.74	-876.5	0.0	-204.37	502.9	-3639.0
	3AD	(H1)	1324.34	-421.3	0.0	-27.69	416.4	-2943.4
	3AD	(H2)	1339.74	-876.5	0.0	-27.69	416.4	-2943.4
	4	(H1)	2167.66	-298.3	0.0	-1018.73	420.6	-2961.5
	4	(H2)	3116.52	-639.5	0.0	-1018.73	420.6	-2961.5
	5	(H1)	2722.69	-175.3	0.0	-2060.71	425.1	-2994.1
	5	(H2)	4337.73	-402.5	0.0	-2060.71	425.1	-2994.1
	6	(H1)	2989.43	-52.3	0.0	-2947.39	218.4	-3078.4
	6	(H2)	1381.04	-189.6	0.0	-2947.39	218.4	-3078.4
	7	(H1)	6110.22	177.9	0.0	-3185.94	-7.5	-3142.6
	7	(H2)	1681.24	-66.6	0.0	-3185.94	-7.5	-3142.6
	8	(H1)	5415.46	414.9	0.0	-3070.96	-116.2	-3169.2
	8	(H2)	1693.14	56.4	0.0	-3070.96	-116.2	-3169.2
	9	(H1)	4165.13	651.9	0.0	-2691.40	-226.5	-3191.3
	9	(H2)	1416.76	179.4	0.0	-2691.40	-226.5	-3191.3
	10	(H1)	2359.22	888.9	0.0	-2044.68	-337.6	-3208.6
	10	(H2)	852.10	302.4	0.0	-2044.68	-337.6	-3208.6
	11	(H1)	0.00	1125.8	0.0	-1173.19	-385.5	-3220.2
	11	(H2)	0.00	425.3	0.0	-1173.19	-385.5	-3220.2

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1)	AB	1.6831	14.2	1268.9	0.01	157.64	--	12.00
	1	(H2)	AB	1.6831	-686.3	1268.9	0.54	157.64	34.62	12.00
	2	(H1)	AB	1.6808	72.3	1269.7	0.06	157.64	--	12.00
	2	(H2)	AB	1.6808	-496.8	1269.7	0.39	157.64	22.24	12.00
	3	(H1)	AB	1.6772	70.9	1271.0	0.06	157.64	--	12.00
	3	(H2)	AB	1.6772	-366.9	1271.0	0.29	157.64	13.75	12.00
	4	(H1)	AB	1.6725	71.0	1272.7	0.06	157.64	--	12.00
	4	(H2)	AB	1.6725	-235.4	1272.7	0.18	157.64	5.12	12.00
	5	(H1)	AB	1.6669	73.9	1274.8	0.06	157.64	--	12.00
	5	(H2)	AB	1.6669	-145.3	1274.8	0.11	157.64	--	12.00
	6	(H1)	AB	1.6596	125.2	1277.4	0.10	157.64	--	12.00
	6	(H2)	AB	1.6596	-75.8	1277.4	0.06	157.64	--	12.00
	7	(H1)	AB	1.6514	247.8	1280.3	0.19	157.64	6.02	12.00
	7	(H2)	AB	1.6514	-83.4	1280.3	0.07	157.64	--	12.00
	8	(H1)	AB	1.6423	377.0	1283.6	0.29	157.64	14.73	12.00
	8	(H2)	AB	1.6423	-85.5	1283.6	0.07	157.64	--	12.00
	9	(H1)	AB	1.6345	509.9	1286.4	0.40	157.64	23.76	12.00
	9	(H2)	AB	1.6345	-84.0	1286.4	0.07	157.64	--	12.00
	10	(H1)	AB	1.6290	644.0	1288.3	0.50	157.64	32.91	12.00
	10	(H2)	AB	1.6290	-81.2	1288.3	0.06	157.64	--	12.00
	11	(H1)	C	1.6543	1643.3	1785.1	0.92	0.00	109.50	13.33
	11	(H2)	AB	1.6543	786.7	1785.1	0.44	219.96	37.76	13.33
2	1	(H1)	AB	1.6543	-747.6	1785.1	0.42	219.96	35.16	13.33
	1	(H2)	C	1.6543	-1725.1	1785.1	0.97	0.00	114.95	13.33
	2	(H1)	AB	1.6625	-127.0	1276.3	0.10	157.64	--	12.00
	2	(H2)	AB	1.6625	-969.0	1276.3	0.76	157.64	53.80	12.00
	3	(H1)	AB	1.7133	20.5	1258.0	0.02	157.64	--	12.00
	3	(H2)	AB	1.7133	-682.6	1258.0	0.54	157.64	33.78	12.00
	4AI	(H1)	AB	1.7542	130.6	1243.2	0.11	157.64	--	12.00
	4AI	(H2)	AB	1.7542	-451.0	1243.2	0.36	157.64	18.43	12.00
	4AD	(H1)	AB	1.6424	40.7	1283.5	0.03	157.64	--	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	4AD	(H2)	AB	1.6424	-540.8	1283.5	0.42	157.64	25.72	12.00
	5	(H1)	AB	1.6488	271.6	1281.2	0.21	157.64	7.62	12.00
	5	(H2)	C	1.6488	-109.3	1281.2	0.09	157.64	--	12.00
	6	(H1)	AB	1.6689	118.1	1274.0	0.09	157.64	--	12.00
	6	(H2)	AB	1.6689	-84.3	1274.0	0.07	157.64	--	12.00
	7	(H1)	AB	1.6776	287.0	1270.9	0.23	157.64	8.50	12.00
	7	(H2)	AB	1.6776	-82.5	1270.9	0.06	157.64	--	12.00
	8	(H1)	AB	1.6837	481.0	1268.7	0.38	157.64	21.17	12.00
	8	(H2)	AB	1.6837	-89.2	1268.7	0.07	157.64	--	12.00
	9	(H1)	AB	1.6509	601.9	1280.5	0.47	157.64	29.66	12.00
	9	(H2)	AB	1.6509	-90.0	1280.5	0.07	157.64	--	12.00
	10	(H1)	AB	1.6249	890.1	1289.8	0.69	157.64	49.69	12.00
	10	(H2)	AB	1.6249	59.4	1289.8	0.05	157.64	--	12.00
	11	(H1)	C	1.6543	1761.9	1785.1	0.99	0.00	117.40	13.33
	11	(H2)	AB	1.6543	793.8	1785.1	0.44	219.96	38.23	13.33
3	1	(H1)	AB	1.6543	-785.6	1785.1	0.44	219.96	37.69	13.33
	1	(H2)	C	1.6543	-1753.7	1785.1	0.98	0.00	116.86	13.33
	2	(H1)	AB	1.6625	-165.0	1276.3	0.13	157.64	0.49	12.00
	2	(H2)	AB	1.6625	-995.8	1276.3	0.78	157.64	55.57	12.00
	3	(H1)	AB	1.7133	-17.5	1258.0	0.01	157.64	--	12.00
	3	(H2)	AB	1.7133	-709.4	1258.0	0.56	157.64	35.50	12.00
	4AI	(H1)	AB	1.7542	92.6	1243.2	0.07	157.64	--	12.00
	4AI	(H2)	AB	1.7542	-477.7	1243.2	0.38	157.64	20.11	12.00
	4AD	(H1)	AB	1.6424	2.7	1283.5	0.00	157.64	--	12.00
	4AD	(H2)	AB	1.6424	-567.6	1283.5	0.44	157.64	27.51	12.00
	5	(H1)	AB	1.6488	233.5	1281.2	0.18	157.64	5.07	12.00
	5	(H2)	AB	1.6488	-136.0	1281.2	0.11	157.64	--	12.00
	6	(H1)	AB	1.6689	92.4	1274.0	0.07	157.64	--	12.00
	6	(H2)	AB	1.6689	-110.0	1274.0	0.09	157.64	--	12.00
	7	(H1)	AB	1.6776	260.3	1270.9	0.20	157.64	6.75	12.00
	7	(H2)	AB	1.6776	-120.5	1270.9	0.09	157.64	--	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	8	(H1)	AB	1.6837	454.3	1268.7	0.36	157.64	19.42	12.00
	8	(H2)	AB	1.6837	-127.3	1268.7	0.10	157.64	--	12.00
	9	(H1)	AB	1.6509	575.2	1280.5	0.45	157.64	27.88	12.00
	9	(H2)	AB	1.6509	-128.0	1280.5	0.10	157.64	--	12.00
	10	(H1)	AB	1.6249	863.4	1289.8	0.67	157.64	47.87	12.00
	10	(H2)	AB	1.6249	21.4	1289.8	0.02	157.64	--	12.00
	11	(H1)	C	1.6543	1733.2	1785.1	0.97	0.00	115.49	13.33
	11	(H2)	AB	1.6543	755.7	1785.1	0.42	219.96	35.70	13.33
4	1	(H1)	AB	1.6543	-796.6	1785.1	0.45	219.96	38.42	13.33
	1	(H2)	C	1.6543	-1653.2	1785.1	0.93	0.00	110.16	13.33
	2	(H1)	AB	1.6650	-73.4	1275.4	0.06	157.64	--	12.00
	2	(H2)	AB	1.6650	-729.3	1275.4	0.57	157.64	37.85	12.00
	3AI	(H1)	AB	1.6856	81.6	1268.0	0.06	157.64	--	12.00
	3AI	(H2)	AB	1.6856	-373.7	1268.0	0.29	157.64	14.13	12.00
	3AD	(H1)	AB	1.5778	-4.9	1306.6	0.00	157.64	--	12.00
	3AD	(H2)	AB	1.5778	-460.1	1306.6	0.35	157.64	21.13	12.00
	4	(H1)	AB	1.5807	122.3	1305.6	0.09	157.64	--	12.00
	4	(H2)	AB	1.5807	-218.9	1305.6	0.17	157.64	4.27	12.00
	5	(H1)	AB	1.5859	249.8	1303.7	0.19	157.64	6.40	12.00
	5	(H2)	AB	1.5859	22.6	1303.7	0.02	157.64	--	12.00
	6	(H1)	AB	1.5993	166.1	1299.0	0.13	157.64	0.58	12.00
	6	(H2)	AB	1.5993	28.9	1299.0	0.02	157.64	--	12.00
	7	(H1)	C	1.6094	170.4	1295.4	0.13	157.64	0.87	12.00
	7	(H2)	AB	1.6094	-74.1	1295.4	0.06	157.64	--	12.00
	8	(H1)	AB	1.6136	298.7	1293.9	0.23	157.64	9.64	12.00
	8	(H2)	AB	1.6136	-59.8	1293.9	0.05	157.64	--	12.00
	9	(H1)	AB	1.6170	425.5	1292.6	0.33	157.64	18.26	12.00
	9	(H2)	AB	1.6170	-47.1	1292.6	0.04	157.64	--	12.00
	10	(H1)	AB	1.6197	551.4	1291.7	0.43	157.64	26.80	12.00
	10	(H2)	AB	1.6197	-35.2	1291.7	0.03	157.64	--	12.00
	11	(H1)	AB	1.6215	740.2	1291.0	0.57	157.64	39.60	12.00
	11	(H2)	AB	1.6215	39.7	1291.0	0.03	157.64	--	12.00

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 - E-3

FECHA

HOJA N.º

ARMADURAS ANCLAJES PRETENSADO

Cables principales

Horizontal: $538 \times 1.6 \times 0.3 \times \left(\frac{0.746 - 0.43}{0.746}\right) \times \frac{1.15}{5.1} = 25\ cm^2$/anclaje
$5 \times 2c\ \phi 12$/anclaje

Vertical: $4 \times 538 \times 1.6 \times 0.3 \times \left(\frac{2.62 - 2.15}{2.62}\right) \times \frac{1.15}{5.1} = 42\ cm^2$
$\left(\frac{2.74 - 2.01}{2.74}\right) \times \frac{1.15}{5.1} = 62.1\ cm^2$

$5 \times 2c\ \phi 20$

Cables de cosido al estribo

Fmax = 513 + 134 - 647
Fmin = 478

Pieza de anclaje 0.43 × 0.43

Axes: Vert. / Horiz.

$A_{vert} = 1.6 \times (478) \times 0.3 \times \frac{1.15}{5.1} \times \left(\frac{2.00 - 0.45}{2.00}\right) = 40\ cm^2$

$\left(\frac{2.60 - 0.45}{2.60}\right) = 43\ cm^2$

Pieza de anclaje 750 × 350

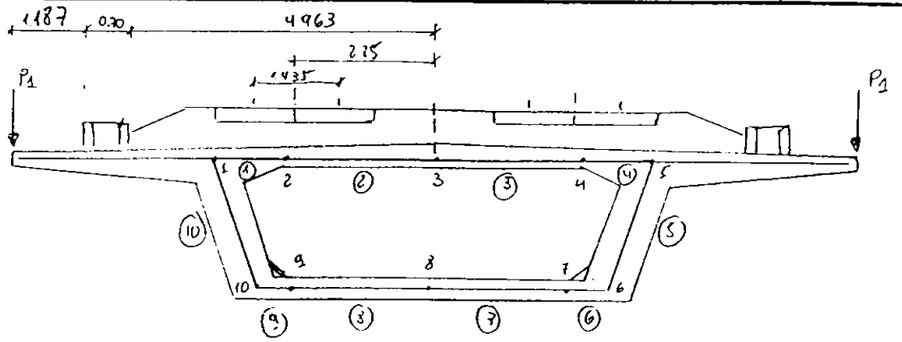
$1.6 \times \left(478 + \frac{647}{2}\right) \times 0.3 \times \frac{1.15}{5.1} \left(\frac{2.00 - 0.75}{2.00}\right) = 54\ cm^2$

$\left(\frac{2.60 - 0.75}{2.60}\right) = 62\ cm^2$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1. PUENTES CAJON
CALCULO TRANSVERSAL

FECHA

HOJA N.º 1



Coordenadas de los nudos

NUDO	X	Y
1	-3.687	2.10
2	-2.50	2.10
3	0.00	2.10
4	2.50	2.10
5	3.687	2.10
6	3.015	0.00
7	2.50	0.00
8	0.00	0.00
9	-2.50	0.00
10	-3.015	0.00

Características de las barras

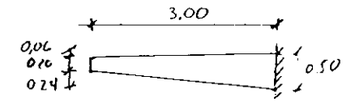
BARRAS	Area (m²)	Inercia (m⁴)	E (t/m²)
2 a 3	0.325	0.002861	35000000
1 a 2	0.466	0.003432	=
5 a 10	0.54	0.013122	=
6 a 9	0.40	0.005333	=
7 a 8	0.30	0.002250	=

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 PUENTES CAJON
CALCULO TRANSVERSAL

FECHA

HOJA N.º 2

HIPOTESIS DE CARGAS:



- Cargas en extremo de voladizo:

Imposta: $(0.70 \times 0.30 + 0.08 \times 0.25) \times 2.5 = 0.58$ t/m

Barandilla: 0.1 t/m

TOTAL 0.68 t/m

- Arqueta longitudinal

$(2 \times 0.40 \times 0.15 + 0.40 \times 0.05) \times 2.5 = 0.35$ t/m

- Balasto + traviesas + vía 4.74 t/m por vía $= \frac{4.74}{4.96} = 0.96$ t/m²

Cargas en ejenes de modelización:

$V = 0.20 \times 3.00 \times 2.5 + \frac{1}{2} \times 0.30 \times 3.00 \times 2.50 + 0.68 + 0.35 + 0.96 \times 1.13 = 4.72$ t

$M = 0.2 \times 2.5 \times \frac{3^2}{2} + \frac{1}{2} \times 0.3 \times 3 \times 2.5 \times \frac{1}{3} \times 3.00 + 0.68 \times 3 + 0.35 \times 1.463 + 0.96 \times \frac{1.13^2}{2} = 6.52$ mt

HIPOTESIS 1: PESO PROPIO + CARGA PERMANENTE

Nudo 1 P = -4.72 M = 6.52
5 P = -4.72 M = -6.52

Barra 1 p = -3.31 t/m $\lambda = 270°$
2 1.73
3 1.73
4 1.13
5 1.35
6 1.50
7 0.75
8 0.75
9 1.00
10 1.35

```
L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.
CONTROL
10 10 9 4
:
NUDOS
1 -3.687 2.10
2 -2.50 2.10
3 0 2.10
4 2.50 2.10
5 3.687 2.10
6 3.015 0.0
7 2.50 0
8 0 0
9 -2.50 0
10 -3.015 0.0
:
BARRAS TIPO
5
.325 .002861 3500000
.466 .008433 3500000
.54 .013122 3500000
.40 .005333 3500000
.30 .002250 3500000
:
BARRAS
1 1 2 2
2 2 3 1
3 3 4 1
4 4 5 2
5 5 6 3
6 6 7 4
7 7 8 5
8 8 9 5
9 9 10 4
10 1 10 3
:
APOYOS
2
6 1 1 0
10 0 1 0
:
CARGAS
H-1 PESO PROPIO+CARGA PERMANENTE
2
1 0 -4.72 6.52
5 0 -4.72 -6.52
10
1  2 2.13 270
2  2 1.78 270
3  2 1.78 270
4  2 2.13 270
5  2 1.35 270
6  2 1.00 270
7  2 0.75 270
8  2 0.75 270
9  2 1.00 270
10 2 1.35 270
H-2.DOS TRENES SIN RIPAR
0
```



```
4
1 1 16.9 0.7195 270
2 1 16.9 0.9675 270
3 1 16.9 1.5325 270
4 1 16.9 0.4675 270
H-3 DOS TRENES RIPADOS 30 CM.
0
4
1 1 16.9 0.4195  270
2 1 16.9 0.6675  270
3 1 16.9 1.2325  270
4 1 16.9 0.1675  270
H-4.PEATONES VOLADIZOS
2
1 0 -.75 1.55
5 0 -.75 -1.55
0
:
```

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 1 H-1 PESO PROPIO+CARGA PERMANENTE

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000019	-0.000025
2	0.000001	-0.000214	-0.000258
3	0.000005	-0.000826	-0.000000
4	0.000008	-0.000214	0.000258
5	0.000009	-0.000019	0.000025
6	0.000000	-0.000000	0.000006
7	0.000001	-0.000018	0.000058
8	0.000005	-0.000245	-0.000000
9	0.000008	-0.000018	-0.000058
10	0.000009	-0.000000	-0.000006

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	17.06	-0.00
10	0.00	17.06	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	1.64	-9.46	-6.98
	2	1.64	-2.67	-4.45
2	2	1.64	-2.67	-4.45
	3	1.64	2.89	0.00
3	3	1.64	2.89	-0.00
	4	1.64	-2.67	4.45
4	4	1.64	-2.67	4.45
	5	1.64	-9.46	6.98
5	5	-11.64	-2.94	-2.00
	6	-14.48	2.48	-2.91
6	6	-1.64	2.48	2.39
	7	-1.64	1.38	1.87
7	7	-1.64	1.38	1.87
	8	-1.64	-0.96	-0.00
8	8	-1.64	-0.96	-0.00
	9	-1.64	1.38	-1.88
9	9	-1.64	1.38	-1.88
	10	-1.64	2.48	-2.39
10	1	-11.64	2.94	2.00
	10	-14.48	-2.48	2.91

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 2 H-2.DOS TRENES SIN RIPAR

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000001	-0.000021	-0.000642
2	-0.000005	-0.001416	-0.001485
3	-0.000023	-0.004005	-0.000000
4	-0.000041	-0.001416	0.001485
5	-0.000047	-0.000021	0.000642
6	0.000000	-0.000000	-0.000285
7	-0.000003	0.000141	-0.000262
8	-0.000023	0.000469	0.000000
9	-0.000043	0.000141	0.000262
10	-0.000046	-0.000000	0.000285

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	33.80	0.00
10	-0.00	33.80	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.37	-39.46	-33.80
	2	-8.37	-7.24	-16.90
2	2	-8.37	-7.24	-16.90
	3	-8.37	9.11	-0.00
3	3	-8.37	9.11	0.00
	4	-8.37	-7.24	16.90
4	4	-8.37	-7.24	16.90
	5	-8.37	-39.46	33.80
5	5	-29.64	-39.46	-18.27
	6	-29.64	0.83	-18.27
6	6	8.37	0.83	-0.00
	7	8.37	0.83	-0.00
7	7	8.37	0.83	0.00
	8	8.37	0.83	0.00
8	8	8.37	0.83	0.00
	9	8.37	0.83	0.00
9	9	8.37	0.83	-0.00
	10	8.37	0.83	-0.00
10	1	-29.64	39.46	18.27
	10	-29.64	-0.83	18.27

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 3 H-3 DOS TRENES RIPADOS 30 CM.

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000368	-0.000143	-0.000452
2	-0.000374	-0.001318	-0.001333
3	-0.000392	-0.004033	-0.000235
4	-0.000410	-0.001509	0.001651
5	-0.000416	0.000100	0.000821
6	0.000000	-0.000000	-0.000130
7	-0.000003	0.000072	-0.000147
8	-0.000023	0.000465	-0.000097
9	-0.000042	0.000208	0.000373
10	-0.000045	-0.000000	0.000436

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	30.44	-0.00
10	-0.00	37.16	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.21	-39.43	-36.63
	2	-8.21	-8.92	-19.73
2	2	-8.21	-8.92	-19.73
	3	-8.21	9.44	-2.83
	4	-8.21	-4.89	14.07
4	4	-8.21	-4.89	14.07
	5	-8.21	-38.82	30.97
5	5	-26.99	-38.82	-17.25
	6	-26.99	-0.78	-17.25
6	6	8.21	-0.78	-0.53
	7	8.21	-0.51	-0.53
7	7	8.21	-0.51	-0.53
	8	8.21	0.82	-0.53
8	8	8.21	0.82	-0.53
	9	8.21	2.14	-0.53
9	9	8.21	2.14	-0.53
	10	8.21	2.42	-0.53
10	1	-32.39	39.43	18.98
	10	-32.39	-2.42	18.98

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 4 H-4.PEATONES VOLADIZOS

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000003	0.000026
2	0.000001	0.000026	0.000022
3	0.000003	0.000054	0.000000
4	0.000005	0.000026	-0.000022
5	0.000005	-0.000003	-0.000026
6	0.000000	-0.000000	0.000009
7	0.000000	-0.000004	0.000008
8	0.000003	-0.000014	-0.000000
9	0.000005	-0.000004	-0.000008
10	0.000005	-0.000000	-0.000009

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	0.75	0.00
10	0.00	0.75	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	0.95	-0.09	-0.00
	2	0.95	-0.09	-0.00
2	2	0.95	-0.09	-0.00
	3	0.95	-0.09	-0.00
3	3	0.95	-0.09	0.00
	4	0.95	-0.09	0.00
4	4	0.95	-0.09	0.00
	5	0.95	-0.09	0.00
5	5	-1.00	1.46	0.67
	6	-1.00	-0.02	0.67
6	6	-0.95	-0.02	-0.00
	7	-0.95	-0.02	-0.00
7	7	-0.95	-0.02	-0.00
	8	-0.95	-0.02	-0.00
8	8	-0.95	-0.02	-0.00
	9	-0.95	-0.02	-0.00
9	9	-0.95	-0.02	-0.00
	10	-0.95	-0.02	-0.00
10	1	-1.00	-1.46	-0.67
	10	-1.00	0.02	-0.67

ARMADURA DE RASANTE

Momentos estáticos

Sección A:

$M_E = 0{,}20 \cdot 3{,}0 \cdot \left(0{,}95 - 0{,}237\right) + \frac{1}{2}\, 0{,}06 \cdot 3 \cdot \left(0{,}95 - 0{,}137 + \frac{0{,}06}{3}\right) + \frac{1}{2}\, 0{,}24 \cdot 3 \cdot \left(0{,}95 - 0{,}137 - \frac{0{,}24}{3}\right)$

$= 0{,}7667\ m^3$

Sección B

$M_E = 3{,}249 \cdot 0{,}285 \cdot \left(0{,}95 - 0{,}065 - \frac{0{,}285}{2}\right) + \frac{1}{2}\, 3{,}249 \cdot 0{,}065 \left(0{,}95 - \frac{0{,}065 \cdot 2}{3}\right) + \frac{1}{2}\, 0{,}749 \cdot 0{,}332 \cdot \left(0{,}95 - 3{,}065 - \frac{0{,}332}{3}\right)$

$= 0{,}68475 + 0{,}0957 + 0{,}06084 = 0{,}8441\ m^3$

Sección F:

$M_E = 2{,}843 \cdot 0{,}30 \cdot \left(1{,}5 - 0{,}15\right) + \frac{1}{2}\, 0{,}343 \cdot 0{,}20 \cdot \left(1{,}5 - 0{,}30 - \frac{1}{3}\, 0{,}20\right) =$

$1{,}15111 + 0{,}0389 = 1{,}1903\ m^3$

Armadura: $A_{wc} = \frac{V_{rd,m} \cdot M_E}{I} \cdot \frac{1}{42}\ cm^2/m$

SECCION A ⇒ 0,02674 V_{rd} cm^2/m

B ⇒ 0,02944 V_{rd} cm^2/m

F ⇒ 0,04151 V_{rd} cm^2/m

Tomando un valor medio por tramos:

	V_{rd}	(A)	(B)	(F)
Estribos	528/583	15.6 cm^2/m	17.2 cm^2/m	24.2 cm^2/m
2L/10 Estribo	303/363	9.7	10.7	15,1
2L/10 V. lateral	444/341	11.9	13,1	18.4
P. Lateral	1203 / 1157	32.2	35.4	49,9
2L/10 V intermedios	641	17,1	18.9	26.6
Pilas intermedias	1234	33.0	36.3	51.2

TORSION

Hipotesis de carga a tener en cuenta:

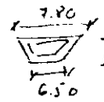
- Dos vías cargadas ripadas 30cm
- Una vía cargada ripada 30cm
- Viento → $0.2 \times (2.45 \times (0.95 - 1.225) + 0.70 \times (0.95+0.35) + 3.50 \times (0.95+1.75) =$
  $= 1.94$ mt/m
- S. aceras → $0.75 \times 5.90 = 4.43$ mt/m

· Respecto a las almas hay que comparar para ver el estado mas desfavorable las acciones debidas a cortante y las debidas a torsión. Suponiendo una carga p t/m y por vía:

a) 2 vías cargadas: Fuerza por alma. $p \times \frac{33}{2} = \underline{16.5\,p}$

b) 1 vía cargada. Cortante 8,25 p fuerza por alma por cortante

Torsión $2.25\,p \times \frac{33}{2} = 37.125$ mt

Area resistente a torsión 

$\lambda e = 0.30$ $Ae = 14,6\ m^2$

Flujo de fuerza por metro: $f = \frac{37.125}{14.6}\,p = 2.54\,p$

Longitud alma 2.20 => fuerza por alma (por torsión) = $5,6\,p$ t

Total b) => $5,6 + 8.25 = \underline{13,85\,p}$

Para las almas es más desfavorable cargar las dos vías y para las cabezas superior e inferior cargar una sola vía.

SECCION DE APOYO

Maximas acciones en almas:

$$Td = 1.6 \times \left[1.24 \times 24 \times 30 \times \frac{18}{33} \times 0.30 + 1.24 \times \frac{1.5}{33} \times 20 \times 3 \times 0.30 + \right.$$
$$\left. + 1.35 \times \frac{33}{2} + 4.43 \times \frac{33}{2} \right] = 1.6 \left[\underset{242,5}{146,1} + 1,0 + 27.3 + 73 \right] = 388 \text{ mt}$$

A transversal: $\frac{388}{2 \times 14.6 \times 42} = 3.2\ cm^2/m$ $A_{long} = 3,0\ cm^2/m$

$Tu_1 = 0,36 \times \frac{3500}{1.5} \times 14,6 \times 0.54 = 6622$ mt $\frac{Td}{Tu_1} = 0,06$

$\frac{Vd}{Vu_1} + \frac{Td}{Tu_1} < 1$ En el final de la costilla $0.99 - \frac{0.99 - 0.6}{2.275} \times 1 + 0.06 = 0.94$

Máximas acciones en losas superior e inferior:

$$Td = 1.6 \times \left[1.24 \times 12 \times 30 \times \frac{18}{33} \times 2.25 + 1.24 \times 10 \times 3 \times \frac{1.5}{33} \times 2.55 + (135+44.3) \times \frac{33}{2} \right] =$$
$$= 1.6 \times \left[\underset{720,5}{621} + 4.3 + 27.3 + 73 \right] = 1153 \text{ mt}$$

$At = \frac{1153}{2 \times 14.6 \times 4.2} = 9.4\ cm^2/m$ $Al = 8.9\ cm^2/m$

$Tu_1 = 0.36 \times \frac{3500}{1.5} \times 14.6 \times 0.30 = 3679$ $\frac{Td}{Tu_1} = 0.31$

SECCION A CUARTOS DE LUZ

Losa superior e inferior $Td = 1.6 \times \left[1.24 \times 12 \times 27.75 \times 2.55 \times \frac{12.375}{33} + (135+44.3) \times \frac{12.38}{33} \times \right.$
$14.75 = 650$ mt $At = 5.3\ cm^2/m$ $Al = 5.0\ cm^2/m$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 PUENTES CAJON
COSTILLA SOBRE PILAS

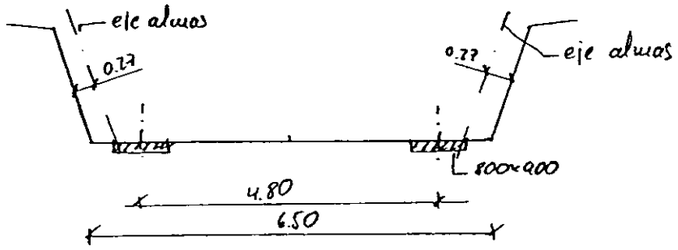
FECHA

HOJA N.° 15

COSTILLA SOBRE PILAS

Reacción en apoyos:

$$R_{max} = \frac{1}{2}\left(793{,}2 + 352{,}5 + 6{,}6 + 843{,}5 + 9{,}3\right) + \frac{485}{4{,}80} = 1104\,t$$



Tracción $F = 1{,}6 \cdot 1104 \cdot 0{,}58 \cdot \frac{1}{2{,}30} = 445\,t \rightarrow 100\,cm^2$

Armado $0{,}3 \cdot 1104 \cdot 1{,}6 \cdot \frac{1{,}15}{5{,}1} \cdot \left(\frac{1{,}70 - 0{,}8}{1{,}70}\right) = 56\,cm^2$

$\left(\frac{2{,}0 - 0{,}8}{2{,}0}\right) = 72\,cm^2$

Compresión $\Rightarrow 445 + 1{,}6 \times 1000 \times 0{,}305 = 934\,t$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 PUENTES CAJON
COSTILLA SOBRE E. MOVIL

FECHA

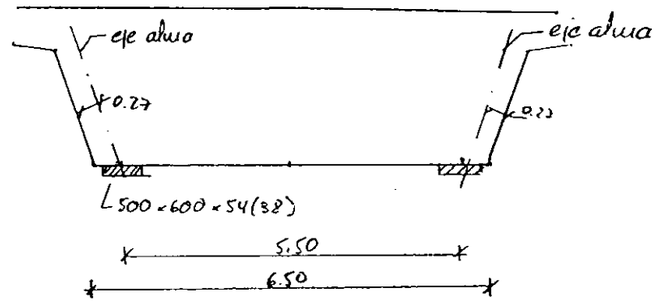
HOJA N.° 16

COSTILLA EN ESTRIBO MOVIL

Reacciones en estribo

$$R_{max} = \frac{1}{2}\left(284 + 108 + 25 + 298 + 67\right) + \frac{M_E}{5{,}50} = 427\,t$$

$$M_E = 1{,}24 \times 24 \times \frac{2{,}7}{2} \times 0{,}30 + \left(1{,}35 + 4{,}43\right) \times \frac{2{,}7}{2} = 199$$



Tracción en parte superior $F = 1{,}6 \cdot 427 \cdot \frac{1}{2{,}30} \cdot 0{,}23 = 68{,}3\,t \Rightarrow 16\,cm^2$

Armado $\Rightarrow$ $0{,}3 \cdot 427 \cdot 1{,}6 \cdot \frac{1{,}15}{5{,}1} \cdot \left(\frac{2{,}060}{2{,}0}\right) = 32{,}4\,cm^2$

$\frac{2{,}050}{2{,}0} = 34{,}7\,cm^2$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1. PUENTES CASAU
COSTILLA APOYO EN ESTRIBO FIJO E3

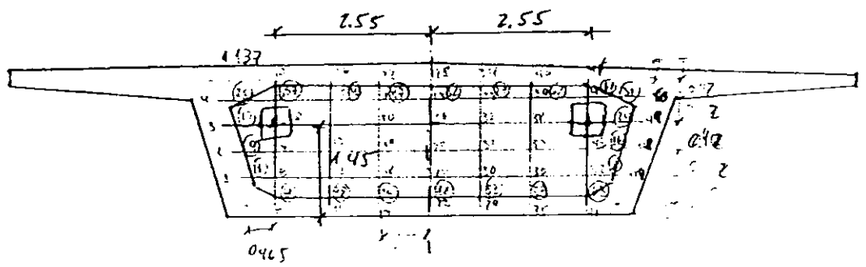
FECHA

HOJA N.º 17

COSTILLA APOYO EN ESTRIBO FIJO

El tirón debido al frenado + deformaciones diferidas es de:

513 + 134 = 647 t repartido en 2 puntos y cosido al estribo situados:



Para distribuir la armadura se usa una empanillado

		x	y
Nudo	1	-3.5526	0.42
	2	-3.4182	0.84
	3	-3.2838	1.26
	4	-3.149	1.68

Barras horizontales → $I = \frac{1}{12} 0.42 \cdot 2^3 \rightarrow 0.280\ m^4$ $I = 7I$

vertical: $I = \frac{1}{12} 0.85 \cdot 2^3 = 0.567\ m^4$

Barras verticales $|M| + |T|_{max} = 97\ mt/m \times 1.6 \rightarrow 19\ cm^2/m$

horizontales $72\ mt/m \times 1.6 \rightarrow 14\ cm^2/m$

cortante → $V_d = 249\ t/m$

$V_{cu} = 310$

$A_{min} = 17.7\ cm^2/m.$

COSTIE3 pag. 1

```
COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3
CONTROL
  50    67     6     1
:
NUDOS
    1      -3.1490      0.420
    2      -3.2838      0.840
    3      -3.4182      1.260
    4      -3.5526      1.680
    5      -2.550       0.000
    6      -2.550       0.420
    7      -2.550       0.840
    8      -2.550       1.260
    9      -2.550       1.680
   10      -2.550       2.100
   11      -1.700       0.000
   12      -1.700       0.420
   13      -1.700       0.840
   14      -1.700       1.260
   15      -1.700       1.680
   16      -1.700       2.100
   17      -0.850       0.000
   18      -0.850       0.420
   19      -0.850       0.840
   20      -0.850       1.260
   21      -0.850       1.680
   22      -0.850       2.100
   23       0.000       0.000
   24       0.000       0.420
   25       0.000       0.840
   26       0.000       1.260
   27       0.000       1.680
   28       0.000       2.100
   29       0.850       0.000
   30       0.850       0.420
   31       0.850       0.840
   32       0.850       1.260
   33       0.850       1.680
   34       0.850       2.100
   35       1.700       0.000
   36       1.700       0.420
   37       1.700       0.840
   38       1.700       1.260
   39       1.700       1.680
   40       1.700       2.100
   41       2.550       0.000
   42       2.550       0.420
   43       2.550       0.840
   44       2.550       1.260
   45       2.550       1.680
   46       2.550       2.100
   47       3.149       0.420
   48       3.2838      0.840
   49       3.4182      1.260
   50       3.5526      1.680
:
SECCIONES
2
  0.280000    0.560000     3500000     1500000
```

```
  0.567000   1.134000    3500000    1500000
:
BARRAS
   1    1    6    1
   2    6   12    1
   3   12   18    1
   4   18   24    1
   5   24   30    1
   6   30   36    1
   7   36   42    1
   8   42   47    1
   9    2    7    1
  10    7   13    1
  11   13   19    1
  12   19   25    1
  13   25   31    1
  14   31   37    1
  15   37   43    1
  16   43   48    1
  17    3    8    1
  18    8   14    1
  19   14   20    1
  20   20   26    1
  21   26   32    1
  22   32   38    1
  23   38   44    1
  24   44   49    1
  25    4    9    1
  26    9   15    1
  27   15   21    1
  28   21   27    1
  29   27   33    1
  30   33   39    1
  31   39   45    1
  32   45   50    1
  33    5    6    2
  34    6    7    2
  35    7    8    2
  36    8    9    2
  37    9   10    2
  38   11   12    2
  39   12   13    2
  40   13   14    2
  41   14   15    2
  42   15   16    2
  43   17   18    2
  44   18   19    2
  45   19   20    2
  46   20   21    2
  47   21   22    2
  48   23   24    2
  49   24   25    2
  50   25   26    2
  51   26   27    2
  52   27   28    2
  53   29   30    2
  54   30   31    2
  55   31   32    2
  56   32   33    2
```



```
  57   33   34    2
  58   35   36    2
  59   36   37    2
  60   37   38    2
  61   38   39    2
  62   39   40    2
  63   41   42    2
  64   42   43    2
  65   43   44    2
  66   44   45    2
  67   45   46    2
:
APOYOS
22
   1          0          0          1
   2          0          0          1
   3          0          0          1
   4          0          0          1
   5          0          0          1
  10          0          0          1
  11          0          0          1
  16          0          0          1
  17          0          0          1
  22          0          0          1
  23          0          0          1
  28          0          0          1
  29          0          0          1
  34          0          0          1
  35          0          0          1
  40          0          0          1
  41          0          0          1
  46          0          0          1
  47          0          0          1
  48          0          0          1
  49          0          0          1
  50          0          0          1
:
HIPOTESIS DE CARGA
H-1.TIRON DE              ARTICULADO
2
8   0 0 323.5
44  0 0 323.5
0
:
```

COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3

Hip. nº 1 H-1.TIRON DE ARTICULADO

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000011	0.000010	0.000000
2	-0.000008	0.000016	0.000000
3	0.000003	0.000017	0.000000
4	0.000014	0.000009	0.000000
5	-0.000012	0.000005	0.000000
6	-0.000011	0.000005	0.000005
7	-0.000008	0.000005	0.000009
8	0.000003	0.000003	0.000011
9	0.000014	0.000002	0.000007
10	0.000017	0.000002	0.000000
11	-0.000011	-0.000004	0.000000
12	-0.000009	-0.000004	0.000004
13	-0.000004	-0.000006	0.000007
14	0.000003	-0.000006	0.000007
15	0.000009	-0.000005	0.000004
16	0.000011	-0.000005	0.000000
17	-0.000003	-0.000003	0.000000
18	-0.000003	-0.000003	0.000001
19	-0.000001	-0.000004	0.000002
20	0.000001	-0.000004	0.000002
21	0.000003	-0.000003	0.000001
22	0.000003	-0.000003	0.000000
23	-0.000001	-0.000000	-0.000000
24	-0.000001	-0.000000	0.000000
25	-0.000000	-0.000000	0.000001
26	0.000001	-0.000000	0.000001
27	0.000001	-0.000000	0.000000
28	0.000001	-0.000000	-0.000000
29	-0.000003	0.000003	0.000000
30	-0.000003	0.000003	0.000001
31	-0.000001	0.000004	0.000002
32	0.000001	0.000004	0.000002
33	0.000003	0.000003	0.000001
34	0.000003	0.000003	0.000000
35	-0.000011	0.000004	0.000000
36	-0.000009	0.000004	0.000004
37	-0.000004	0.000006	0.000007
38	0.000003	0.000006	0.000007
39	0.000009	0.000005	0.000004
40	0.000011	0.000005	0.000000
41	-0.000012	-0.000005	0.000000
42	-0.000011	-0.000005	0.000005
43	-0.000008	-0.000005	0.000009
44	0.000003	-0.000003	0.000011
45	0.000014	-0.000002	0.000007
46	0.000017	-0.000002	0.000000
47	-0.000011	-0.000010	0.000000
48	-0.000008	-0.000016	0.000000
49	0.000003	-0.000017	0.000000
50	0.000014	-0.000009	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	0.00	0.00	28.22
2	0.00	0.00	41.85
3	0.00	-0.00	34.12
4	-0.00	0.00	13.07
5	-0.00	0.00	12.56
10	-0.00	0.00	80.35
11	-0.00	0.00	46.47
16	0.00	0.00	55.46
17	0.00	0.00	8.19
22	-0.00	0.00	6.85
23	-0.00	0.00	-3.51
28	0.00	-0.00	-3.75
29	0.00	0.00	8.19
34	-0.00	0.00	6.85
35	0.00	0.00	46.47
40	0.00	0.00	55.46
41	-0.00	0.00	12.56
46	0.00	-0.00	80.35
47	-0.00	0.00	28.22
48	-0.00	-0.00	41.85
49	0.00	0.00	34.12
50	0.00	-0.00	13.07

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	0.00	0.00	28.22
	6	0.00	16.90	28.22
2	6	2.57	16.94	-15.96
	12	2.57	3.38	-15.96
3	12	5.39	-2.98	2.70
	18	5.39	-0.68	2.70
4	18	1.93	-4.24	2.86
	24	1.93	-1.81	2.86
5	24	-1.93	-1.81	-2.86
	30	-1.93	-4.24	-2.86
6	30	-5.39	-0.68	-2.70
	36	-5.39	-2.98	-2.70
7	36	-2.57	3.38	15.96
	42	-2.57	16.94	15.96
8	42	-0.00	16.90	-28.22
	47	-0.00	-0.00	-28.22
9	2	0.00	0.00	41.85
	7	0.00	30.71	41.85
10	7	4.22	25.84	-32.60
	13	4.22	-1.87	-32.60
11	13	2.47	1.83	-10.49
	19	2.47	-7.09	-10.49
12	19	0.73	-3.54	-1.16
	25	0.73	-4.53	-1.16
13	25	-0.73	-4.53	1.16
	31	-0.73	-3.54	1.16
14	31	-2.47	-7.09	10.49
	37	-2.47	1.83	10.49
15	37	-4.22	-1.87	32.60
	43	-4.22	25.84	32.60
16	43	-0.00	30.71	-41.85

	48	-0.00	0.00	-41.85
17	3	0.00	-0.00	34.12
	8	0.00	29.62	34.12
18	8	0.34	29.90	-43.62
	14	0.34	-7.17	-43.62
19	14	-1.63	0.41	-8.92
	20	-1.63	-7.17	-8.92
20	20	-0.73	-3.58	-1.08
	26	-0.73	-4.50	-1.08
21	26	0.73	-4.50	1.08
	32	0.73	-3.58	1.08
22	32	1.63	-7.17	8.92
	38	1.63	0.41	8.92
23	38	-0.34	-7.17	43.62
	44	-0.34	29.90	43.62
24	44	0.00	29.62	-34.12
	49	0.00	-0.00	-34.12
25	4	0.00	0.00	13.07
	9	0.00	13.11	13.07
26	9	-4.80	17.66	-21.15
	15	-4.80	-0.32	-21.15
27	15	-5.77	-5.25	5.31
	21	-5.77	-0.74	5.31
28	21	-1.95	-4.31	3.02
	27	-1.95	-1.75	3.02
29	27	1.94	-1.75	-3.02
	33	1.94	-4.31	-3.02
30	33	5.77	-0.74	-5.31
	39	5.77	-5.25	-5.31
31	39	4.80	-0.32	21.15
	45	4.80	17.66	21.15
32	45	0.00	13.11	-13.07
	50	0.00	0.00	-13.07
33	5	0.00	0.00	12.56
	6	0.00	5.27	12.56
34	6	0.04	2.71	56.73
	7	0.04	26.53	56.73
35	7	-4.83	22.31	131.19
	8	-4.83	77.41	131.19
36	8	-4.55	77.07	-114.57
	9	-4.55	28.95	-114.57
37	9	0.00	33.75	-80.35
	10	0.00	-0.00	-80.35
38	11	0.00	0.00	46.47
	12	0.00	19.52	46.47
39	12	-6.36	16.70	27.81
	13	-6.36	28.38	27.81
40	13	-2.66	30.13	5.69
	14	-2.66	32.52	5.69
41	14	4.93	34.50	-29.00
	15	4.93	22.32	-29.00
42	15	0.00	23.29	-55.46
	16	0.00	0.00	-55.46
43	17	0.00	-0.00	8.19
	18	0.00	3.44	8.19
44	18	-3.56	6.89	8.03
	19	-3.56	10.26	8.03
45	19	-0.02	12.00	-1.30
	20	-0.02	11.45	-1.30

46	20	3.57	10.54	-9.14
	21	3.57	6.70	-9.14
47	21	0.00	2.88	-6.85
	22	0.00	-0.00	-6.85
48	23	0.00	0.00	-3.51
	24	0.00	-1.48	-3.51
49	24	-0.00	2.38	2.21
	25	-0.00	3.31	2.21
50	25	-0.00	4.78	-0.12
	26	-0.00	4.73	-0.12
51	26	0.00	3.28	-2.28
	27	0.00	2.32	-2.28
52	27	-0.00	-1.57	3.75
	28	-0.00	0.00	3.75
53	29	0.00	-0.00	8.19
	30	0.00	3.44	8.19
54	30	3.56	6.89	8.03
	31	3.56	10.26	8.03
55	31	0.02	12.00	-1.30
	32	0.02	11.45	-1.30
56	32	-3.57	10.54	-9.14
	33	-3.57	6.70	-9.14
57	33	0.00	2.88	-6.85
	34	0.00	-0.00	-6.85
58	35	0.00	-0.00	46.47
	36	0.00	19.52	46.47
59	36	6.36	16.70	27.81
	37	6.36	28.38	27.81
60	37	2.66	30.13	5.69
	38	2.66	32.52	5.69
61	38	-4.93	34.50	-29.00
	39	-4.93	22.32	-29.00
62	39	0.00	23.29	-55.46
	40	0.00	0.00	-55.46
63	41	0.00	0.00	12.56
	42	0.00	5.27	12.56
64	42	-0.04	2.71	56.73
	43	-0.04	26.53	56.73
65	43	4.83	22.31	131.19
	44	4.83	77.41	131.19
66	44	4.55	77.07	-114.57
	45	4.55	28.95	-114.57
67	45	-0.00	33.75	-80.35
	46	-0.00	0.00	-80.35

ALARGAMIENTOS TESADO

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LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE 1.

N° puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	2.1120	-0.24937
2	1.1500	1.6132	-0.24937
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	32.0000	2.2100	-0.32700
7	33.2500	2.1400	-0.12000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	2.112	0.000	-0.2494	0.0000
2	0.000	1.900	0.000	-0.2494	0.0000
3	1.000	1.651	0.000	-0.2494	0.0000
4	2.000	1.411	0.000	-0.2274	0.0000
5	3.000	1.196	0.000	-0.2016	0.0000
6	4.000	1.007	0.000	-0.1757	0.0000
7	5.000	0.845	0.000	-0.1499	0.0000
8	6.000	0.708	0.000	-0.1240	0.0000
9	7.000	0.597	0.000	-0.0982	0.0000
10	8.000	0.511	0.000	-0.0724	0.0000
11	9.000	0.452	0.000	-0.0465	0.0000
12	10.000	0.418	0.000	-0.0207	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.262	0.000	0.0916	0.0000
31	29.000	2.367	0.000	0.1046	0.0000
32	30.000	2.445	0.000	0.0392	0.0000
33	31.000	2.419	0.000	-0.1046	0.0000
34	32.000	2.210	0.000	-0.3270	0.0000
35	33.000	2.153	0.000	-0.0006	0.0000
36	34.000	2.050	0.000	-0.1200	0.0000
37	35.000	1.930	0.000	-0.1200	0.0000
38	35.250	1.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	-0.850	0.0000	0.0000	0.0000	574.00	556.94	138.89
2	0.000	0.0000	0.0000	0.0000	573.38	556.34	138.76
3	1.000	0.0000	0.0000	0.0000	572.66	555.64	138.57
4	2.000	0.0208	0.0000	0.0208	569.45	555.28	126.27
5	3.000	0.0455	0.0000	0.0455	565.79	554.64	111.79
6	4.000	0.0704	0.0000	0.0704	562.13	553.64	97.29
7	5.000	0.0956	0.0000	0.0956	558.46	552.29	82.78
8	6.000	0.1210	0.0000	0.1210	554.79	550.57	68.29
9	7.000	0.1465	0.0000	0.1465	551.13	548.49	53.86
10	8.000	0.1722	0.0000	0.1722	547.48	546.05	39.51
11	9.000	0.1979	0.0000	0.1979	543.84	543.25	25.27
12	10.000	0.2237	0.0000	0.2237	540.22	540.11	11.17
13	11.000	0.2477	0.0000	0.2477	536.83	536.83	-1.77
14	12.000	0.2641	0.0000	0.2641	534.31	534.20	-10.55
15	13.000	0.2806	0.0000	0.2806	531.79	531.45	-19.25
16	14.000	0.2970	0.0000	0.2970	529.29	528.56	-27.84
17	15.000	0.3134	0.0000	0.3134	526.81	525.56	-36.34
18	16.000	0.3298	0.0000	0.3298	524.34	522.43	-44.72
19	17.000	0.3461	0.0000	0.3461	521.89	519.19	-52.99
20	18.000	0.3624	0.0000	0.3624	519.46	515.85	-61.14
21	19.000	0.3786	0.0000	0.3786	517.04	512.39	-69.16
22	20.000	0.3947	0.0000	0.3947	514.64	508.84	-77.06
23	21.000	0.4107	0.0000	0.4107	512.27	505.19	-84.82
24	22.000	0.4267	0.0000	0.4267	509.91	501.46	-92.45
25	23.000	0.4426	0.0000	0.4426	507.57	497.64	-99.94
26	24.000	0.4583	0.0000	0.4583	505.26	493.74	-107.28
27	25.000	0.5186	0.0000	0.5186	498.28	491.66	-80.93
28	26.000	0.5948	0.0000	0.5948	500.73	499.05	-41.07
29	27.000	0.5127	0.0000	0.5127	510.09	510.09	-0.00
30	28.000	0.6040	0.0000	0.6040	501.03	498.94	-45.68
31	29.000	0.6169	0.0000	0.6169	500.30	497.58	-52.07
32	30.000	0.5519	0.0000	0.5519	507.82	507.43	-19.91
33	31.000	0.4084	0.0000	0.4084	524.01	521.17	54.53
34	32.000	0.1966	0.0000	0.1966	548.53	521.37	170.49
35	33.000	0.1188	0.0000	0.1188	558.27	558.27	0.33
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 258.9 mm. Retesado = 9.6 mm.
larg. tesado ext. final = 239.7 mm. Retesado = 28.8 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	1.5410	-0.16569
2	1.1500	1.2090	-0.16569
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	33.2500	1.7400	-0.17000
7	35.2500	1.4000	-0.17000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

P	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.541	0.000	-0.1657	0.0000
2	0.000	1.400	0.000	-0.1661	0.0000
3	1.000	1.234	0.000	-0.1658	0.0000
4	2.000	1.074	0.000	-0.1511	0.0000
5	3.000	0.932	0.000	-0.1339	0.0000
6	4.000	0.807	0.000	-0.1167	0.0000
7	5.000	0.699	0.000	-0.0995	0.0000
8	6.000	0.608	0.000	-0.0823	0.0000
9	7.000	0.534	0.000	-0.0652	0.0000
10	8.000	0.477	0.000	-0.0480	0.0000
11	9.000	0.438	0.000	-0.0309	0.0000
12	10.000	0.415	0.000	-0.0137	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.201	0.000	-0.0193	0.0000
31	29.000	2.170	0.000	-0.0416	0.0000
32	30.000	2.116	0.000	-0.0669	0.0000
33	31.000	2.036	0.000	-0.0953	0.0000
34	32.000	1.925	0.000	-0.1266	0.0000
35	33.000	1.781	0.000	-0.1609	0.0000
36	34.000	1.613	0.000	-0.1700	0.0000
37	35.000	1.442	0.000	-0.1700	0.0000
38	35.250	1.400	0.000	-0.1700	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	566.28	93.83
2	0.000	0.0004	0.0000	0.0004	573.33	565.58	93.97
3	1.000	0.0001	0.0000	0.0001	572.65	564.93	93.68
4	2.000	0.0143	0.0000	0.0143	570.23	563.83	85.18
5	3.000	0.0311	0.0000	0.0311	567.50	562.48	75.31
6	4.000	0.0480	0.0000	0.0480	564.78	560.97	65.46
7	5.000	0.0650	0.0000	0.0650	562.06	559.30	55.66
8	6.000	0.0820	0.0000	0.0820	559.35	557.46	45.90
9	7.000	0.0991	0.0000	0.0991	556.64	555.46	36.20
10	8.000	0.1162	0.0000	0.1162	553.95	553.31	26.57
11	9.000	0.1333	0.0000	0.1333	551.27	551.00	17.01
12	10.000	0.1505	0.0000	0.1505	548.59	548.54	7.52
13	11.000	0.1675	0.0000	0.1675	545.95	545.95	-1.80
14	12.000	0.1839	0.0000	0.1839	543.38	543.27	-10.73
15	13.000	0.2004	0.0000	0.2004	540.82	540.47	-19.57
16	14.000	0.2168	0.0000	0.2168	538.28	537.54	-28.32
17	15.000	0.2332	0.0000	0.2332	535.76	534.48	-36.95
18	16.000	0.2496	0.0000	0.2496	533.25	531.30	-45.48
19	17.000	0.2659	0.0000	0.2659	530.75	528.01	-53.89
20	18.000	0.2822	0.0000	0.2822	528.28	524.61	-62.18
21	19.000	0.2984	0.0000	0.2984	525.82	521.10	-70.34
22	20.000	0.3145	0.0000	0.3145	523.38	517.48	-78.37
23	21.000	0.3305	0.0000	0.3305	520.97	513.77	-86.26
24	22.000	0.3465	0.0000	0.3465	518.57	509.97	-94.02
25	23.000	0.3624	0.0000	0.3624	516.19	506.09	-101.63
26	24.000	0.4407	0.0000	0.4407	515.89	504.13	-109.54
27	25.000	0.3805	0.0000	0.3805	523.12	516.17	-84.97
28	26.000	0.2995	0.0000	0.2995	532.77	530.97	-43.70
29	27.000	0.2174	0.0000	0.2174	542.72	542.72	-0.00
30	28.000	0.1981	0.0000	0.1981	545.61	545.51	10.53
31	29.000	0.1758	0.0000	0.1758	548.86	548.39	22.82
32	30.000	0.1505	0.0000	0.1505	552.47	551.24	36.89
33	31.000	0.1224	0.0000	0.1224	556.45	553.94	52.76
34	32.000	0.0914	0.0000	0.0914	560.78	556.34	70.43
35	33.000	0.0578	0.0000	0.0578	565.47	558.29	89.85
36	34.000	0.0490	0.0000	0.0490	567.23	559.21	95.07
37	35.000	0.0490	0.0000	0.0490	567.95	559.92	95.19
38	35.250	0.0490	0.0000	0.0490	568.13	560.09	95.22

larg. tesado ext. inicial = 264.2 mm. Retesado = 10.4 mm.
Alarg. tesado ext. final = 254.6 mm. Retesado = 20.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE 1.

N° puntos singulares en alzado = 8

PTO	----X----	----Y----	----p----
1	-0.8500	1.0010	-0.11883
2	1.1500	0.7630	-0.11883
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.9500	1.5110	-0.18190
7	33.2500	1.1400	-0.12000
8	35.2500	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----p----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.001	0.000	-0.1188	0.0000
2	0.000	0.900	0.000	-0.1191	0.0000
3	1.000	0.781	0.000	-0.1189	0.0000
4	2.000	0.666	0.000	-0.1083	0.0000
5	3.000	0.564	0.000	-0.0960	0.0000
6	4.000	0.474	0.000	-0.0837	0.0000
7	5.000	0.397	0.000	-0.0714	0.0000
8	6.000	0.332	0.000	-0.0591	0.0000
9	7.000	0.279	0.000	-0.0467	0.0000
10	8.000	0.238	0.000	-0.0344	0.0000
11	9.000	0.210	0.000	-0.0221	0.0000
12	10.000	0.194	0.000	-0.0098	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.948	0.000	-0.0804	0.0000
31	29.000	1.837	0.000	-0.1376	0.0000
32	30.000	1.680	0.000	-0.1714	0.0000
33	31.000	1.502	0.000	-0.1819	0.0000
34	32.000	1.324	0.000	-0.1691	0.0000
35	33.000	1.172	0.000	-0.1327	0.0000
36	34.000	1.050	0.000	-0.1200	0.0000
37	35.000	0.930	0.000	-0.1200	0.0000
38	35.250	0.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	569.99	67.73
2	0.000	0.0002	0.0000	0.0002	573.36	569.33	67.80
3	1.000	0.0000	0.0000	0.0000	572.66	568.65	67.61
4	2.000	0.0104	0.0000	0.0104	570.70	567.38	61.47
5	3.000	0.0226	0.0000	0.0226	568.52	565.92	54.34
6	4.000	0.0348	0.0000	0.0348	566.35	564.38	47.23
7	5.000	0.0470	0.0000	0.0470	564.19	562.75	40.16
8	6.000	0.0593	0.0000	0.0593	562.03	561.05	33.13
9	7.000	0.0716	0.0000	0.0716	559.87	559.26	26.14
10	8.000	0.0839	0.0000	0.0839	557.73	557.40	19.19
11	9.000	0.0961	0.0000	0.0961	555.59	555.45	12.29
12	10.000	0.1084	0.0000	0.1084	553.46	553.43	5.44
13	11.000	0.1216	0.0000	0.1216	551.24	551.24	-1.81
14	12.000	0.1380	0.0000	0.1380	548.65	548.54	-10.84
15	13.000	0.1545	0.0000	0.1545	546.07	545.71	-19.76
16	14.000	0.1709	0.0000	0.1709	543.50	542.75	-28.59
17	15.000	0.1873	0.0000	0.1873	540.95	539.66	-37.31
18	16.000	0.2037	0.0000	0.2037	538.41	536.45	-45.92
19	17.000	0.2200	0.0000	0.2200	535.90	533.13	-54.41
20	18.000	0.2362	0.0000	0.2362	533.40	529.69	-62.78
21	19.000	0.2524	0.0000	0.2524	530.92	526.15	-71.02
22	20.000	0.2686	0.0000	0.2686	528.46	522.50	-79.13
23	21.000	0.2846	0.0000	0.2846	526.01	518.75	-87.10
24	22.000	0.3006	0.0000	0.3006	523.59	514.92	-94.93
25	23.000	0.3165	0.0000	0.3165	521.19	510.99	-102.62
26	24.000	0.3322	0.0000	0.3322	518.82	506.99	-110.16
27	25.000	0.4036	0.0000	0.4036	520.59	513.68	-84.56
28	26.000	0.3226	0.0000	0.3226	530.19	528.40	-43.49
29	27.000	0.2404	0.0000	0.2404	540.09	540.09	-0.00
30	28.000	0.1602	0.0000	0.1602	549.97	548.20	44.10
31	29.000	0.1037	0.0000	0.1037	557.23	552.03	75.94
32	30.000	0.0707	0.0000	0.0707	561.81	553.74	94.90
33	31.000	0.0605	0.0000	0.0605	563.73	554.63	100.87
34	32.000	0.0480	0.0000	0.0480	565.92	558.00	94.33
35	33.000	0.0125	0.0000	0.0125	570.87	565.90	75.12
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 265.4 mm. Retesado = 11.1 mm.
arg. tesado ext. final = 254.8 mm. Retesado = 21.7 mm.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	0.4299	-0.03515
2	1.1500	0.3596	-0.03515
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.3500	1.2590	-0.32700
7	33.2500	0.5500	-0.08000
8	35.2500	0.3900	-0.08000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	0.430	0.000	-0.0352	0.0000
2	0.000	0.400	0.000	-0.0352	0.0000
3	1.000	0.365	0.000	-0.0352	0.0000
4	2.000	0.331	0.000	-0.0321	0.0000
5	3.000	0.301	0.000	-0.0284	0.0000
6	4.000	0.274	0.000	-0.0248	0.0000
7	5.000	0.251	0.000	-0.0211	0.0000
8	6.000	0.232	0.000	-0.0175	0.0000
9	7.000	0.216	0.000	-0.0138	0.0000
10	8.000	0.204	0.000	-0.0102	0.0000
11	9.000	0.196	0.000	-0.0066	0.0000
12	10.000	0.191	0.000	-0.0029	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.902	0.000	-0.1663	0.0000
31	29.000	1.677	0.000	-0.2742	0.0000
32	30.000	1.373	0.000	-0.3235	0.0000
33	31.000	1.049	0.000	-0.3144	0.0000
34	32.000	0.764	0.000	-0.2468	0.0000
35	33.000	0.575	0.000	-0.1207	0.0000
36	34.000	0.490	0.000	-0.0800	0.0000
37	35.000	0.410	0.000	-0.0800	0.0000
38	35.250	0.390	0.000	-0.0800	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	573.65	20.16
2	0.000	0.0000	0.0000	0.0000	573.39	573.03	20.14
3	1.000	0.0000	0.0000	0.0000	572.66	572.31	20.12
4	2.000	0.0031	0.0000	0.0031	571.57	571.28	18.31
5	3.000	0.0067	0.0000	0.0067	570.42	570.19	16.20
6	4.000	0.0104	0.0000	0.0104	569.26	569.09	14.10
7	5.000	0.0140	0.0000	0.0140	568.11	567.98	12.00
8	6.000	0.0177	0.0000	0.0177	566.96	566.87	9.91
9	7.000	0.0213	0.0000	0.0213	565.81	565.76	7.83
10	8.000	0.0249	0.0000	0.0249	564.67	564.64	5.76
11	9.000	0.0286	0.0000	0.0286	563.53	563.52	3.69
12	10.000	0.0322	0.0000	0.0322	562.39	562.39	1.64
13	11.000	0.0384	0.0000	0.0384	560.95	560.95	-1.85
14	12.000	0.0549	0.0000	0.0549	558.31	558.20	-11.03
15	13.000	0.0713	0.0000	0.0713	555.68	555.32	-20.11
16	14.000	0.0878	0.0000	0.0878	553.07	552.31	-29.09
17	15.000	0.1042	0.0000	0.1042	550.48	549.17	-37.97
18	16.000	0.1205	0.0000	0.1205	547.90	545.90	-46.73
19	17.000	0.1368	0.0000	0.1368	545.34	542.52	-55.37
20	18.000	0.1531	0.0000	0.1531	542.79	539.02	-63.88
21	19.000	0.1693	0.0000	0.1693	540.27	535.41	-72.27
22	20.000	0.1854	0.0000	0.1854	537.76	531.70	-80.52
23	21.000	0.2015	0.0000	0.2015	535.28	527.89	-88.63
24	22.000	0.2174	0.0000	0.2174	532.81	523.98	-96.60
25	23.000	0.2333	0.0000	0.2333	530.37	519.99	-104.43
26	24.000	0.2491	0.0000	0.2491	527.95	515.92	-112.10
27	25.000	0.3093	0.0000	0.3093	520.66	513.75	-84.57
28	26.000	0.3903	0.0000	0.3903	511.23	509.51	-41.94
29	27.000	0.5522	0.0000	0.5522	505.86	505.86	-0.00
30	28.000	0.3874	0.0000	0.3874	524.34	517.23	86.04
31	29.000	0.2846	0.0000	0.2846	536.45	517.36	141.86
32	30.000	0.2393	0.0000	0.2393	542.26	515.93	166.93
33	31.000	0.2248	0.0000	0.2248	544.61	519.54	163.34
34	32.000	0.1621	0.0000	0.1621	552.52	536.43	132.37
35	33.000	0.0403	0.0000	0.0403	567.56	563.47	67.99
36	34.000	0.0000	0.0000	0.0000	573.10	571.27	45.70
37	35.000	0.0000	0.0000	0.0000	573.82	571.99	45.76
38	35.250	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alarg. tesado ext. inicial = 267.0 mm. Retesado = 9.8 mm.
Alarg. tesado ext. final = 241.8 mm. Retesado = 35.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE 2.

e puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.7000	1.0570	-0.27428
4	8.2500	0.4100	0.00000
5	21.4500	1.9100	0.22222
6	24.7500	2.2100	0.00000
7	29.7500	2.2100	-0.32700
8	31.0000	2.1400	-0.12000
9	33.0000	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

ef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.490	0.000	-0.2138	0.0000
5	4.000	1.247	0.000	-0.2645	0.0000
6	5.000	0.975	0.000	-0.2720	0.0000
7	6.000	0.717	0.000	-0.2367	0.0000
8	7.000	0.516	0.000	-0.1583	0.0000
9	8.000	0.415	0.000	-0.0370	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
20	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.214	0.000	0.0302	0.0000
27	26.000	2.287	0.000	0.1022	0.0000
28	27.000	2.392	0.000	0.0956	0.0000
29	28.000	2.452	0.000	0.0106	0.0000
30	29.000	2.387	0.000	-0.1529	0.0000
31	30.000	2.155	0.000	-0.1248	0.0000
32	31.000	2.140	0.000	-0.1200	0.0000
33	32.000	2.020	0.000	-0.1200	0.0000
34	33.000	1.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

^	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	0.000	1.3659	0.0000	1.3659	413.31	410.37	49.24
2	1.000	1.3659	0.0000	1.3659	413.83	410.88	49.31
3	2.000	1.3659	0.0000	1.3659	414.35	411.40	49.37
4	3.000	1.2748	0.0000	1.2748	422.90	413.55	88.41
5	4.000	1.2268	0.0000	1.2268	427.71	413.50	109.35
6	5.000	1.2156	0.0000	1.2156	429.26	414.21	112.68
7	6.000	1.1824	0.0000	1.1824	432.82	421.18	99.68
8	7.000	1.1070	0.0000	1.1070	440.27	434.86	68.85
9	8.000	0.9870	0.0000	0.9870	452.08	451.77	16.73
10	9.000	0.9365	0.0000	0.9365	457.47	457.43	-6.15
11	10.000	0.9188	0.0000	0.9188	459.76	459.54	-14.34
12	11.000	0.9012	0.0000	0.9012	462.04	461.49	-22.52
13	12.000	0.8839	0.0000	0.8839	464.31	463.30	-30.68
14	13.000	0.8667	0.0000	0.8667	466.57	464.96	-38.80
15	14.000	0.8498	0.0000	0.8498	468.83	466.48	-46.89
16	15.000	0.8331	0.0000	0.8331	471.07	467.85	-54.94
17	16.000	0.8166	0.0000	0.8166	473.29	469.09	-62.93
18	17.000	0.8004	0.0000	0.8004	475.51	470.20	-70.86
19	18.000	0.7844	0.0000	0.7844	477.71	471.18	-78.72
0	19.000	0.7687	0.0000	0.7687	479.89	472.03	-86.51
21	20.000	0.7533	0.0000	0.7533	482.06	472.76	-94.22
22	21.000	0.7381	0.0000	0.7381	484.21	473.38	-101.84
23	22.000	0.6794	0.0000	0.6794	490.83	484.01	-81.48
24	23.000	0.6001	0.0000	0.6001	499.70	497.79	-43.63
25	24.000	0.5419	0.0000	0.5419	506.49	506.27	-14.79
26	25.000	0.5429	0.0000	0.5429	507.02	506.78	-15.33
27	26.000	0.6145	0.0000	0.6145	500.08	497.49	-50.84
28	27.000	0.6080	0.0000	0.6080	501.39	499.11	-47.74
29	28.000	0.5233	0.0000	0.5233	511.04	511.01	-5.43
3^	29.000	0.3610	0.0000	0.3610	529.42	523.34	80.00
:)	30.000	0.0047	0.0000	0.0047	571.27	566.87	70.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 220.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 2.

N° de puntos singulares en alzado = 7

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	8.2500	0.4100	0.00000
4	21.4500	1.9100	0.22222
5	24.7500	2.2100	0.00000
6	31.0000	1.7400	-0.17000
7	33.0000	1.4000	-0.17000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

)	---X---	---Y---	---Z---	--P V--	--P H--
	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.895	0.000	-0.1581	0.0000
5	4.000	0.746	0.000	-0.1404	0.0000
6	5.000	0.617	0.000	-0.1169	0.0000
7	6.000	0.514	0.000	-0.0875	0.0000
8	7.000	0.444	0.000	-0.0522	0.0000
9	8.000	0.411	0.000	-0.0112	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
0	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.209	0.000	-0.0045	0.0000
27	26.000	2.195	0.000	-0.0246	0.0000
28	27.000	2.159	0.000	-0.0477	0.0000
29	28.000	2.099	0.000	-0.0737	0.0000
30	29.000	2.011	0.000	-0.1028	0.0000
3	) 30.000	1.892	0.000	-0.1349	0.0000
32	31.000	1.740	0.000	-0.1700	0.0000
33	32.000	1.570	0.000	-0.1700	0.0000
34	33.000	1.400	0.000	-0.1700	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.7741	0.0000	0.7741	468.01	461.39	78.44
2	1.000	0.7741	0.0000	0.7741	468.60	461.97	78.53
3	2.000	0.7741	0.0000	0.7741	469.19	462.55	78.63
4	3.000	0.7625	0.0000	0.7625	470.92	465.14	73.55
5	4.000	0.7452	0.0000	0.7452	473.24	468.64	65.80
6	5.000	0.7221	0.0000	0.7221	476.14	472.93	55.26
7	6.000	0.6930	0.0000	0.6930	479.66	477.84	41.79
8	7.000	0.6579	0.0000	0.6579	483.82	483.16	25.24
9	8.000	0.6169	0.0000	0.6169	488.62	488.59	5.46
10	9.000	0.5923	0.0000	0.5923	491.77	491.72	-6.61
11	10.000	0.5745	0.0000	0.5745	494.23	493.99	-15.41
12	11.000	0.5570	0.0000	0.5570	496.68	496.09	-24.21
13	12.000	0.5396	0.0000	0.5396	499.12	498.03	-32.98
14	13.000	0.5225	0.0000	0.5225	501.55	499.82	-41.71
15	14.000	0.5055	0.0000	0.5055	503.98	501.45	-50.41
16	15.000	0.4888	0.0000	0.4888	506.38	502.93	-59.06
17	16.000	0.4724	0.0000	0.4724	508.78	504.26	-67.64
18	17.000	0.4562	0.0000	0.4562	511.16	505.45	-76.17
19	18.000	0.4402	0.0000	0.4402	513.52	506.50	-84.62
20	19.000	0.4245	0.0000	0.4245	515.87	507.42	-92.99
21	20.000	0.4090	0.0000	0.4090	518.20	508.20	-101.28
22	21.000	0.3938	0.0000	0.3938	520.51	508.87	-109.48
23	22.000	0.3352	0.0000	0.3352	527.62	520.30	-87.59
24	23.000	0.2558	0.0000	0.2558	537.17	535.11	-46.90
25	24.000	0.1976	0.0000	0.1976	544.46	544.23	-15.90
26	25.000	0.1638	0.0000	0.1638	549.02	549.02	2.49
27	26.000	0.1438	0.0000	0.1438	552.03	551.87	13.57
28	27.000	0.1208	0.0000	0.1208	555.41	554.78	26.44
29	28.000	0.0948	0.0000	0.0948	559.15	557.64	41.11
30	29.000	0.0659	0.0000	0.0659	563.26	560.31	57.60
31	30.000	0.0343	0.0000	0.0343	567.73	562.63	75.90
32	31.000	0.0000	0.0000	0.0000	572.56	564.46	95.96
33	32.000	0.0000	0.0000	0.0000	573.28	565.17	96.08
34	33.000	0.0000	0.0000	0.0000	574.00	565.88	96.20

Alargamiento = 236.9 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE 2.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	8.2500	0.1900	0.00000
4	21.4500	1.6900	0.22222
5	24.7500	1.9900	0.00000
6	28.7000	1.5110	-0.18190
7	31.0000	1.1400	-0.12000
8	33.0000	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.543	0.000	-0.1131	0.0000
5	4.000	0.435	0.000	-0.1014	0.0000
6	5.000	0.342	0.000	-0.0852	0.0000
7	6.000	0.267	0.000	-0.0642	0.0000
8	7.000	0.215	0.000	-0.0386	0.0000
9	8.000	0.191	0.000	-0.0083	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.987	0.000	-0.0223	0.0000
27	26.000	1.926	0.000	-0.0969	0.0000
28	27.000	1.801	0.000	-0.1482	0.0000
29	28.000	1.637	0.000	-0.1762	0.0000
30	29.000	1.457	0.000	-0.1809	0.0000
31	30.000	1.283	0.000	-0.1622	0.0000
32	31.000	1.140	0.000	-0.1200	0.0000
33	32.000	1.020	0.000	-0.1200	0.0000
34	33.000	0.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
	0.000	0.7972	0.0000	0.7972	465.74	462.43	55.49
2	1.000	0.7972	0.0000	0.7972	466.33	463.01	55.56
3	2.000	0.7972	0.0000	0.7972	466.92	463.59	55.63
4	3.000	0.7903	0.0000	0.7903	468.18	465.22	52.60
5	4.000	0.7789	0.0000	0.7789	469.90	467.50	47.43
6	5.000	0.7627	0.0000	0.7627	472.09	470.39	40.06
7	6.000	0.7419	0.0000	0.7419	474.76	473.79	30.42
8	7.000	0.7163	0.0000	0.7163	477.92	477.56	18.43
9	8.000	0.6861	0.0000	0.6861	481.57	481.55	4.00
10	9.000	0.6643	0.0000	0.6643	484.38	484.34	-6.51
11	10.000	0.6466	0.0000	0.6466	486.81	486.57	-15.18
12	11.000	0.6290	0.0000	0.6290	489.22	488.64	-23.84
13	12.000	0.6117	0.0000	0.6117	491.63	490.55	-32.48
14	13.000	0.5945	0.0000	0.5945	494.02	492.31	-41.09
15	14.000	0.5776	0.0000	0.5776	496.41	493.92	-49.65
16	15.000	0.5609	0.0000	0.5609	498.78	495.38	-58.17
17	16.000	0.5444	0.0000	0.5444	501.14	496.69	-66.63
18	17.000	0.5282	0.0000	0.5282	503.48	497.86	-75.02
19	18.000	0.5122	0.0000	0.5122	505.81	498.90	-83.35
0	19.000	0.4965	0.0000	0.4965	508.12	499.80	-91.60
21	20.000	0.4811	0.0000	0.4811	510.42	500.57	-99.76
22	21.000	0.4659	0.0000	0.4659	512.69	501.23	-107.84
23	22.000	0.4072	0.0000	0.4072	519.70	512.49	-86.28
24	23.000	0.3279	0.0000	0.3279	529.10	527.08	-46.20
25	24.000	0.2696	0.0000	0.2696	536.28	536.06	-15.66
26	25.000	0.2181	0.0000	0.2181	542.80	542.66	12.10
27	26.000	0.1438	0.0000	0.1438	552.03	549.46	53.25
28	27.000	0.0933	0.0000	0.0933	558.62	552.59	81.90
29	28.000	0.0660	0.0000	0.0660	562.54	554.01	97.61
?	29.000	0.0595	0.0000	0.0595	564.02	555.02	100.39
3	30.000	0.0414	0.0000	0.0414	566.89	559.58	90.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 234.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE 2.

N° de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	3.2500	0.1900	0.00000
4	8.2500	0.1900	0.00000
5	21.4500	1.6900	0.22222
6	24.7500	1.9900	0.00000
7	28.1000	1.2590	-0.32700
8	31.0000	0.5500	-0.08000
9	33.0000	0.3900	-0.08000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.191	0.000	-0.0083	0.0000
5	4.000	0.190	0.000	0.0000	0.0000
6	5.000	0.190	0.000	0.0000	0.0000
7	6.000	0.190	0.000	0.0000	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0000	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.984	0.000	-0.0471	0.0000
27	26.000	1.856	0.000	-0.1988	0.0000
28	27.000	1.606	0.000	-0.2920	0.0000
29	28.000	1.292	0.000	-0.3267	0.0000
30	29.000	0.972	0.000	-0.3030	0.0000
31	30.000	0.705	0.000	-0.2207	0.0000
32	31.000	0.550	0.000	-0.0800	0.0000
33	32.000	0.470	0.000	-0.0800	0.0000
34	33.000	0.390	0.000	-0.0800	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	1.0694	0.0000	1.0694	439.87	438.47	35.08
2	1.000	1.0694	0.0000	1.0694	440.42	439.02	35.12
3	2.000	1.0694	0.0000	1.0694	440.98	439.57	35.17
4	3.000	0.9979	0.0000	0.9979	448.21	448.20	3.73
5	4.000	0.9896	0.0000	0.9896	449.56	449.56	-0.00
6	5.000	0.9896	0.0000	0.9896	450.13	450.13	-0.00
7	6.000	0.9896	0.0000	0.9896	450.70	450.70	-0.00
8	7.000	0.9896	0.0000	0.9896	451.27	451.27	-0.00
9	8.000	0.9896	0.0000	0.9896	451.83	451.83	-0.00
10	9.000	0.9761	0.0000	0.9761	453.68	453.64	-6.10
11	10.000	0.9584	0.0000	0.9584	455.95	455.73	-14.22
12	11.000	0.9408	0.0000	0.9408	458.21	457.67	-22.33
13	12.000	0.9235	0.0000	0.9235	460.47	459.46	-30.42
14	13.000	0.9063	0.0000	0.9063	462.71	461.11	-38.48
15	14.000	0.8894	0.0000	0.8894	464.94	462.61	-46.51
16	15.000	0.8727	0.0000	0.8727	467.17	463.98	-54.48
17	16.000	0.8562	0.0000	0.8562	469.37	465.21	-62.41
18	17.000	0.8400	0.0000	0.8400	471.57	466.30	-70.27
19	18.000	0.8240	0.0000	0.8240	473.75	467.27	-78.07
20	19.000	0.8083	0.0000	0.8083	475.92	468.12	-85.79
21	20.000	0.7929	0.0000	0.7929	478.07	468.85	-93.44
22	21.000	0.7777	0.0000	0.7777	480.20	469.46	-101.00
23	22.000	0.7190	0.0000	0.7190	486.76	480.01	-80.81
24	23.000	0.6397	0.0000	0.6397	495.56	493.67	-43.27
25	24.000	0.5815	0.0000	0.5815	502.29	502.08	-14.67
26	25.000	0.5052	0.0000	0.5052	511.04	510.48	24.03
27	26.000	0.3560	0.0000	0.3560	527.97	517.84	102.94
28	27.000	0.2681	0.0000	0.2681	538.49	516.90	150.94
29	28.000	0.2364	0.0000	0.2364	542.77	515.92	168.58
30	29.000	0.2144	0.0000	0.2144	545.98	522.52	158.31
31	30.000	0.1374	0.0000	0.1374	555.57	542.51	119.75
32	31.000	0.0000	0.0000	0.0000	572.56	570.73	45.66
33	32.000	0.0000	0.0000	0.0000	573.28	571.45	45.72
34	33.000	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alargamiento = 223.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE ULTIMA.

de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.6000	1.0540	-0.28911
4	7.9500	0.4100	0.00000
5	17.4000	1.5689	0.24527
6	19.4000	2.0594	0.24527

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.483	0.000	-0.2255	0.0000
5	4.000	1.226	0.000	-0.2805	0.0000
6	5.000	0.939	0.000	-0.2847	0.0000
7	6.000	0.673	0.000	-0.2379	0.0000
8	7.000	0.480	0.000	-0.1401	0.0000
9	8.000	0.410	0.000	0.0013	0.0000
10	9.000	0.424	0.000	0.0273	0.0000
11	10.000	0.465	0.000	0.0532	0.0000
12	11.000	0.531	0.000	0.0792	0.0000
13	12.000	0.623	0.000	0.1051	0.0000
14	13.000	0.741	0.000	0.1311	0.0000
15	14.000	0.885	0.000	0.1570	0.0000
16	15.000	1.055	0.000	0.1830	0.0000
17	16.000	1.251	0.000	0.2089	0.0000
18	17.000	1.473	0.000	0.2349	0.0000
19	18.000	1.716	0.000	0.2452	0.0000
20	19.000	1.961	0.000	0.2453	0.0000
21	19.400	2.059	0.000	0.2453	0.0000

Cables tesados desde el extremo final.

	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.6840	0.0000	0.6840	431.10	428.03	51.36
2	1.000	0.6840	0.0000	0.6840	431.64	428.57	51.43
3	2.000	0.6840	0.0000	0.6840	432.19	429.11	51.49
4	3.000	0.5816	0.0000	0.5816	442.14	431.30	97.28
5	4.000	0.5300	0.0000	0.5300	447.52	430.89	120.85
6	5.000	0.5179	0.0000	0.5179	449.22	432.06	122.99
7	6.000	0.4741	0.0000	0.4741	453.94	441.62	105.06
8	7.000	0.3797	0.0000	0.3797	463.61	459.13	64.33
9	8.000	0.2392	0.0000	0.2392	478.10	478.09	-0.62
10	9.000	0.2133	0.0000	0.2133	481.31	481.13	-13.11
11	10.000	0.1874	0.0000	0.1874	484.55	483.87	-25.74
12	11.000	0.1615	0.0000	0.1615	487.80	486.28	-38.49
13	12.000	0.1358	0.0000	0.1358	491.06	488.37	-51.34
14	13.000	0.1102	0.0000	0.1102	494.33	490.14	-64.24
15	14.000	0.0848	0.0000	0.0848	497.60	491.58	-77.19
16	15.000	0.0595	0.0000	0.0595	500.88	492.70	-90.15
17	16.000	0.0346	0.0000	0.0346	504.15	493.49	-103.11
18	17.000	0.0098	0.0000	0.0098	507.41	493.97	-116.03
19	18.000	0.0000	0.0000	0.0000	509.10	494.45	-121.26
20	19.000	0.0000	0.0000	0.0000	509.74	495.07	-121.42
21	19.400	0.0000	0.0000	0.0000	510.00	495.32	-121.49

Alargamiento = 144.6 mm.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	7.9500	0.4100	0.00000
4	17.4000	1.1800	0.16296
5	19.4000	1.5060	0.16296

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.893	0.000	-0.1618	0.0000
5	4.000	0.739	0.000	-0.1453	0.0000
6	5.000	0.606	0.000	-0.1206	0.0000
7	6.000	0.501	0.000	-0.0878	0.0000
8	7.000	0.433	0.000	-0.0467	0.0000
9	8.000	0.410	0.000	0.0009	0.0000
10	9.000	0.420	0.000	0.0181	0.0000
11	10.000	0.446	0.000	0.0354	0.0000
12	11.000	0.490	0.000	0.0526	0.0000
13	12.000	0.551	0.000	0.0698	0.0000
14	13.000	0.630	0.000	0.0871	0.0000
15	14.000	0.726	0.000	0.1043	0.0000
16	15.000	0.839	0.000	0.1216	0.0000
17	16.000	0.969	0.000	0.1388	0.0000
18	17.000	1.116	0.000	0.1561	0.0000
19	18.000	1.278	0.000	0.1630	0.0000
20	19.000	1.441	0.000	0.1630	0.0000
21	19.400	1.506	0.000	0.1630	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3299	0.0000	0.3299	464.37	457.80	77.83
2	1.000	0.3299	0.0000	0.3299	464.96	458.38	77.92
3	2.000	0.3299	0.0000	0.3299	465.54	458.96	78.02
4	3.000	0.3219	0.0000	0.3219	466.91	460.92	74.56
5	4.000	0.3058	0.0000	0.3058	469.08	464.21	67.46
6	5.000	0.2816	0.0000	0.2816	472.07	468.67	56.54
7	6.000	0.2491	0.0000	0.2491	475.91	474.08	41.61
8	7.000	0.2082	0.0000	0.2082	480.62	480.10	22.40
9	8.000	0.1607	0.0000	0.1607	486.05	486.05	-0.42
10	9.000	0.1434	0.0000	0.1434	488.42	488.34	-8.84
11	10.000	0.1262	0.0000	0.1262	490.81	490.51	-17.34
12	11.000	0.1090	0.0000	0.1090	493.21	492.53	-25.91
13	12.000	0.0918	0.0000	0.0918	495.62	494.41	-34.53
14	13.000	0.0747	0.0000	0.0747	498.03	496.15	-43.21
15	14.000	0.0576	0.0000	0.0576	500.45	497.75	-51.93
16	15.000	0.0406	0.0000	0.0406	502.88	499.20	-60.69
17	16.000	0.0236	0.0000	0.0236	505.31	500.51	-69.48
18	17.000	0.0067	0.0000	0.0067	507.74	501.67	-78.29
19	18.000	0.0000	0.0000	0.0000	509.10	502.46	-81.91
20	19.000	0.0000	0.0000	0.0000	509.74	503.10	-82.00
21	19.400	0.0000	0.0000	0.0000	510.00	503.36	-82.03

Alargamiento = 148.2 mm.

N° puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	7.9500	0.1900	0.00000
4	17.4000	0.7420	0.11687
5	19.4000	0.9760	0.11687

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.542	0.000	-0.1158	0.0000
5	4.000	0.431	0.000	-0.1051	0.0000
6	5.000	0.334	0.000	-0.0880	0.0000
7	6.000	0.257	0.000	-0.0644	0.0000
8	7.000	0.207	0.000	-0.0344	0.0000
9	8.000	0.190	0.000	0.0006	0.0000
10	9.000	0.197	0.000	0.0130	0.0000
11	10.000	0.216	0.000	0.0253	0.0000
12	11.000	0.247	0.000	0.0377	0.0000
13	12.000	0.291	0.000	0.0501	0.0000
14	13.000	0.348	0.000	0.0624	0.0000
15	14.000	0.416	0.000	0.0748	0.0000
16	15.000	0.497	0.000	0.0872	0.0000
17	16.000	0.591	0.000	0.0995	0.0000
18	17.000	0.696	0.000	0.1119	0.0000
19	18.000	0.812	0.000	0.1170	0.0000
20	19.000	0.929	0.000	0.1170	0.0000
21	19.400	0.976	0.000	0.1169	0.0000

Cables tesados desde el extremo final.

	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.2358	0.0000	0.2358	473.64	470.27	56.43
2	1.000	0.2358	0.0000	0.2358	474.24	470.86	56.50
3	2.000	0.2358	0.0000	0.2358	474.84	471.46	56.57
4	3.000	0.2316	0.0000	0.2316	475.85	472.70	54.72
5	4.000	0.2210	0.0000	0.2210	477.51	474.90	49.91
6	5.000	0.2041	0.0000	0.2041	479.82	477.97	42.05
7	6.000	0.1807	0.0000	0.1807	482.79	481.79	31.04
8	7.000	0.1508	0.0000	0.1508	486.44	486.16	16.75
9	8.000	0.1157	0.0000	0.1157	490.66	490.66	-0.30
10	9.000	0.1034	0.0000	0.1034	492.55	492.51	-6.39
11	10.000	0.0910	0.0000	0.0910	494.45	494.29	-12.52
12	11.000	0.0787	0.0000	0.0787	496.36	496.01	-18.69
13	12.000	0.0663	0.0000	0.0663	498.28	497.65	-24.91
14	13.000	0.0540	0.0000	0.0540	500.20	499.23	-31.16
15	14.000	0.0417	0.0000	0.0417	502.13	500.73	-37.45
16	15.000	0.0294	0.0000	0.0294	504.06	502.15	-43.77
17	16.000	0.0171	0.0000	0.0171	506.00	503.51	-50.12
18	17.000	0.0049	0.0000	0.0049	507.94	504.79	-56.49
19	18.000	0.0002	0.0000	0.0002	509.08	505.63	-59.18
20	19.000	0.0001	0.0000	0.0001	509.73	506.28	-59.23
21	19.400	0.0000	0.0000	0.0000	510.00	506.55	-59.20

Alargamiento = 149.6 mm.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	6.7000	0.1900	0.00000
4	7.9500	0.1900	0.00000
5	17.4000	0.3530	0.03457
6	19.4000	0.4225	0.03457

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.176	0.000	-0.0313	0.0000
5	4.000	0.162	0.000	0.0002	0.0000
6	5.000	0.171	0.000	0.0147	0.0000
7	6.000	0.185	0.000	0.0120	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0002	0.0000
10	9.000	0.192	0.000	0.0038	0.0000
11	10.000	0.198	0.000	0.0075	0.0000
12	11.000	0.207	0.000	0.0111	0.0000
13	12.000	0.220	0.000	0.0148	0.0000
14	13.000	0.236	0.000	0.0184	0.0000
15	14.000	0.257	0.000	0.0221	0.0000
16	15.000	0.281	0.000	0.0257	0.0000
17	16.000	0.308	0.000	0.0294	0.0000
18	17.000	0.339	0.000	0.0331	0.0000
19	18.000	0.374	0.000	0.0348	0.0000
20	19.000	0.409	0.000	0.0347	0.0000
21	19.400	0.422	0.000	0.0346	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.1144	0.0000	0.1144	485.87	484.32	38.75
2	1.000	0.1144	0.0000	0.1144	486.48	484.94	38.79
3	2.000	0.1144	0.0000	0.1144	487.10	485.55	38.84
4	3.000	0.0659	0.0000	0.0659	492.71	492.46	15.43
5	4.000	0.0348	0.0000	0.0348	496.56	496.56	-0.11
6	5.000	0.0492	0.0000	0.0492	495.68	495.62	-7.28
7	6.000	0.0466	0.0000	0.0466	496.58	496.54	-5.98
8	7.000	0.0346	0.0000	0.0346	498.46	498.46	-0.00
9	8.000	0.0344	0.0000	0.0344	499.11	499.11	-0.09
10	9.000	0.0307	0.0000	0.0307	500.12	500.12	-1.91
11	10.000	0.0271	0.0000	0.0271	501.14	501.12	-3.74
12	11.000	0.0234	0.0000	0.0234	502.15	502.12	-5.58
13	12.000	0.0198	0.0000	0.0198	503.17	503.12	-7.43
14	13.000	0.0161	0.0000	0.0161	504.19	504.11	-9.29
15	14.000	0.0125	0.0000	0.0125	505.22	505.09	-11.15
16	15.000	0.0088	0.0000	0.0088	506.24	506.07	-13.03
17	16.000	0.0051	0.0000	0.0051	507.27	507.05	-14.92
18	17.000	0.0015	0.0000	0.0015	508.30	508.02	-16.81
19	18.000	0.0002	0.0000	0.0002	509.08	508.77	-17.70
20	19.000	0.0002	0.0000	0.0002	509.72	509.42	-17.70
21	19.400	0.0000	0.0000	0.0000	510.00	509.70	-17.62

Alargamiento = 152.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE REFUERZO.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	0.5000	-0.17500
2	1.5000	0.2375	-0.17500
3	2.5000	0.1500	0.00000
4	19.0000	0.1500	0.00000
5	20.0000	0.2375	0.17500
6	21.5000	0.5000	0.17500

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	21.5000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 299.000 t.
Area del cable = 2100 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.500	0.000	-0.1750	0.0000
2	1.000	0.325	0.000	-0.1750	0.0000
3	2.000	0.172	0.000	-0.0875	0.0000
4	3.000	0.150	0.000	0.0000	0.0000
5	4.000	0.150	0.000	0.0000	0.0000
6	5.000	0.150	0.000	0.0000	0.0000
7	6.000	0.150	0.000	0.0000	0.0000
8	7.000	0.150	0.000	0.0000	0.0000
9	8.000	0.150	0.000	0.0000	0.0000
10	9.000	0.150	0.000	0.0000	0.0000
11	10.000	0.150	0.000	0.0000	0.0000
12	11.000	0.150	0.000	0.0000	0.0000
13	12.000	0.150	0.000	0.0000	0.0000
14	13.000	0.150	0.000	0.0000	0.0000
15	14.000	0.150	0.000	0.0000	0.0000
16	15.000	0.150	0.000	0.0000	0.0000
17	16.000	0.150	0.000	0.0000	0.0000
18	17.000	0.150	0.000	0.0000	0.0000
19	18.000	0.150	0.000	0.0000	0.0000
20	19.000	0.150	0.000	0.0000	0.0000
21	20.000	0.237	0.000	0.1750	0.0000
22	21.000	0.412	0.000	0.1750	0.0000
23	21.500	0.500	0.000	0.1750	0.0000

Cables tesados desde el extremo final.

	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3465	0.0000	0.3465	270.59	266.54	46.64
2	1.000	0.3465	0.0000	0.3465	270.93	266.87	46.70
3	2.000	0.2605	0.0000	0.2605	276.21	275.16	24.08
4	3.000	0.1732	0.0000	0.1732	281.67	281.67	-0.00
5	4.000	0.1732	0.0000	0.1732	282.03	282.03	-0.00
6	5.000	0.1732	0.0000	0.1732	282.39	282.39	-0.00
7	6.000	0.1732	0.0000	0.1732	282.74	282.74	-0.00
8	7.000	0.1732	0.0000	0.1732	283.10	283.10	-0.00
9	8.000	0.1732	0.0000	0.1732	283.45	283.45	-0.00
10	9.000	0.1732	0.0000	0.1732	283.81	283.81	-0.00
11	10.000	0.1732	0.0000	0.1732	284.17	284.17	-0.00
12	11.000	0.1732	0.0000	0.1732	284.53	284.53	-0.00
13	12.000	0.1732	0.0000	0.1732	284.89	284.89	-0.00
14	13.000	0.1732	0.0000	0.1732	285.25	285.25	-0.00
15	14.000	0.1732	0.0000	0.1732	285.61	285.61	-0.00
16	15.000	0.1732	0.0000	0.1732	285.97	285.97	-0.00
17	16.000	0.1732	0.0000	0.1732	286.33	286.33	-0.00
18	17.000	0.1732	0.0000	0.1732	286.69	286.69	-0.00
19	18.000	0.1732	0.0000	0.1732	287.05	287.05	-0.00
20	19.000	0.1732	0.0000	0.1732	287.41	287.41	-0.00
21	20.000	0.0000	0.0000	0.0000	298.44	293.97	-51.44
22	21.000	0.0000	0.0000	0.0000	298.81	294.34	-51.51
23	21.500	0.0000	0.0000	0.0000	299.00	294.52	-51.54

Alargamiento = 153.3 mm.

2.- CALCULO REACCIONES Y APOYOS

E-3

VIATAV34 757 15/10/96 1

Reacciones y giros acumulados por peso propio

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	236.65	-.000414
11	718.74	0.000132
21	732.36	0.000228
31	707.75	0.000304
41	242.70	0.000449

DR por macizados:

Apoyo 1: $2.50 \times 10.813 \times 2.5 = 67.6\,t$

Apoyo 41: $2.50 \times 8.163 \times 2.5 = 40.8\,t$

Apoyo intermedio: $\left(3.50 \times 8.163 - \pi \times \frac{1.25^2}{4} \times 0.30\right) 2.5 = 60.3\,t$

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Reacciones y giros acumulados por peso propio

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	223.88	-.000354
11	732.56	0.000012
21	725.71	0.000019
31	731.66	0.000024
41	224.38	0.000357

Reacciones y giros debidos a cargas muertas

Apoyo	Reaccion (t)	Giro (gr)
1	108.27	-.000170
11	356.67	0.000001
21	352.45	0.000000
31	356.67	-.000001
41	108.27	0.000170

Reacciones y giros debidos a temperatura

Apoyo	Reaccion (t)	Giro (gr)
1	24.50	0.000158
11	-30.71	-.000044
21	12.42	0.000000
31	-30.73	0.000044
41	24.51	-.000158

Reacciones y giros por ferrocarril (RENFE)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	298.147	-54.963	0.0002579	-0.0006225
11	803.998	-68.414	0.0004682	-0.0005159
21	836.969	-52.989	0.0005601	-0.0005574
31	803.998	-68.301	0.0005150	-0.0004682
41	298.147	-54.873	0.0006225	-0.0002575

Reacciones y giros por ferrocarril (UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	229.817	-44.654	0.0002096	-0.0005116
11	636.065	-56.947	0.0003475	-0.0004191
21	655.113	-46.103	0.0004275	-0.0004275
31	636.066	-56.947	0.0004191	-0.0003475
41	229.817	-44.654	0.0005116	-0.0002096

Reacciones y giros por ferrocarril (RENFE/UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	298.147	-54.963	0.0002579	-0.0006225
11	803.998	-68.414	0.0004682	-0.0005159
21	836.969	-52.989	0.0005601	-0.0005574
31	803.998	-68.301	0.0005150	-0.0004682
41	298.147	-54.873	0.0006225	-0.0002575

Reacciones y giros por sobrecarga total

(sobrecarga repartida+carro)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro (gr) maximo	Giro (gr) minimo
1	298.147	-54.963	0.0002579	-0.0006225
11	803.998	-68.414	0.0004682	-0.0005159
21	836.969	-52.989	0.0005601	-0.0005574
31	803.998	-68.301	0.0005150	-0.0004682
41	298.147	-54.873	0.0006225	-0.0002575

Reacciones y giros por pretensado (sin ponderar)
---------- 0.9511

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	48.88	0.001367
11	-49.30	-.000414
21	-1.57	-.000302
31	-43.95	-.000333
41	45.94	-.001169

Reacciones y giros por pretensado (sin ponderar)
---------- 0.8570

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	70.28	0.001109
11	-82.70	-.000127
21	21.72	-.000011
31	-75.73	0.000037
41	66.44	-.000963

PROYECTO T.A.V. ZARAGOZA - LÉRIDA
SUB-TRAMO 1
E-9

FECHA

HOJA N.º

REACCIONES VERTICALES (A TODO ANCHO)

	P.P.I.	P.P.F.	C.M.	TEMP.	RENFE		PRET. I.	PRET. F.
E-2 (FIJO)	304,2	291.5	108.3	24,5	298,2	-53.0	48.9	70,3
P-3	779,0	792.9	356,7	-30,7	804,0	-68,4	-49,3	-82,7
P-2	792,7	786.0	352.5	12.4	837.0	-53.0	-1.6	21,7
P-1	768,1	792,0	356,7	-30,7	804.0	-68,3	-44,0	-75,7
E-1	283,5	265.2	108,3	24.5	298,2	-54,9	46,0	66,4
Σ	2927.5	2927.6	1282.5	0	—	—	0	0

APARATOS DE APOYO

REACCIONES MAXIMAS POR APOYO:

E-2: $\frac{1}{2}(304.2 + 108,3 + 24.5 + 298,2 + 70,3) + \frac{298,2 \times 0.30}{5,50} = 419.0$ t

P-3: $\frac{1}{2}(792.9 + 356,7 + 804.0 - 49.3) + \frac{804.0 \times 0,30}{4.80} = 1002,4$ t

P-2: $\frac{1}{2}(792.7 + 352.5 + 12,4 + 837,0 + 21,7) + \frac{837.0 \times 0,30}{4.80} = 1060,5$ t

P-1: $\frac{1}{2}(792.0 + 356.7 + 804,0 - 44,0) + \frac{804.0 \times 0.30}{4.80} = 1004.6$ t

E-1: $\frac{1}{2}(283,5 + 108,3 + 24.5 + 298,2 + 66,4) + \frac{298,2 \times 0.30}{5,50} = 406.7$ t

Disponemos en cada pila de apoyo:

E-2:	2 de	500 × 600 × 54 (38)	$\sigma_{máx}$: 139.7 kg/cm²
P-3:	2 de	800 × 900 × 102 (77)	$\sigma_{máx}$: 139.2 kg/cm²
P-2:	2 de	800 × 900 × 118 (113)	$\sigma_{máx}$: 147.3 kg/cm²
P-1:	2 de	800 × 900 × 194 (149)	$\sigma_{máx}$: 139.5 kg/cm²
E-1:	2 de	500 × 600 × 54 (38) + Teflón	$\sigma_{máx}$: 135.6 kg/cm²

PROYECTO
E-3

FECHA

HOJA N.º

REACCIONES HORIZONTALES LONGITUDINALES

- FRENADO: RENFE: $F_H = \frac{1}{8}(30 \times 12.00 + 192.00 \times 10.00)1.9 = 304,0$ t

U.I.C: $F_H = \frac{1}{4}(100 + 115.60 \times 8.00) \times 2 = 512.4$ t.

Esta carga se la lleva íntegra el estribo 2 (fijo)

- DEFORMACIONES DIFERIDAS:

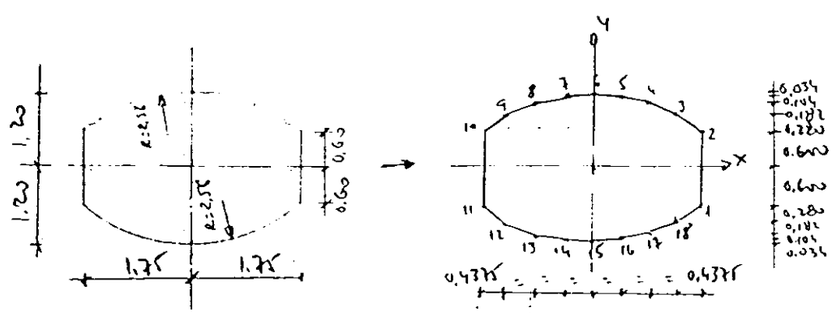
- RETRACCIÓN = $\varepsilon = -25 \times 10^{-5}$
- TEMPERATURA = $\varepsilon = \pm 20 \times 10^{-5}$
- FLUENCIA: $\sigma_{media} = \frac{3600}{8,79} = 410$ t/m² = 41 kg/cm²

$$\varepsilon = -\frac{41}{3,5 \times 10^5} \times 3,5 = -41 \times 10^{-5}$$

$\varepsilon_{total} = -86 \times 10^{-5}$.

Cada pila se llevará la correspondiente a su rigidez y desplazamiento.

Sección de pila:



ECCION: ZARAGOZA-LERIDA.T-1.E-3.SECCION PILA

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 18

	COORD. X	Y
1	1.750	-0.600
2	1.750	0.600
3	1.313	0.880
4	0.875	1.062
5	0.438	1.166
6	0.000	1.200
7	-0.438	1.166
8	-0.875	1.062
9	-1.313	0.880
10	-1.750	0.600
11	-1.750	-0.600
12	-1.313	-0.880
13	-0.875	-1.062
14	-0.438	-1.166
15	0.000	-1.200
16	0.438	-1.166
17	0.875	-1.062
18	1.313	-0.880

FIBRA INFERIOR X	FIBRA INFERIOR Y	FIBRA SUPERIOR X	FIBRA SUPERIOR Y
0.000	-1.200	0.000	1.200

RESULTADOS

AREA = 7.01400 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= -0.00000

******************* EJES ORIGINALES **************************

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.5577340	ANG. FI = 0.0000
My = 0.0000000	Iyy = 6.0299668	
	Ixy = 0.0000000	

******************* EJES PARALELOS POR G **************************

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.5577340	ANG. FI = 0.0000
My = 0.0000000	Iyy = 6.0299668	
	Ixy = 0.0000000	

******************* EJES PRINCIPALES **************************

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 2.5577340	ANG. FI = 0.0000
My = 0.0000000	Iyy = 6.0299668	
	Ixy = 0.0000000	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.20000	Ds = 1.20000
Wi = 2.13145	Ws = 2.13145
Radio Giro X-X = 0.60387	Radio Giro Y-Y= 0.92720

PROYECTO E-3 FECHA HOJA N.°

Flexibilidad = $\frac{L^3}{3EI} + \frac{he}{GA} = \frac{L^3}{3\times3,0\times10^6\times2,5577} + \frac{he}{100\times2\times0,72} =$

$= \frac{L^3}{23,0193\times10^6} + \frac{he}{144}$

$F_{HL} = \frac{\delta}{\text{Flexibilidad}}$

Elemento	L	δ	F_{HL}	Rigidez (t/m)
E-2	—	0	-185,0	∞
P3	14,90	0,0232	34,2	1474
P-2	15,00	0,0516	55,4	1074
P-1	12,60	0,0800	71,3	892
E-1	—	0,1032	24,1	—

($F_{HL\,E-1}$: 0.05 (283.5+108.3+24.5+66,4) = 24.1 t)

SISMO LONGITUDINAL

El puente es rígido al movimiento longitudinal, por estar anclado en el estribo 2.

Por tanto S = 0,08 (grado VII).

Fuerza sobre estribo 2:

F_{HL} = 0.08 (2927.6+1282.5+0.6×2049.6) = 435,2 t.

PROYECTO

E-3

FECHA

HOJA N.º

FUERZAS HORIZONTALES TRANSVERSALES.

– VIENTO

Tablero $q = 0{,}2\,(2{,}45 + 0{,}70 + 3{,}50) = 1{,}33$ t/m.

Pila: $q = 0{,}2 \times 2{,}40 = 0{,}48$ t/m

Rigideces transversales de pilas y apoyos.

$$F = \frac{L^3}{3 \times 3 \times 10^6 \times 6.030} + \frac{ne}{144}$$

Elemento	L	ne	Rigidez.
E-2	–	–	∞
P-3	14.50	0.077	1679
P-2	15.00	0,113	1181
P-1	12.60	0.149	933
E-1	–	–	∞

Barra (tablero) | $A = 8.79\,m^2$; $I = 99.99\,m^4$


```
ZARAGOZA-LERIDA.T-1.E-3.VIENTO
CONTROL
5  4 1 1
:
NUDOS
 1    0.00  0.00
 2   27.00  0.00
 3   60.00  0.00
 4   93.00  0.00
 5  120.00  0.00
:
SECCIONES
1
8.7900 99.990 4.0E6
:
BARRAS
 1   1   2  1
 2   2   3  1
 3   3   4  1
 4   4   5  1
:
APOYOS
5
1  1        1      0
2  0     1679      0
3  0     1181      0
4  0      933      0
5  0        1      0
:
HIPOTESIS DE CARGA
H-1 FUERZA DE VIENTO 1.33t/m
0
4
1  2  1.33  90
2  2  1.33  90
3  2  1.33  90
4  2  1.33  90
:
```

ZARAGOZA-LERIDA.T-1.E-3.VIENTO

ip. nº 1 H-1 FUERZA DE VIENTO 1.33t/m

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.000000	0.000199
2	-0.000000	0.004876	0.000147
3	-0.000000	0.007462	0.000001
4	-0.000000	0.004915	-0.000148
5	-0.000000	0.000000	-0.000201

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.00	-68.02	0.00
2	-0.00	-8.19	0.00
3	-0.00	-8.81	0.00
4	0.00	-4.59	0.00
5	-0.00	-70.00	0.00

E-2
E-3
E-2
E-1
E-1

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	-0.00	68.02
	2	-0.00	-1351.70	32.11
2	2	-0.00	-1351.70	40.29
	3	-0.00	-1957.21	-3.60
3	3	-0.00	-1957.21	5.22
	4	-0.00	-1405.16	-38.67
4	4	-0.00	-1405.16	-34.09
	5	-0.00	0.00	-70.00

	PROYECTO E-3	FECHA
		HOJA N.º

SISMO TRANSVERSAL.

Aplicamos la fórmula de Lord Rayleigh para calcular el período.

Carga debida al $g_p + c_p + 0.6 \times$ sobrecarga.

$$P = 2.5 \times 8.79 + 9.60 + 0.6 \times 2 \times 10.00 = 43.6 \text{ t/m}$$

Por tanto, los desplazamientos de los nudos son los que dé el cálculo de viento multiplicados por $\frac{436}{1,33}$.

$$T = 2\pi \sqrt{\frac{\Sigma m \cdot u^2}{g \Sigma m \cdot u}}$$

Las masas son las que actúan instantáneamente en cada pila, que, valen: $m = g \times 33 \times 43.6$, iguales en todas ellas, por tanto: $T = 2\pi \sqrt{\frac{\Sigma u^2}{g \Sigma u}}$

PILA	u	u^2
3	0,159845	0,025550
2	0,244619	0,059838
1	0,161123	0,025961
Σ	0,565587	0,111349

$T = 0,89$ segundos

Coeficiente sísmico:

$$S = \alpha \cdot \eta \times \beta + \delta$$

$\alpha \cdot C \cdot R = \frac{0.08}{2 \times 0,89} \times 1 = 0,045$ (grado VII)

PROYECTO

E-3

FECHA

HOJA N.º

$$\eta = u \times \frac{\Sigma \cdot \Phi \cdot u}{\Sigma \Phi \cdot u^2} = u \times \frac{\Sigma u}{\Sigma u^2} = u \times \frac{0,565587}{0,111349}$$

$\beta = 1$

$\delta = 0,8$ (zapatas aisladas sobre roca blanda).

PILA	η	S	F_T pila
3	0.81	0,0292	42,0 t
2	1.24	0.0446	64,2 t
1	0.82	0,0295	42,5 t

F_T pila $= S \times 33 \times 43.6 = 1438.8 \cdot S$

$F_{T\,E-2} = 0.08\,(304.2 + 108.3 + 24.5 + 70.3 + 0.6 \times 298,2) = 54.9$ t

$F_{T\,E-1} = 0.08\,(283.5 + 108.3 + 24.5 + 66.4 + 0.6 \times 298,2) = 52,9$ t

3.- CALCULO PILAS

3.1.- CALCULO FUSTES

PROYECTO TAV ZARAGOZA-LERIDA
TRAMO I
ESTRUCTURA E-3

FECHA

HOJA N.º

PILAS

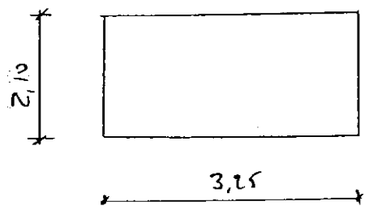
Sección de pila

AREA = 7.014 m²

$I_{xx} = I_L = 2.577 m^4$

$I_{yy} = I_T = 6.030 m^4$

Sección rectangular equivalente:



AREA: 6.825 m² → 97.3 %

I_{xx}: 2582 m⁴ → 98,1 %

Combinaciones de cargas:

H-1: 1.60 × (P propio + c. permanente + def. diferidas + sobrecarga + frenada + f. centrífuga + lazo)

H-2 - 1.44 × (P. propio + c. permanente + def. diferidas + sobrecarga + frenada + f. centrífuga + lazo + viento)

H-3 1.28 (P. propio + c. permanente + def. diferida + sobrecarga + 0,25 × viento) + fuerza transversal

PILA	F(1.44 × viento)	F(0,25 × 1.28 × viento + fuerza transv.)
1	6,6	44,0
2	12,7	67,0
3	11,8	44,6

PROYECTO E-3

FECHA

HOJA N.º

ESFUERZOS MAYORADOS EN CABEZAS DE PILAS

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
1	12.65	114.1	8.0	3080,3	0	385.9
		102.7	13.8	2767.9	0	369.3
		91.3	44.0	2455,5	0	454,9
2	15.00	88.7	8.0	3213,1	0	401.8
		79.8	19.9	2893.9	0	403.8
		70.9	67.0	2574.8	0	544,3
3	14.90	54.7	8.0	3076.5	0	385.5
		49.2	19.0	2763.9	0	386,5
		43.8	44.6	2451.3	0	457.1

VIADUCTO 3. PILA 1. (58 ϕ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 12.65

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	78	78	78	78	78	78	78	78	78	78	78
"Aey:"	206	206	206	206	206	206	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	114.10	8.00	3080.30	000.00	385.90	0	0	0	0	1.60
2	102.70	13.80	2767.90	000.00	369.30	0	0.69	0	0.69	1.44
3	91.30	44.00	2455.50	000.00	454.90	0	1.52	0	1.52	1.28

VIADUCTO 3. PILA 1.

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	103.82	1938.81	3425.60	0.177	6.433
1	0.001	0.000	93.65	1792.72	3391.07	0.149	5.625
2	0.002	0.000	83.40	1643.61	3356.54	0.124	4.898
3	0.004	0.000	73.09	1491.93	3322.01	0.101	4.257
4	0.007	0.000	62.72	1338.07	3287.48	0.081	3.697
5	0.010	0.000	52.32	1182.38	3252.95	0.063	3.212
6	0.014	0.000	41.89	1025.15	3218.42	0.049	2.774
7	0.019	0.000	31.43	866.63	3183.89	0.037	2.338
8	0.024	0.001	20.96	707.08	3149.36	0.025	1.902
9	0.029	0.001	10.48	546.75	3114.83	0.012	1.467
10	0.034	0.001	-0.00	385.86	3080.30	0.012	1.033

Exc. totales result. cabeza 0.12527 -0.00000
Exc. reales 1er ord. cabeza 0.12528 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 1.

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	234.70	1756.36	3078.66	0.389	5.717
1	0.000	0.000	206.66	1625.05	3047.59	0.321	5.007
2	0.002	0.000	179.57	1491.31	3016.51	0.261	4.368
3	0.004	0.000	153.46	1355.52	2985.43	0.208	3.802
4	0.006	0.000	128.36	1217.99	2954.36	0.163	3.308
5	0.009	0.001	104.29	1078.97	2923.28	0.124	2.879
6	0.013	0.001	81.27	938.72	2892.21	0.094	2.494
7	0.017	0.001	59.32	797.42	2861.13	0.069	2.113
8	0.021	0.001	38.45	655.29	2830.05	0.044	1.732
9	0.026	0.001	18.67	512.51	2798.98	0.021	1.352
10	0.030	0.002	-0.00	369.27	2767.90	0.021	0.972

Exc. totales result. cabeza 0.13341 -0.00000
Exc. reales 1er ord. cabeza 0.13342 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 1.

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	692.11	1690.70	2731.74	1.228	5.978
1	0.000	0.000	613.08	1573.91	2704.11	1.018	5.222
2	0.002	0.000	536.04	1454.88	2676.49	0.831	4.535
3	0.004	0.001	461.09	1333.95	2648.86	0.666	3.926
4	0.007	0.001	388.30	1211.43	2621.24	0.523	3.394
5	0.010	0.002	317.74	1087.56	2593.62	0.399	2.932
6	0.013	0.002	249.46	962.57	2565.99	0.294	2.533
7	0.017	0.003	183.51	836.65	2538.37	0.209	2.181
8	0.022	0.004	119.93	709.96	2510.75	0.136	1.846
9	0.027	0.005	58.75	582.65	2483.12	0.066	1.512
10	0.032	0.005	-0.00	454.88	2455.50	0.066	1.178

Exc. totales result. cabeza 0.18525 -0.00000
Exc. reales 1er ord. cabeza 0.18526 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 2. (S8#25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 15.00

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	78	78	78	78	78	78	78	78	78	78	78
"Aey:"	206	206	206	206	206	206	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	88.70	8.00	3213.10	000.00	401.80	0	0	0	0	1.60
2	79.80	19.90	2893.90	000.00	403.80	0	0.69	0	0.69	1.44
3	70.90	67.00	2574.80	000.00	544.30	0	1.52	0	1.52	1.28

VIADUCTO 3. PILA 2.

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	124.47	1888.28	3622.54	0.200	5.980
1	0.001	0.000	112.39	1752.81	3581.60	0.170	5.317
2	0.003	0.000	100.17	1613.10	3540.65	0.143	4.706
3	0.005	0.000	87.84	1469.74	3499.71	0.118	4.153
4	0.009	0.000	75.43	1323.25	3458.76	0.095	3.658
5	0.014	0.000	62.94	1174.09	3417.82	0.075	3.217
6	0.019	0.001	50.41	1022.66	3376.88	0.060	2.792
7	0.025	0.001	37.83	869.34	3335.93	0.045	2.365
8	0.032	0.001	25.23	714.51	3294.99	0.030	1.938
9	0.039	0.001	12.62	558.52	3254.04	0.015	1.510
10	0.046	0.001	-0.00	401.72	3213.10	0.015	1.083

Exc. totales result. cabeza 0.12502 -0.00000
Exc. reales 1er ord. cabeza 0.12505 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 2.

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	387.94	1728.81	3262.40	0.614	5.431
1	0.001	0.000	343.11	1607.13	3225.55	0.513	4.831
2	0.002	0.000	299.47	1481.98	3188.70	0.421	4.279
3	0.005	0.001	257.10	1353.85	3151.85	0.341	3.780
4	0.008	0.001	216.04	1223.14	3115.00	0.269	3.334
5	0.013	0.001	176.36	1090.24	3078.15	0.209	2.933
6	0.018	0.002	138.11	955.49	3041.30	0.161	2.559
7	0.023	0.002	101.31	819.17	3004.45	0.118	2.187
8	0.029	0.003	66.01	681.58	2967.60	0.077	1.815
9	0.036	0.003	32.23	543.01	2930.75	0.037	1.442
10	0.042	0.004	-0.01	403.74	2893.90	0.037	1.070

Exc. totales result. cabeza 0.13951 -0.00000
Exc. reales 1er ord. cabeza 0.13953 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 2.

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	1213.82	1739.97	2902.35	2.235	6.525
1	0.001	0.000	1080.11	1631.50	2869.60	1.861	5.731
2	0.003	0.001	948.62	1519.37	2836.84	1.526	5.002
3	0.006	0.002	819.61	1404.14	2804.09	1.228	4.346
4	0.010	0.003	693.29	1286.28	2771.33	0.968	3.765
5	0.015	0.005	569.82	1166.23	2738.58	0.742	3.257
6	0.021	0.006	449.37	1044.34	2705.82	0.550	2.814
7	0.027	0.008	332.07	920.94	2673.07	0.387	2.429
8	0.034	0.010	218.01	796.29	2640.31	0.249	2.085
9	0.041	0.012	107.28	670.64	2607.56	0.122	1.752
10	0.049	0.014	-0.03	544.21	2574.80	0.122	1.419

Exc. totales result. cabeza 0.21136 -0.00001
Exc. reales 1er ord. cabeza 0.21140 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 3. (58425)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 14.90

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	78	78	78	78	78	78	78	78	78	78	78
"Aey:"	206	206	206	206	206	206	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

HIP.	FUERZAS Y MOMENTOS EN LA CABEZA FUERZAS (t) Fx	Fy	Fz	MOMENTOS (mt) Mx	My	FUERZAS EN EL FUSTE (t/m) SEC.BASE fx0	fy0	SEC.CABEZA fx1	fy1	COEF. GAMMA PP
1	54.70	8.00	3076.50	000.00	385.90	0	0	0	0	1.60
2	49.20	19.00	2763.90	000.00	386.50	0	0.69	0	0.69	1.44
3	43.80	44.60	2451.30	000.00	457.10	0	1.52	0	1.52	1.28

VIADUCTO 3. PILA 3.

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	122.76	1299.92	3483.21	0.152	3.592
1	0.000	0.000	110.78	1217.03	3442.54	0.134	3.343
2	0.002	0.000	98.71	1131.62	3401.87	0.118	3.097
3	0.003	0.000	86.54	1043.93	3361.20	0.103	2.848
4	0.006	0.000	74.30	954.20	3320.53	0.088	2.595
5	0.009	0.000	62.00	862.67	3279.86	0.073	2.340
6	0.012	0.000	49.65	769.57	3239.18	0.059	2.081
7	0.016	0.001	37.26	675.12	3198.51	0.044	1.821
8	0.021	0.001	24.85	579.56	3157.84	0.029	1.559
9	0.026	0.001	12.43	483.09	3117.17	0.015	1.296
10	0.031	0.001	-0.00	385.92	3076.50	0.015	1.032

Exc. totales result. cabeza 0.12544 -0.00000
Exc. reales 1er ord. cabeza 0.12543 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 3.

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	368.74	1201.10	3129.94	0.458	3.289
1	0.000	0.000	325.72	1126.66	3093.34	0.394	3.053
2	0.001	0.000	283.96	1050.14	3056.73	0.336	2.824
3	0.003	0.000	243.52	971.76	3020.13	0.285	2.601
4	0.005	0.001	204.42	891.71	2983.52	0.238	2.380
5	0.008	0.001	166.71	810.17	2946.92	0.194	2.157
6	0.011	0.001	130.42	727.33	2910.32	0.151	1.931
7	0.015	0.002	95.57	643.37	2873.71	0.110	1.704
8	0.019	0.002	62.20	558.47	2837.11	0.072	1.476
9	0.023	0.003	30.34	472.79	2800.50	0.035	1.247
10	0.028	0.003	-0.00	386.50	2763.90	0.035	1.017

Exc. totales result. cabeza 0.13984 -0.00000
Exc. reales 1er ord. cabeza 0.13984 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 3. PILA 3.

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

	0.000	0.000	852.74	1184.11	2776.67	1.149	3.441
	0.000	0.000	753.88	1117.79	2744.13	0.979	3.156
2	0.001	0.000	657.80	1049.58	2711.59	0.824	2.889
3	0.003	0.001	564.61	979.67	2679.06	0.684	2.640
4	0.005	0.002	474.42	908.25	2646.52	0.558	2.408
5	0.008	0.002	387.29	835.51	2613.98	0.446	2.192
6	0.012	0.003	303.30	761.59	2581.45	0.345	1.988
7	0.015	0.004	222.53	686.65	2548.91	0.253	1.789
8	0.020	0.005	145.02	610.83	2516.37	0.164	1.588
9	0.024	0.006	70.82	534.26	2483.84	0.080	1.386
10	0.029	0.008	-0.01	457.08	2451.30	0.080	1.184

Exc. totales result. cabeza 0.18646 -0.00000
Exc. reales 1er ord. cabeza 0.18647 0.00000

Convergencia del equilibrio sin agotamiento

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3.2.- CALCULO CIMENTACION

244

PROYECTO IN. ZARAGOZA – LERIDA
TRAMO I
E-3

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ACCIONES EN CADA SUPERFICIE DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{\pi 1{,}80^2}{4}(6{,}5+13{,}5) + 3{,}00 + 7{,}14(12{,}50 - 3{,}00)\right] = 236{,}7\,t$

P-1 (h = 12,6 m)

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
	PESO PROPIO	1	396.0	—	—	—	—
		2	396.0	—	—	—	—
	CARGA PERMANENTE	1	178.4	—	—	—	—
		2	178.4	—	—	—	—
	SOBRECARGA MAXIMA	1	452.3	—	—	—	—
		2	351,7	—	—	—	—
	SOBRECARGA MINIMA	1	−38.4	—	—	—	—
		2	−29.9	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	−15,3	35.7	—	457.6	—
		2	−15,3	35.7	—	451.6	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	−22.0	—	—	—	—
		2	−22,0	—	—	—	—
	PRETENSADO FINAL	1	−37.9	—	—	—	—
		2	−37.9	—	—	—	—
	VIENTO	1	3.2	—	5.4	—	48.2
		2	−3.2	—	5.4	—	48.2
	SISMO	1	29.5	—	30.1	—	325.0
		2	−29.5	—	30.1	—	325.6

PROYECTO IN. ZARAGOZA – LERIDA
TRAMO I
E-3

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ACCIONES EN CADA SUPERFICIE DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{\pi 1{,}80^2}{4}(6{,}5+13{,}5) + 3{,}00 + 7{,}14(15{,}00 - 3{,}00)\right] = 277{,}9\,t$

P-2 (h = 15,5 m)

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
	PESO PROPIO	1	396.4	—	—	—	—
		2	396.4	—	—	—	—
	CARGA PERMANENTE	1	176.3	—	—	—	—
		2	176.3	—	—	—	—
	SOBRECARGA MAXIMA	1	470,8	—	—	—	—
		2	366,2	—	—	—	—
	SOBRECARGA MINIMA	1	−29.8	—	—	—	—
		2	−23.2	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	6.2	27.7	—	415.5	—
		2	6.2	27.7	—	415,5	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	−0,8	—	—	—	—
		2	−0.8	—	—	—	—
	PRETENSADO FINAL	1	10,9	—	—	—	—
		2	10.9	—	—	—	—
	VIENTO	1	6.1	—	8,0	—	93,0
		2	−6.1	—	8.0	—	93,0
	SISMO	1	44.5	—	42.6	—	560.4
		2	−44.5	—	42,6	—	560.4

PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-3

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

PILA PILA: $N = 2.5\left[\frac{11.80(65+3.N)}{12} \times 3.00 + 7.14(4.90-3.00)\right] = 226.2t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-3 (h=14,90mm)	PESO PROPIO	1	396.5	—	—	—	—
		2	396.5	—	—	—	—
	CARGA PERMANENTE	1	178.4	—	—	—	—
		2	178.4	—	—	—	—
	SOBRECARGA MAXIMA	1	452.3	—	—	—	—
		2	351.7	—	—	—	—
	SOBRECARGA MINIMA	1	-38.4	—	—	—	—
		2	-29.5	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-15.3	17.1	—	254.8	—
		2	-15.3	17.1	—	254.8	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-24.7	—	—	—	—
		2	-24.7	—	—	—	—
	PRETENSADO FINAL	1	-41.4	—	—	—	—
		2	-41.4	—	—	—	—
	VIENTO	1	5.7	—	7.7	—	87.7
		2	-5.7	—	7.7	—	87.7
	SISMO	1	29.1	—	31.5	—	390.8
		2	-29.1	—	31.5	—	390.8

PROYECTO

FECHA

HOJA N.º

HIPOTESIS COMBINADAS

H-1 – P. PROPIO + C. PERMANENTE + SOBRECARGA MÁXIMA + DEFORMACIONES DIFERIDAS + FRENADO + PRETENSADO

H-2 Como H-1 con sobrecarga mínima

H-3 Como H-1 con viento

H-4 Como H-2 con viento

H-5 – Como H-1 con 1/4 viento + sismo

H-6 Como H-2 con 1/4 viento + sismo

ZARAGOZA-LERIDA.TRAMO 1.E-3.ZAPATA PILA 1

Zapata:
H = 2.500 m
BL = 8.200 m
BT = 10.000 m
Fuste:
AL = 2.100 m
AT = 3.250 m

Materiales:
Hormigón.: Fck = 2500 T/m2 gc = 1.500
Acero....: Fyk = 51000 T/m2 gs = 1.150 r = 0.100 m

Esfuerzos en arranque de fuste: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2145.50	71.40	0.00	903.20	241.30
2	1210.80	71.40	0.00	903.20	20.70
3	2145.50	71.40	10.80	903.20	353.30
4	1210.80	71.40	10.80	903.20	132.70
5	2145.50	71.40	62.90	903.20	1060.70
6	1210.80	71.40	62.90	903.20	840.10

Esfuerzos en cara inferior de zapata: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2145.50	71.40	0.00	1081.70	241.30
2	1210.80	71.40	0.00	1081.70	20.70
3	2145.50	71.40	10.80	1081.70	380.30
4	1210.80	71.40	10.80	1081.70	159.70
5	2145.50	71.40	62.90	1081.70	1217.95
6	1210.80	71.40	62.90	1081.70	997.35

Esfuerzos en hipótesis combinadas: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2658.00	71.40	0.00	1081.70	241.30
2	1723.30	71.40	0.00	1081.70	20.70
3	2658.00	71.40	10.80	1081.70	380.30
4	1723.30	71.40	10.80	1081.70	159.70
5	2658.00	71.40	62.90	1081.70	1217.95
6	1723.30	71.40	62.90	1081.70	997.35

Tensiones: (T/m2)

--H--	---T1--	---T2--	---T3--	---T4--	---TC--
1	21.00	24.53	40.30	43.83	36.65
2	11.21	11.52	30.52	30.82	24.87
3	19.98	25.55	39.28	44.85	37.05
4	10.20	12.53	29.50	31.84	25.28
5	13.85	31.67	33.16	50.98	39.62
6	4.07	18.66	23.37	37.97	28.06

Tmáx = 50.98 Tmín = 4.07 TCmáx = 39.62

Armaduras:

Longitudinal:

Uc = 4000.00 T/m Vcu = 175.06 T/m
Md = 316.52 mT/m Hip = 1 gf = 1.60
Vd = 104.80 T/m Hip = 1 gf = 1.60
As = 30.72 cm2/m
0.04*Uc = 36.08 cm2/m 0.0015*Ac = 37.50 cm2/m

Transversal:

Uc = 4000.00 T/m Vcu = 170.03 T/m
Md = 443.13 mT/m Hip = 1 gf = 1.60
Vd = 129.45 T/m Hip = 1 gf = 1.60
As = 43.56 cm2/m
0.04*Uc = 36.08 cm2/m 0.0015*Ac = 37.50 cm2/m

Dimensiones encepado
Canto = 2.70
Ancho L = 8.30
Ancho T = 8.30

Reacc. pilote máx= 869.53 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 71.28 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.650	2.650
2	2.650	-2.650
3	-2.650	2.650
4	-2.650	-2.650
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2294.5	55.4	0.0	831.0	251.2
H- 2	1368.7	55.4	0.0	831.0	16.2
H- 3	2294.5	55.4	16.0	831.0	466.4
H- 4	1368.7	55.4	16.0	831.0	231.5
H- 5	2294.5	55.4	89.2	831.0	1639.3
H- 6	1368.7	55.4	89.2	831.0	1404.4

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2759.5	55.4	0.0	980.6	251.2
H- 2	1833.7	55.4	0.0	980.6	16.2
H- 3	2759.5	55.4	16.0	980.6	509.6
H- 4	1833.7	55.4	16.0	980.6	274.7
H- 5	2759.5	55.4	89.2	980.6	1880.1
H- 6	1833.7	55.4	89.2	980.6	1645.2

Axiles en pilotes:

..IPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	686.4	639.0	464.8	417.4	551.9
H- 2	479.1	476.0	257.5	254.4	366.7
H- 3	716.1	609.3	494.5	387.7	551.9
H- 4	508.7	446.3	287.1	224.7	366.7
H- 5	869.5	455.9	647.9	234.3	551.9
H- 6	662.2	292.9	440.6	71.3	366.7

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	1098.24	667.85	17.73	62.05	0.518	0.315	0.020
H- 2	766.51	407.06	17.73	62.05	0.362	0.192	0.020
H- 3	1145.70	620.39	18.45	64.58	0.541	0.293	0.020
H- 4	813.98	359.59	18.45	64.58	0.384	0.170	0.020
H- 5	1391.24	374.84	33.60	117.60	0.656	0.177	0.037
H- 6	1059.53	114.04	33.60	117.60	0.500	0.054	0.037

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	4178.95 Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	4178.95
Acciones		1.60	Vcu esqu=	1169.77
Recubri=	0.10			
Banda=	3.00			

Flexión:

Mld=	2131.40	Ail en banda=	195.10 cm2
Mtd=	1683.40	Ait en banda=	153.00 cm2
		Ail entre bandas=	20.08 cm2/m
		Ait entre bandas=	15.71 cm2/m
		A min mecánica=	39.08 cm2/m
		A min geométrica=	19.54 cm2/m

Cortante:

Vld=	3158.14	Astl=	0.00 cm2/m
Vtd=	3930.88	Astt=	0.00 cm2/m

Resistencia local:
Vesqd= 1112.96 Comprobación válida

Armadura de suspensión= 132.74 cm2

TAV ZARAGOZA-LERIDA.TRAMO 1.E-3.ENCEPADO P-3

Dimensiones encepado
Canto = 2.70
Ancho L = 8.30
Ancho T = 8.30

Reacc. pilote máx= 750.79 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 141.00 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.650	2.650
2	2.650	-2.650
3	-2.650	2.650
4	-2.650	-2.650
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2180.6	34.2	0.0	509.6	241.3
H- 2	1244.3	34.2	0.0	509.6	20.7
H- 3	2180.6	34.2	15.4	509.6	444.1
H- 4	1244.3	34.2	15.4	509.6	223.5
H- 5	2180.6	34.2	66.9	509.6	1213.3
H- 6	1244.3	34.2	66.9	509.6	992.7

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2645.6	34.2	0.0	601.9	241.3
H- 2	1709.3	34.2	0.0	601.9	20.7
H- 3	2645.6	34.2	15.4	601.9	485.7
H- 4	1709.3	34.2	15.4	601.9	265.1
H- 5	2645.6	34.2	66.9	601.9	1393.9
H- 6	1709.3	34.2	66.9	601.9	1173.3

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	620.0	574.4	483.8	438.3	529.1
H- 2	411.9	408.0	275.7	271.8	341.9
H- 3	648.1	546.3	511.9	410.1	529.1
H- 4	440.0	379.8	303.9	243.7	341.9
H- 5	750.8	443.6	614.6	307.4	529.1
H- 6	542.7	277.2	406.6	141.0	341.9

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	991.94	701.25	10.94	38.30	0.468	0.331	0.012
H- 2	659.03	434.93	10.94	38.30	0.311	0.205	0.012
H- 3	1036.97	656.22	12.00	42.01	0.489	0.310	0.013
H- 4	704.05	389.90	12.00	42.01	0.332	0.184	0.013
H- 5	1201.27	491.92	24.04	84.15	0.567	0.232	0.026
H- 6	868.36	225.60	24.04	84.15	0.410	0.106	0.026

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	4178.95	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	4178.95	
Acciones		1.60	Vcu esqu=	1169.77	
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld= 1899.68 Ail en banda= 173.89 cm2
Mtd= 1500.39 Ait en banda= 136.37 cm2

Ail entre bandas= 17.23 cm2/m
Ait entre bandas= 13.50 cm2/m

A min mecánica= 39.08 cm2/m
A min geométrica= 19.54 cm2/m

Cortante:

Vld= 2814.91 Astl= 0.00 cm2/m
Vtd= 3503.66 Astt= 0.00 cm2/m

Resistencia local:
Vesqd= 992.00 Comprobación válida

Armadura de suspensión= 127.27 cm2

PROYECTO E-3 FECHA HOJA N.º

LONGITUD DE PILOTES

De acuerdo con el informe geotécnico se calculan las longitudes de pilotes en cada pila.

Corte estratigráfico según sondeo

	PILA 2 y 3	Rozamiento (t/m^2)
LIMO YESÍFERO	0 - 7.60	4
LIMO YESÍFERO CON GRAVA	7.60 - 15.00	10
YESO NODULAR	15.00 →	40

Rozamiento negativo (limo colapsable) $Q_N = 28$ t.

$$N = \frac{1}{3}\left(4.60 \times 4 + 7.40 \times 10\right) \times \pi \times 1.50 + \frac{1}{2.5} \times \pi \times 1.50 \times 40 \times L - 28 = 716{,}1$$

L: 7,95 ≃ 8m → pero: L pilote: 15.00 - 3.00 + 8.00 = 20.00 m

4.- CALCULO ESTRIBOS

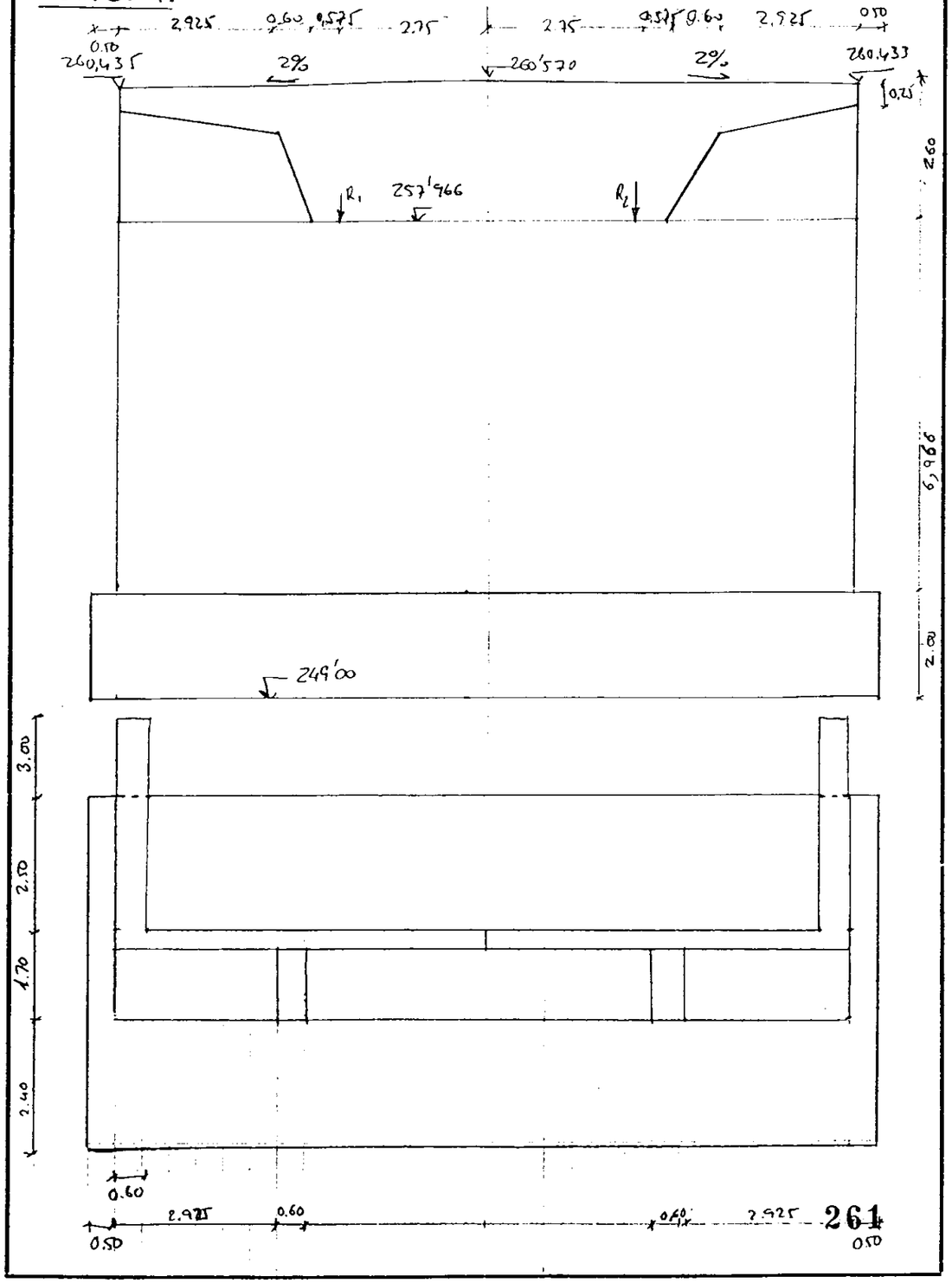
4.1.- ESTRIBO 1 (Móvil)

PROYECTO TAV ZARAGOZA - LÉRIDA
TRAMO 1.
E-3 ESTRIBO 1.

FECHA

HOJA N.º 1

ESTRIBO 1:

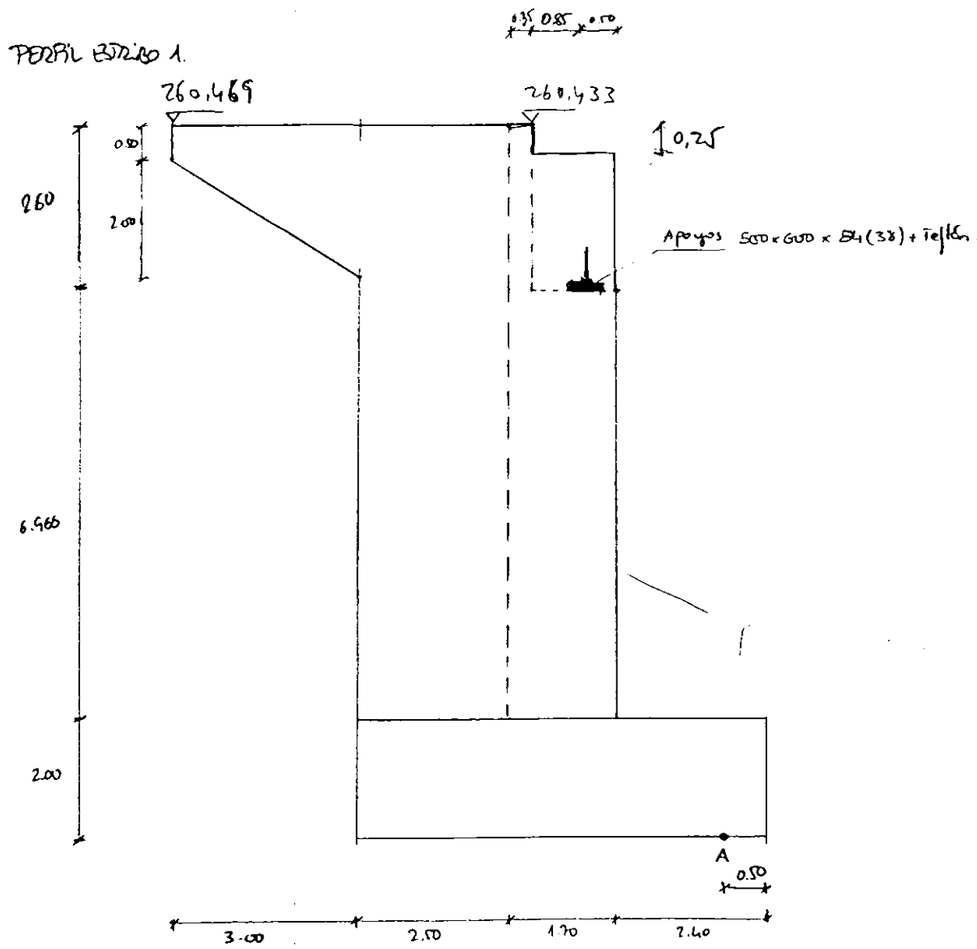


PROYECTO TAV ZARAGOZA - LÉRIDA
TRAMO 1.
E-3

FECHA

HOJA N.º 1 bis

PERFIL ESTRIBO 1.



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TAV ZARAGOZA-LERIDA ESTRUCTURA-3 ESTRIBO-1

CARACTERISTICAS DEL RELLENO

PESO ESPECIFICO (TN/M3)		= 2.00
ANGULO DE ROZAMIENTO FI		= 35.00
ANGULO ROZAMIENTO TERRENO-MURO		= .00
SOBRECARGA (TN/M2)		= 3.00
COEFICIENTE SISMICO BASICO	C	= .080
COEFICIENTE SISMICO	S	= .080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		= .293
COEFICIENTE DE EMPUJE ACTIVO		= .271

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250. KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.050 M

CARGAS SOBRE EL ESTRIBO

CARGA VERTICAL DE TABLERO PESO PROPIO Y CARGA PERMANENTE	482.7 TN
CARGA VERTICAL DE SOBRECARGAS	298.2 TN
FUERZA LONGITUDINAL DE FRENADO RETRACCION Y TEMPERATURA	24.1 TN
FUERZA TRANSVERSAL DE VIENTO	70.0 TN
MOMENTO TRANSVERSAL DE SOBRECARGAS	89.5 MT
FUERZA LONGITUDINAL DE SISMO	.0 TN
FUERZA TRANSVERSAL DE SISMO	52.9 TN

GEOMETRIA DEL ESTRIBO

ANCHURA DEL ESTRIBO B = 13.70

ESVIAJE (GRADOS SEXAGESIMALES) BETA = .00

ALZADO DEL ESTRIBO

ESPESOR DEL FALDON	A3	= .35
ALTURA DEL FALDON	A6	= 2.60
DISTANCIA DE APOYO A BORDE ESTRIBO	A5	= .50
ESPESOR DEL ESTRIBO	A2	= 1.70
ESPESOR DE LAS ALETAS	A7	= .60
ALTURA TOTAL DEL ESTRIBO	H + C	= 11.57
ALTURA DE TIERRAS	H	= 9.57

ZAPATA

VUELO DELANTERO	A1	= 2.40
VUELO TRASERO	A4	= 2.50
LONGITUD TOTAL	L	= 6.60
CANTO	C	= 2.00
RESGUARDO SOBRE ZAPATA		= 0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		= 40.00 TN/M2

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 24.8 CM2/M	(FI 20 A .125 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
	5.2 M. SUPERIORES	AV.= 12.4 CM2/M	(FI 20 A .250 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
INTRADOS		AV.= 5.5 CM2/M	(FI 12 A .200 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
FALDON	TRASDOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 4.1 CM2/M	(FI 12 A .250 M)
	INTRADOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 1.9 CM2/M	(FI 8 A .200 M)
ALETAS	TRASDOS	AV.= 8.3 CM2/M	(FI 16 A .225 M)
		AH.= 8.3 CM2/M	(FI 16 A .225 M)

INTRADOS AV.= 4.1 CM2/M (FI 12 A .250 M)
AH.= 4.1 CM2/M (FI 12 A .250 M)

ARMADURA DE ZAPATA

CARA INFERIOR. A. PRINCIPAL = 29.3 CM2/M (FI 25 A .150 M)
A. DE REPARTO = 8.8 CM2/M (FI 16 A .225 M)

CARA SUPERIOR. A. PRINCIPAL = 29.3 CM2/M (FI 25 A .150 M)
A. DE REPARTO = 8.8 CM2/M (FI 16 A .225 M)

ESTRIBO CON RELLENO DE TIERRAS Y SIN TABLERO

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 23.5

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S1 = 29.4 SA = 21.3 SB = 15.5 S2 = 7.1

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.52

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.63

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 22.9

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S11 = 34.4 SA1 = 22.6 SB1 = 14.3 S21 = 2.0

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.25

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.21

ESTRIBO CON PUENTE EN SERVICIO

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 37.4

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS1 = 43.3 SSA = 31.3 SSB = 22.9 SS2 = 10.4

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 46.8 SMIN = 6.9

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 2.16

COEFICIENTE DE SEGURIDAD AL VUELCO = 3.22

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 31.3

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS11= 43.8 SSA1= 29.1 SSB1= 18.6 SS21= 3.3

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 46.9 SMIN = .2

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.57

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.48

MEDICION DEL ESTRIBO

HORMIGON

ZAPATA		180.84
ALZADO		162.33
FALDON TRASERO		12.47
ALETAS		28.71
TOTAL M3	=	384.35

ARMADURAS

DIAMETRO	NUMERO	LONGITUD	PESO	PESO TOTAL

FALDON				
	12.	69	7.35	.89	450.59
	12.	10	14.10	.89	125.28
	8.	13	14.10	.39	72.38
ZAPATA				
	25.	91	10.30	3.86	3614.46
	25.	91	10.30	3.86	3614.46
	16.	29	17.40	1.58	797.03
	16.	29	17.40	1.58	797.03
ALZADO				
	20.	109	10.67	2.47	2870.36
	12.	69	8.97	.89	549.91
	20.	39	16.80	2.47	1617.03
	20.	31	16.80	2.47	1285.33
	20.	19	16.80	2.47	787.79
A DEDUCIR				
	20.	54	4.27	2.47	-569.07
	20.	19	16.80	2.47	-787.79
ALETAS				
	16.	22	11.87	1.58	412.48
	16.	86	3.90	1.58	529.77
	12.	20	11.87	.89	210.93
	12.	76	3.90	.89	263.35

			TOTAL KG =		16641.30

PARADA DE PROGRAMA

PROYECTO TAV ZARAGOZA - LÉRIDA TRAMO 1. E-3 | FECHA | HOJA N.º 2

REACCIONES VERTICALES TRANSMITIDAS POR EL TABLERO.

PPI	P.P.F	C.M	TERD	RENFE		PRET. I	PRET. F
283'5	265'2	108'3	24'5	298'2	-54'9	46'0	66'4

PESO PROPIO

$PP_{zapata} = 2 \times 13'70 \cdot 6'60 \times 2'5 = \underline{452'10\ t}$

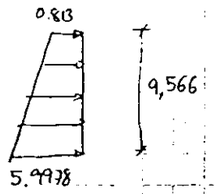
$PP_{pilarcho} = 6'966 \times 13'70 \times 1'70 \times 2'5 + 2 \times \left(2'925 \times 1'35 \times 1'879 + \frac{1}{2} 1'35 \times 0'60 \times 1'879 + \frac{1}{2} \cdot 2'925 \times 0'234 \times 1'35 \right) \times 2'5 + \left(2'55 + 2'413 \right) \cdot \frac{1}{2} \times 13'70 \times 2'5 \times 0'35 + 2 \times 0'60 \times 9'379 \times 2'50 \times 2'5 = \underline{548'90\ t}$

$PP_{pilarete} = 2 \times 0'60 \times \left(3 \times 0'5 + \frac{1}{2} 3 \times 2 \right) \times 2'5 = \underline{13'5\ t}$

$M^{\blacktriangle}_{long} = -2'8 \times 452'1 - 2'75 \times 448'81 - 3'425 \times 29'75 - 4'85 \times 70'34 - 7'6 \times 4'5 - 3'1 \times 9 =$

$= -1813'17\ t. \quad (\curvearrowleft)$

EMPUJE DE TIERRAS: $\phi = 35°$ $K_a = 0'271.$ $\gamma = 2\ t/m^3$



$F_{HL} = \frac{1}{2} \cdot 9'586 \times 13'70 \cdot (0'813 + 5'9978) = 446'29\ t \ (\rightarrow)$

$M^{\blacktriangle}_{long} = 722'71 + 1762'82 = 2485'53\ mt \ (\curvearrowleft)$

FUERZAS TABLERO

$N_{máx} = 265'2 + 108'3 + 24'5 + 298'2 + 66'4 = 762'6$ t (↓)

$M^{\Delta}_{long} = -762'6 \times 2'4 = -1830'24$ mt (↶) $F_L = 24'1$ t (→)

PESO DE TIERRAS

$N = 2\ t/m^3 \times (6'966 + 2'60) \times 13'70 \times 2'50 = 655'27$ t (↓)

$M^{\Delta}_{long} = -655'271 \times \left(\frac{2'5}{2} + 1'70 + 2'90 - 0.50\right) = -3178'06$ mt (↶)

SOBRECARGA SOBRE TERRAPLÉN:

$N = 3 \times (13'70 - 2 \times 0'60) \times 2'5 = 93'75$ t. (↓)

$M^{\Delta}_{long} = -93'75 \times 4'85 = -454'69$ t. (↶)

SISMO: $c = 0'08$

$k_a = \frac{1 - \operatorname{sen}\beta^\circ}{1 + \operatorname{sen}35^\circ} = 0'271.$

$k_{AH} = 0'3166. \sim k_{AD}.$

$\Delta E = \frac{1}{2}(0'3166 - 0'271) \times 2 \times 13'70 \times 9'566^2 = 57'17$ t (→)

$\Delta M^{\Delta}_{long} = 57'17 \times \left(\frac{9'566}{2} + 2\right) = 387'76$ mt (↷)

COMPROBACIÓN AL DESLIZAMIENTO Y AL VUELCO:

H1) ESTRIBO CON RELLENO DE TIERRAS Y SIN TABLERO

$N = 452'1 + 548'9 + 13'5 + 655'27 + 93'75 = 1763'52$ t.

$F_L = 446'29$ t

$M_L = -1813'17 + 2485'53 - 317806 - 454'69 = -2960'39$ mt (↶)

$\gamma_D = \frac{1768'52 \times 0'4}{446'29} = \frac{705'41}{446'3} = 1'58.$

$\gamma_V = \left|\frac{-2960'39 - 2485'53}{+2485'53}\right| = 2'19$

H2) ESTRIBO CON PUENTE EN SERVICIO SIN SISMO

$N = 452'1 + 548'9 + 13'5 + 762'6 + 655'27 + 93'75 = 2526'12$ t.

$F_L = 446'29$ t

$M_L = -1813'17 + 2485'53 - 1830'24 - 3178'06 - 454'69 = -4790'63$ mt (↶)

$\gamma_D = \frac{2526'12 \times 0'4}{446'29 + 24'1} \simeq 2'15$

$\gamma_V = \left|\frac{-4790'63 - 2485'53}{2485'53}\right| = 2'93$

H3) PUENTE EN SERVICIO, CON SISMO.

$N = 2526'12$ t

$F_H = 446'29 + 57'17 = 503'46$.

$M_L = -4790'63 + 387'76 = -4402'87$ mt (↶)

$$\gamma_D = \frac{2526'12 \times 0'4}{503'43 + 2'1} = 1'91.$$

$$\gamma_V = \left| \frac{-4402'87 - 387'76 - 2485'53}{387'76 + 2485'53} \right| = 2'53.$$

H4) H1 + SISMO:

$N = 1763'52$

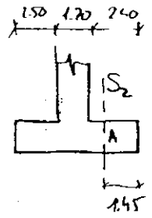
$F_L = 503'46$

$M_L = -2960'39 + 387'76$

$$\gamma_D = \frac{1763'52 \times 0'4}{503'46} = 1'40.$$

$$\gamma_V = \left| \frac{-2960'39 - 2485'53}{2485'53 + 387'76} \right| = 1'89$$

- ARMADURA DE CORTANTE EN ZAPATA



$b = 13.70$

$V_{d_2} \leq 2 \times 13'70 \times 1'90 \times 5 \times \sqrt{\frac{250}{1.5}} = 3360'46$ t.

$V_{d_2} = 1'6 \times 450'58 = 720'92$ t. No necesita

- PARRILLAS DE APOYO EN ALZADO.

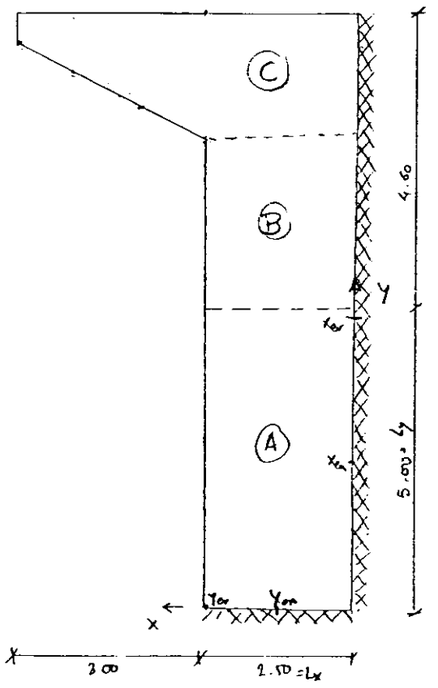
$R_{máx} = 406'7$ t

Apoyos: $500 \times 600 \times 54\ (38) + \text{Tefl6}_1$.

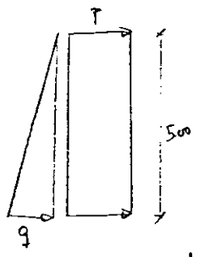
$A_{sl} = 0'3 \times 1'6 \times 406'7 \times \frac{1'15}{5,1} \times \left(1 - \frac{500}{1000}\right) = 22'01\ cm^2 \Rightarrow 11\phi 16 \circ 20\phi 12$

$A_{st} = 0'3 \times 1'6 \times 406'7 \times \frac{1'15}{5'1} \times \left(1 - \frac{600}{1150}\right) = 21'05\ cm^2 \Rightarrow 11\phi 16 \circ 19\phi 12$

ARMADURAS MURO EN VUELTA Y ALETAS



ZONA A: $\frac{L_x}{L_y} \geq 2$.



$p = 0'271 \cdot (3 + 4'60 \times 2) =$

$= 3'31 \ t/m2$

$q = 0'271 \times (3 \times 2) = 2'71 \ t/m^2$

$K_1 = 3'31 \times 2'5 \times 5'00 = 41'33 \ t$

$K_2 = \frac{1}{2} 2'71 \times 2'5 \times 5'6 = 16'94 \ t.$

$M_{x_{er}} = -\frac{41'33}{4,18} - \frac{16'94}{10.30} = -11'53 \ mt/m \Rightarrow A_{inf} = 91'66 \times \frac{1'15}{5'1} \times \left(1 - \sqrt{1 - \frac{2 \times 11'53 \times 10^3}{0'55 \times 91'66^2}}\right)$

$= 7'71 \ cm^2/m$

$\Downarrow$

$\phi 16 / 0.25$

$M_{xem} = -\frac{41'33}{5.90} - \frac{16'94}{6.76} = -9'51 \ mt/m$

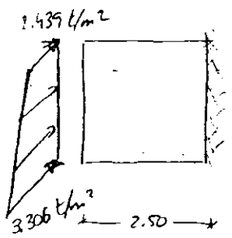
$M_{yer} = -\frac{41'33}{4.88} - \frac{16'94}{4.75} = -12'08 \ mt/m \Rightarrow A_{inf} = 8'05 \ cm^2/m$

$\Downarrow$

$\phi 16 / 0.20$

$M_{yem} = -\frac{41'33}{12.40} - \frac{16'94}{10.4} = -4'96 \ mt/m$

ZONA B: Ménsula.



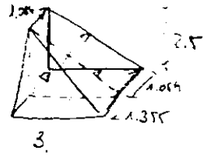
$M_y = 1'6 \times \frac{2'50}{2} \times \left(2'439 + 3'306\right) \frac{1}{2} \times 1'6 \times 2'5 = 22'98 \ mt.$

$A_{int} = 6'59 \ cm^2/m \longrightarrow \phi 16 / 0.30$

ZONA C: Ménsula

$M_d = 1'6 \times \frac{5'5}{2} \times \left(0'913 + 2'439\right) \times \frac{1}{2} \times 5'5 \times 3 -$

$- 1'6 \times \frac{1}{2} \times 2'5 \times 3 \times 1'684 \times 4'5 = 88'78 \ mt.$



$A_{inf} = 91'667 \frac{1'15}{5'1} \times \left(1 - \sqrt{1 - 2 \times \frac{35'51}{0'55 \times 91'667}}\right) = 15'11 \ cm^2/m$

$\longrightarrow \phi 16 / 0.15$

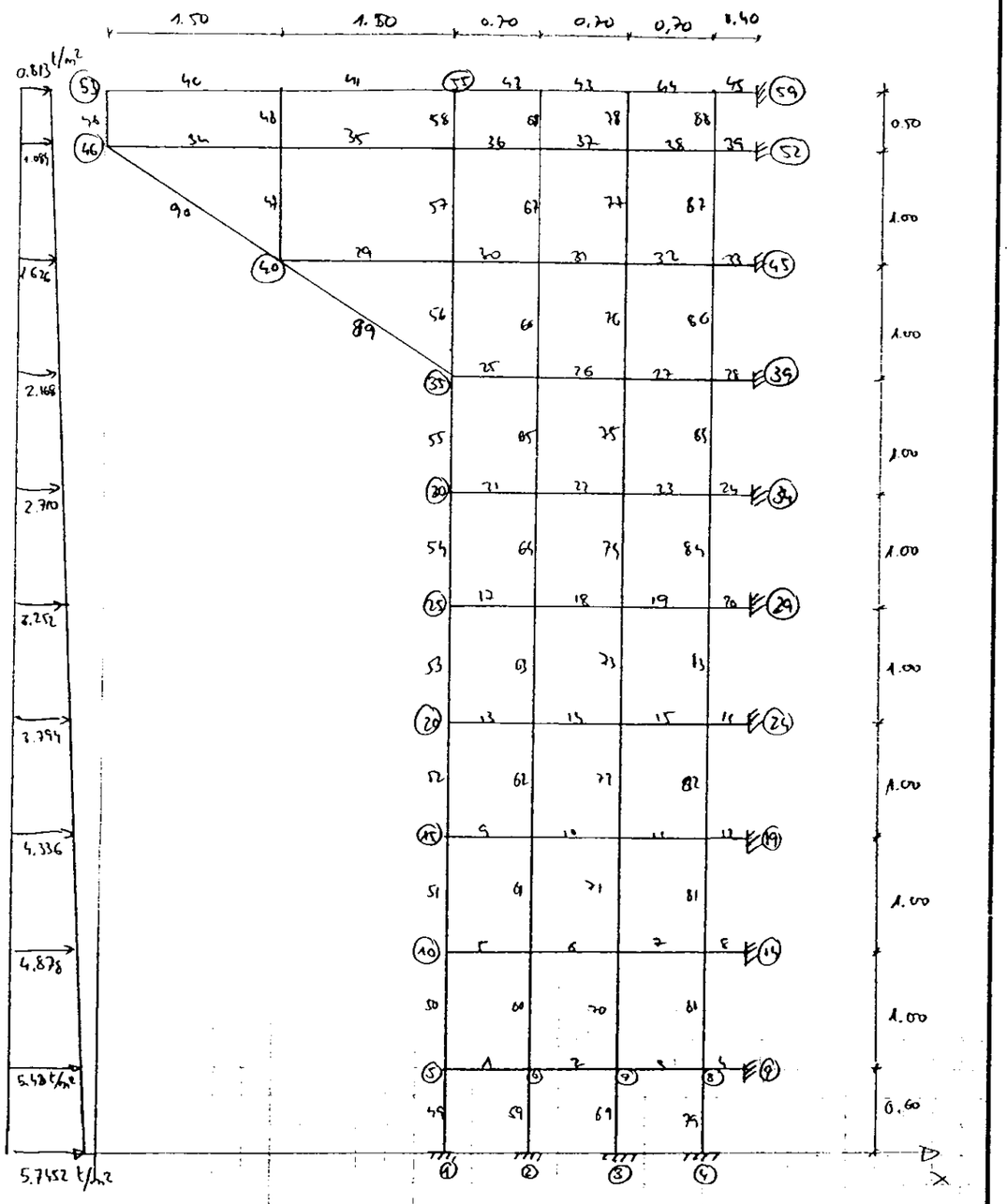
PROYECTO TAV ZARAGOZA - LLEIDA

TRAMO I E-3. ESTRIBO 1.

ENPARRILLADO ALETAS

FECHA

HOJA N.º 9




```
TAV ZARAGOZA-LLEIDA. E-3. ALETAS ESTR.1
**control**
59 90  7  1
:
**nudos**
  1   3     0
  2   3.7   0
  3   4.4   0
  4   5.1   0
  5   3     0.6
  6   3.7   0.6
  7   4.4   0.6
  8   5.1   0.6
  9   5.5   0.6
 10   3     1.6
 11   3.7   1.6
 12   4.4   1.6
 13   5.1   1.6
 14   5.5   1.6
 15   3     2.6
 16   3.7   2.6
 17   4.4   2.6
 18   5.1   2.6
 19   5.5   2.6
 2    3     3.6
 21   3.7   3.6
 22   4.4   3.6
 23   5.1   3.6
 24   5.5   3.6
 25   3     4.6
 26   3.7   4.6
 27   4.4   4.6
 28   5.1   4.6
 29   5.5   4.6
 30   3     5.6
 31   3.7   5.6
 32   4.4   5.6
 33   5.1   5.6
 34   5.5   5.6
 35   3     6.6
 36   3.7   6.6
 37   4.4   6.6
 38   5.1   6.6
 39   5.5   6.6
 4    1.5   7.6
 41   3     7.6
 42   3.7   7.6
 43   4.4   7.6
 44   5.1   7.6
 45   5.5   7.6
 46   0.0   8.6
 47   1.5   8.6
 48   3     8.6
 49   3.7   8.6
 50   4.4   8.6
 51   5.1   8.6
 52   5.5   8.6
 53   0.0   9.1
 54   1.5   9.1
 55   3     9.1
 56   3.7   9.1
 57   4.4   9.1
 58   5.1   9.1
 59   5.5   9.1
:
**barras tipo**
10
  0.0144        0.0288        3500000    1500000
```

```
 0.0180        0.0360        3500000    1500000
 0.0135        0.0270        3500000    1500000
 0.0045        0.0090        3500000    1500000
 0.0270        0.0540        3500000    1500000
 0   )63       0.0126        3500000    1500000
 0.    )8      0.0396        3500000    1500000
 0.0126        0.0252        3500000    1500000
 0.0099        0.0198        3500000    1500000
 0.0004        0.0008        3500000    1500000

*barras**
 1     5      6      1
 2     6      7      1
 3     7      8      1
 4     8      9      1
 5     10     11     2
 6     11     12     2
 7     12     13     2
 8     13     14     2
 9     15     16     2
10     16     17     2
11     17     18     2
12     18     19     2
13     20     21     2
1      21     22     2
15     22     23     2
16     23     24     2
17     25     26     2
18     26     27     2
19     27     28     2
20     28     29     2
21     30     31     2
22     31     32     2
23     32     33     2
24     33     34     2
25     )5     36     2
26     36     37     2
27     37     38     2
28     38     39     2
29     40     41     2
30     41     42     2
31     42     43     2
32     43     44     2
33     44     45     2
3      46     47     3
35     47     48     3
36     48     49     3
37     49     50     3
38     50     51     3
39     51     52     3
40     53     54     4
41     54     55     4
42     55     56     4
43     56     57     4
44     57     58     4
45     58     59     4
46     46     53     3
47     40     47     5
48     47     54     5
49     1      5      6
50     5      10     6
51     10     15     6
52     15     20     6
53     20     25     6
(      25     30     6
55      )     35     6
56     35     41     7
57     41     48     7
```



```
58     48     55     7
59     2      6      8
60     6      11     8
61     11     16     8
62     16     21     8
63     21     26     8
64     26     31     8
65     31     36     8
66     36     42     8
67     42     49     8
68     49     56     8
69     3      7      8
70     7      12     8
71     12     17     8
72     17     22     8
73     22     27     8
74     27     32     8
75     32     37     8
76     37     43     8
77     43     50     8
78     50     57     8
79     4      8      9
80     8      13     9
81     13     18     9
(      18     23     9
83     23     28     9
84     28     33     9
85     33     38     9
86     38     44     9
87     44     51     9
88     51     58     9
89     35     40     10
90     40     46     10
:
**apoyos**
14
  1      1      1     1
  2      1      1     1
  3      1      1     1
  4      1      1     1
  9      1      1     1
  14     1      1     1
  19     1      1     1
  24     1      1     1
  2      1      1     1
  34     1      1     1
  39     1      1     1
  45     1      1     1
  52     1      1     1
  59     1      1     1
:
**cargas**
EMPUJE DE TIERRAS
0
45
  1     3    4.336    4.336
  2     3    4.336    4.336
  3     3    4.336    4.336
  4     3    4.336    4.336
  5     3    4.878    4.878
  6     3    4.878    4.878
  7     3    4.878    4.878
  8     3    4.878    4.878
  9     3    4.336    4.336
  10    3    4.336    4.336
  11    3    4.336    4.336
  12    3    4.336    4.336
  13    3    3.794    3.794
```

14	3	3.794	3.794
15	3	3.794	3.794
16	3	3.794	3.794
17	3	3.252	3.252
1	3	3.252	3.252
19	3	3.252	3.252
20	3	3.252	3.252
21	3	2.710	2.710
22	3	2.710	2.710
23	3	2.710	2.710
24	3	2.710	2.710
25	3	2.168	2.168
26	3	2.168	2.168
27	3	2.168	2.168
28	3	2.168	2.168
29	3	1.626	1.626
30	3	1.626	1.626
31	3	1.626	1.626
32	3	1.626	1.626
33	3	1.626	1.626
34	3	0.813	0.813
35	3	0.813	0.813
36	3	0.813	0.813
37	3	0.813	0.813
3.	3	0.813	0.813
39	3	0.813	0.813
40	3	.2033	.2033
41	3	.2033	.2033
42	3	.2033	.2033
43	3	.2033	.2033
44	3	.2033	.2033
45	3	.2033	.2033

Hip. n° 1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	-0.000000	0.000000
2	-0.000000	-0.000000	0.000000
3	-0.000000	-0.000000	0.000000
4	-0.000000	-0.000000	0.000000
5	-0.000064	-0.000011	0.000024
6	-0.000045	-0.000012	0.000016
7	-0.000023	-0.000012	0.000008
8	-0.000005	-0.000007	0.000002
9	-0.000000	-0.000000	0.000000
10	-0.000076	-0.000050	0.000106
11	-0.000054	-0.000052	0.000070
12	-0.000027	-0.000049	0.000034
13	-0.000006	-0.000028	0.000006
14	-0.000000	-0.000000	0.000000
15	-0.000053	-0.000087	0.000177
16	-0.000036	-0.000088	0.000116
17	-0.000017	-0.000080	0.000056
18	-0.000004	-0.000044	0.000009
19	-0.000000	-0.000000	0.000000
20	-0.000032	-0.000114	0.000223
21	-0.000020	-0.000114	0.000143
22	-0.000008	-0.000100	0.000067
23	-0.000002	-0.000052	0.000011
24	-0.000000	-0.000000	0.000000
25	-0.000022	-0.000134	0.000252
26	-0.000013	-0.000131	0.000159
27	-0.000005	-0.000111	0.000072
28	-0.000001	-0.000055	0.000012
29	-0.000000	-0.000000	0.000000
30	-0.000023	-0.000154	0.000277
31	-0.000012	-0.000147	0.000171
32	-0.000004	-0.000119	0.000076
33	-0.000001	-0.000057	0.000012
34	-0.000000	-0.000000	0.000000
35	-0.000029	-0.000186	0.000307
36	-0.000014	-0.000166	0.000183
37	-0.000004	-0.000127	0.000079
38	-0.000001	-0.000058	0.000012
39	-0.000000	-0.000000	0.000000
40	-0.000035	-0.000259	0.000703
41	-0.000026	-0.000217	0.000337
42	-0.000014	-0.000184	0.000196
43	-0.000005	-0.000136	0.000083
44	-0.000001	-0.000060	0.000012
45	-0.000000	-0.000000	0.000000
46	-0.000034	-0.000275	0.001147
47	-0.000034	-0.000266	0.000738
48	-0.000020	-0.000230	0.000360
49	-0.000013	-0.000198	0.000209
50	-0.000006	-0.000145	0.000088
51	-0.000001	-0.000063	0.000013
52	-0.000000	-0.000000	0.000000
53	-0.000034	-0.000275	0.001164
54	-0.000033	-0.000267	0.000755
55	-0.000020	-0.000234	0.000370
56	-0.000013	-0.000202	0.000216
57	-0.000006	-0.000148	0.000091
58	-0.000001	-0.000065	0.000014
59	-0.000000	-0.000000	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	4.01	0.36	5.51
2	5.08	0.77	5.90
3	2.58	0.73	2.98
4	0.33	0.36	0.08
9	0.57	1.29	2.43
14	0.85	5.69	7.19
19	0.49	8.63	9.28
24	0.22	9.90	9.24
29	0.10	10.27	8.40
34	0.08	10.32	7.36
39	0.09	10.32	6.28
45	0.13	10.49	5.48
52	0.12	8.23	3.92
59	0.04	2.92	1.74

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	5	1.18	-0.38	2.28
	6	1.18	0.15	-0.76
2	6	1.35	-0.57	2.50
	7	1.35	0.12	-0.53
3	7	1.09	-0.55	1.71
	8	1.09	-0.42	-1.32
4	8	0.57	-0.67	-0.69
	9	0.57	-1.29	-2.43
5	10	1.73	0.04	1.48
	11	1.73	-0.12	-1.94
6	11	2.07	-0.00	0.30
	12	2.07	-0.99	-3.11
7	12	1.59	-0.79	-1.94
	13	1.59	-3.34	-5.35
	13	0.85	-3.21	-5.24
	14	0.85	-5.69	-7.19
9	15	1.35	0.18	0.88
	16	1.35	-0.27	-2.16
10	16	1.47	0.14	-1.42
	17	1.47	-1.92	-4.46
11	17	1.02	-1.45	-4.27
	18	1.02	-5.50	-7.31
12	18	0.49	-5.27	-7.55
	19	0.49	-8.63	-9.28
13	20	0.92	0.14	0.41
	21	0.92	-0.51	-2.25
14	21	0.90	-0.20	-2.12
	22	0.90	-2.62	-4.78
15	22	0.52	-2.30	-4.88
	23	0.52	-6.65	-7.54
16	23	0.22	-6.51	-7.72
	24	0.22	-9.90	-9.24
17	25	0.72	0.00	-0.01
	26	0.72	-0.80	-2.28
18	26	0.63	-0.74	-2.38
	27	0.63	-3.20	-4.66
19	27	0.29	-3.09	-4.76
	28	0.29	-7.22	-7.03
20	28	0.10	-7.17	-7.10
	29	0.10	-10.27	-8.40
21	30	0.87	-0.23	-0.59
	31	0.87	-1.30	-2.49
22	31	0.64	-1.42	-2.54
	32	0.64	-3.86	-4.44
	32	0.25	-3.86	-4.39
	33	0.25	-7.60	-6.28
24	33	0.08	-7.59	-6.27
	34	0.08	-10.32	-7.36

25	35	1.19	-1.33	-0.94
	36	1.19	-2.52	-2.46
26	36	0.74	-2.49	-2.37
	37	0.74	-4.67	-3.89
27	37	0.29	-4.69	-3.91
	38	0.29	-7.96	-5.43
28	38	0.09	-7.98	-5.42
	39	0.09	-10.32	-6.28
29	40	0.33	-0.61	-0.72
	41	0.33	-3.52	-3.16
30	41	0.96	-2.50	-0.94
	42	0.96	-3.56	-2.07
31	42	0.67	-3.38	-2.33
	43	0.67	-5.41	-3.47
32	43	0.32	-5.42	-3.67
	44	0.32	-8.39	-4.81
33	44	0.13	-8.43	-4.83
	45	0.13	-10.49	-5.48
34	46	0.01	-0.00	0.03
	47	0.01	-0.88	-1.19
35	47	0.37	-0.54	-0.36
	48	0.37	-2.00	-1.58
36	48	0.44	-1.61	-1.55
	49	0.44	-2.89	-2.12
37	49	0.40	-2.71	-2.23
	50	0.40	-4.47	-2.80
38	50	0.27	-4.39	-3.03
	51	0.27	-6.71	-3.60
39	51	0.12	-6.73	-3.59
	52	0.12	-8.23	-3.92
40	53	0.01	-0.00	-0.00
	54	0.01	-0.23	-0.31
41	54	0.12	-0.01	-0.35
	55	0.12	-0.77	-0.66
42	55	0.13	-0.35	-1.00
	56	0.13	-1.10	-1.14
43	56	0.13	-0.78	-1.16
	57	0.13	-1.64	-1.30
44	57	0.10	-1.39	-1.32
	58	0.10	-2.36	-1.46
45	58	0.04	-2.24	-1.65
	59	0.04	-2.92	-1.74
46	46	0.00	0.01	0.00
	53	0.00	0.01	0.00
47	40	-0.56	-0.28	0.78
	47	-0.56	0.50	0.78
48	47	-0.22	0.14	-0.05
	54	-0.22	0.12	-0.05
49	1	-0.36	-4.01	5.51
	5	-0.36	-0.70	5.51
50	5	-0.73	-1.88	3.23
	10	-0.73	1.35	3.23
51	10	-0.69	-0.38	1.76
	15	-0.69	1.38	1.76
52	15	-0.52	0.03	0.88
	20	-0.52	0.91	0.88
53	20	-0.38	-0.01	0.47
	25	-0.38	0.45	0.47
54	25	-0.38	-0.27	0.47
	30	-0.38	0.21	0.47
55	30	-0.61	-0.66	1.06
	35	-0.61	0.40	1.06
56	35	-1.82	-0.74	1.92
	41	-1.82	1.18	1.92
57	41	-0.80	0.55	-0.31
	48	-0.80	0.25	-0.31
58	48	-0.41	0.18	-0.34
	55	-0.41	0.01	-0.34

59	2	-0.77	-5.08	5.90
	6	-0.77	-1.54	5.90
60	6	-1.50	-1.71	2.64
	11	-1.50	0.93	2.64
	11	-1.38	0.59	0.40
	16	-1.38	0.99	0.40
62	16	-0.96	0.86	-0.33
	21	-0.96	0.53	-0.33
63	21	-0.66	0.55	-0.45
	26	-0.66	0.10	-0.45
64	26	-0.60	0.20	-0.35
	31	-0.60	-0.16	-0.35
65	31	-0.71	0.07	-0.30
	36	-0.71	-0.23	-0.30
66	36	-0.68	0.21	-0.39
	42	-0.68	-0.18	-0.39
67	42	-0.51	0.11	-0.13
	49	-0.51	-0.03	-0.13
68	49	-0.32	0.01	-0.02
	56	-0.32	-0.00	-0.02
69	3	-0.73	-2.58	2.98
	7	-0.73	-0.80	2.98
70	7	-1.40	-0.54	0.73
	12	-1.40	0.19	0.73
1	12	-1.20	0.67	-0.44
	17	-1.20	0.23	-0.44
72	17	-0.73	0.69	-0.63
	22	-0.73	0.06	-0.63
73	22	-0.42	0.43	-0.52
	27	-0.42	-0.09	-0.52
74	27	-0.31	0.24	-0.43
	32	-0.31	-0.18	-0.43
75	32	-0.31	0.21	-0.48
	37	-0.31	-0.26	-0.48
7[illegible]	37	-0.33	0.19	-0.45
	43	-0.33	-0.26	-0.45
77	43	-0.34	0.09	-0.25
	50	-0.34	-0.16	-0.25
78	50	-0.26	-0.02	-0.02
	57	-0.26	-0.03	-0.02
79	4	-0.36	-0.33	0.08
	8	-0.36	-0.28	0.08
80	8	-0.61	0.24	-0.55
	13	-0.61	-0.31	-0.55
1	13	-0.47	0.43	-0.67
	18	-0.47	-0.24	-0.67
82	18	-0.24	0.28	-0.43
	23	-0.24	-0.14	-0.43
83	23	-0.10	0.16	-0.25
	28	-0.10	-0.09	-0.25
84	28	-0.05	0.10	-0.18
	33	-0.05	-0.08	-0.18
85	33	-0.04	0.09	-0.19
	38	-0.04	-0.10	-0.19
86	38	-0.06	0.09	-0.20
	44	-0.06	-0.11	-0.20
87	44	-0.10	0.08	-0.18
	51	-0.10	-0.10	-0.18
88	51	-0.12	0.04	-0.19
	58	-0.12	-0.05	-0.19
89	35	-0.02	-0.13	0.08
	40	-0.02	0.03	0.08
90	40	-0.01	-0.03	0.03
	46	-0.01	0.01	0.03

PROYECTO TAV ZARAGOZA - LLEIDA
TRAMO 1. E-3
ESTRIBO 1.

FECHA

HOJA N.º 10

ARMADURA EN MUROS EN VUELTA Y ALETAS.

ARMADURA VERTICAL:

$M_d^2 = 1'6 \times 5'08 \text{ mt.} = 8'13 \text{ mt}$

$A_s = \frac{2500}{1.5} \times 0'55 \times \frac{1'15}{5,1} \times \left(1 - \sqrt{1 - \frac{2 \times 8'13}{\frac{2500}{1.5} \times 0'55 \times 0'70 \times 0'55}}\right) = 4'82 \text{ cm}^2/\text{m}.$

$\Rightarrow \underline{\phi 16/0.30}$

ARMADURA HORIZONTAL:

→ 3'6 primeros metros inferiores: $M_d^{24} = 9'90 \times 1'6 = 15'84$ mt

→ 4'5 siguientes metros: $M_d^{39} = 1'6 \times 10'49 = 16'79$ mt

→ Último 1 metro: $M_d = 1'6 \times 8'23 = 13'17$ mt.

3'6 primeros metros inf → $A_s = 6'60 \text{ cm}^2/\text{m} \Rightarrow \underline{\phi 16/0.30}$

4'5 siguientes metros → $A_s = 7 \text{ cm}^2/\text{m} \Rightarrow \underline{\phi 16/0.25}$

1 último metro superior → $A_s = 7'33 \text{ cm}^2/\text{m} \Rightarrow \underline{\phi 16/0.25}$

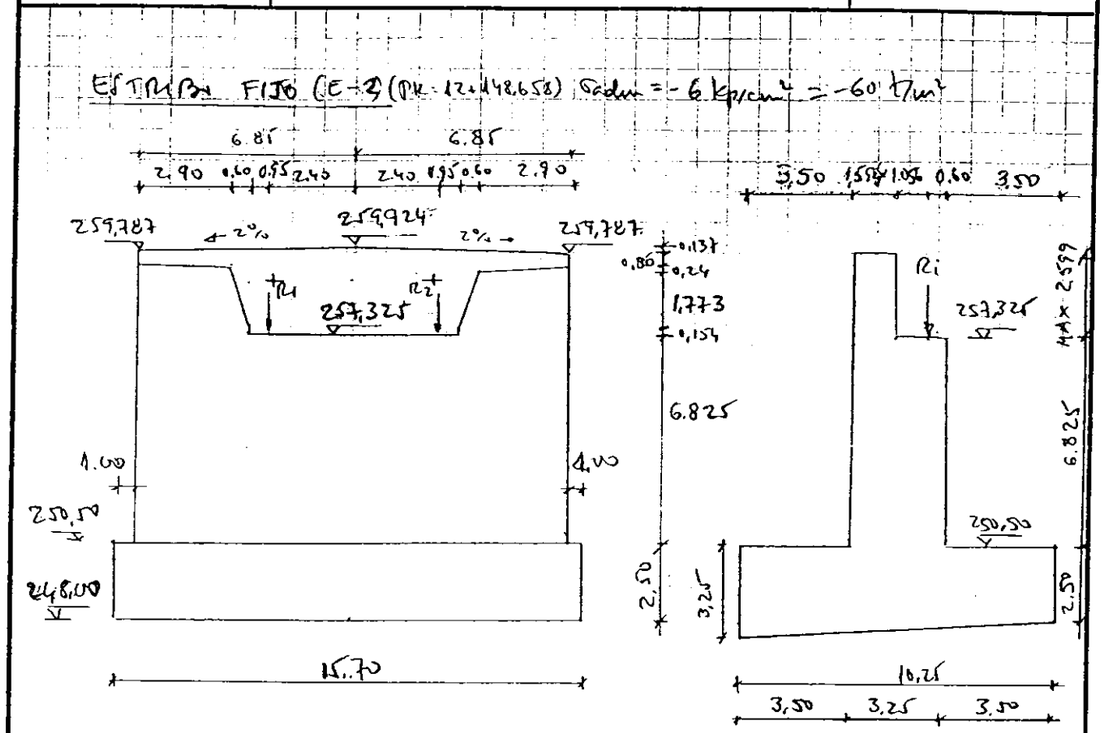
4.2.- ESTRIBO 2 (Fijo)

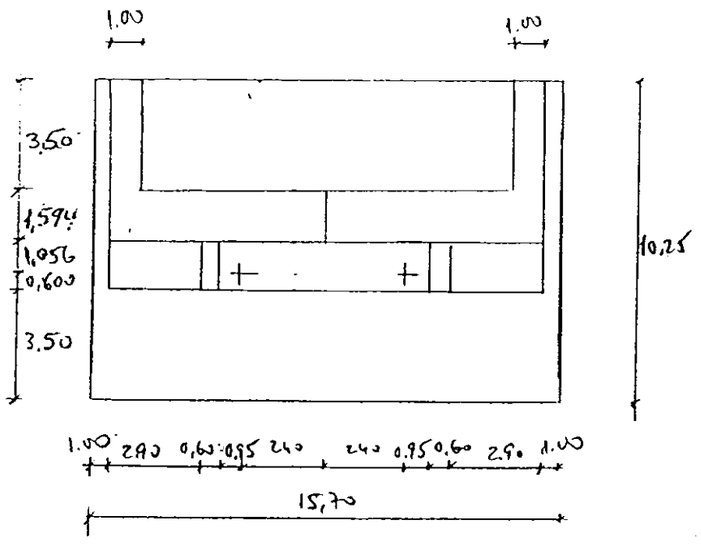
PROYECTO ZARAGOZA - LERIDA
SUB-TRAMO 1
E-3

FECHA

HOJA N.º 1

ESTRIBO FIJO (E-3) (PK 124+48,658) $\sigma_{adm} = -6\ kp/cm^2 = -60\ t/m^2$





PROYECTO

E-3

FECHA

HOJA N.º 2

- $R_1 + R_2$

pp rep: 304,2 + 108,2 + 24,5 + 70,3 = 507,3 t

sobre: 298,2 t M: 298,2 × 0,30 = 89,5 mt

F_{H_L} frenado = 512,4 t

F_{H_L} del dil = 1850 t

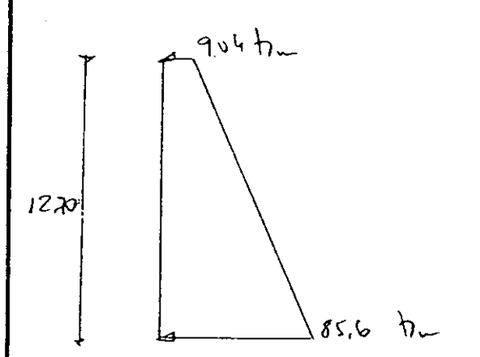
F_{H_L} viento = 435,2 t + 89,8 = 525,0 t

F_{H_T} viento = 68,0 t

F_{H_T} viento = 80,3 t + 89,8 = 170,1 t.

- Empuje de tierra

$\varphi = 40°$ $K_A = 0,22$. $\gamma = 3\ t/m^3$



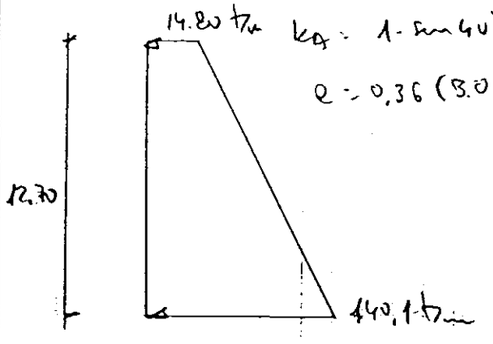
$e = 0,22\ (3,0 + 2,0 \times h)$

$E = e \times 13,70$

$F_{H_L} = \frac{9,04 + 85,6}{2} \times 12,70 = 601,0$ t.

$M_L = 601,0 \left(\frac{18,08 + 856}{9,04 + 85,6} \times \frac{12,70}{3} \right) = 2787,0$ mt

- Empuje de tierra al reposo.



$K_0 = 1 - \sin 40° = 0,36$

$e = 0,36\ (3,0 + 2,0\,h)$ $E = e \times 13,70$

$F_{H_L} = \frac{14,8 + 140,1}{2} \times 12,70 = 983,6$ t

$M_L = 983,6 \left(\frac{29,6 + 140,1}{14,8 + 140,1} \times \frac{12,70}{3} \right) = 4561,7$ mt

- Incremento de empuje de tierras por sismo:

$C = 0.08$

$k_a = 0,22$

$$k_{AH} = \left[\frac{\sec\alpha \cos(\varphi-\alpha)}{\sqrt{\cos(\alpha+\delta)} + \sqrt{\frac{\sin(\varphi+\delta)\sin(\varphi-\beta)}{\cos(\beta-\alpha)}}}\right]^2 = 0,254$$

$\alpha = \psi$; $\varphi = 40^\circ$; $\beta = \psi$; $\delta = 0$; $\psi = \operatorname{arctg}(0.08) = 4.57^\circ$

$$k_{AD} = \frac{k_{AH}}{\cos\psi} = \frac{0,254}{0.997} = 0,26$$

$\Delta F_{HL} = \frac{1}{2}(0.26-0.22)\cdot 2.0 \times 12,70^2 \times 13,70 = 88,4\ t$

$\Delta M_L = 88,4 \times \frac{12.70}{2} = 561,3\ mt$

DECENAS RESPECTO AL CENTRO DE LA ZAPATA (C. INFERIOR)

	N	F_{HL}	F_{HT}	M_L	M_T
ZAPATA: 10,25 × 15,7 × 2,20 × 2,5	1085.8	—	—	—	—
½ 10,25 × 15,7 × 0,75 × 2,5	110,9	—	—	-258.0	—
MURO FR.: 13,7 × 6,875 × 3,25 × 2,5	759.7	—	—	—	—
MURETE: 13,7 × 2,53 × 1,60 × 2,5	138.6	—	—	-115,2	—
TAPES: 2 × 3,20 × 2,32 × 1,65 × 2,5	61,2	—	—	49.0	—
MUROS LAT: 2 × 3,50 × 1,10 × 9,30 × 2,5	162.8	—	—	-549,3	—
PESO TIERRAS: 12,70 × 3,50 × 9,30 × 2,0	826.8	—	—	-2790,3	—
C.P. TAB: 304,2 + 108.3 + 24.5 + 70,3	507.3	—	—	520.0	—
SOB. TAB MAX:	298,2	—	—	305,7	89.5
SOB. TAB. MIN:	-55.0	—	—	-56.4	—
EMPUJE TIERRAS:	—	601.0	—	2787.0	—
EMP. TIERRAS REPOSO:	—	983.6	—	4561.7	—
INCR. EMP. T. SISMO:	±	± 88,4	—	± 561,3	—
FRENADO:	±	± 512,4	—	± 5790,1	—
DEFOT:	—	185.0	—	2090,5	—
VIENTO:	—	—	68.0	—	896.2
SISMO VNG:	±	± 525,0	±	5592,1	—
SISMO TRANS:	—	—	170.1	—	1433.2

H-1 P. propio + C. perm. + Sobrec. uso + dif. dil. + Fenómeno + Emp. tierras + viento

$N = 3911,3$ t.

$F_{HL} = 1298.4$ t

$F_{HT} = 68.0$

$M_L = 7829,5$ mt $\quad e_L = 2,002$ m

$M_T = 985.7$ mt. $\quad e_T = 0,252$ m

$$\sigma_{cab} = \frac{-3911,3}{4\,(5.125-2.002)(7.85-0,252)} = -41,2\ t/m^2$$

$$\sigma_{suelo} = -\frac{3911,3}{160.92} \pm \frac{7829.5 \times 5.125}{1408,93} \pm \frac{985,7 \times 7,85}{3305.5} = \begin{cases} -55,1\ t/m^2 \\ +6.5\ t/m^2 \end{cases}$$

$$\gamma_{vuelco} = \frac{3911.3 \times 4.625}{7829,5} = 2,31 > 1,35$$

$$\gamma_{desliz} = \frac{3911.3 \times (0.40+0.073)}{\sqrt{1298.4^2+68.0^2}} = \frac{1854.0}{1300.2} = 1,42 > 1,35$$

H-2 P. propio + C. perm. + sobrec. uniforme + calentamiento − Fenómeno + + empuje al reposo + viento

$N = 3558,1$ t

$F_{HL} = 427.7$ t

$F_{HT} = 68.0$ t

$M_L = -4920.5$ mt $\quad e_L = 1,383$ m

$M_T = 985.7$ mt $\quad e_T = 0,277$ m

$\sigma_{cab} = -31,4\ t/m^2$ $\quad \sigma_{suelo} = \begin{cases} -42,4\ t/m^2 \\ -19\ t/m^2 \end{cases}$

$\gamma_{vuelco} = 3,34 > 1,35$ $\quad \gamma_{desliz.} = 3.89 > 1,35$

PROYECTO E-3 FECHA HOJA N.° ✓

H-3 Punto H-1, sin frenado.

$N = 3911.3$ t

$F_{HL} = 786.0$ t

$F_{HT} = 68.1$ t

$M_L = 2039.4$ mt → $e_L = 0.521$ m.

$M_T = 985.7$ mt → $e_T = 0.252$ m

$\sigma_{cab} = -28.0$ t/m² $\quad \sigma_{min} = \begin{cases} -34.1 \text{ t/m}^2 \\ -14.6 \text{ t/m}^2 \end{cases}$

$\gamma_{vuelco} = 8.87 > 1.50$ $\quad \gamma_{desliz} = 2.34 > 1.50$

H-4 P. propio + peso + 0.6 × nieve + dif. emp. tierra + sismo long + 0.6 × frenada

$N = 3792.0$ t

$F_{HL} = 1618.4$ t

$F_{HT} = 0$

$M_L = 10963.3$ mt → $e_L = 2.891$ m

$M_T = 53.7$ mt → $e_T = 0.014$ m

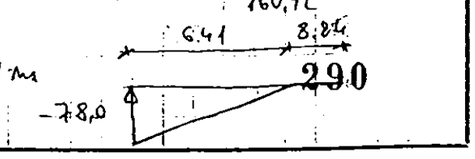
$\sigma_{cab} = -54.2$ t/m² $\quad \sigma_{min} = \begin{cases} -63.6 \text{ t/m}^2 \\ +16.4 \text{ t/m}^2 \end{cases}$ $\sigma_{máx} = -75.4$ t/m²*

$\gamma_{vuelco} = 1.85 > 1$ $\quad \gamma_{desliz} = 1.02 > 1$

* Obtenida del libro "Cálculo de estructuras de cimentación" de José Calavera.

$\frac{e_L}{10.25} = 0.282$ $\quad \frac{e_t}{15.70} \simeq 0$ $\quad \sigma_{ind} = -3.20 \times \frac{3792.0}{160.92} = -75.4$ t/m²

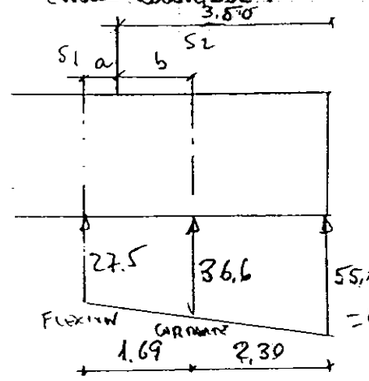
$\frac{1}{2} \cdot 75.4 \times l \times 15.70 = 37920 \rightarrow l = 6.41$ m



PROYECTO E-3 FECHA HOJA N.° 6

ARMADO DE ZAPATA

- Zonas delantera:



$a = 0.15 \times 3.25 = 0.49$ m

$b = 1/2 = 2.40 : 1.20$ m

$M_d = 1.6 \left[27.5 \times \frac{3.99^2}{2} + 21.4 \times \frac{3.99^2}{3} \right] =$

$= 531.9$ mt/m

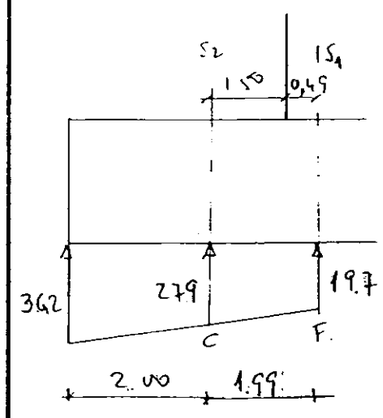
Ancho de 1.00×2.79

$V_c = \frac{2500}{1.5} \times 1.00 \times 2.69 = 4483$ t/m $\quad A = 45.6$ cm²/m → Φ25/0.10

$V_d = 1.6 \times 42.8 \times 2.30 = 157.5$ t/m $\quad$ Ancho de 1.00×2.64

$V_{cu} = 2 \times 5 \sqrt{\frac{250}{1.5}} \times 1.00 \times 2.56 = 330.5$ t/m > V_d

- Zonas traseras:



$M_d = 1.6 \left[19.7 \times \frac{3.99^2}{2} + 16.5 \times \frac{3.99^2}{3} \right] =$

$= 391.0$ mt/m

Ancho de 1.00×2.95

$V_c = \frac{2500}{1.5} \times 1.00 \times 2.77 = 4710$ t/m² : $A = 31.4$ cm²/m (Φ25/0.15)

$V_d = 1.6 \times 32.5 \times 1.62 = 84.2$ t/m < V_{cu}

$A_{min} = \frac{1}{2} \cdot 0.0018 \times \frac{41}{51} \times 100 \times 250 = 21.0$ cm²/m → Φ25/0.20

- Armadura superior: $M_d = 1.6 (9.30 \times 2.0 + 3.0) \times \frac{3.60^2}{2} = 224.0$ mt/m

Ancho de 1.00×3.00 → $A_{sup} = 17.6$ cm²/m → Φ20/0.20

- Armadura transversal { SUPERIOR: Φ20/0.20 ; INFERIOR: Φ20/0.20

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PROYECTO E-3 | FECHA | HOJA N.° 7

ARMADURA DE L. CUERPO DEL ESTRIBO Y ALETAS.

- Armadura trasera

$$Md = \frac{1}{13,7} \times 1.6 \times \left[9.04 \times \frac{9.45^2}{2} + 57.0 \times \frac{9.45^2}{6} + 697.4 \times 8,45 \right] = 835 mt/m$$

$A = 62 cm^2/m \rightarrow \phi 32/0,125$

Mínima: $49 cm^2/m$.

$$Vd = \frac{1}{13,7} \times 1.6 \left[9.04 \times 9,45 + \frac{1}{2} 57.0 \times 9.45 + 697,4 \right] = 122,9 t$$

$$Vu = 0,50 \times 64.35 \times 3,20 \times 1.00 \left[1 + 50 - 0.002 \right] = 113.6 t$$

En definitiva una reducción del coeficiente de seguridad del 10% para la estimación de la fuerza de frenado:

$113.6 > 110.6$

Se mantiene armadura de cálculo.

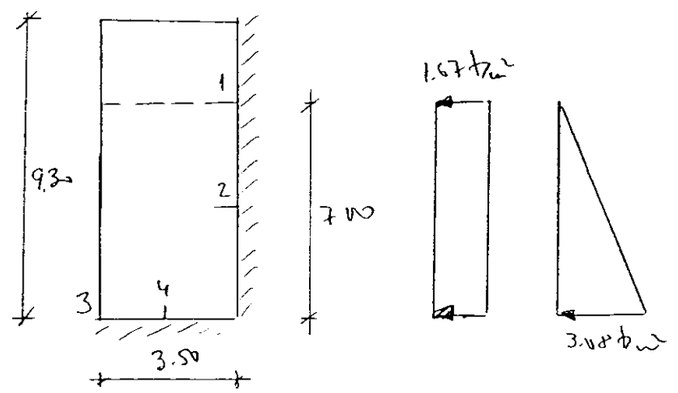
- Armadura del alzado

$$Md = \frac{1}{13,7} \times 1.6 \left[57.0 \times \frac{7.45^2}{6} - 555.9 \times 8.45 \right] = -449.5 mt/m$$

$A = 32,2 cm^2/m$ (mínima $37,7 cm^2/m \rightarrow \phi 25/0.125$)

PROYECTO E-3 | FECHA | HOJA N.° 8

ARMADURA DE ALETAS.



Espesor: 1 m.

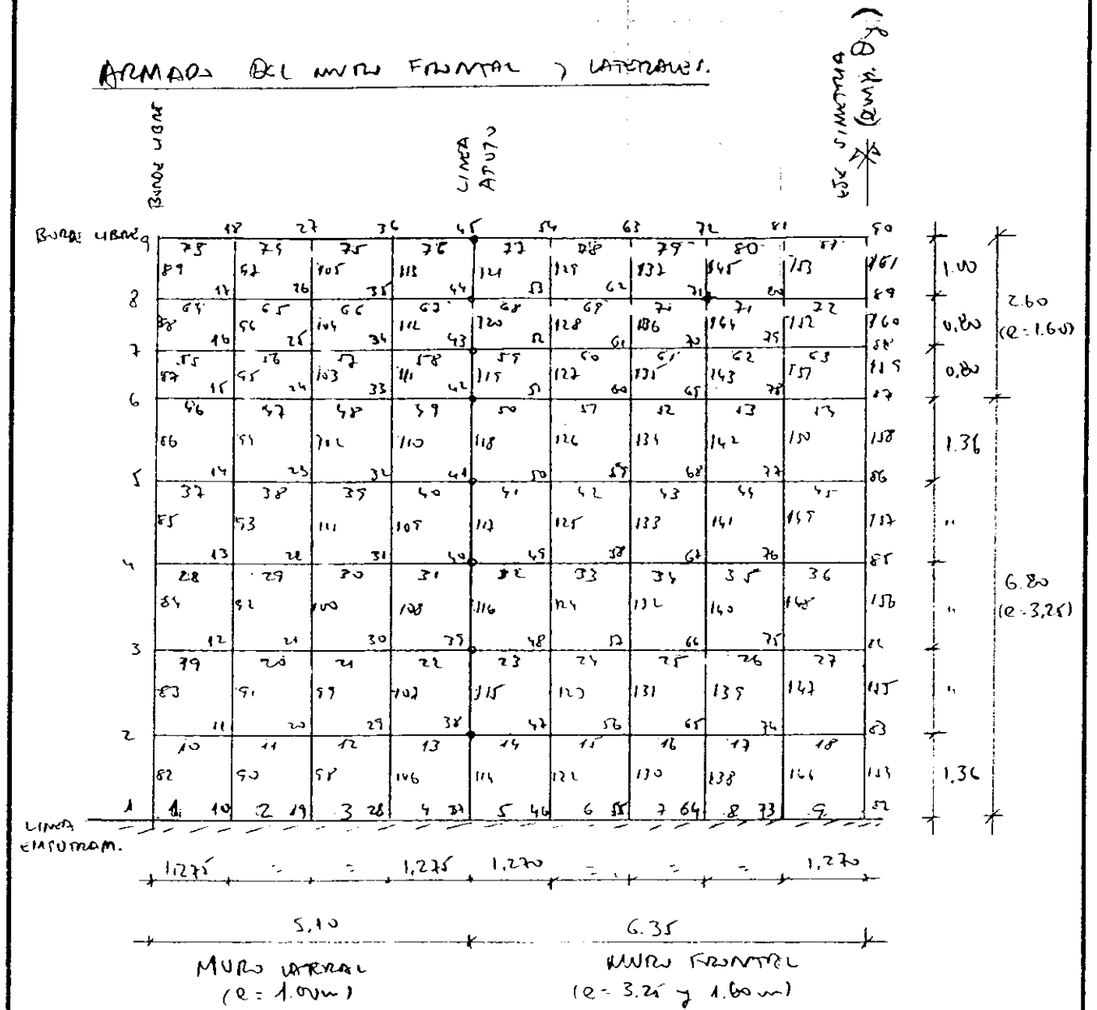
Sección N	UNIFORME k = 40.92	TRIANGULAR k = 37.73	TOTAL	ARMADURA (cm^2/m)
1	9.8 mt/m	3.7	13.5	5.4
2	6.9 mt/m	5,6	12.5	5.0
3	8.4 mt/m	8.0	16.4	6.5
4	3.2 mt/m	3,5	6,9	2.8

Armadura vertical: $4.5 cm^2/m$.

Armadura horizontal: $8 cm^2/m$.

PROYECTO E-3 FECHA HOJA N.° 7

ARMADO DEL MURO FRONTAL Y LATERALES.



Características de barras

BARRAS	ANCHO	CANTO	I	J
82 a 85	0.638	1.00	0.0532	0.1064
90 a 113	1.275	1.00	0,1062	0,2124
114 a 121	1.272	(1.00 - 3.25)	1.8724	3.7448
122 a 134; 138 a 142; 146 a 150	1.275	3.25	3.6474	7.2948
135 a 137; 143 a 145; 151 a 153	1,275	1.60	0.4352	0,8704
154 a 158	0.635	3.25	1.8165	3.6330
155 a 161	0.635	1.60	0,2167	0.4334
1 a 9	0.68	3.25	1.9453	3.8906
10 a 13; 18 a 22; 28 a 31; 37 a 40	1.36	1.00	0,1133	0,2266
14 a 18; 23 a 27; 32 a 36; 41 a 45	1.36	3.25	3.8905	7,7810

PROYECTO E-3 FECHA HOJA N.° 8

BARRAS (UNIT.)	ANCHO	CANTO	I	J
146 a 49	1.08	1,00	0,09W	0,18W
58 a 57	0.68+0.40	3,25-1.60	2.0818	4,1636
55 a 58; 64 a 67	0.80	1.00	0.0667	0,1334
59 a 60; 68 a 69	0,80	3.25	2,2885	4.5770
61 a 63; 70 a 72	0.80	1.60	0,2731	0.5462
173 a 76	0.60	1.00	0.0500	0,1000
77, 78	0.60	3.25	1,7164	3,4328
179 a 81	0.60	1.60	0,2048	0.4096

H-1 EMPUJE DE TIERRAS SOBRE MURO LATERAL

$$e = 0{,}22\,(3W + 2U \times h)$$

h	0	1.00	1.80	2.60	3.36	5.32	6.68	8.04	9.40
e	0.66	1.10	1.45	1.80	2,40	3.00	3.60	4.20	4.80

Carga en barra

Barra	P_1	P_2	Barra	P_1	P_2
82, 114	3.06	2,68	90, 98, 106	6.12	5.36
83, 115	2.68	2,30	91, 99, 107	5.36	4.59
84, 116	2.30	1.91	92, 100, 108	4.59	3.82
85, 117	1.91	1.53	93, 101, 109	3,82	3.06
86, 118	1.53	1.15	94, 102, 110	3.06	2.30
87, 119	1.15	0.93	95, 103, 111	2.30	1.85
88, 120	0.93	0.70	96, 104, 112	1.85	1.40
85, 121	0,70	0,42	97, 105, 113	1.40	0.84

PROYECTO E-3

FECHA

HOJA N.º 9

H-2 EMPUJE DE TIERRAS SOBRE MURO FRONTAL

Carga en barras

Barra	P_1	P_2	Barra	P_1	P_2
114, 154	3.05	2.67	122-130-138-146	6.10	5.34
115, 155	2.67	2.29	123-131-139-147	5.34	4.58
116, 156	2.29	1.91	124-132-140-148	4.58	3.81
117, 157	1.91	1.52	125-133-141-149	3.81	3.05
118, 158	1.52	1.15	126-134-142-150	3.05	2.29
119, 159	1.15	0.92	127-135-143-151	2.29	1.84
120, 160	0.92	0.70	128-136-144-152	1.84	1.40
121, 161	0.70	0.42	129-137-145-153	1.40	0.84

H-3 FRENADO

$F_z = \frac{512.4}{2} = 256,2$ t en nudo 71

H-4 Def. diferida

$F_z = \frac{185.0}{2} = 92.5$ t en nudo 71

H-4: $\frac{92.5}{256.2} \times$ (H-3)

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-3.
CONTROL
90 161 9 4
:
NUDOS

1	0.000	0.000
2	0.000	1.360
3	0.000	2.720
4	0.000	4.080
5	0.000	5.440
6	0.000	6.800
7	0.000	7.600
8	0.000	8.400
9	0.000	9.400
10	1.270	0.000
11	1.270	1.360
12	1.270	2.720
13	1.270	4.080
14	1.270	5.440
15	1.270	6.800
16	1.270	7.600
17	1.270	8.400
18	1.270	9.400
19	2.540	0.000
20	2.540	1.360
21	2.540	2.720
22	2.540	4.080
23	2.540	5.440
24	2.540	6.800
25	2.540	7.600
26	2.540	8.400
27	2.540	9.400
28	3.810	0.000
29	3.810	1.360
30	3.810	2.720
31	3.810	4.080
32	3.810	5.440
33	3.810	6.800
34	3.810	7.600
35	3.810	8.400
36	3.810	9.400
37	5.080	0.000
38	5.080	1.360
39	5.080	2.720
40	5.080	4.080
41	5.080	5.440
42	5.080	6.800
43	5.080	7.600
44	5.080	8.400
45	5.080	9.400
46	6.350	0.000
47	6.350	1.360
48	6.350	2.720
49	6.350	4.080
50	6.350	5.440
51	6.350	6.800
52	6.350	7.600
53	6.350	8.400
54	6.350	9.400

55	7.620	0.000
56	7.620	1.360
57	7.620	2.720
58	7.620	4.080
59	7.620	5.440
60	7.620	6.800
61	7.620	7.600
62	7.620	8.400
63	7.620	9.400
64	8.890	0.000
65	8.890	1.360
66	8.890	2.720
67	8.890	4.080
68	8.890	5.440
69	8.890	6.800
70	8.890	7.600
71	8.890	8.400
72	8.890	9.400
73	10.160	0.000
74	10.160	1.360
75	10.160	2.720
76	10.160	4.080
77	10.160	5.440
78	10.160	6.800
79	10.160	7.600
80	10.160	8.400
81	10.160	9.400
82	11.430	0.000
83	11.430	1.360
84	11.430	2.720
85	11.430	4.080
86	11.430	5.440
87	11.430	6.800
88	11.430	7.600
89	11.430	8.400
90	11.430	9.400

:

SECCIONES

18

0.053200	0.106400	3000000	1300000
0.106200	0.212400	3000000	1300000
1.872400	3.744800	3000000	1300000
3.647400	7.294800	3000000	1300000
0.435200	0.870400	3000000	1300000
1.816500	3.633000	3000000	1300000
0.216700	0.433400	3000000	1300000
1.945300	3.890600	3000000	1300000
0.113300	0.226600	3000000	1300000
3.890500	7.781000	3000000	1300000
0.090000	0.180000	3000000	1300000
2.081800	4.163600	3000000	1300000
0.066700	0.133400	3000000	1300000
2.288500	4.577000	3000000	1300000
0.273100	0.546200	3000000	1300000
0.050000	0.100000	3000000	1300000
1.716400	3.432800	3000000	1300000
0.204800	0.409600	3000000	1300000

:

BARRAS

1	1	10	8
2	10	19	8
3	19	28	8
4	28	37	8
5	37	46	8
6	46	55	8
7	55	64	8
8	64	73	8
9	73	82	8
10	2	11	9
11	11	20	9
12	20	29	9
13	29	38	9
14	38	47	10
15	47	56	10
16	56	65	10
17	65	74	10
18	74	83	10
19	3	12	9
20	12	21	9
21	21	30	9
22	30	39	9
23	39	48	10
24	48	57	10
25	57	66	10
26	66	75	10
27	75	84	10
28	4	13	9
29	13	22	9
30	22	31	9
31	31	40	9
32	40	49	10
33	49	58	10
34	58	67	10
35	67	76	10
36	76	85	10
37	5	14	9
38	14	23	9
39	23	32	9
40	32	41	9
41	41	50	10
42	50	59	10
43	59	68	10
44	68	77	10
45	77	86	10
46	6	15	11
47	15	24	11
48	24	33	11
49	33	42	11
50	42	51	12
51	51	60	12
52	60	69	12
53	69	78	12
54	78	87	12
55	7	16	13
56	16	25	13
57	25	34	13
58	34	43	13
59	43	52	14

60	52	61	14
61	61	70	15
.	70	79	15
63	79	88	15
64	8	17	13
65	17	26	13
66	26	35	13
67	35	44	13
68	44	53	14
69	53	62	14
70	62	71	15
71	71	80	15
72	80	89	15
73	9	18	16
74	18	27	16
75	27	36	16
76	36	45	16
77	45	54	17
78	54	63	17
79	63	72	18
80	72	81	18
81	81	90	18
82	1	2	1
83	2	3	1
84	3	4	1
85	4	5	1
86	5	6	1
87	6	7	1
88	7	8	1
89	8	9	1
90	10	11	2
91	11	12	2
)	12	13	2
93	13	14	2
94	14	15	2
95	15	16	2
96	16	17	2
97	17	18	2
98	19	20	2
99	20	21	2
100	21	22	2
01	22	23	2
102	23	24	2
103	24	25	2
104	25	26	2
105	26	27	2
106	28	29	2
107	29	30	2
108	30	31	2
109	31	32	2
110	32	33	2
111	33	34	2
112	34	35	2
113	35	36	2
114	37	38	3
115	38	39	3
116	39	40	3
117	40	41	3
118	41	42	3

119	42	43	3
120	43	44	3
121	44	45	3
122	46	47	4
123	47	48	4
124	48	49	4
125	49	50	4
126	50	51	4
127	51	52	4
128	52	53	4
129	53	54	4
130	55	56	4
131	56	57	4
132	57	58	4
133	58	59	4
134	59	60	4
135	60	61	5
136	61	62	5
137	62	63	5
138	64	65	4
139	65	66	4
140	66	67	4
141	67	68	4
142	68	69	4
143	69	70	5
144	70	71	5
145	71	72	5
146	73	74	4
147	74	75	4
148	75	76	4
149	76	77	4
150	77	78	4
151	78	79	5
152	79	80	5
153	80	81	5
154	82	83	6
155	83	84	6
156	84	85	6
157	85	86	6
158	86	87	6
159	87	88	7
160	88	89	7
161	89	90	7

:
APOYOS
18

1	1.000	1.000	1.000
10	1.000	1.000	1.000
19	1.000	1.000	1.000
28	1.000	1.000	1.000
37	1.000	1.000	1.000
46	1.000	1.000	1.000
55	1.000	1.000	1.000
64	1.000	1.000	1.000
73	1.000	1.000	1.000
82	1.000	1.000	1.000
38	0.000	0.000	1.000
39	0.000	0.000	1.000
40	0.000	0.000	1.000

```
  41      0.000      0.000      1.000
  42      0.000      0.000      1.000
  43      0.000      0.000      1.000
  44      0.000      0.000      1.000
  45      0.000      0.000      1.000
:
CARGAS
H-1 EMPUJE TIERRAS MURO LATERAL
     0
    40
    82  3  3.06  2.68
   114  3  3.06  2.68
    83  3  2.68  2.30
   115  3  2.68  2.30
    84  3  2.30  1.91
   116  3  2.30  1.91
    85  3  1.91  1.53
   117  3  1.91  1.53
    86  3  1.53  1.15
   118  3  1.53  1.15
    87  3  1.15  0.93
   119  3  1.15  0.93
    88  3  0.93  0.70
   120  3  0.93  0.70
    89  3  0.70  0.42
   121  3  0.70  0.42
    90  3  6.12  5.36
    98  3  6.12  5.36
   106  3  6.12  5.36
    91  3  5.36  4.59
    99  3  5.36  4.59
   107  3  5.36  4.59
    92  3  4.59  3.82
   100  3  4.59  3.82
   108  3  4.59  3.82
    93  3  3.82  3.06
   101  3  3.82  3.06
   109  3  3.82  3.06
    94  3  3.06  2.30
   102  3  3.06  2.30
   110  3  3.06  2.30
    95  3  2.30  1.85
   103  3  2.30  1.85
   111  3  2.30  1.85
    96  3  1.85  1.40
   104  3  1.85  1.40
   112  3  1.85  1.40
    97  3  1.40  0.84
   105  3  1.40  0.84
   113  3  1.40  0.84
H-2 EMPUJE TIERRAS MURO FRONTAL
     0
    48
   154  3  3.06  2.68
   114  3  3.06  2.68
   155  3  2.68  2.30
   115  3  2.68  2.30
   156  3  2.30  1.91
   116  3  2.30  1.91
```



```
   157  3  1.91  1.53
   117  3  1.91  1.53
   158  3  1.53  1.15
   118  3  1.53  1.15
   159  3  1.15  0.93
   119  3  1.15  0.93
   160  3  0.93  0.70
   120  3  0.93  0.70
   161  3  0.70  0.42
   121  3  0.70  0.42
   122  3  6.12  5.36
   130  3  6.12  5.36
   138  3  6.12  5.36
   146  3  6.12  5.36
   123  3  5.36  4.59
   131  3  5.36  4.59
   139  3  5.36  4.59
   147  3  5.36  4.59
   124  3  4.59  3.82
   132  3  4.59  3.82
   140  3  4.59  3.82
   148  3  4.59  3.82
   125  3  3.82  3.06
   133  3  3.82  3.06
   141  3  3.82  3.06
   149  3  3.82  3.06
   126  3  3.06  2.30
   134  3  3.06  2.30
   142  3  3.06  2.30
   150  3  3.06  2.30
   127  3  2.30  1.85
   135  3  2.30  1.85
   143  3  2.30  1.85
   151  3  2.30  1.85
   128  3  1.85  1.40
   136  3  1.85  1.40
   144  3  1.85  1.40
   152  3  1.85  1.40
   129  3  1.40  0.84
   137  3  1.40  0.84
   145  3  1.40  0.84
   153  3  1.40  0.84
H-3.FRENADO
     1
    71  0  0  256.2
     0
H-4.DEFORMACIONES DIFERIDAS
     1
    71  0  0   92.5
     0
:
```

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-3.

Hip. n° 1 H-1 EMPUJE TIERRAS MURO LATERAL

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	-0.000000	0.000000
2	-0.000087	-0.000018	0.000076
3	-0.000092	-0.000046	0.000209
4	-0.000069	-0.000073	0.000325
5	-0.000041	-0.000093	0.000402
6	-0.000019	-0.000106	0.000444
7	-0.000011	-0.000111	0.000456
8	-0.000006	-0.000114	0.000463
9	-0.000003	-0.000116	0.000467
10	-0.000000	-0.000000	0.000000
11	-0.000065	-0.000018	0.000054
12	-0.000068	-0.000047	0.000150
13	-0.000049	-0.000075	0.000231
14	-0.000027	-0.000095	0.000283
15	-0.000011	-0.000107	0.000308
16	-0.000006	-0.000111	0.000315
17	-0.000003	-0.000114	0.000318
18	-0.000001	-0.000116	0.000320
19	-0.000000	-0.000000	0.000000
20	-0.000039	-0.000018	0.000033
21	-0.000040	-0.000048	0.000089
22	-0.000027	-0.000075	0.000135
23	-0.000014	-0.000092	0.000162
24	-0.000004	-0.000102	0.000174
25	-0.000002	-0.000104	0.000176
26	-0.000000	-0.000106	0.000177
27	0.000000	-0.000107	0.000177
28	-0.000000	-0.000000	0.000000
29	-0.000015	-0.000015	0.000012
30	-0.000014	-0.000039	0.000031
31	-0.000009	-0.000059	0.000047
32	-0.000004	-0.000070	0.000055
33	-0.000001	-0.000075	0.000058
34	-0.000000	-0.000075	0.000058
35	0.000000	-0.000076	0.000058
36	0.000001	-0.000075	0.000058
37	-0.000000	-0.000000	0.000000
38	0.000000	-0.000001	0.000000
39	0.000000	-0.000003	0.000000
40	0.000000	-0.000005	0.000000
41	0.000000	-0.000007	0.000000
42	0.000000	-0.000008	0.000000
43	0.000000	-0.000009	0.000000
44	0.000000	-0.000009	0.000000
45	0.000000	-0.000010	-0.000000
46	0.000000	-0.000000	-0.000000
47	0.000001	-0.000000	-0.000001
48	0.000001	-0.000002	-0.000003
49	0.000002	-0.000003	-0.000005
50	0.000002	-0.000004	-0.000007
51	0.000001	-0.000006	-0.000009
52	0.000001	-0.000007	-0.000010

53	0.000001	-0.000007	-0.000010
54	0.000001	-0.000008	-0.000011
55	0.000000	-0.000000	-0.000000
56	0.000002	-0.000000	-0.000001
57	0.000002	-0.000001	-0.000004
58	0.000003	-0.000002	-0.000008
59	0.000003	-0.000003	-0.000011
60	0.000003	-0.000004	-0.000015
61	0.000002	-0.000005	-0.000017
62	0.000001	-0.000006	-0.000019
63	0.000001	-0.000007	-0.000020
64	0.000000	-0.000000	-0.000000
65	0.000002	-0.000000	-0.000001
66	0.000003	-0.000000	-0.000005
67	0.000003	-0.000001	-0.000009
68	0.000003	-0.000002	-0.000014
69	0.000004	-0.000002	-0.000019
70	0.000003	-0.000003	-0.000022
71	0.000003	-0.000003	-0.000024
72	0.000003	-0.000004	-0.000027
73	0.000000	-0.000000	-0.000000
74	0.000002	-0.000000	-0.000002
75	0.000003	-0.000000	-0.000005
76	0.000004	-0.000001	-0.000010
77	0.000004	-0.000001	-0.000016
78	0.000004	-0.000001	-0.000021
79	0.000004	-0.000002	-0.000024
80	0.000004	-0.000002	-0.000027
81	0.000004	-0.000002	-0.000031
82	0.000000	-0.000000	-0.000000
83	0.000002	-0.000000	-0.000002
84	0.000004	-0.000000	-0.000006
85	0.000004	-0.000001	-0.000011
86	0.000004	-0.000001	-0.000017
87	0.000004	-0.000001	-0.000023
88	0.000004	-0.000001	-0.000026
89	0.000004	-0.000002	-0.000030
90	0.000004	-0.000002	-0.000034

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	19.69	1.85	15.33
10	26.57	3.64	19.40
19	16.39	3.61	13.30
28	6.33	3.13	6.87
37	1.22	3.64	3.70
46	-13.53	3.42	-7.26
55	-18.39	1.62	-7.54
64	-20.32	0.94	-6.61
73	-21.99	0.87	-6.56
82	-12.39	0.47	-4.38
38	-0.00	0.00	15.70
39	-0.00	0.00	20.80
40	0.00	0.00	22.43
41	-0.00	0.00	15.94
42	-0.00	0.00	14.76
43	-0.00	0.00	7.58
44	0.00	-0.00	7.60

	45	-0.00	0.00	-0.26

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	-0.00	-0.00	0.00
	10	-0.00	0.00	0.00
2	10	0.00	0.00	-0.00
	19	0.00	-0.00	-0.00
3	19	0.00	0.00	-0.00
	28	0.00	-0.00	-0.00
4	28	0.00	-0.00	0.00
	37	0.00	0.00	0.00
5	37	0.00	0.00	-0.00
	46	0.00	-0.00	-0.00
6	46	0.00	-0.00	0.00
	55	0.00	0.00	0.00
7	55	0.00	-0.00	0.00
	64	0.00	0.00	0.00
8	64	0.00	-0.00	0.00
	73	0.00	0.00	0.00
9	73	-0.00	-0.00	0.00
	82	-0.00	0.00	0.00
10	2	5.06	-1.00	1.45
	11	5.06	0.84	1.45
11	11	5.98	-1.47	2.26
	20	5.98	1.40	2.26
12	20	5.63	-1.09	0.73
	29	5.63	-0.17	0.73
13	29	3.47	-1.90	-3.09
	38	3.47	-5.82.	-3.09
14	38	7.77	-8.76	6.18
	47	7.77	-0.91	6.18
15	47	4.63	-4.92	4.02
	56	4.63	0.19	4.02
16	56	2.53	-2.42	2.39
	65	2.53	0.61	2.39
17	65	1.69	-1.00	1.42
	74	1.69	0.81	1.42
18	74	1.34	-0.20	0.47
	83	1.34	0.39	0.47
19	3	5.51	0.15	0.18
	12	5.51	0.38	0.18
20	12	6.58	0.78	-0.95
	21	6.58	-0.44	-0.95
21	21	5.94	0.22	-3.93
	30	5.94	-4.77	-3.93
22	30	3.36	-3.88	-9.28
	39	3.36	-15.66	-9.28
23	39	10.60	-16.26	6.84
	48	10.60	-7.57	6.84
24	48	7.49	-9.68	4.90
	57	7.49	-3.46	4.90
25	57	4.60	-5.26	3.33
	66	4.60	-1.03	3.33
26	66	2.95	-2.19	1.91
	75	2.95	0.24	1.91
27	75	1.99	-0.39	0.47
	84	1.99	0.21	0.47

28	4	4.51	0.63	-0.21
	13	4.51	0.36	-0.21
29	13	5.05	1.84	-2.86
	22	5.05	-1.79	-2.86
30	22	4.19	0.04	-6.70
	31	4.19	-8.46	-6.70
31	31	2.21	-6.80	-12.10
	40	2.21	-22.16	-12.10
32	40	11.22	-21.78	6.32
	49	11.22	-13.75	6.32
33	49	8.80	-14.49	5.22
	58	8.80	-7.87	5.22
34	58	5.70	-8.74	3.98
	67	5.70	-3.68	3.98
35	67	3.58	-4.17	2.52
	76	3.58	-0.97	2.52
36	76	2.27	-1.10	0.87
	85	2.27	0.00	0.87
37	5	3.06	0.72	-0.45
	14	3.06	0.14	-0.45
38	14	3.11	1.72	-3.63
	23	3.11	-2.89	-3.63
39	23	2.22	-1.16	-7.50
	32	2.22	-10.68	-7.50
40	32	1.08	-9.26	-12.23
	41	1.08	-24.78	-12.23
41	41	10.53	-24.14	3.94
	50	10.53	-19.14	3.94
42	50	9.26	-19.06	5.41
	59	9.26	-12.19	5.41
43	59	6.14	-12.55	4.36
	68	6.14	-7.01	4.36
44	68	3.62	-6.69	3.25
	77	3.62	-2.56	3.25
45	77	2.11	-2.18	1.56
	86	2.11	-0.20	1.56
46	6	1.46	0.55	-0.65
	15	1.46	-0.27	-0.65
47	15	1.25	0.79	-3.02
	24	1.25	-3.04	-3.02
48	24	0.65	-2.10	-5.72
	33	0.65	-9.36	-5.72
49	33	0.16	-8.72	-8.46
	42	0.16	-19.46	-8.46
50	42	4.91	-15.94	4.90
	51	4.91	-9.72	4.90
51	51	6.32	-8.05	-3.74
	60	6.32	-12.80	-3.74
52	60	3.48	-7.76	0.20
	69	3.48	-7.51	0.20
53	69	1.82	-4.11	0.76
	78	1.82	-3.14	0.76
54	78	1.07	-1.26	0.43
	87	1.07	-0.71	0.43
55	7	0.71	0.29	-0.41
	16	0.71	-0.23	-0.41
56	16	0.55	0.31	-2.17
	25	0.55	-2.45	-2.17
57	25	0.22	-2.02	-3.99

	34	0.22	-7.09	-3.99
58	34	0.01	-6.85	-5.73
	43	0.01	-14.13	-5.73
59	43	3.86	-13.93	2.16
	52	3.86	-11.18	2.16
60	52	5.15	-9.47	4.13
	61	5.15	-4.22	4.13
61	61	0.79	-3.16	2.14
	70	0.79	-0.44	2.14
62	70	0.28	-0.78	0.40
	79	0.28	-0.27	0.40
63	79	0.20	-0.30	0.24
	88	0.20	-0.00	0.24
64	8	0.44	0.23	-0.41
	17	0.44	-0.29	-0.41
65	17	0.33	0.11	-2.14
	26	0.33	-2.60	-2.14
66	26	0.08	-2.35	-3.81
	35	0.08	-7.20	-3.81
67	35	-0.04	-7.11	-5.23
	44	-0.04	-13.75	-5.23
68	44	3.06	-13.20	2.49
	53	3.06	-10.04	2.49
69	53	3.71	-7.78	3.60
	62	3.71	-3.21	3.60
70	62	0.81	-2.87	1.43
	71	0.81	-1.05	1.43
71	71	0.42	-1.11	0.62
	80	0.42	-0.32	0.62
72	80	0.22	-0.35	0.25
	89	0.22	-0.02	0.25
73	9	0.21	0.28	-0.53
	18	0.21	-0.39	-0.53
74	18	0.17	0.11	-1.81
	27	0.17	-2.19	-1.81
75	27	0.03	-1.94	-2.79
	36	0.03	-5.49	-2.79
76	36	-0.05	-5.56	-3.43
	45	-0.05	-9.92	-3.43
77	45	1.86	-8.04	-0.47
	54	1.86	-8.64	-0.47
78	54	1.95	-4.10	1.56
	63	1.95	-2.11	1.56
79	63	0.61	-1.29	-0.26
	72	0.61	-1.62	-0.26
80	72	0.37	-0.76	0.05
	81	0.37	-0.69	0.05
81	81	0.17	-0.27	0.11
	90	0.17	-0.13	0.11
82	1	-1.85	-19.69	15.33
	2	-1.85	-1.55	11.43
83	2	-2.85	-6.62	9.98
	3	-2.85	4.59	6.59
84	3	-2.70	-0.92	6.41
	4	-2.70	5.79	3.55
85	4	-2.07	1.29	3.76
	5	-2.07	4.75	1.42
86	5	-1.35	1.69	1.87
	6	-1.35	2.94	0.05

87	6	-0.80	1.48	0.70
	7	-0.80	1.69	-0.14
88	7	-0.51	0.98	0.27
	8	-0.51	0.93	-0.38
89	8	-0.28	0.49	0.03
	9	-0.28	0.21	-0.53
90	10	-3.64	-26.57	19.40
	11	-3.64	-5.62	11.59
91	11	-5.95	-6.54	10.78
	12	-5.95	3.41	4.02
92	12	-5.56	2.34	5.15
	13	-5.56	5.34	-0.56
93	13	-4.07	4.80	2.09
	14	-4.07	4.34	-2.59
94	14	-2.50	4.29	0.59
	15	-2.50	2.49	-3.06
95	15	-1.44	2.70	-0.69
	16	-1.44	1.46	-2.35
96	16	-0.89	1.62	-0.59
	17	-0.89	0.60	-1.89
97	17	-0.50	0.72	-0.16
	18	-0.50	-0.05	-1.28
98	19	-3.61	-16.39	13.30
	20	-3.61	-3.72	5.49
99	20	-6.10	-3.37	7.02
	21	-6.10	1.46	0.25
100	21	-5.44	2.10	3.23
	22	-5.44	2.49	-2.49
101	22	-3.61	3.35	1.35
	23	-3.61	1.88	-3.33
102	23	-1.87	2.77	0.54
	24	-1.87	0.90	-3.11
103	24	-0.93	1.50	-0.41
	25	-0.93	0.48	-2.07
104	25	-0.50	0.82	-0.24
	26	-0.50	0.08	-1.54
105	26	-0.25	0.33	0.13
	27	-0.25	-0.14	-0.99
106	28	-3.13	-6.33	6.87
	29	-3.13	-2.41	-0.93
107	29	-4.86	-0.25	2.89
	30	-4.86	-1.04	-3.88
108	30	-3.98	1.53	1.46
	31	-3.98	-0.48	-4.26
109	31	-2.31	1.49	1.15
	32	-2.31	-0.24	-3.53
110	32	-0.89	0.91	1.20
	33	-0.89	-0.06	-2.45
111	33	-0.25	0.43	0.29
	34	-0.25	-0.02	-1.37
112	34	-0.01	0.18	0.37
	35	-0.01	-0.07	-0.93
113	35	0.07	0.05	0.48
	36	0.07	-0.08	-0.64
114	37	-3.64	-1.22	3.70
	38	-3.64	1.11	-0.20
115	38	-6.57	-3.19	6.22
	39	-6.57	2.91	2.84
116	39	-7.17	-4.32	7.52

	40	-7.17	3.89	4.65
117	40	-6.78	-5.12	8.66
	41	-6.78	5.01	6.32
118	41	-6.14	-4.44	6.10
	42	-6.14	2.56	4.28
119	42	-2.63	-2.19	5.68
	43	-2.63	2.01	4.85
120	43	-2.43	-1.83	4.54
	44	-2.43	1.53	3.89
121	44	-1.88	-1.57	3.78
	45	-1.88	1.91	3.22
122	46	-3.42	13.53	-7.26
	47	-3.42	3.66	-7.26
123	47	-7.43	6.80	-5.10
	48	-7.43	-0.13	-5.10
124	48	-9.53	2.98	-3.15
	49	-9.53	-1.31	-3.15
125	49	-10.27	1.11	-2.05
	50	-10.27	-1.68	-2.05
126	50	-10.19	-0.40	-3.52
	51	-10.19	-5.19	-3.52
127	51	-8.51	-6.61	5.12
	52	-8.51	-2.51	5.12
128	52	-6.80	-3.81	3.15
	53	-6.80	-1.29	3.15
129	53	-4.54	-1.94	2.03
	54	-4.54	0.09	2.03
130	55	-1.62	18.39	-7.54
	56	-1.62	8.15	-7.54
131	56	-4.24	10.24	-5.90
	57	-4.24	2.22	-5.90
132	57	-6.03	5.10	-4.34
	58	-6.03	-0.80	-4.34
133	58	-6.90	2.30	-3.11
	59	-6.90	-1.93	-3.11
134	59	-7.27	1.19	-2.06
	60	-7.27	-1.61	-2.06
135	60	-2.22	1.23	-6.00
	61	-2.22	-3.57	-6.00
136	61	-1.16	0.79	-4.00
	62	-1.16	-2.41	-4.00
137	62	-0.83	0.49	-1.83
	63	-0.83	-1.33	-1.83
138	64	-0.94	20.32	-6.61
	65	-0.94	11.33	-6.61
139	65	-2.54	12.16	-5.65
	66	-2.54	4.48	-5.65
140	66	-3.71	6.14	-4.23
	67	-3.71	0.39	-4.23
141	67	-4.19	2.51	-2.76
	68	-4.19	-1.24	-2.76
142	68	-3.87	1.28	-1.65
	69	-3.87	-0.97	-1.65
143	69	-0.47	0.70	-2.22
	70	-0.47	-1.08	-2.22
144	70	-0.81	-0.56	-0.49
	71	-0.81	-0.95	-0.49
145	71	-0.86	-0.56	0.32
	72	-0.86	-0.24	0.32

146	73	-0.87	21.99	-6.56
	74	-0.87	13.06	-6.56
147	74	-1.87	13.41	-5.61
	75	-1.87	5.78	-5.61
148	75	-2.50	6.74	-4.16
	76	-2.50	1.08	-4.16
149	76	-2.63	2.39	-2.52
	77	-2.63	-1.03	-2.52
150	77	-2.24	0.48	-0.82
	78	-2.24	-0.63	-0.82
151	78	-0.36	0.11	-0.49
	79	-0.36	-0.28	-0.49
152	79	-0.39	-0.20	-0.32
	80	-0.39	-0.46	-0.32
153	80	-0.42	-0.26	0.05
	81	-0.42	-0.20	0.05
154	82	-0.47	12.39	-4.38
	83	-0.47	6.43	-4.38
155	83	-0.86	7.77	-3.92
	84	-0.86	2.44	-3.92
156	84	-1.07	4.43	-3.45
	85	-1.07	-0.26	-3.45
157	85	-1.07	2.01	-2.58
	86	-1.07	-1.50	-2.58
158	86	-0.87	0.61	-1.02
	87	-0.87	-0.79	-1.02
159	87	-0.16	0.28	-0.60
	88	-0.16	-0.19	-0.60
160	88	-0.16	0.01	-0.36
	89	-0.16	-0.28	-0.36
161	89	-0.13	-0.06	-0.11
	90	-0.13	-0.17	-0.11

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-3.

Hip. n° 2 H-2 EMPUJE TIERRAS MURO FRONTAL

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	0.000000	0.000000	-0.000000
2	0.000004	0.000001	-0.000003
3	0.000005	0.000001	-0.000010
4	0.000006	0.000003	-0.000018
5	0.000005	0.000004	-0.000025
6	0.000004	0.000005	-0.000032
7	0.000004	0.000005	-0.000036
8	0.000003	0.000005	-0.000039
9	0.000003	0.000006	-0.000042
10	0.000000	0.000000	-0.000000
11	0.000003	0.000000	-0.000002
12	0.000005	0.000001	-0.000008
13	0.000005	0.000003	-0.000014
14	0.000004	0.000004	-0.000021
15	0.000004	0.000005	-0.000026
16	0.000003	0.000005	-0.000029
17	0.000003	0.000006	-0.000031
18	0.000003	0.000006	-0.000034
19	0.000000	0.000000	-0.000000
20	0.000002	0.000001	-0.000002
21	0.000003	0.000002	-0.000006
22	0.000004	0.000003	-0.000011
23	0.000003	0.000004	-0.000015
24	0.000003	0.000006	-0.000020
25	0.000002	0.000006	-0.000022
26	0.000002	0.000007	-0.000023
27	0.000002	0.000008	-0.000025
28	0.000000	0.000000	-0.000000
29	0.000001	0.000001	-0.000001
30	0.000002	0.000002	-0.000004
31	0.000002	0.000004	-0.000006
32	0.000002	0.000006	-0.000009
33	0.000001	0.000007	-0.000011
34	0.000001	0.000008	-0.000012
35	0.000001	0.000009	-0.000013
36	0.000001	0.000010	-0.000014
37	0.000000	0.000000	-0.000000
38	-0.000000	0.000001	-0.000000
39	-0.000000	0.000003	0.000000
40	-0.000000	0.000006	0.000000
41	-0.000000	0.000009	0.000000
42	-0.000000	0.000011	0.000000
43	-0.000000	0.000011	0.000000
44	-0.000000	0.000012	0.000000
45	-0.000000	0.000013	0.000000
46	-0.000000	0.000000	0.000000
47	-0.000002	0.000001	0.000001
48	-0.000002	0.000003	0.000004
49	-0.000002	0.000006	0.000008
50	-0.000002	0.000008	0.000011
51	-0.000002	0.000010	0.000013
52	-0.000001	0.000011	0.000015

53	-0.000001	0.000012	0.000015
54	-0.000001	0.000012	0.000016
55	-0.000000	0.000000	0.000000
56	-0.000003	0.000001	0.000003
57	-0.000004	0.000003	0.000008
58	-0.000005	0.000005	0.000014
59	-0.000004	0.000007	0.000021
60	-0.000004	0.000009	0.000026
61	-0.000002	0.000011	0.000029
62	-0.000002	0.000012	0.000031
63	-0.000001	0.000013	0.000032
64	-0.000000	0.000000	0.000000
65	-0.000005	0.000001	0.000004
66	-0.000006	0.000002	0.000011
67	-0.000007	0.000004	0.000020
68	-0.000006	0.000006	0.000029
69	-0.000006	0.000008	0.000037
70	-0.000005	0.000009	0.000041
71	-0.000004	0.000010	0.000045
72	-0.000003	0.000012	0.000049
73	-0.000000	0.000000	0.000000
74	-0.000006	0.000001	0.000004
75	-0.000008	0.000002	0.000014
76	-0.000008	0.000004	0.000025
77	-0.000008	0.000005	0.000036
78	-0.000007	0.000007	0.000046
79	-0.000007	0.000008	0.000052
80	-0.000006	0.000009	0.000057
81	-0.000006	0.000010	0.000063
82	-0.000000	0.000000	0.000000
83	-0.000007	0.000001	0.000005
84	-0.000009	0.000002	0.000017
85	-0.000009	0.000004	0.000030
86	-0.000009	0.000005	0.000043
87	-0.000008	0.000006	0.000054
88	-0.000008	0.000007	0.000061
89	-0.000008	0.000008	0.000068
90	-0.000007	0.000009	0.000075

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	-0.66	-0.05	-0.32
10	-0.98	-0.10	-0.35
19	-0.75	-0.10	-0.29
28	-0.50	-0.14	-0.27
37	-1.76	-4.26	-2.87
46	21.77	-7.65	13.78
55	39.26	-6.29	21.42
64	52.88	-5.40	25.88
73	66.32	-5.44	31.74
82	42.42	-2.84	23.78
38	0.00	-0.00	-6.35
39	0.00	-0.00	4.16
40	-0.00	-0.00	8.08
41	-0.00	-0.00	16.40
42	0.00	0.00	8.14
43	-0.00	-0.00	6.69
44	0.00	-0.00	5.52

	34	-0.15	-0.37	-0.11
58	34	-0.17	-0.40	-0.17
	43	-0.17	-0.61	-0.17
59	43	-4.94	-2.29	4.57
	52	-4.94	3.52	4.57
60	52	-5.52	0.45	1.97
	61	-5.52	2.96	1.97
61	61	-1.43	1.60	-0.52
	70	-1.43	0.93	-0.52
62	70	-1.10	1.06	-0.23
	79	-1.10	0.77	-0.23
63	79	-0.89	0.76	-0.59
	88	-0.89	0.02	-0.59
64	8	-0.08	-0.02	-0.06
	17	-0.08	-0.09	-0.06
65	17	-0.11	-0.13	-0.07
	26	-0.11	-0.22	-0.07
66	26	-0.14	-0.26	-0.09
	35	-0.14	-0.37	-0.09
67	35	-0.15	-0.42	-0.09
	44	-0.15	-0.54	-0.09
68	44	-3.64	-1.71	3.30
	53	-3.64	2.48	3.30
69	53	-4.10	-0.12	0.61
	62	-4.10	0.66	0.61
70	62	-1.27	0.33	0.92
	71	-1.27	1.51	0.92
71	71	-1.16	1.20	-0.10
	80	-1.16	1.07	-0.10
72	80	-0.84	0.83	-0.53
	89	-0.84	0.15	-0.53
73	9	-0.05	-0.05	-0.01
	18	-0.05	-0.06	-0.01
74	18	-0.08	-0.18	0.04
	27	-0.08	-0.13	0.04
75	27	-0.10	-0.30	0.08
	36	-0.10	-0.20	0.08
76	36	-0.11	-0.41	0.12
	45	-0.11	-0.26	0.12
77	45	-2.15	-2.72	4.60
	54	-2.15	3.12	4.60
78	54	-2.24	-1.88	1.22
	63	-2.24	-0.33	1.22
79	63	-0.91	-1.29	2.60
	72	-0.91	2.01	2.60
80	72	-0.84	0.27	1.18
	81	-0.84	1.77	1.18
81	81	-0.54	0.45	0.06
	90	-0.54	0.52	0.06
82	1	0.05	0.66	-0.32
	2	0.05	0.23	-0.32
83	2	0.09	0.38	-0.27
	3	0.09	0.01	-0.27
84	3	0.11	0.21	-0.25
	4	0.11	-0.13	-0.25
85	4	0.11	0.09	-0.21
	5	0.11	-0.20	-0.21
86	5	0.10	0.01	-0.16
	6	0.10	-0.21	-0.16

87	6	0.08	-0.06	-0.12
	7	0.08	-0.15	-0.12
88	7	0.07	-0.06	-0.07
	8	0.07	-0.12	-0.07
89	8	0.05	-0.04	-0.01
	9	0.05	-0.05	-0.01
90	10	0.10	0.98	-0.35
	11	0.10	0.49	-0.35
91	11	0.20	0.52	-0.28
	12	0.20	0.14	-0.28
92	12	0.24	0.20	-0.20
	13	0.24	-0.07	-0.20
93	13	0.24	-0.01	-0.13
	14	0.24	-0.19	-0.13
94	14	0.22	-0.13	-0.06
	15	0.22	-0.21	-0.06
95	15	0.18	-0.17	0.00
	16	0.18	-0.17	0.00
96	16	0.16	-0.14	0.04
	17	0.16	-0.12	0.04
97	17	0.12	-0.08	0.05
	18	0.12	-0.03	0.05
98	19	0.10	0.75	-0.29
	20	0.10	0.36	-0.29
99	20	0.23	0.41	-0.24
	21	0.23	0.09	-0.24
100	21	0.28	0.16	-0.18
	22	0.28	-0.08	-0.18
101	22	0.28	0.00	-0.12
	23	0.28	-0.16	-0.12
102	23	0.26	-0.09	-0.06
	24	0.26	-0.17	-0.06
103	24	0.23	-0.13	-0.01
	25	0.23	-0.14	-0.01
104	25	0.21	-0.11	0.02
	26	0.21	-0.09	0.02
105	26	0.17	-0.06	0.03
	27	0.17	-0.02	0.03
106	28	0.14	0.50	-0.27
	29	0.14	0.14	-0.27
107	29	0.31	0.29	-0.23
	30	0.31	-0.03	-0.23
108	30	0.38	0.16	-0.20
	31	0.38	-0.11	-0.20
109	31	0.36	0.06	-0.17
	32	0.36	-0.17	-0.17
110	32	0.32	-0.01	-0.10
	33	0.32	-0.14	-0.10
111	33	0.28	-0.09	-0.02
	34	0.28	-0.10	-0.02
112	34	0.25	-0.08	0.04
	35	0.25	-0.05	0.04
113	35	0.20	-0.05	0.04
	36	0.20	-0.00	0.04
114	37	4.26	1.76	-2.87
	38	4.26	-4.85	-6.77
115	38	8.07	6.72	-9.06
	39	8.07	-7.97	-12.45
116	39	9.25	7.70	-10.30

	40	9.25	-8.31	-13.16
117	40	8.99	7.93	-11.02
	41	8.99	-8.71	-13.36
118	41	7.27	6.08	-6.52
	42	7.27	-4.09	-8.34
119	42	5.31	2.47	-5.90
	43	5.31	-2.60	-6.73
120	43	3.64	2.17	-4.78
	44	3.64	-1.92	-5.43
121	44	2.46	1.57	-3.31
	45	2.46	-2.04	-3.87
122	46	7.65	-21.77	13.78
	47	7.65	-8.45	5.98
123	47	14.94	-8.23	7.46
	48	14.94	-2.80	0.69
124	48	17.35	-2.06	4.19
	49	17.35	-0.37	-1.53
125	49	17.10	0.37	2.96
	50	17.10	1.10	-1.72
126	50	15.69	2.43	4.90
	51	15.69	6.51	1.26
127	51	10.67	9.56	-4.59
	52	10.67	5.20	-6.25
128	52	7.60	5.78	-3.65
	53	7.60	2.31	-4.95
129	53	5.00	2.77	-2.26
	54	5.00	-0.09	-3.38
130	55	6.29	-39.26	21.42
	56	6.29	-15.55	13.61
131	56	12.99	-17.24	13.64
	57	12.99	-3.41	6.87
132	57	15.37	-5.51	8.40
	58	15.37	1.90	2.68
133	58	15.17	-0.31	5.30
	59	15.17	3.60	0.62
134	59	13.93	1.60	3.35
	60	13.93	3.56	-0.29
135	60	2.65	1.68	3.28
	61	2.65	3.62	1.62
136	61	1.28	-0.47	4.11
	62	1.28	2.27	2.81
137	62	0.96	-0.56	2.50
	63	0.96	1.33	1.38
138	64	5.40	-52.88	25.88
	65	5.40	-23.11	18.07
139	65	11.14	-24.24	17.47
	66	11.14	-5.20	10.70
140	66	13.03	-7.39	10.45
	67	13.03	2.81	4.73
141	67	12.72	0.26	5.49
	68	12.72	4.44	0.82
142	68	11.37	1.61	2.80
	69	11.37	2.83	-0.85
143	69	1.92	1.12	1.93
	70	1.92	1.98	0.27
144	70	2.04	1.64	-0.03
	71	2.04	1.08	-1.33
145	71	1.74	0.97	-0.30
	72	1.74	0.07	-1.42

146	73	5.44	-66.32	31.74
	74	5.44	-28.58	23.94
147	74	9.90	-30.04	21.13
	75	9.90	-6.03	14.36
148	75	11.06	-8.84	12.40
	76	11.06	4.02	6.68
149	76	10.37	0.97	5.89
	77	10.37	5.68	1.21
150	77	8.73	2.28	1.83
	78	8.73	2.17	-1.82
151	78	1.57	0.24	2.17
	79	1.57	1.29	0.51
152	79	1.56	1.08	0.87
	80	1.56	1.23	-0.43
153	80	1.33	0.91	-0.00
	81	1.33	0.30	-1.12
154	82	2.84	-42.42	23.78
	83	2.84	-12.79	19.88
155	83	4.71	-20.69	17.51
	84	4.71	0.77	14.13
156	84	5.11	-9.07	13.13
	85	5.11	6.78	10.27
157	85	4.65	-2.93	8.93
	86	4.65	7.57	6.59
158	86	3.68	-0.83	3.95
	87	3.68	3.24	2.12
159	87	0.69	-1.14	3.11
	88	0.69	1.00	2.27
160	88	0.67	0.11	1.69
	89	0.67	1.18	1.04
161	89	0.52	0.34	0.50
	90	0.52	0.54	-0.06

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-3.

Hip. n° 3 H-3.FRENADO

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	0.000000	0.000000	-0.000000
2	0.000021	0.000004	-0.000017
3	0.000031	0.000010	-0.000054
4	0.000034	0.000016	-0.000100
5	0.000034	0.000023	-0.000148
6	0.000030	0.000028	-0.000192
7	0.000028	0.000031	-0.000216
8	0.000025	0.000033	-0.000237
9	0.000024	0.000035	-0.000261
10	0.000000	0.000000	-0.000000
11	0.000017	0.000003	-0.000012
12	0.000025	0.000010	-0.000042
13	0.000029	0.000017	-0.000079
14	0.000029	0.000023	-0.000119
15	0.000026	0.000029	-0.000156
16	0.000024	0.000032	-0.000176
17	0.000022	0.000035	-0.000194
18	0.000021	0.000038	-0.000215
19	0.000000	0.000000	-0.000000
20	0.000012	0.000003	-0.000008
21	0.000018	0.000010	-0.000029
22	0.000022	0.000019	-0.000057
23	0.000022	0.000027	-0.000087
24	0.000020	0.000034	-0.000116
25	0.000018	0.000038	-0.000131
26	0.000017	0.000042	-0.000146
27	0.000016	0.000046	-0.000162
28	0.000000	0.000000	-0.000000
29	0.000006	0.000004	-0.000004
30	0.000010	0.000012	-0.000016
31	0.000012	0.000022	-0.000031
32	0.000013	0.000034	-0.000049
33	0.000012	0.000044	-0.000067
34	0.000011	0.000050	-0.000076
35	0.000010	0.000055	-0.000084
36	0.000009	0.000061	-0.000094
37	0.000000	0.000000	-0.000000
38	-0.000001	0.000004	-0.000000
39	-0.000001	0.000013	-0.000000
40	-0.000002	0.000027	-0.000000
41	-0.000003	0.000044	0.000000
42	-0.000001	0.000062	0.000000
43	-0.000001	0.000071	0.000000
44	-0.000001	0.000079	0.000000
45	-0.000001	0.000086	0.000000
46	-0.000000	0.000000	0.000000
47	-0.000006	0.000004	0.000004
48	-0.000011	0.000012	0.000016
49	-0.000015	0.000026	0.000033
50	-0.000018	0.000042	0.000055
51	-0.000017	0.000062	0.000079
52	-0.000014	0.000072	0.000091

53	-0.000012	0.000080	0.000101
54	-0.000011	0.000088	0.000113
55	-0.000000	0.000000	0.000000
56	-0.000012	0.000003	0.000008
57	-0.000020	0.000011	0.000031
58	-0.000027	0.000022	0.000063
59	-0.000033	0.000036	0.000105
60	-0.000036	0.000051	0.000153
61	-0.000031	0.000071	0.000182
62	-0.000025	0.000085	0.000207
63	-0.000019	0.000096	0.000230
64	-0.000000	0.000000	0.000000
65	-0.000017	0.000003	0.000012
66	-0.000029	0.000010	0.000044
67	-0.000038	0.000019	0.000089
68	-0.000044	0.000029	0.000145
69	-0.000051	0.000038	0.000211
70	-0.000069	0.000050	0.000261
71	-0.000057	0.000065	0.000315
72	-0.000038	0.000082	0.000358
73	-0.000000	0.000000	0.000000
74	-0.000022	0.000003	0.000016
75	-0.000036	0.000009	0.000056
76	-0.000045	0.000016	0.000111
77	-0.000052	0.000023	0.000178
78	-0.000058	0.000028	0.000253
79	-0.000074	0.000029	0.000308
80	-0.000072	0.000031	0.000367
81	-0.000065	0.000040	0.000436
82	-0.000000	0.000000	0.000000
83	-0.000026	0.000003	0.000020
84	-0.000041	0.000009	0.000067
85	-0.000051	0.000016	0.000131
86	-0.000057	0.000021	0.000206
87	-0.000061	0.000025	0.000287
88	-0.000074	0.000026	0.000342
89	-0.000077	0.000027	0.000403
90	-0.000075	0.000030	0.000479

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	-3.70	-0.36	-1.84
10	-5.01	-0.68	-1.66
19	-3.34	-0.67	-0.94
28	-1.75	-0.75	-0.51
37	-6.93	-13.34	-15.29
46	53.51	-25.29	7.07
55	107.30	-23.31	19.94
64	156.80	-21.59	31.74
73	210.78	-22.58	54.14
82	144.12	-11.95	60.05
38	0.00	-0.00	-54.92
39	0.00	-0.00	-38.03
40	-0.00	-0.00	-25.55
41	-0.00	-0.00	51.73
42	0.00	-0.00	9.53
43	0.00	0.00	27.35
44	0.00	-0.00	25.20

	45	0.00	-0.00	108.18

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	0.00	0.00	-0.00
	10	0.00	-0.00	-0.00
2	10	-0.00	0.00	-0.00
	19	-0.00	-0.00	-0.00
3	19	-0.00	0.00	-0.00
	28	-0.00	-0.00	-0.00
4	28	0.00	0.00	-0.00
	37	0.00	-0.00	-0.00
5	37	-0.00	-0.00	-0.00
	46	-0.00	-0.00	-0.00
6	46	-0.00	0.00	-0.00
	55	-0.00	-0.00	-0.00
7	55	-0.00	0.00	-0.00
	64	-0.00	-0.00	-0.00
8	64	-0.00	0.00	-0.00
	73	-0.00	-0.00	-0.00
9	73	0.00	0.00	-0.00
	82	0.00	-0.00	-0.00
10	2	-1.00	0.24	-0.30
	11	-1.00	-0.14	-0.30
11	11	-1.17	0.43	-0.65
	20	-1.17	-0.39	-0.65
12	20	-1.29	0.35	-0.70
	29	-1.29	-0.55	-0.70
13	29	-1.58	0.36	-0.59
	38	-1.58	-0.39	-0.59
14	38	-41.53	19.03	-28.54
	47	-41.53	-17.21	-28.54
15	47	-44.59	18.75	-25.42
	56	-44.59	-13.53	-25.42
16	56	-41.06	17.75	-24.39
	65	-41.06	-13.22	-24.39
17	65	-38.35	12.54	-21.81
	74	-38.35	-15.16	-21.81
18	74	-33.09	4.37	-9.79
	83	-33.09	-8.06	-9.79
19	3	-1.26	0.07	-0.13
	12	-1.26	-0.10	-0.13
20	12	-1.62	0.08	-0.41
	21	-1.62	-0.44	-0.41
21	21	-1.96	-0.15	-0.43
	30	-1.96	-0.70	-0.43
22	30	-2.63	-0.19	-0.15
	39	-2.63	-0.39	-0.15
23	39	-74.17	16.25	-18.84
	48	-74.17	-7.67	-18.84
24	48	-76.98	22.48	-17.47
	57	-76.98	0.29	-17.47
25	57	-66.47	23.24	-17.98
	66	-66.47	0.40	-17.98
26	66	-55.44	14.71	-14.38
	75	-55.44	-3.55	-14.38
27	75	-42.43	3.42	-4.28
	84	-42.43	-2.01	-4.28

28	4	-1.29	-0.02	-0.17
	13	-1.29	-0.24	-0.17
29	13	-1.69	-0.29	-0.37
	22	-1.69	-0.76	-0.37
30	22	-2.17	-0.78	-0.39
	31	-2.17	-1.27	-0.39
31	31	-3.27	-1.15	0.02
	40	-3.27	-1.13	0.02
32	40	-101.41	11.63	-1.52
	49	-101.41	9.70	-1.52
33	49	-101.13	34.46	-7.59
	58	-101.13	24.82	-7.59
34	58	-81.37	41.46	-13.74
	67	-81.37	24.01	-13.74
35	67	-61.41	30.68	-13.40
	76	-61.41	13.65	-13.40
36	76	-43.06	11.65	-7.11
	85	-43.06	2.61	-7.11
37	5	-1.18	-0.08	-0.27
	14	-1.18	-0.41	-0.27
38	14	-1.55	-0.58	-0.52
	23	-1.55	-1.24	-0.52
39	23	-2.12	-1.41	-0.65
	32	-2.12	-2.23	-0.65
40	32	-3.60	-2.34	-0.71
	41	-3.60	-3.23	-0.71
41	41	-117.55	-1.38	29.21
	50	-117.55	35.71	29.21
42	50	-121.85	54.40	6.63
	59	-121.85	62.82	6.63
43	59	-92.56	73.67	-10.83
	68	-92.56	59.91	-10.83
44	68	-61.12	60.40	-16.08
	77	-61.12	39.98	-16.08
45	77	-35.31	28.52	-16.86
	86	-35.31	7.11	-16.86
46	6	-0.81	-0.12	-0.25
	15	-0.81	-0.43	-0.25
47	15	-1.06	-0.62	-0.64
	24	-1.06	-1.43	-0.64
48	24	-1.46	-1.56	-0.93
	33	-1.46	-2.74	-0.93
49	33	-2.36	-2.92	-1.28
	42	-2.36	-4.55	-1.28
50	42	-67.64	-11.90	21.94
	51	-67.64	15.95	21.94
51	51	-83.74	0.28	82.07
	60	-83.74	104.50	82.07
52	60	-61.31	27.51	53.17
	69	-61.31	95.03	53.17
53	69	-30.82	42.98	11.49
	78	-30.82	57.57	11.49
54	78	-13.41	22.96	-9.03
	87	-13.41	11.49	-9.03
55	7	-0.53	-0.08	-0.29
	16	-0.53	-0.44	-0.29
56	16	-0.72	-0.57	-0.55
	25	-0.72	-1.26	-0.55
57	25	-1.02	-1.35	-0.82

	34	-1.02	-2.39	-0.82
58	34	-1.60	-2.54	-1.23
	43	-1.60	-4.11	-1.23
59	43	-62.52	-13.69	18.74
	52	-62.52	10.11	18.74
60	52	-79.12	-4.23	14.25
	61	-79.12	13.86	14.25
61	61	-21.32	5.99	11.30
	70	-21.32	20.35	11.30
62	70	-2.72	24.92	-17.53
	79	-2.72	2.66	-17.53
63	79	-0.22	4.10	-3.34
	88	-0.22	-0.14	-3.34
64	8	-0.45	-0.10	-0.36
	17	-0.45	-0.56	-0.36
65	17	-0.67	-0.75	-0.54
	26	-0.67	-1.43	-0.54
66	26	-0.97	-1.62	-0.79
	35	-0.97	-2.63	-0.79
67	35	-1.42	-2.96	-1.17
	44	-1.42	-4.44	-1.17
68	44	-53.56	-15.09	11.53
	53	-53.56	-0.45	11.53
69	53	-61.87	-31.30	10.81
	62	-61.87	-17.57	10.81
70	62	-17.57	-25.17	59.52
	71	-17.57	50.43	59.52
71	71	-8.65	48.08	-40.44
	80	-8.65	-3.27	-40.44
72	80	-2.70	5.29	-4.83
	89	-2.70	-0.84	-4.83
73	9	-0.28	-0.27	-0.08
	18	-0.28	-0.37	-0.08
74	18	-0.49	-1.09	0.17
	27	-0.49	-0.87	0.17
75	27	-0.72	-1.96	0.29
	36	-0.72	-1.60	0.29
76	36	-1.04	-3.12	0.17
	45	-1.04	-2.90	0.17
77	45	-33.11	-39.33	50.74
	54	-33.11	25.11	50.74
78	54	-29.33	-48.86	27.04
	63	-29.33	-14.52	27.04
79	63	-8.03	-27.08	53.22
	72	-8.03	40.51	53.22
80	72	-11.42	21.51	-2.04
	81	-11.42	18.92	-2.04
81	81	-3.91	7.90	-4.81
	90	-3.91	1.79	-4.81
82	1	0.36	3.70	-1.84
	2	0.36	1.20	-1.84
83	2	0.60	2.20	-1.54
	3	0.60	0.11	-1.54
84	3	0.67	1.38	-1.41
	4	0.67	-0.54	-1.41
85	4	0.65	0.76	-1.24
	5	0.65	-0.93	-1.24
86	5	0.57	0.26	-0.97
	6	0.57	-1.06	-0.97

87	6	0.45	-0.25	-0.72
	7	0.45	-0.83	-0.72
88	7	0.38	-0.30	-0.44
	8	0.38	-0.65	-0.44
89	8	0.27	-0.21	-0.08
	9	0.27	-0.28	-0.08
90	10	0.68	5.01	-1.66
	11	0.68	2.76	-1.66
91	11	1.26	2.93	-1.31
	12	1.26	1.16	-1.31
92	12	1.43	1.51	-1.03
	13	1.43	0.11	-1.03
93	13	1.38	0.51	-0.83
	14	1.38	-0.62	-0.83
94	14	1.22	-0.25	-0.58
	15	1.22	-1.03	-0.58
95	15	1.03	-0.79	-0.18
	16	1.03	-0.93	-0.18
96	16	0.91	-0.74	0.08
	17	0.91	-0.68	0.08
97	17	0.72	-0.46	0.25
	18	0.72	-0.21	0.25
98	19	0.67	3.34	-0.94
	20	0.67	2.07	-0.94
99	20	1.41	2.19	-0.88
	21	1.41	0.99	-0.88
100	21	1.70	1.33	-0.86
	22	1.70	0.16	-0.86
101	22	1.68	0.64	-0.84
	23	1.68	-0.50	-0.84
102	23	1.51	0.07	-0.71
	24	1.51	-0.90	-0.71
103	24	1.38	-0.50	-0.42
	25	1.38	-0.83	-0.42
104	25	1.29	-0.53	-0.14
	26	1.29	-0.64	-0.14
105	26	1.09	-0.34	0.11
	27	1.09	-0.23	0.11
106	28	0.75	1.75	-0.51
	29	0.75	1.05	-0.51
107	29	1.65	1.34	-0.63
	30	1.65	0.48	-0.63
108	30	2.16	1.16	-0.91
	31	2.16	-0.08	-0.91
109	31	2.28	1.02	-1.32
	32	2.28	-0.77	-1.32
110	32	2.18	0.71	-1.26
	33	2.18	-1.00	-1.26
111	33	1.99	-0.10	-0.91
	34	1.99	-0.83	-0.91
112	34	1.85	-0.25	-0.49
	35	1.85	-0.64	-0.49
113	35	1.52	-0.20	-0.12
	36	1.52	-0.32	-0.12
114	37	13.34	6.93	-15.29
	38	13.34	-13.86	-15.29
115	38	32.76	26.09	-42.26
	39	32.76	-31.38	-42.26
116	39	49.40	40.16	-61.61

	40	49.40	-43.63	-61.61
117	40	62.16	54.51	-85.61
	41	62.16	-61.92	-85.61
118	41	64.01	52.03	-63.80
	42	64.01	-34.74	-63.80
119	42	56.66	30.54	-77.49
	43	56.66	-31.44	-77.49
120	43	47.08	29.48	-70.11
	44	47.08	-26.61	-70.11
121	44	36.43	25.53	-57.60
	45	36.43	-32.07	-57.60
122	46	25.29	-53.51	7.07
	47	25.29	-43.89	7.07
123	47	61.25	-40.83	3.95
	48	61.25	-35.45	3.95
124	48	91.39	-32.65	2.59
	49	91.39	-29.13	2.59
125	49	116.15	-29.41	8.65
	50	116.15	-17.64	8.65
126	50	134.84	-13.34	31.23
	51	134.84	29.14	31.23
127	51	119.17	45.24	-28.90
	52	119.17	22.12	-28.90
128	52	104.82	38.71	-24.42
	53	104.82	19.18	-24.42
129	53	73.97	27.48	-23.70
	54	73.97	3.78	-23.70
130	55	23.31	-107.30	19.94
	56	23.31	-80.18	19.94
131	56	54.59	-83.71	18.91
	57	54.59	-57.99	18.91
132	57	77.54	-68.50	19.42
	58	77.54	-42.08	19.42
133	58	94.18	-61.85	25.58
	59	94.18	-27.06	25.58
134	59	105.03	-56.35	43.04
	60	105.03	2.18	43.04
135	60	28.03	-20.25	71.94
	61	28.03	37.30	71.94
136	61	20.16	-20.49	74.89
	62	20.16	39.42	74.89
137	62	12.56	-4.88	26.18
	63	12.56	21.30	26.18
138	64	21.59	-156.80	31.74
	65	21.59	-113.64	31.74
139	65	47.35	-116.35	29.16
	66	47.35	-76.69	29.16
140	66	61.67	-87.72	25.56
	67	61.67	-52.96	25.56
141	67	68.34	-72.91	25.22
	68	68.34	-38.61	25.22
142	68	68.83	-70.05	30.47
	69	68.83	-28.61	30.47
143	69	16.77	-59.09	72.14
	70	16.77	-1.38	72.14
144	70	21.34	-19.98	100.97
	71	21.34	60.79	100.97
145	71	19.00	51.87	-55.26
	72	19.00	-3.39	-55.26

146	73	22.58	-210.78	54.14
	74	22.58	-137.15	54.14
147	74	42.11	-142.41	42.11
	75	42.11	-85.14	42.11
148	75	49.09	-98.15	32.01
	76	49.09	-54.61	32.01
149	76	47.08	-72.96	25.72
	77	47.08	-37.98	25.72
150	77	35.62	-63.79	26.49
	78	35.62	-27.76	26.49
151	78	1.01	-45.18	47.03
	79	1.01	-7.55	47.03
152	79	2.45	-10.05	32.85
	80	2.45	16.23	32.85
153	80	11.02	10.27	-2.77
	81	11.02	7.51	-2.77
154	82	11.95	-144.12	60.05
	83	11.95	-62.45	60.05
155	83	20.01	-95.54	50.26
	84	20.01	-27.19	50.26
156	84	22.02	-69.62	45.98
	85	22.02	-7.09	45.98
157	85	19.41	-50.15	38.87
	86	19.41	2.70	38.87
158	86	12.30	-32.60	22.01
	87	12.30	-2.68	22.01
159	87	0.81	-16.08	12.98
	88	0.81	-5.70	12.98
160	88	0.95	-5.92	9.64
	89	0.95	1.79	9.64
161	89	1.79	-0.90	4.81
	90	1.79	3.91	4.81

PROYECTO ZARAGOZA-LERIDA
SUB-TRAMO 1.
E-3.

FECHA

HOJA N.º 328

ARMADURAS

$$Uc = \frac{2fm}{1.5} \times 1.00 \times d.$$

d = canto − 0,10.

$Md = 1.6 \times Mwás / Anch.$

+ → tracciones en esterior
− → tracciones en interior

$$A = Uc\left[1 - \sqrt{1 - \frac{2Md}{Uc \cdot d}}\right]$$

DIRECCIÓN	NUDO	ANCHO	CANTO	MOMENTOS MAYORADOS		ARMADURAS (cm²/m)	
				Md⁺	Md⁻	Aest.	A.int.
VERTICAL	1	0,638	1.00	14,3	−62,1	3.6	16.0
	10-19-28	1.27	1.00	9.9	−65.9	2.5	17.0
	4	0,638	1.00	2.2	−12.7	0.5	3.2
	13-22-31	1.27	1.00	7,4	—	1.8	—
	46-55 64-73	1.27	3,25	293.2	−445.0	71,2	32,3
	82	0,635	3.25	394,3	−601,1	28.6	44,0
	49-58 67-76	1.27	3,25	85,7	−109.4	6.2	8.0
	85	0.635	3.25	79,2	−98.2	5.7	7.1
	51-60	1.27	3,25	58.2	−43.3	4.2	3.1
	69-78	1.27	3.25	39.6	−50,3	2.8	3.6
	87	0.635	3,25	14,9	−11.2	1.0	0,8
	51-60	1.27	1.60	89,6	−43.1	13.6	6.5
	69-78	1.27	1.60	76,7	−101,3	11.6	15,5
	87	0.635	1.60	28.3	−32.8	3.9	4.9

H-1 : 1,6 (Empuje de tierras + Fincado + Def. diferidas) (F_{73_d}: 557,9t)
H-2 : 1.6 (− Fincado) (F_{73_d} = −409,9t)
H-3 : 1.28 × (Empuje tierras + 0.6 · Fincado + def. diferidas) + Pisuerga (F_{73_d} = 532,8t)

PROYECTO ZARAGOZA-LERIDA
SUB-TRAMO 1
E-3.

FECHA

HOJA N.º 329

ARMADURAS

$$Uc = \frac{2fm}{1.5} \times 1.00 \times d.$$

d = canto − 0,10.

$Md = 1.6 \times Mwás / Anch.$

+ → tracciones en esterior
− → tracciones en interior

$$A = Uc\left[1 - \sqrt{1 - \frac{2Md}{Uc \cdot d}}\right]$$

DIRECCIÓN	NUDO	ANCHO	CANTO	MOMENTOS MAYORADOS		ARMADURAS (cm²/m)	
				Md⁺	Md⁻	Aest.	A.int.
HORIZONTAL	38-47 56-65	1,36	3.25	105,3	−122,1	7.6	8.8
	39-48 57-66	1.36	3,25	185.6	−157,2	13.4	10.9
	40-49 58-67	1.36	3.25	245,0	−207.3	17.7	14,9
	41-50 59-68	1,36	3.25	328.4	−241,9	23.8	17.5
	43-52	0.80	3.25	214.6	−256,1	15.4	18.5
	61-70-79	0.80	1.60	270.0	−271,8	42,2	42.5
	44-53	0.80	3,25	225.4	−253.4	16.2	18.3
	62-71-80	0.80	1.60	197.5	−204.5	30.9	32 0
	45-54	0,80	3,25	340.6	−373.1	24.7	27.0
	63-72-81	0,80	1.60	220,7	−218,5	34.5	34,1
	39	1.36	1.00	—	−35.2	—	9,0
	41	1,36	1.00	—	−43 0	-	11.0
	42	1.08	1 00	—	−44.6	-	11,4
	43	0.80	1 00	—	−45.4	-	11 6

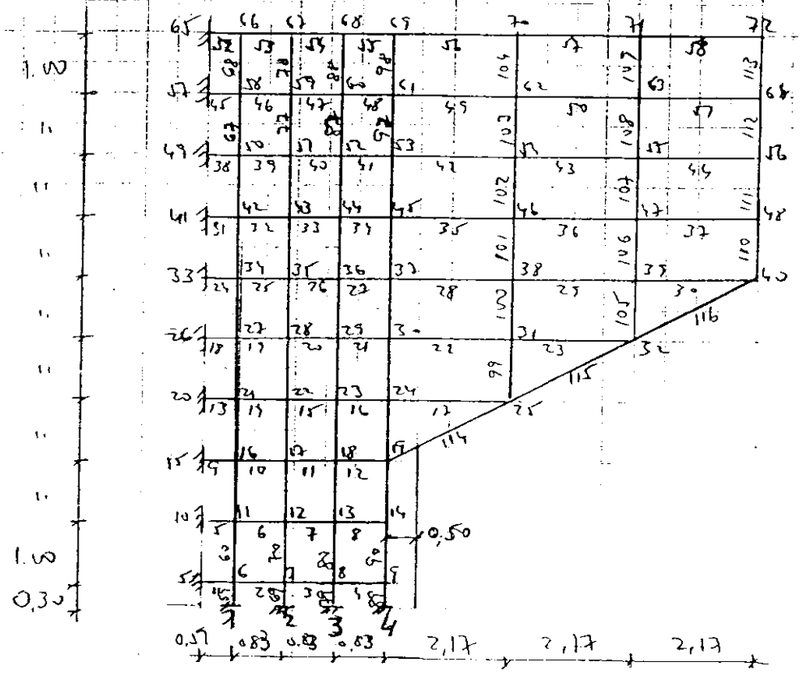
H-1 : 1,6 (Empuje de tierras + Fincado + Def. diferidas) (F_{73_d}: 557.9t)
H-2 : 1.6 (− Fincado) (F_{73_d} = −409,9t)
H-3 : 1.28 × (Empuje tierras + 0.6 · Fincado + def. diferidas) + Pisuerga (F_{73_d} = 532,8t)

PROYECTO T.A.V. ZARAGOZA-LERIDA
PORTAL 1
E-3

FECHA

HOJA N.º

Alzado pantalla 2.



Caracteristicas de barras

$I = \frac{a \times l^3}{12}$ $\quad J = 2I$.

Barra	a	I	J
1 a 4	0.80	0.0667	0,1334
5 a 11	1.00	0.0833	0,1666
12 a 58	0,50	0.0417	0.0834
59 a 68	0.67	0.0558	0,1116
69 a 88	0,83	0.0692	0,1384
89 a 91	0 91	0.0758	0,1516
92 a 98	1.41	0.1175	0,2350
99 a 113	2.17	0,1808	0,3616
114 a 116	0.67	0.0558	0.1116

PROYECTO

FECHA

HOJA N.º

Empuje de tierras.

$e = 0,22 (3.w + 2,0 \times h)$

h	e
0	0.66
1.50	1.10
2.00	1.54
3.00	1.98
4.00	2,42
5.00	2.86
6.00	3,30
7.00	3,74
8.00	4.18
9.00	4,62.

Cargas en barras

1 a 4 : $p = 4,62$ t/m

5 a 8 : $p = 4.18$

9 a 12 : $p = 3,74$

13 a 17 : $p = 3,30$

18 a 23 : $p = 2.86$

24 a 30 : $p = 2,42$

31 a 37 : $p = 1.98$

38 a 44 : $p = 1.54$

45 a 57 : $p = 1.10$ t/m

58 a 58 : $p = 0,78 \times 0,50 = 0,39$

114 : $p = 0.45 \times 3,52 = 1.58$ t/m

115 : $p = 0.45 \times 3,08 = 1.39$ t/m

116 : $p = 0,45 \times 2,64 = 1.19$ t/m

```
ZARAGOZA-LERIDA.T-1.E-3.ALETAS ESTRIBO 2
CONTROL
72 116 8 1
:
NUDOS
 1    0.51   0.00
 2    1.34   0.00
 3    2.17   0.00
 4    3.00   0.00
 5    0.00   0.30
 6    0.51   0.30
 7    1.34   0.30
 8    2.17   0.30
 9    3.00   0.30
10    0.00   1.30
11    0.51   1.30
12    1.34   1.30
13    2.17   1.30
14    3.00   1.30
15    0.00   2.30
16    0.51   2.30
17    1.34   2.30
18    2.17   2.30
19    3.00   2.30
20    0.00   3.30
21    0.51   3.30
22    1.34   3.30
23    2.17   3.30
24    3.00   3.30
25    5.17   3.30
26    0.00   4.30
27    0.51   4.30
28    1.34   4.30
29    2.17   4.30
30    3.00   4.30
31    5.17   4.30
32    7.34   4.30
33    0.00   5.30
34    0.51   5.30
35    1.34   5.30
36    2.17   5.30
37    3.00   5.30
38    5.17   5.30
39    7.34   5.30
40    9.51   5.30
41    0.00   6.30
42    0.51   6.30
43    1.34   6.30
44    2.17   6.30
45    3.00   6.30
46    5.17   6.30
47    7.34   6.30
48    9.51   6.30
49    0.00   7.30
50    0.51   7.30
51    1.34   7.30
52    2.17   7.30
53    3.00   7.30
54    5.17   7.30
```



```
55    7.34   7.30
56    9.51   7.30
57    0.00   8.30
58    0.51   8.30
59    1.34   8.30
60    2.17   8.30
61    3.00   8.30
62    5.17   8.30
63    7.34   8.30
64    9.51   8.30
65    0.00   9.30
66    0.51   9.30
67    1.34   9.30
68    2.17   9.30
69    3.00   9.30
70    5.17   9.30
71    7.34   9.30
72    9.51   9.30
:
SECCIONES
9
0.0667 0.1334 3.0E6 1.3E6
0.0833 0.1666 3.0E6 1.3E6
0.0417 0.0834 3.0E6 1.3E6
0.0558 0.1116 3.0E6 1.3E6
0.0692 0.1384 3.0E6 1.3E6
0.0758 0.1516 3.0E6 1.3E6
0.1175 0.2350 3.0E6 1.3E6
0.1667 0.3334 3.0E6 1.3E6
0.0558 0.1116 3.0E6 1.3E6
:
BARRAS
  1    5    6   1
  2    6    7   1
  3    7    8   1
  4    8    9   1
  5   10   11   2
  6   11   12   2
  7   12   13   2
  8   13   14   2
  9   15   16   2
 10   16   17   2
 11   17   18   2
 12   18   19   2
 13   20   21   2
 14   21   22   2
 15   22   23   2
 16   23   24   2
 17   24   25   2
 18   26   27   2
 19   27   28   2
 20   28   29   2
 21   29   30   2
 22   30   31   2
 23   31   32   2
 24   33   34   2
 25   34   35   2
 26   35   36   2
 27   36   37   2
```

```
 28  37  38  2
 29  38  39  2
 30  39  40  2
 31  41  42  2
 32  42  43  2
 33  43  44  2
 34  44  45  2
 35  45  46  2
 36  46  47  2
 37  47  48  2
 38  49  50  2
 39  50  51  2
 40  51  52  2
 41  52  53  2
 42  53  54  2
 43  54  55  2
 44  55  56  2
 45  57  58  2
 46  58  59  2
 47  59  60  2
 48  60  61  2
 49  61  62  2
 50  62  63  2
 51  63  64  2
 52  65  66  3
 53  66  67  3
 54  67  68  3
 55  68  69  3
 56  69  70  3
 57  70  71  3
 58  71  72  3
 59  1    6  3
 60  6   11  4
 61 11   16  4
 62 16   21  4
 63 21   27  4
 64 27   34  4
 65 34   42  4
 66 42   50  4
 67 50   58  4
 68 58   66  4
 69  2    7  5
 70  7   12  5
 71 12   17  5
 72 17   22  5
 73 22   28  5
 74 28   35  5
 75 35   43  5
 76 43   51  5
 77 51   59  5
 78 59   67  5
 79  3    8  5
 80  8   13  5
 81 13   18  5
 82 18   23  5
 83 23   29  5
 84 29   36  5
 85 36   44  5
 86 44   52  5
```



```
 87 52   60  5
 88 60   68  5
 89  4    9  6
 90  9   14  6
 91 14   19  6
 92 19   24  7
 93 24   30  7
 94 30   37  7
 95 37   45  7
 96 45   53  7
 97 53   61  7
 98 61   69  7
 99 25   31  8
100 31   38  8
101 38   46  8
102 46   54  8
103 54   62  8
104 62   70  8
105 32   39  8
106 39   47  8
107 47   55  8
108 55   63  8
109 63   71  8
110 40   48  8
111 48   56  8
112 56   64  8
113 64   72  8
114 19   25  9
115 25   32  9
116 32   40  9
:
APOYOS
14
  1  1       1     1
  2  1       1     1
  3  1       1     1
  4  1       1     1
  5  1       1     1
 10  1       1     1
 15  1       1     1
 20  1       1     1
 26  1       1     1
 33  1       1     1
 41  1       1     1
 49  1       1     1
 57  1       1     1
 65  1       1     1
:
HIPOTESIS DE CARGA
H-1 EMPUJE DE TIERRAS
0
61
  1  3  4.62  4.62
  2  3  4.62  4.62
  3  3  4.62  4.62
  4  3  4.62  4.62
  5  3  4.18  4.18
  6  3  4.18  4.18
  7  3  4.18  4.18
```

8	3	4.18	4.18
9	3	3.74	3.74
10	3	3.74	3.74
11	3	3.74	3.74
12	3	3.74	3.74
13	3	3.30	3.30
14	3	3.30	3.30
15	3	3.30	3.30
16	3	3.30	3.30
17	3	3.30	3.30
18	3	2.86	2.86
19	3	2.86	2.86
20	3	2.86	2.86
21	3	2.86	2.86
22	3	2.86	2.86
23	3	2.86	2.86
24	3	2.42	2.42
25	3	2.42	2.42
26	3	2.42	2.42
27	3	2.42	2.42
28	3	2.42	2.42
29	3	2.42	2.42
30	3	2.42	2.42
31	3	1.98	1.98
32	3	1.98	1.98
33	3	1.98	1.98
34	3	1.98	1.98
35	3	1.98	1.98
36	3	1.98	1.98
37	3	1.98	1.98
38	3	1.54	1.54
39	3	1.54	1.54
40	3	1.54	1.54
41	3	1.54	1.54
42	3	1.54	1.54
43	3	1.54	1.54
44	3	1.54	1.54
45	3	1.10	1.10
46	3	1.10	1.10
47	3	1.10	1.10
48	3	1.10	1.10
49	3	1.10	1.10
50	3	1.10	1.10
51	3	1.10	1.10
52	3	0.39	0.39
53	3	0.39	0.39
54	3	0.39	0.39
55	3	0.39	0.39
56	3	0.39	0.39
57	3	0.39	0.39
58	3	0.39	0.39
114	3	1.58	1.58
115	3	1.39	1.39
116	3	1.19	1.19

:

ZARAGOZA-LERIDA.T-1.E-3.ALETAS ESTRIBO 2

Hip. nº 1 H-1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	0.000000	-0.000000
2	-0.000000	0.000000	-0.000000
3	-0.000000	0.000000	0.000000
4	-0.000000	0.000000	0.000000
5	-0.000000	0.000000	-0.000000
6	-0.000001	0.000001	0.000000
7	-0.000010	0.000004	0.000002
8	-0.000032	0.000007	0.000005
9	-0.000067	0.000015	0.000011
10	-0.000000	0.000000	-0.000000
11	-0.000008	0.000014	0.000003
12	-0.000038	0.000041	0.000025
13	-0.000096	0.000076	0.000072
14	-0.000178	0.000111	0.000150
15	-0.000000	0.000000	0.000000
16	-0.000010	0.000037	0.000010
17	-0.000045	0.000097	0.000065
18	-0.000105	0.000165	0.000173
19	-0.000183	0.000260	0.000347
20	-0.000000	0.000000	0.000000
21	-0.000008	0.000062	0.000016
22	-0.000039	0.000152	0.000106
23	-0.000087	0.000241	0.000269
24	-0.000137	0.000339	0.000510
25	-0.000171	0.000566	0.001527
26	-0.000000	0.000000	0.000000
27	-0.000006	0.000082	0.000022
28	-0.000028	0.000196	0.000139
29	-0.000061	0.000295	0.000343
30	-0.000096	0.000385	0.000627
31	-0.000147	0.000579	0.001688
32	-0.000142	0.000671	0.003069
33	-0.000000	0.000000	0.000000
34	-0.000004	0.000096	0.000025
35	-0.000018	0.000226	0.000161
36	-0.000041	0.000331	0.000394
37	-0.000066	0.000420	0.000707
38	-0.000117	0.000591	0.001821
39	-0.000128	0.000672	0.003205
40	-0.000119	0.000689	0.004691
41	-0.000000	0.000000	0.000000
42	-0.000002	0.000105	0.000027
43	-0.000012	0.000246	0.000175
44	-0.000028	0.000358	0.000427
45	-0.000047	0.000447	0.000763
46	-0.000091	0.000605	0.001925
47	-0.000110	0.000674	0.003324
48	-0.000112	0.000688	0.004807
49	-0.000000	0.000000	0.000000
50	-0.000002	0.000110	0.000029
51	-0.000009	0.000260	0.000185
52	-0.000021	0.000377	0.000451

53	-0.000036	0.000469	0.000804
54	-0.000074	0.000620	0.002007
55	-0.000097	0.000679	0.003428
56	-0.000104	0.000689	0.004915
57	-0.000000	0.000000	0.000000
58	-0.000002	0.000115	0.000030
59	-0.000009	0.000271	0.000193
60	-0.000019	0.000392	0.000470
61	-0.000031	0.000486	0.000836
62	-0.000065	0.000633	0.002076
63	-0.000088	0.000685	0.003520
64	-0.000099	0.000691	0.005017
65	-0.000000	0.000000	0.000000
66	-0.000002	0.000121	0.000032
67	-0.000009	0.000281	0.000202
68	-0.000019	0.000404	0.000489
69	-0.000029	0.000497	0.000866
70	-0.000063	0.000642	0.002140
71	-0.000086	0.000690	0.003607
72	-0.000097	0.000693	0.005115

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	0.33	-0.39	-1.83
2	7.00	-2.52	-1.16
3	22.68	-4.46	5.08
4	60.22	-10.17	63.75
5	0.49	-0.10	-0.50
10	3.27	-5.53	-3.54
15	4.07	-18.66	2.36
20	3.59	-32.49	8.60
26	2.57	-43.56	13.11
33	1.63	-50.78	15.10
41	1.02	-55.00	15.21
49	0.77	-57.68	14.70
57	0.82	-60.29	15.12
65	0.47	-32.23	10.25

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	5	-0.49	-0.10	-0.50
	6	-0.49	-0.96	-2.86
2	6	-1.86	0.45	-1.62
	7	-1.86	-2.48	-5.45
3	7	-4.45	1.69	-4.67
	8	-4.45	-3.78	-8.50
4	8	-7.35	4.17	-13.45
	9	-7.35	-8.58	-17.29
5	10	-3.27	-5.53	-3.54
	11	-3.27	-7.88	-5.67
6	11	-7.89	-6.25	-4.03
	12	-7.89	-11.03	-7.50
7	12	-15.01	-7.75	-5.58
	13	-15.01	-13.82	-9.05
8	13	-21.46	-10.38	1.36
	14	-21.46	-10.69	-2.11
9	15	-4.07	-18.66	2.36

	16	-4.07	-17.94	0.45
10	16	-9.31	-17.76	0.52
	17	-9.31	-18.61	-2.58
11	17	-15.61	-18.63	-3.14
	18	-15.61	-22.53	-6.25
12	18	-20.42	-24.64	-8.89
	19	-20.42	-33.30	-11.99
13	20	-3.59	-32.49	8.60
	21	-3.59	-28.53	6.92
14	21	-8.10	-29.22	5.96
	22	-8.10	-25.41	3.22
15	22	-12.39	-27.55	2.98
	23	-12.39	-26.21	0.24
16	23	-13.02	-30.30	2.99
	24	-13.02	-28.96	0.25
17	24	-3.43	-38.81	14.05
	25	-3.43	-16.10	6.88
18	26	-2.57	-43.56	13.11
	27	-2.57	-37.25	11.66
19	27	-5.82	-38.19	10.58
	28	-5.82	-30.40	8.21
20	28	-8.64	-32.83	8.19
	29	-8.64	-27.02	5.82
21	29	-8.90	-30.02	7.44
	30	-8.90	-24.83	5.06
22	30	-5.10	-28.35	7.57
	31	-5.10	-18.66	1.36
23	31	0.45	-19.41	10.24
	32	0.45	-3.92	4.04
24	33	-1.63	-50.78	15.10
	34	-1.63	-43.40	13.87
25	34	-3.80	-44.15	13.01
	35	-3.80	-34.19	11.00
26	35	-5.90	-35.98	10.56
	36	-5.90	-28.05	8.56
27	36	-6.57	-29.98	8.71
	37	-6.57	-23.58	6.71
28	37	-5.05	-25.90	7.44
	38	-5.05	-15.45	2.19
29	38	-1.08	-14.57	6.58
	39	-1.08	-5.98	1.33
30	39	0.86	-5.72	5.19
	40	0.86	-0.14	-0.06
31	41	-1.02	-55.00	15.21
	42	-1.02	-47.50	14.20
32	42	-2.50	-47.91	13.66
	43	-2.50	-37.25	12.02
33	43	-4.14	-38.32	11.49
	44	-4.14	-29.46	9.85
34	44	-4.95	-30.70	9.56
	45	-4.95	-23.45	7.92
35	45	-4.45	-25.24	7.95
	46	-4.45	-12.66	3.65
36	46	-1.90	-12.42	5.56
	47	-1.90	-5.01	1.27
37	47	-0.14	-3.84	3.49
	48	-0.14	-0.93	-0.81
38	49	-0.77	-57.68	14.70
	50	-0.77	-50.38	13.91

39	50	-1.87	-50.47	13.69
	51	-1.87	-39.65	12.41
40	51	-3.12	-40.13	11.87
	52	-3.12	-30.81	10.59
41	52	-3.83	-31.59	10.05
	53	-3.83	-23.78	8.78
42	53	-3.84	-25.15	8.29
	54	-3.84	-10.79	4.95
43	54	-2.24	-11.25	5.21
	55	-2.24	-3.57	1.87
44	55	-0.78	-2.91	2.72
	56	-0.78	-0.64	-0.62
45	57	-0.82	-60.29	15.12
	58	-0.82	-52.71	14.56
46	58	-1.78	-52.64	14.26
	59	-1.78	-41.18	13.35
47	59	-2.62	-41.47	12.25
	60	-2.62	-31.68	11.34
48	60	-3.06	-32.27	10.20
	61	-3.06	-24.18	9.28
49	61	-3.46	-25.76	8.91
	62	-3.46	-9.02	6.52
50	62	-2.32	-10.85	5.30
	63	-2.32	-1.95	2.91
51	63	-1.06	-2.43	2.36
	64	-1.06	0.11	-0.03
52	65	-0.47	-32.23	10.25
	66	-0.47	-27.05	10.06
53	66	-0.92	-27.86	9.24
	67	-0.92	-20.33	8.91
54	67	-1.24	-22.07	8.47
	68	-1.24	-15.18	8.14
55	68	-1.37	-17.30	7.85
	69	-1.37	-10.92	7.53
56	69	-1.67	-14.52	5.98
	70	-1.67	-2.46	5.13
57	70	-1.16	-6.41	3.66
	71	-1.16	0.61	2.81
58	71	-0.57	-1.54	1.53
	72	-0.57	0.85	0.68
59	1	0.39	-0.33	-1.83
	6	0.39	-0.88	-1.83
60	6	1.80	0.49	-3.07
	11	1.80	-2.58	-3.07
61	11	3.44	2.04	-4.70
	16	3.44	-2.66	-4.70
62	16	3.62	2.57	-4.77
	21	3.62	-2.20	-4.77
63	21	2.93	2.31	-3.81
	27	2.93	-1.51	-3.81
64	27	1.98	1.74	-2.74
	34	1.98	-1.00	-2.74
65	34	1.23	1.18	-1.88
	42	1.23	-0.70	-1.88
66	42	0.83	0.77	-1.35
	50	0.83	-0.57	-1.35
67	50	0.73	0.54	-1.12
	58	0.73	-0.58	-1.12
68	58	0.81	0.37	-0.82

	66	0.81	-0.45	-0.82
69	2	2.52	-7.00	-1.16
	7	2.52	-7.35	-1.16
70	7	6.69	-4.76	-1.95
	12	6.69	-6.70	-1.95
71	12	9.98	0.42	-3.87
	17	9.98	-3.45	-3.87
72	17	9.96	2.85	-3.30
	22	9.96	-0.45	-3.30
73	22	7.82	3.84	-3.07
	28	7.82	0.77	-3.07
74	28	5.38	3.59	-3.05
	35	5.38	0.54	-3.05
75	35	3.59	2.64	-2.61
	43	3.59	0.03	-2.61
76	43	2.52	1.67	-2.09
	51	2.52	-0.42	-2.09
77	51	2.03	0.82	-1.54
	59	2.03	-0.72	-1.54
78	59	1.74	0.12	-0.45
	67	1.74	-0.32	-0.45
79	3	4.46	-22.68	5.08
	8	4.46	-21.16	5.08
80	8	12.41	-18.26	10.03
	13	12.41	-8.24	10.03
81	13	15.85	-1.80	-0.38
	18	15.85	-2.18	-0.38
82	18	13.74	2.63	2.26
	23	13.74	4.89	2.26
83	23	9.65	5.53	-0.48
	29	9.65	5.04	-0.48
84	29	6.65	5.30	-2.10
	36	6.65	3.20	-2.10
85	36	4.72	3.87	-2.26
	44	4.72	1.61	-2.26
86	44	3.48	2.42	-1.97
	52	3.48	0.45	-1.97
87	52	2.71	1.16	-1.44
	60	2.71	-0.27	-1.44
88	60	2.13	0.16	-0.29
	68	2.13	-0.13	-0.29
89	4	10.17	-60.22	63.75
	9	10.17	-41.10	63.75
90	9	18.75	-48.45	46.46
	14	18.75	-1.99	46.46
91	14	29.44	-23.44	44.35
	19	29.44	20.91	44.35
92	19	24.03	9.04	14.67
	24	24.03	23.71	14.67
93	24	14.18	14.11	0.87
	30	14.18	14.98	0.87
94	30	10.66	11.18	-1.64
	37	10.66	9.54	-1.64
95	37	8.35	8.02	-2.37
	45	8.35	5.65	-2.37
96	45	6.55	5.15	-2.40
	53	6.55	2.75	-2.40
97	53	5.17	2.76	-1.92
	61	5.17	0.84	-1.92

98	61	3.60	1.24	-1.54
	69	3.60	-0.30	-1.54
99	25	5.89	5.87	12.74
	31	5.89	18.61	12.74
100	31	5.13	13.05	3.86
	38	5.13	16.92	3.86
101	38	6.01	12.95	-0.53
	46	6.01	12.42	-0.53
102	46	6.25	9.87	-2.44
	54	6.25	7.42	-2.44
103	54	5.79	5.82	-2.70
	62	5.79	3.12	-2.70
104	62	3.95	1.99	-1.48
	70	3.95	0.51	-1.48
105	32	0.54	4.78	5.10
	39	0.54	9.88	5.10
106	39	0.80	7.94	1.24
	47	0.80	9.18	1.24
107	47	1.97	7.42	-0.98
	55	1.97	6.44	-0.98
108	55	2.63	4.98	-1.83
	63	2.63	3.15	-1.83
109	63	2.15	1.88	-1.29
	71	2.15	0.60	-1.29
110	40	-0.60	3.14	0.78
	48	-0.60	3.91	0.78
111	48	0.33	3.77	-0.03
	56	0.33	3.74	-0.03
112	56	0.96	2.96	-0.65
	64	0.96	2.31	-0.65
113	64	0.86	1.25	-0.69
	72	0.86	0.56	-0.69
114	19	8.44	-38.73	17.69
	25	8.44	-0.98	13.91
115	25	4.27	-14.15	8.06
	32	4.27	1.14	4.74
116	32	1.75	-3.74	3.67
	40	1.75	1.63	0.83

PROYECTO .....

FECHA .....

HOJA N.° .....

ARMADURAS

$U_c = \frac{250 - 0.5}{1.5} \times 1.00 \times 0.95 = 1425$ t/m²

Md = 1.6 × (M+T)/ancho banda + → tracción exterior
− → tracción interior

$A = U_c \left[1 - \sqrt{1 - \frac{2Md}{U_c \times 0.95}}\right] \times \frac{1.15}{5.1}$ cm²/m

Dirección horizontal:

Md máx = −1.6 (32,23 + 0.47)/0,50 = 104,6 mt/m (nudo 65)

Aint = 25.9 cm²/m

Dirección vertical:

Md máx = −1.6 (60,22 + 10.17)/0,91 = −123.8 mt/m (nudo 4)

Aint = 30,9 cm²/m

Otros puntos:

DIRECCIÓN	NUDO	M	T	ancho	Md	A (cm²/m)
HORIZONTAL	15	−18.66	−4.07	1.00	−36.4	8,8
	20	−32.49	−3.59	1.00	−57.7	14.0
	26	−43.56	−2.57	1.00	−73.8	18.0
	33	−50.78	−1.63	1.00	−83.9	20.6
	57	−60.29	−0,82	1.00	−97.8	24,1
	65	−32,23	−0.47	0,50	−104.6	25.9
VERTICAL	2	−7.00	+2.52	0,83	−18.4	4,4
	3	−22.68	−4.46	0,83	−57.3	12.7
	4	−60.22	−10,17	0.91	−123.8	30.9

PROYECTO TAV ZARAGOZA-LERIDA
SUBTRAMO 1
E-3

FECHA

HOJA N.º

Armadura existente en zona de cimentación (los 2.50 m. inferiores)

Horizontal: ϕ 20/0,20 → 15,7 cm²/m > 14,0 cm²/m que es la necesaria en el muro 20, a 3,00 m del arranque del muro.

Vertical: ϕ 20/0,15 → 20,94 cm²/m

En el muro 4 se necesitan 30,9 cm²/m. para, teniendo en cuenta que el empotramiento disminuye mucho el problema vamos a suponer que necesita entre los muros 3 y 4:

12,7 × 0,83 + 30,9 × 0,91 = 38,7 cm²/m

En la zona de arranque existe:

(0,83 + 0,91) × 3,14/0,15 = 36,4 cm²/m más las 8 x 25 existentes en la cara final del muro, que tienen en parte, una buena colaboración frente a este momento, por tanto, vale la armadura dispuesta.

A partir de esta zona se disponen ϕ 20/0,15 en horizontal, hasta el muro 33 y ϕ 25/0,20 desde este muro hasta arriba, en el paramento interior.

En vertical se mantienen los ϕ 20/0,15 en toda la altura

ESTRUCTURA E-4

ESTRUCTURA E-4

ÍNDICE

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- Programa general de puentes continuos

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3. CÁLCULO DE PILAS
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   - 4.1. Estribo 1 (Móvil)
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L.A.V. ZARAGOZA-LLEIDA

SUBTRAMO-I

E-4

GENERALIDADES

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Union Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril" de 25 de junio de 1975.
- "L.A.V. Zaragoza-Lérida. Proyecto de Estructuras de Puentes de Ferrocarril. Bases del Cálculo" de 29 de julio de 1993.
- "Instrucción EP-93, para el proyecto y ejecución de obras de hormigón pretensado".
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- Encepados y zapatas..... $f_{ck} \geq 250$ Kp/cm²
- Pilotes..... $f_{ck} \geq 200$ Kp/cm²
- Alzados de estribos ..... $f_{ck} \geq 250$ kp/cm²
- Alzados de pilas ..... $f_{ck} \geq 300$ Kp/cm²
- Tablero postesado..... $f_{ck} \geq 350$ kp/cm²
- Coeficiente de seguridad ..... $\gamma_c = 1,5$

Armaduras activas

- Tensión de rotura ≥ 190 Kp/mm²
- Límite elástico ≥ 170 Kp/mm²
- Coeficiente de seguridad $\gamma_s = 1,1$

Armaduras pasivas

- Límite elástico ≥ 5100 Kp/cm²
- Coeficiente de seguridad $\gamma_s = 1,15$

Cargas

Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

3.- Criterios generales de cálculo

Para el cálculo de la estructura se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

El cálculo del viaducto se ha realizado básicamente en las siguientes fases:

- Tablero:
  - Cálculo longitudinal
  - Cálculo transversal
- Reacciones y aparatos de apoyo
- Pilas
- Estribos

La obtención de esfuerzos que permiten realizar el análisis longitudinal del tablero, se ha realizado con la ayuda de un programa de cálculo matricial basado en el método de la rigidez, discretizándose el tablero como viga contínua, sometida a las acciones de peso propio, carga permanente, sobrecarga, gradiente térmico y pretensado, tanto inicial como final, con sus correspondientes coeficientes de ponderación. De este cálculo como viga se obtienen los estados tensionales en servicio y la comprobación a rotura por flexión y cortante.

En el análisis transversal, se ha estudiado la flexión transversal, la armadura necesaria en el voladizo, el rasante y las costillas sobre pilas y estribos, en particular el anclaje del tablero al estribo.

En cuanto al cálculo de pilas y estribos se han tenido en cuenta, además de las acciones verticales, las horizontales debidas a los acortamientos por retracción, fluencia y temperatura, frenado, viento, empuje de tierras y efectos sísmicos.

En la distribución de acciones horizontales en los distintos elementos se han tenido en cuenta las distintas rigideces de éstos, tanto para cargas rápidas como de larga duración.

En la comprobación de las pilas se ha empleado un programa que tiene en cuenta los efectos de 2º orden, considerando la no linealidad, tanto geométrica como del material.

En la comprobación de los elementos de hormigón armado y pretensado, se ha tenido en cuenta lo prescrito en las Instrucciones correspondientes EH-91 y EP-93, respectivamente.

4.- Equipo redactor del proyecto

El cálculo del proyecto ha sido realizado por la oficina **SIEGRIST Y MORENO, S.L.**

Madrid, 25 de junio de 1997

Fdo.: Carlos Siegrist Fernández

PROGRAMA GENERAL DE PUENTES CONTINUOS (VI-0)

- Objeto del programa y campo de aplicación: El programa está diseñado para el cálculo matricial en teoría de primer orden de una viga continua recta, teniendo en cuenta el proceso constructivo de la estructura. Se aplica a estructuras de varios vanos cuyo comportamiento pueda considerarse tipo viga. Permite la introducción de un coeficiente de excentricidad para tener en cuenta los efectos de cargas locales que hagan que el comportamiento tipo viga no se real.

- Identificación: Este programa ha sido desarrollado en la oficina SIEGRIST Y MORENO S.L. por Juan Moreno Torres y Miguel Angel Utrilla Arroyo. La última revisión del mismo, utilizada en estos calculos, se realizó en enero de 1994.

- Datos de entrada:

  - Definición de **vanos, cargas y características de los materiales** que componen la estructura.
  - Definición de **secciones de cálculo** en la estructura final con sus características geométricas.
  - Definición de **estados** de la estructura. (Proceso constructivo).
  - Definición de los **cables de pretensado** con los puntos singulares del trazado y fuerzas de tesado.

- Resultados:

  - **Esfuerzos en las secciones de cálculo en las hipótesis:**

    . Peso propio estructura en cada uno de los estados constructivos y peso propio de la estructura completa en los estados inicial y final (teniendo en cuenta el reajuste por fluencia). En todos los casos se tiene en cuenta la construcción por fases.

    . Cargas muertas

    . Temperatura

    . Descenso de apoyos

    . Envolvente de cortantes y momentos para sobrecarga tipo renfe y tipo UIC.

  - Definición general de los **cables de pretensado**, con su replanteo.

  - **Esfuerzos unitarios producidos por los cables de pretensado**, tanto en las estructuras parciales como en la completa.

  - **Coeficientes de pérdidas de pretensado y resumen de familias de cables.**

  - **Esfuerzos de pretensado** en estado inicial y final.

  - **Tensiones en construcción** en cada uno de los estados evolutivos. En

cada fase se calculan cuatro hipótesis: Pretensado con pérdidas instantáneas ponderado y sin ponderar; peso propio; y la suma de peso propio y pretensado ponderado.

- **Tensiones en servicio** en estados inicial y final, ponderando el pretensado con 0,9 y 1,1 y considerando las diferentes envolventes de sobrecarga, así como la sobrecarga frecuente.

- **Reacciones y giros** en cada una de las hipótesis en que se han dado esfuerzos.

- **Comprobación a cortante.** En este apartado se detallan inicialmente los esfuerzos, tanto de cargas exteriores (envolvente de esfuerzos máximos y mínimos ponderados) como de pretensado, en cada una de las secciones de cálculo. A partir de estos esfuerzos el programa obtiene de acuerdo con la EP-93 el esfuerzo cortante reducido, así como la armadura necesaria en cada sección. También se obtiene la armadura mínima de las secciones y se comprueba la compresión en el hormigón (Vrd/Vu1).

- **Comprobación a rotura.** Se calcula el momento de cálculo, (envolventes de momentos máximos y mínimos), el momento hiperestático de pretensado y el momento último de cada sección. En este cálculo se tiene en cuenta tanto el pretensado como la armadura pasiva del tablero. En los momentos totales se suma a los momentos de cálculo el momento hiperestático ponderado por 1.1 o por 0.9 según sea desfavorable o favorable.

1.- CALCULO TABLERO

CALCULO DEL TABLERO

Para el cálculo del tablero se han seguido los siguientes pasos:

- Sección transversal del tablero

- Cálculo longitudinal

  - Cálculo como viga contínua
  - Comprobación de tensiones
  - Comprobación a rotura por flexión
  - Combrobación a cortante
  - Cálculo armadura anclajes pretensado

- Cálculo transversal

  - Flexión transversal y torsión de la losa
  - Armadura de rasante
  - Cálculo a torsión
  - Costilla sobre pilas
  - Costilla apoyo en estribo fijo
  - Costilla apoyo en estribo móvil

- Cálculo de alargamientos de tesado

SECCION TRANSVERSAL

PROYECTO LAV ZARAGOZA - LERIDA
SUBTRAMO 1
PUENTES CAJON (E-3, E-4 y E-5)

FECHA

HOJA N.º

CALCULO DE VIENTO

Según la instrucción de acciones en puentes de ferrocarril.

presión básica: $p_w = 154(2-0.7\lambda) = 200\ kp/m^2$

$\lambda = \frac{A_u}{A_{tot}} = 1$

Superficie a considerar: $S = 2.45$ (canto tablero) $+ 0.70$ (balasto + carril) $+ 3.50$ (tren) $= 6.65\ m^2/m$

Presión sobre el tablero: $0.2\ T/m^2 \cdot 6.65\ m^2/m = \underline{1.33\ T/m}$

Pilas → E-3 y E-5 $S = 2.40\ m^2/m \Rightarrow$ Presión $= \underline{0.48\ T/m}$

E-4 $S = 1.40\ m^2/m \Rightarrow$ Presión $= \underline{0.28\ T/m}$

COEFICIENTE DE IMPACTO

- RENFE Según la instrucción:

Tramos apoyados continuos. $I = 65 \frac{\mu}{1-\mu+\mu^2} = 23.5$ Se toma 24% $\Rightarrow \underline{I = 1.24}$

$\mu = \frac{V \cdot T}{2L} = 0.2874$

$V = 200\ km/h = 55.56\ m/s$ $L = 33\ m$

$T = \frac{2\pi}{\omega}$ $\omega = \sqrt{\frac{EJ\,\pi^4}{m\,l^4}}$ $EI = 3.5 \cdot 10^6 \times 6.828$

$T = 0.3414$

$m = \frac{1}{9.8}\left(\underbrace{8.84 \times 2.5}_{\text{P. propio}} + \underbrace{10.686}_{\text{C. perm}} + \underbrace{24}_{\text{sobrecarga}}\right) = 5.8$

UIC

$L_m = \frac{1}{7}(27 \times 2 + 33 \times 5) = 31.3\ m$ $L_\phi = 15 + 31.3 = 46.95$

Tomando ϕ_2 para 40-50 → IMPACTO = 1,06

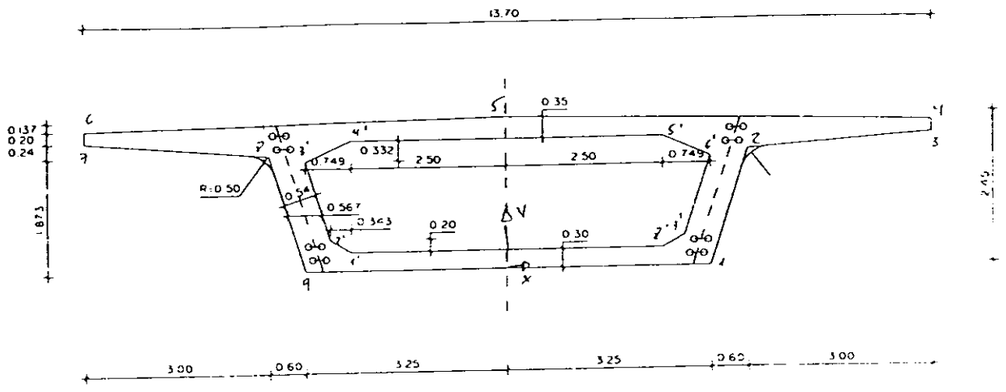
PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO - 1. SECCION CAJÓN

FECHA

HOJA N.º 1/5

SECCION TIPO

ESCALA 1:50
1:100



PUNTO	X	Y
1	3,25	0,0
2	3,85	1.873
3	6,85	2.113
4	6.85	2313
5	0,0	245
6	-6,85	2313
7	-6,85	2.113
8	-3 85	1.873
9	-3 25	0,0

PUNTO	X	Y
1'	- 250	0.30
2'	- 2 843	050
3'	-3.249	1 768
4'	-2.50	2 10
5'	2 50	2.10
6'	3 249	1 768
7'	2 843	0 50
8'	2 50	0.30

Area 8,843 m^2

I_L : 6,828 m^4

I_T 100,99 m^4

Y_i : 1.499 m

Y_s : 0,951 m

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION ALIGERADA.

NUM. CONTORNOS	NUM. CIRCULOS
2	0

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

CONTORNO 2 PUNTOS 8	COORD. X	Y
1	-2.500	0.300
2	-2.843	0.500
3	-3.249	1.768
4	-2.500	2.100
5	2.500	2.100
6	3.249	1.768
7	2.843	0.500
8	2.500	0.300

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
0.000	0.000	0.000	2.450

3/

RESULTADOS

AREA = 8.84283 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.49870

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 13.2527186	Ixx = 26.6898422	ANG. FI = 0.0000
My = 0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.49870 Ds = 0.95130
Wi = 4.55598 Ws = 7.17756
Radio Giro X-X = 0.87872 Radio Giro Y-Y= 3.37943

4/

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION MACIZA.

NUM. CONTORNOS 1 NUM. CIRCULOS 0

CONTORNO 1 PUNTOS 9

COORD.	X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
0.000	0.000	0.000	2.450

RESULTADOS

AREA = 19.54475 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.34198

********** EJES ORIGINALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 26.2286056	Ixx = 45.1849251	ANG. FI = 0.0000
My = 0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

********** EJES PARALELOS POR G **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 0.0000000	Ixx = 9.9867392	ANG. FI = 0.0000
My = -0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

********** EJES PRINCIPALES **********

MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 0.0000000	Ixx = 9.9867392	ANG. FI = 0.0000
My = -0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.34198		Ds = 1.10802	
Wi = 7.44181		Ws = 9.01312	
Radio Giro X-X =	0.71482	Radio Giro Y-Y=	2.60749

CALCULO LONGITUDINAL

014

CALCULO COMO VIGA CONTINUA

Los datos introducidos en el cálculo como viga contínua son:

- Definición de vanos de la estructura y estados de la misma.
- Hipótesis de cargas actuantes.
- Características de los materiales empleados.
- Características geométricas de las secciones en que se divide el tablero.
- Definición del pretensado (se introduce el cable medio).

A partir de estos datos se obtiene:

- Esfuerzos en las secciones de la viga para las distintas hipótesis de carga consideradas.
- Definición del pretensado, acciones unitarias de los cables y esfuerzos de pretensado
- Reacciones en las distintas hipótesis de cargas
- Tensiones ponderadas en los distintos estados de la estructura.
- Cálculo a cortante
- Comprobación a rotura

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Programa general de puentes continuos (V1-0)
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Proyecto : ZARAGOZA-LERIDA. T-1. E-4
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Definicion geometrica de vanos

	Longitud
Vano 1	27.0000 m
Vano 2	33.0000 m
Vano 3	33.0000 m
Vano 4	33.0000 m
Vano 5	27.0000 m

Definicion de cargas

Cargas muertas (t.I) ..... = 0.780 t/m2
Cargas muertas (t.II)..... = 0.000 t/m

Sobrecarga repartida ..... = 0.000 t/m2

Tanque :

	Coeficientes de excentricidad			
	Flexion		Cortante	
	C.Vano	Apoyos	C.Vano	Apoyos
Vano 1	1.00	1.00	1.00	1.00
Vano 2	1.00	1.00	1.00	1.00
Vano 3	1.00	1.00	1.00	1.00
Vano 4	1.00	1.00	1.00	1.00
Vano 5	1.00	1.00	1.00	1.00

Ancho de aceras 1.300 m
Coef. de impacto para tren de RENFE 1.240
Coef. de impacto para tren de U.I.C. 1.060
Numero de vias 2

Temperatura :

Coef. de dilatacion termica de 1E-04
Gradiente lineal termico de ..... 5.000 grad

Caracteristicas de los materiales

Resistencia caracteristica del hormigon ..... = 350.00 kg/cm2
Densidad del hormigon ..... = 2.50 t/m3

Modulo de elasticidad del acero de pretensar .. = 19000.00 kg/mm2
Tension de rotura de los cables ..... = 190.00 kg/mm2
Porcentaje a que se tesan los cables ..... = 75./80 %

Retraccion del hormigon ..... = 0.00025
Coeficiente de relajacion del acero ..... = 0.06000
Coeficiente de fluencia del hormigon ..... = 2.50000

Coef. de ponderacion maximo del pretensado .... = 1.1000
Coef. de ponderacion minimo del pretensado .... = 0.9000
Coef. de perdidas finales en estado inicial ... = 0.3000

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
1	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.700	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.400	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.100	0.951	1.499	2.45	8.84	6.8280	13.70
	5	10.800	0.951	1.499	2.45	8.84	6.8280	13.70
	6	13.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	16.200	0.951	1.499	2.45	8.84	6.8280	13.70
	8	18.900	0.951	1.499	2.45	8.84	6.8280	13.70
	9	21.600	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.300	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70
2	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
3	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
4	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
5	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	4.125	0.951	1.499	2.45	8.84	6.8280	13.70

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
	3	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	4	10.594	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.938	0.951	1.499	2.45	8.84	6.8280	13.70
	6	15.282	0.951	1.499	2.45	8.84	6.8280	13.70
	7	17.626	0.951	1.499	2.45	8.84	6.8280	13.70
	8	19.970	0.951	1.499	2.45	8.84	6.8280	13.70
	9	22.314	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.658	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70

Definicion de estados de la estructura

	Numero de secciones	Numero de secciones activas
Estado 1	14	de 1 a 14
Estado 2	24	de 14 a 24
Estado 3	34	de 24 a 34
Estado 4	43	de 34 a 43
Estado 5	51	de 43 a 51

Cable Numero 1 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Cable Numero 2 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Cable Numero 3 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Cable Numero 4 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Cable Numero 5 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Cable Numero 6 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Cable Numero 7 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Cable Numero 8 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Cable Numero 9 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Cable Numero 10 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Cable Numero 11 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Cable Numero 12 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Cable Numero 13 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Cable Numero 14 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Cable Numero 15 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Cable Numero 16 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Cable Numero 17 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Cable Numero 18 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Cable Numero 19 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Cable Numero 20 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Cable Fase Final Numero 1

Definicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Cable Fase Final Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Cable Fase Final Numero 3

Definicion general

Seccion inicial ..... = 33 (98.750) Activa
Seccion final ..... = 39 (120.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Esfuerzos acumulados por peso propio

Estado 1

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-270.58	0.00	0.00	0.00
	2	650.00	-210.90	0.00	9.05	-14.27
	3	1138.83	-151.21	0.00	15.86	-25.00
	4	1466.51	-91.51	0.00	20.43	-32.20
	5	1633.02	-31.82	0.00	22.74	-35.85
	6	1638.37	27.86	0.00	22.82	-35.97
	7	1482.55	87.56	0.00	20.65	-32.55
	8	1165.57	147.24	0.00	16.23	-25.59
	9	687.43	206.93	0.00	9.57	-15.09
	10	48.13	266.63	0.00	0.67	-1.06
	11	-752.34	326.32	0.00	-10.48	16.52
2	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 2

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-228.68	0.00	0.00	0.00
	2	536.85	-168.99	0.00	7.48	-11.79
	3	912.54	-109.30	0.00	12.71	-20.03
	4	1127.07	-49.61	0.00	15.70	-24.74
	5	1180.44	10.08	0.00	16.44	-25.91
	6	1072.64	69.77	0.00	14.94	-23.55
	7	803.68	129.46	0.00	11.19	-17.64
	8	373.55	189.15	0.00	5.20	-8.20
	9	-217.73	248.84	0.00	-3.03	4.78
	10	-970.18	308.53	0.00	-13.51	21.30
	11	-1883.80	368.22	0.00	-26.24	41.36
2	1	-1883.80	-399.06	0.00	-26.24	41.36
	2	-827.87	-335.50	0.00	-11.53	18.17
	3	45.33	-271.94	0.00	0.63	-1.00
	4	656.10	-216.67	0.00	9.14	-14.40
	5	1361.79	-125.48	0.00	18.97	-29.90
	6	1691.30	-34.29	0.00	23.56	-37.13
	7	1644.65	56.91	0.00	22.91	-36.11
	8	1221.82	148.10	0.00	17.02	-26.82
	9	782.49	203.37	0.00	10.90	-17.18
	10	106.44	266.93	0.00	1.48	-2.34
	11	-752.34	330.49	0.00	-10.48	16.52
3	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 3

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-239.93	0.00	0.00	0.00
	2	567.23	-180.24	0.00	7.90	-12.45
	3	973.29	-120.55	0.00	13.56	-21.37
	4	1218.20	-60.86	0.00	16.97	-26.74
	5	1301.93	-1.17	0.00	18.13	-28.58
	6	1224.51	58.52	0.00	17.05	-26.88
	7	985.92	118.21	0.00	13.73	-21.64
	8	586.17	177.90	0.00	8.16	-12.87
	9	25.26	237.59	0.00	0.35	-0.55
	10	-696.81	297.28	0.00	-9.71	15.30
	11	-1580.05	356.97	0.00	-22.01	34.69
2	1	-1580.05	-356.39	0.00	-22.01	34.69
	2	-646.82	-292.83	0.00	-9.01	14.20
	3	103.69	-229.27	0.00	1.44	-2.28
	4	607.77	-174.00	0.00	8.47	-13.34
	5	1137.43	-82.80	0.00	15.84	-24.97
	6	1290.91	8.39	0.00	17.98	-28.34
	7	1068.22	99.58	0.00	14.88	-23.45
	8	469.36	190.77	0.00	6.54	-10.30
	9	-76.66	246.04	0.00	-1.07	1.68
	10	-875.40	309.60	0.00	-12.19	19.22
	11	-1856.88	373.16	0.00	-25.86	40.77
3	1	-1856.88	-398.24	0.00	-25.86	40.77
	2	-803.29	-334.68	0.00	-11.19	17.64
	3	67.56	-271.13	0.00	0.94	-1.48
	4	676.29	-215.86	0.00	9.42	-14.85
	5	1378.61	-124.66	0.00	19.20	-30.27
	6	1704.77	-33.47	0.00	23.74	-37.43
	7	1654.75	57.72	0.00	23.05	-36.33
	8	1228.56	148.92	0.00	17.11	-26.97
	9	787.18	204.18	0.00	10.96	-17.28
	10	108.78	267.74	0.00	1.52	-2.39
	11	-752.34	331.30	0.00	-10.48	16.52
4	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-236.91	0.00	0.00	0.00
	2	559.09	-177.22	0.00	7.79	-12.27
	3	957.01	-117.53	0.00	13.33	-21.01
	4	1193.78	-57.84	0.00	16.63	-26.21
	5	1269.37	1.85	0.00	17.68	-27.87
	6	1183.81	61.54	0.00	16.49	-25.99
	7	937.08	121.23	0.00	13.05	-20.57
	8	529.19	180.92	0.00	7.37	-11.62
	9	-39.86	240.61	0.00	-0.56	0.87
	10	-770.07	300.30	0.00	-10.73	16.91
	11	-1661.45	359.99	0.00	-23.14	36.48
2	1	-1661.45	-367.82	0.00	-23.14	36.48
	2	-695.34	-304.26	0.00	-9.68	15.27
	3	88.05	-240.70	0.00	1.23	-1.93
	4	620.72	-185.43	0.00	8.65	-13.63
	5	1197.55	-94.24	0.00	16.68	-26.29
	6	1398.21	-3.05	0.00	19.47	-30.70
	7	1222.69	88.15	0.00	17.03	-26.84
	8	671.01	179.34	0.00	9.35	-14.73
	9	153.58	234.61	0.00	2.14	-3.37
	10	-612.28	298.17	0.00	-8.53	13.44
	11	-1560.88	361.73	0.00	-21.74	34.27
3	1	-1560.88	-355.86	0.00	-21.74	34.27
	2	-629.14	-292.30	0.00	-8.76	13.81
	3	119.86	-228.74	0.00	1.67	-2.63
	4	622.64	-173.47	0.00	8.67	-13.67
	5	1150.14	-82.28	0.00	16.02	-25.25
	6	1301.47	8.91	0.00	18.13	-28.57
	7	1076.62	100.10	0.00	15.00	-23.64
	8	475.61	191.30	0.00	6.62	-10.44
	9	-71.72	246.57	0.00	-1.00	1.57
	10	-871.96	310.13	0.00	-12.14	19.14
	11	-1854.94	373.68	0.00	-25.84	40.72
4	1	-1854.94	-398.18	0.00	-25.84	40.72
	2	-801.52	-334.63	0.00	-11.16	17.60
	3	69.16	-271.07	0.00	0.96	-1.52
	4	677.74	-215.80	0.00	9.44	-14.88
	5	1379.82	-124.60	0.00	19.22	-30.29
	6	1705.73	-33.41	0.00	23.76	-37.45
	7	1655.47	57.78	0.00	23.06	-36.34
	8	1229.04	148.98	0.00	17.12	-26.98
	9	787.52	204.24	0.00	10.97	-17.29
	10	108.95	267.80	0.00	1.52	-2.39
	11	-752.35	331.36	0.00	-10.48	16.52
5	1	-752.35	-182.39	0.00	-10.48	16.52

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	2	-188.09	-91.19	0.00	-2.62	4.13
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.44	0.00	0.00	0.00
	2	560.51	-177.75	0.00	7.81	-12.31
	3	959.85	-118.06	0.00	13.37	-21.07
	4	1198.03	-58.37	0.00	16.69	-26.30
	5	1275.04	1.32	0.00	17.76	-27.99
	6	1190.90	61.01	0.00	16.59	-26.14
	7	945.59	120.70	0.00	13.17	-20.76
	8	539.11	180.39	0.00	7.51	-11.84
	9	-28.52	240.08	0.00	-0.40	0.63
	10	-757.32	299.77	0.00	-10.55	16.63
	11	-1647.28	359.46	0.00	-22.94	36.16
2	1	-1647.28	-365.83	0.00	-22.94	36.16
	2	-686.89	-302.27	0.00	-9.57	15.08
	3	90.78	-238.71	0.00	1.26	-1.99
	4	618.47	-183.44	0.00	8.61	-13.58
	5	1187.08	-92.25	0.00	16.53	-26.06
	6	1379.53	-1.06	0.00	19.21	-30.29
	7	1195.80	90.14	0.00	16.66	-26.25
	8	635.90	181.33	0.00	8.86	-13.96
	9	113.49	236.60	0.00	1.58	-2.49
	10	-658.09	300.16	0.00	-9.17	14.45
	11	-1612.41	363.72	0.00	-22.46	35.40
3	1	-1612.41	-363.24	0.00	-22.46	35.40
	2	-659.46	-299.68	0.00	-9.18	14.48
	3	110.76	-236.12	0.00	1.54	-2.43
	4	631.98	-180.85	0.00	8.80	-13.87
	5	1189.92	-89.66	0.00	16.57	-26.12
	6	1371.68	1.53	0.00	19.10	-30.11
	7	1177.28	92.73	0.00	16.40	-25.85
	8	606.70	183.92	0.00	8.45	-13.32
	9	77.82	239.19	0.00	1.08	-1.71
	10	-701.21	302.75	0.00	-9.77	15.39
	11	-1662.97	366.31	0.00	-23.16	36.51
4	1	-1662.97	-370.66	0.00	-23.16	36.51
	2	-688.69	-307.10	0.00	-9.59	15.12
	3	102.86	-243.54	0.00	1.43	-2.26
	4	642.64	-188.27	0.00	8.95	-14.11
	5	1231.18	-97.08	0.00	17.15	-27.03
	6	1443.55	-5.89	0.00	20.11	-31.69
	7	1279.75	85.31	0.00	17.82	-28.10
	8	739.79	176.50	0.00	10.30	-16.24
	9	229.45	231.77	0.00	3.20	-5.04
	10	-528.24	295.33	0.00	-7.36	11.60
	11	-1468.67	358.89	0.00	-20.46	32.24
5	1	-1468.67	-352.85	0.00	-20.46	32.24
	2	-201.27	-261.65	0.00	-2.80	4.42

Esfuerzos acumulados por peso propio

Estado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	689.97	-170.46	0.00	9.61	-15.15
	4	1028.79	-118.64	0.00	14.33	-22.59
	5	1246.15	-66.82	0.00	17.36	-27.36
	6	1342.04	-15.00	0.00	18.69	-29.46
	7	1316.47	36.82	0.00	18.34	-28.90
	8	1169.43	88.64	0.00	16.29	-25.67
	9	900.92	140.46	0.00	12.55	-19.78
	10	510.95	192.28	0.00	7.12	-11.22
	11	0.00	244.06	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.44	0.00	0.00	0.00
	2	560.51	-177.75	0.00	7.81	-12.31
	3	959.85	-118.06	0.00	13.37	-21.07
	4	1198.03	-58.37	0.00	16.69	-26.30
	5	1275.04	1.32	0.00	17.76	-27.99
	6	1190.90	61.01	0.00	16.59	-26.14
	7	945.59	120.70	0.00	13.17	-20.76
	8	539.11	180.39	0.00	7.51	-11.84
	9	-28.52	240.08	0.00	-0.40	0.63
	10	-757.32	299.77	0.00	-10.55	16.63
	11	-1647.28	359.46	0.00	-22.94	36.16
2	1	-1647.28	-365.83	0.00	-22.94	36.16
	2	-686.89	-302.27	0.00	-9.57	15.08
	3	90.78	-238.71	0.00	1.26	-1.99
	4	618.47	-183.44	0.00	8.61	-13.58
	5	1187.08	-92.25	0.00	16.53	-26.06
	6	1379.53	-1.06	0.00	19.21	-30.29
	7	1195.80	90.14	0.00	16.66	-26.25
	8	635.90	181.33	0.00	8.86	-13.96
	9	113.49	236.60	0.00	1.58	-2.49
	10	-658.09	300.16	0.00	-9.17	14.45
	11	-1612.41	363.72	0.00	-22.46	35.40
3	1	-1612.41	-363.24	0.00	-22.46	35.40
	2	-659.46	-299.68	0.00	-9.18	14.48
	3	110.76	-236.12	0.00	1.54	-2.43
	4	631.98	-180.85	0.00	8.80	-13.87
	5	1189.92	-89.66	0.00	16.57	-26.12
	6	1371.68	1.53	0.00	19.10	-30.11
	7	1177.28	92.73	0.00	16.40	-25.85
	8	606.70	183.92	0.00	8.45	-13.32
	9	77.82	239.19	0.00	1.08	-1.71
	10	-701.21	302.75	0.00	-9.77	15.39
	11	-1662.97	366.31	0.00	-23.16	36.51
4	1	-1662.97	-370.66	0.00	-23.16	36.51
	2	-688.69	-307.10	0.00	-9.59	15.12
	3	102.86	-243.54	0.00	1.43	-2.26
	4	642.64	-188.27	0.00	8.95	-14.11
	5	1231.18	-97.08	0.00	17.15	-27.03
	6	1443.55	-5.89	0.00	20.11	-31.69
	7	1279.75	85.31	0.00	17.82	-28.10
	8	739.79	176.50	0.00	10.30	-16.24
	9	229.45	231.77	0.00	3.20	-5.04
	10	-528.24	295.33	0.00	-7.36	11.60
	11	-1468.67	358.89	0.00	-20.46	32.24
5	1	-1468.67	-352.85	0.00	-20.46	32.24
	2	-201.27	-261.65	0.00	-2.80	4.42

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	689.97	-170.46	0.00	9.61	-15.15
	4	1028.79	-118.64	0.00	14.33	-22.59
	5	1246.15	-66.82	0.00	17.36	-27.36
	6	1342.04	-15.00	0.00	18.69	-29.46
	7	1316.47	36.82	0.00	18.34	-28.90
	8	1169.43	88.64	0.00	16.29	-25.67
	9	900.92	140.46	0.00	12.55	-19.78
	10	510.95	192.28	0.00	7.12	-11.22
	11	0.00	244.06	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-225.10	0.00	0.00	0.00
	2	527.19	-165.41	0.00	7.34	-11.57
	3	893.22	-105.72	0.00	12.44	-19.61
	4	1098.09	-46.03	0.00	15.29	-24.11
	5	1141.79	13.66	0.00	15.90	-25.07
	6	1024.34	73.35	0.00	14.27	-22.49
	7	745.71	133.04	0.00	10.39	-16.37
	8	305.93	192.73	0.00	4.26	-6.72
	9	-295.02	252.42	0.00	-4.11	6.48
	10	-1057.13	312.11	0.00	-14.72	23.21
	11	-1980.40	371.80	0.00	-27.58	43.48
2	1	-1980.40	-364.99	0.00	-27.58	43.48
	2	-1022.42	-301.43	0.00	-14.24	22.45
	3	-247.17	-237.87	0.00	-3.44	5.43
	4	278.43	-182.60	0.00	3.88	-6.11
	5	843.59	-91.41	0.00	11.75	-18.52
	6	1032.57	-0.22	0.00	14.38	-22.67
	7	845.39	90.97	0.00	11.77	-18.56
	8	282.03	182.17	0.00	3.93	-6.19
	9	-242.47	237.44	0.00	-3.38	5.32
	10	-1016.47	301.00	0.00	-14.16	22.32
	11	-1973.20	364.56	0.00	-27.48	43.32
3	1	-1973.20	-364.65	0.00	-27.48	43.32
	2	-1016.20	-301.09	0.00	-14.15	22.31
	3	-241.94	-237.53	0.00	-3.37	5.31
	4	282.80	-182.26	0.00	3.94	-6.21
	5	846.53	-91.07	0.00	11.79	-18.58
	6	1034.10	0.13	0.00	14.40	-22.70
	7	845.50	91.32	0.00	11.78	-18.56
	8	280.72	182.51	0.00	3.91	-6.16
	9	-244.64	237.78	0.00	-3.41	5.37
	10	-1019.63	301.34	0.00	-14.20	22.38
	11	-1977.35	364.90	0.00	-27.54	43.41
4	1	-1977.35	-365.13	0.00	-27.54	43.41
	2	-1018.98	-301.57	0.00	-14.19	22.37
	3	-243.35	-238.01	0.00	-3.39	5.34
	4	282.59	-182.74	0.00	3.94	-6.20
	5	848.29	-91.54	0.00	11.81	-18.62
	6	1037.83	-0.35	0.00	14.45	-22.78
	7	851.19	90.84	0.00	11.86	-18.69
	8	288.39	182.03	0.00	4.02	-6.33
	9	-235.79	237.30	0.00	-3.28	5.18
	10	-1009.40	300.86	0.00	-14.06	22.16
	11	-1965.75	364.42	0.00	-27.38	43.16
5	1	-1965.75	-371.26	0.00	-27.38	43.16
	2	-622.40	-280.06	0.00	-8.67	13.66

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	344.78	-188.87	0.00	4.80	-7.57
	4	726.75	-137.05	0.00	10.12	-15.95
	5	987.26	-85.23	0.00	13.75	-21.67
	6	1126.31	-33.41	0.00	15.69	-24.73
	7	1143.89	18.41	0.00	15.93	-25.11
	8	1040.00	70.23	0.00	14.49	-22.83
	9	814.65	122.05	0.00	11.35	-17.88
	10	467.83	173.87	0.00	6.52	-10.27
	11	0.00	225.65	0.00	0.00	0.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-108.27	0.00	0.00	0.00
	2	253.39	-79.42	0.00	3.53	-5.56
	3	428.87	-50.57	0.00	5.97	-9.42
	4	526.46	-21.72	0.00	7.33	-11.56
	5	546.14	7.14	0.00	7.61	-11.99
	6	487.92	35.99	0.00	6.80	-10.71
	7	351.81	64.84	0.00	4.90	-7.72
	8	137.79	93.69	0.00	1.92	-3.03
	9	-154.13	122.54	0.00	-2.15	3.38
	10	-523.94	151.39	0.00	-7.30	11.50
	11	-971.66	180.25	0.00	-13.53	21.33
2	1	-971.66	-176.39	0.00	-13.53	21.33
	2	-508.71	-145.67	0.00	-7.09	11.17
	3	-134.08	-114.94	0.00	-1.87	2.94
	4	119.89	-88.23	0.00	1.67	-2.63
	5	392.92	-44.15	0.00	5.47	-8.63
	6	484.12	-0.07	0.00	6.74	-10.63
	7	393.49	44.01	0.00	5.48	-8.64
	8	121.03	88.09	0.00	1.69	-2.66
	9	-132.59	114.81	0.00	-1.85	2.91
	10	-506.82	145.53	0.00	-7.06	11.13
	11	-969.38	176.25	0.00	-13.50	21.28
3	1	-969.38	-176.32	0.00	-13.50	21.28
	2	-506.62	-145.60	0.00	-7.06	11.12
	3	-132.19	-114.88	0.00	-1.84	2.90
	4	121.60	-88.16	0.00	1.69	-2.67
	5	394.35	-44.08	0.00	5.49	-8.66
	6	485.26	0.00	0.00	6.76	-10.65
	7	394.35	44.08	0.00	5.49	-8.66
	8	121.60	88.16	0.00	1.69	-2.67
	9	-132.19	114.88	0.00	-1.84	2.90
	10	-506.62	145.60	0.00	-7.06	11.12
	11	-969.38	176.32	0.00	-13.50	21.28
4	1	-969.38	-176.25	0.00	-13.50	21.28
	2	-506.82	-145.53	0.00	-7.06	11.13
	3	-132.59	-114.81	0.00	-1.85	2.91
	4	121.03	-88.09	0.00	1.69	-2.66
	5	393.49	-44.01	0.00	5.48	-8.64
	6	484.12	0.07	0.00	6.74	-10.63
	7	392.92	44.15	0.00	5.47	-8.63
	8	119.88	88.23	0.00	1.67	-2.63
	9	-134.08	114.94	0.00	-1.87	2.94
	10	-508.71	145.67	0.00	-7.09	11.17
	11	-971.66	176.39	0.00	-13.53	21.33
5	1	-971.66	-180.25	0.00	-13.53	21.33
	2	-319.05	-136.17	0.00	-4.44	7.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	151.73	-92.09	0.00	2.11	-3.33
	4	338.23	-67.04	0.00	4.71	-7.43
	5	466.02	-41.99	0.00	6.49	-10.23
	6	535.09	-16.94	0.00	7.45	-11.75
	7	545.46	8.10	0.00	7.60	-11.97
	8	497.11	33.15	0.00	6.92	-10.91
	9	390.04	58.20	0.00	5.43	-8.56
	10	224.27	83.25	0.00	3.12	-4.92
	11	0.00	108.27	0.00	0.00	0.00

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-22.56	0.00	0.00	0.00
	2	60.90	-22.56	0.00	0.85	-1.34
	3	121.81	-22.56	0.00	1.70	-2.67
	4	182.72	-22.56	0.00	2.54	-4.01
	5	243.62	-22.56	0.00	3.39	-5.35
	6	304.53	-22.56	0.00	4.24	-6.69
	7	365.43	-22.56	0.00	5.09	-8.02
	8	426.34	-22.56	0.00	5.94	-9.36
	9	487.24	-22.56	0.00	6.79	-10.70
	10	548.15	-22.56	0.00	7.63	-12.03
	11	609.05	-22.56	0.00	8.48	-13.37
2	1	609.05	4.24	0.00	8.48	-13.37
	2	596.85	4.24	0.00	8.31	-13.10
	3	584.65	4.24	0.00	8.14	-12.84
	4	574.04	4.24	0.00	8.00	-12.60
	5	556.53	4.24	0.00	7.75	-12.22
	6	539.02	4.24	0.00	7.51	-11.83
	7	521.51	4.24	0.00	7.26	-11.45
	8	504.01	4.24	0.00	7.02	-11.06
	9	493.39	4.24	0.00	6.87	-10.83
	10	481.19	4.24	0.00	6.70	-10.56
	11	468.99	4.24	0.00	6.53	-10.30
3	1	468.99	0.00	0.00	6.53	-10.30
	2	468.98	0.00	0.00	6.53	-10.30
	3	468.97	0.00	0.00	6.53	-10.30
	4	468.97	0.00	0.00	6.53	-10.30
	5	468.95	0.00	0.00	6.53	-10.30
	6	468.94	0.00	0.00	6.53	-10.29
	7	468.93	0.00	0.00	6.53	-10.29
	8	468.92	0.00	0.00	6.53	-10.29
	9	468.91	0.00	0.00	6.53	-10.29
	10	468.90	0.00	0.00	6.53	-10.29
	11	468.89	0.00	0.00	6.53	-10.29
4	1	468.89	-4.26	0.00	6.53	-10.29
	2	481.13	-4.26	0.00	6.70	-10.56
	3	493.37	-4.26	0.00	6.87	-10.83
	4	504.01	-4.26	0.00	7.02	-11.06
	5	521.56	-4.26	0.00	7.26	-11.45
	6	539.12	-4.26	0.00	7.51	-11.84
	7	556.67	-4.26	0.00	7.75	-12.22
	8	574.23	-4.26	0.00	8.00	-12.61
	9	584.87	-4.26	0.00	8.15	-12.84
	10	597.10	-4.26	0.00	8.32	-13.11
	11	609.34	-4.26	0.00	8.49	-13.38
5	1	609.34	22.57	0.00	8.49	-13.38
	2	516.25	22.57	0.00	7.19	-11.33

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	423.15	22.57	0.00	5.89	-9.29
	4	370.25	22.57	0.00	5.16	-8.13
	5	317.35	22.57	0.00	4.42	-6.97
	6	264.45	22.57	0.00	3.68	-5.81
	7	211.55	22.57	0.00	2.95	-4.64
	8	158.65	22.57	0.00	2.21	-3.48
	9	105.75	22.57	0.00	1.47	-2.32
	10	52.85	22.57	0.00	0.74	-1.16
	11	0.00	22.57	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.94	0.00	0.00	0.00	0.00
		Q(-)	-370.55	0.00	0.00	0.00	0.00
	2	Q(+)	68.94	-186.14	0.00	2.59	-4.09
		Q(-)	-288.46	889.66	0.00	-12.39	19.53
	3	Q(+)	68.94	-372.27	0.00	5.19	-8.17
		Q(-)	-206.37	1557.67	0.00	-21.70	34.20
	4	Q(+)	68.94	-558.41	0.00	7.78	-12.26
		Q(-)	-124.27	2004.03	0.00	-27.91	44.00
	5	Q(+)	68.94	-744.55	0.00	10.37	-16.35
		Q(-)	-42.18	2228.73	0.00	-31.04	48.93
	6	Q(+)	108.04	1312.02	0.00	-18.27	28.80
		Q(-)	-18.25	246.35	0.00	-3.43	5.41
	7	Q(+)	190.14	909.48	0.00	-12.67	19.97
		Q(-)	-18.25	295.63	0.00	-4.12	6.49
	8	Q(+)	272.23	285.28	0.00	-3.97	6.26
		Q(-)	-18.25	344.89	0.00	-4.80	7.57
	9	Q(+)	354.32	-560.57	0.00	7.81	-12.31
		Q(-)	-18.25	394.17	0.00	-5.49	8.65
	10	Q(+)	436.42	-1628.07	0.00	22.68	-35.74
		Q(-)	-18.25	443.44	0.00	-6.18	9.74
	11	Q(+)	518.51	-2917.23	0.00	40.63	-64.04
		Q(-)	-18.25	492.71	0.00	-6.86	10.82
2	1	Q(+)	69.22	492.71	0.00	-6.86	10.82
		Q(-)	-543.94	-2904.66	0.00	40.46	-63.77
	2	Q(+)	69.22	293.69	0.00	-4.09	6.45
		Q(-)	-459.29	-1489.31	0.00	20.74	-32.70
	3	Q(+)	69.22	94.67	0.00	-1.32	2.08
		Q(-)	-372.50	-292.98	0.00	4.08	-6.43
	4	Q(+)	69.22	-78.39	0.00	1.09	-1.72
		Q(-)	-296.49	543.25	0.00	-7.57	11.93
	5	Q(+)	69.22	-363.94	0.00	5.07	-7.99
		Q(-)	-171.07	1507.58	0.00	-21.00	33.10
	6	Q(+)	69.22	-649.48	0.00	9.05	-14.26
		Q(-)	-62.55	1578.56	0.00	-21.99	34.66
	7	Q(+)	182.30	1326.50	0.00	-18.48	29.12
		Q(-)	-51.72	-279.30	0.00	3.89	-6.13
	8	Q(+)	307.72	315.85	0.00	-4.40	6.93
		Q(-)	-51.72	-65.97	0.00	0.92	-1.45
	9	Q(+)	383.73	-548.46	0.00	7.64	-12.04
		Q(-)	-51.72	63.32	0.00	-0.88	1.39
	10	Q(+)	470.52	-1777.49	0.00	24.76	-39.02
		Q(-)	-51.72	212.01	0.00	-2.95	4.65
	11	Q(+)	553.60	-3182.71	0.00	44.33	-69.87
		Q(-)	-51.72	360.70	0.00	-5.02	7.92
3	1	Q(+)	66.61	465.25	0.00	-6.48	10.21
		Q(-)	-554.64	-3184.80	0.00	44.36	-69.92
	2	Q(+)	66.61	273.73	0.00	-3.81	6.01
		Q(-)	-468.84	-1712.28	0.00	23.85	-37.59

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	66.61	82.21	0.00	-1.15	1.80
		Q(-)	-382.05	-488.49	0.00	6.80	-10.72
	4	Q(+)	66.61	-84.33	0.00	1.17	-1.85
		Q(-)	-306.04	371.62	0.00	-5.18	8.16
	5	Q(+)	66.61	-359.12	0.00	5.00	-7.88
		Q(-)	-180.62	1375.34	0.00	-19.16	30.19
	6	Q(+)	72.51	1424.80	0.00	-19.84	31.28
		Q(-)	-72.68	1423.21	0.00	-19.82	31.24
	7	Q(+)	180.61	1375.49	0.00	-19.16	30.20
		Q(-)	-66.61	-359.10	0.00	5.00	-7.88
	8	Q(+)	306.03	371.81	0.00	-5.18	8.16
		Q(-)	-66.61	-84.33	0.00	1.17	-1.85
	9	Q(+)	382.04	-488.27	0.00	6.80	-10.72
		Q(-)	-66.61	82.21	0.00	-1.14	1.80
	10	Q(+)	468.83	-1712.43	0.00	23.85	-37.59
		Q(-)	-66.61	273.72	0.00	-3.81	6.01
	11	Q(+)	554.64	-3184.80	0.00	44.36	-69.92
		Q(-)	-66.61	465.23	0.00	-6.48	10.21
4	1	Q(+)	51.72	360.70	0.00	-5.02	7.92
		Q(-)	-553.60	-3182.71	0.00	44.33	-69.87
	2	Q(+)	51.72	212.01	0.00	-2.95	4.65
		Q(-)	-470.53	-1777.34	0.00	24.75	-39.02
	3	Q(+)	51.72	63.32	0.00	-0.88	1.39
		Q(-)	-383.74	-548.68	0.00	7.64	-12.05
	4	Q(+)	51.72	-65.97	0.00	0.92	-1.45
		Q(-)	-307.73	315.65	0.00	-4.40	6.93
	5	Q(+)	51.72	-279.30	0.00	3.89	-6.13
		Q(-)	-182.31	1326.35	0.00	-18.47	29.12
	6	Q(+)	62.55	1578.56	0.00	-21.99	34.66
		Q(-)	-69.22	-649.46	0.00	9.05	-14.26
	7	Q(+)	171.06	1507.73	0.00	-21.00	33.10
		Q(-)	-69.22	-363.92	0.00	5.07	-7.99
	8	Q(+)	296.48	543.45	0.00	-7.57	11.93
		Q(-)	-69.22	-78.39	0.00	1.09	-1.72
	9	Q(+)	372.49	-292.76	0.00	4.08	-6.43
		Q(-)	-69.22	94.67	0.00	-1.32	2.08
	10	Q(+)	459.28	-1489.47	0.00	20.75	-32.70
		Q(-)	-69.22	293.68	0.00	-4.09	6.45
	11	Q(+)	543.94	-2904.66	0.00	40.46	-63.77
		Q(-)	-69.22	492.69	0.00	-6.86	10.82
5	1	Q(+)	18.25	492.69	0.00	-6.86	10.82
		Q(-)	-518.51	-2917.23	0.00	40.63	-64.04
	2	Q(+)	18.25	417.42	0.00	-5.81	9.16
		Q(-)	-393.09	-1037.05	0.00	14.44	-22.77
	3	Q(+)	18.25	342.14	0.00	-4.77	7.51
		Q(-)	-267.67	325.77	0.00	-4.54	7.15
	4	Q(+)	18.25	299.37	0.00	-4.17	6.57
		Q(-)	-196.40	869.66	0.00	-12.11	19.09
	5	Q(+)	18.25	256.60	0.00	-3.57	5.63
		Q(-)	-125.13	1246.50	0.00	-17.36	27.37

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Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	18.25	213.83	0.00	-2.98	4.69
		Q(-)	-68.94	-807.81	0.00	11.25	-17.73
	7	Q(+)	85.54	2137.68	0.00	-29.77	46.93
		Q(-)	-68.94	-646.22	0.00	9.00	-14.19
	8	Q(+)	156.80	1853.65	0.00	-25.82	40.69
		Q(-)	-68.94	-484.63	0.00	6.75	-10.64
	9	Q(+)	228.07	1402.57	0.00	-19.53	30.79
		Q(-)	-68.94	-323.04	0.00	4.50	-7.09
	10	Q(+)	299.34	784.44	0.00	-10.93	17.22
		Q(-)	-68.94	-161.45	0.00	2.25	-3.54
	11	Q(+)	370.55	0.00	0.00	0.00	0.00
		Q(-)	-68.94	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-370.55	0.00	0.00	0.00
		M(-)	0.00	68.94	0.00	0.00	0.00
	2	M(+)	889.66	-288.46	0.00	12.39	-19.53
		M(-)	-186.14	68.94	0.00	-2.59	4.09
	3	M(+)	1557.67	-206.37	0.00	21.70	-34.20
		M(-)	-372.27	68.94	0.00	-5.19	8.17
	4	M(+)	2004.03	-124.27	0.00	27.91	-44.00
		M(-)	-558.41	68.94	0.00	-7.78	12.26
	5	M(+)	2228.73	-42.18	0.00	31.04	-48.93
		M(-)	-744.55	68.94	0.00	-10.37	16.35
	6	M(+)	2231.79	39.91	0.00	31.08	-49.00
		M(-)	-930.69	68.94	0.00	-12.96	20.43
	7	M(+)	2013.19	122.01	0.00	28.04	-44.20
		M(-)	-1116.83	68.94	0.00	-15.56	24.52
	8	M(+)	1572.95	204.10	0.00	21.91	-34.53
		M(-)	-1302.96	68.94	0.00	-18.15	28.60
	9	M(+)	911.05	286.19	0.00	12.69	-20.00
		M(-)	-1489.10	68.94	0.00	-20.74	32.69
	10	M(+)	443.44	-18.25	0.00	6.18	-9.74
		M(-)	-1788.73	382.76	0.00	-24.91	39.27
	11	M(+)	492.71	-18.25	0.00	6.86	-10.82
		M(-)	-2917.23	518.51	0.00	-40.63	64.04
2	1	M(+)	492.71	69.22	0.00	6.86	-10.82
		M(-)	-2917.23	-482.39	0.00	-40.63	64.04
	2	M(+)	293.69	69.22	0.00	4.09	-6.45
		M(-)	-1635.51	-409.24	0.00	-22.78	35.91
	3	M(+)	674.41	-269.97	0.00	9.39	-14.81
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1330.83	-261.51	0.00	18.54	-29.22
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2150.89	-136.09	0.00	29.96	-47.22
		M(-)	-840.84	-3.80	0.00	-11.71	18.46
	6	M(+)	2453.60	-10.67	0.00	34.17	-53.87
		M(-)	-850.26	23.86	0.00	-11.84	18.67
	7	M(+)	2241.19	113.40	0.00	31.22	-49.20
		M(-)	-969.78	34.09	0.00	-13.51	21.29
	8	M(+)	1514.72	238.82	0.00	21.10	-33.25
		M(-)	-1220.58	69.22	0.00	-17.00	26.80
	9	M(+)	822.65	314.84	0.00	11.46	-18.06
		M(-)	-1393.64	69.22	0.00	-19.41	30.60
	10	M(+)	413.57	-17.98	0.00	5.76	-9.08
		M(-)	-1895.12	412.01	0.00	-26.40	41.60
	11	M(+)	465.25	-17.98	0.00	6.48	-10.21
		M(-)	-3239.66	549.78	0.00	-45.12	71.12
3	1	M(+)	465.25	66.61	0.00	6.48	-10.21
		M(-)	-3239.66	-492.52	0.00	-45.12	71.12
	2	M(+)	320.84	13.86	0.00	4.47	-7.04
		M(-)	-1928.82	-419.36	0.00	-26.86	42.34

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.23	-320.12	0.00	10.45	-16.47
		M(-)	-1349.97	-66.61	0.00	-18.80	29.64
	4	M(+)	1455.51	-244.10	0.00	20.27	-31.95
		M(-)	-1183.44	-66.61	0.00	-16.48	25.98
	5	M(+)	2205.77	-119.74	0.00	30.72	-48.42
		M(-)	-1028.76	-22.03	0.00	-14.33	22.59
	6	M(+)	2441.12	-5.69	0.00	34.00	-53.59
		M(-)	-958.99	-11.80	0.00	-13.36	21.05
	7	M(+)	2208.07	118.37	0.00	30.75	-48.48
		M(-)	-1026.47	21.86	0.00	-14.30	22.53
	8	M(+)	1461.13	243.79	0.00	20.35	-32.08
		M(-)	-1183.48	66.61	0.00	-16.48	25.98
	9	M(+)	756.64	319.80	0.00	10.54	-16.61
		M(-)	-1350.02	66.61	0.00	-18.80	29.64
	10	M(+)	320.84	-13.86	0.00	4.47	-7.04
		M(-)	-1924.94	419.20	0.00	-26.81	42.26
	11	M(+)	465.23	-66.61	0.00	6.48	-10.21
		M(-)	-3235.29	492.35	0.00	-45.06	71.03
4	1	M(+)	465.23	17.98	0.00	6.48	-10.21
		M(-)	-3235.29	-543.69	0.00	-45.06	71.03
	2	M(+)	413.55	17.98	0.00	5.76	-9.08
		M(-)	-1895.12	-412.01	0.00	-26.40	41.60
	3	M(+)	816.23	-315.15	0.00	11.37	-17.92
		M(-)	-1393.58	-69.22	0.00	-19.41	30.59
	4	M(+)	1509.09	-239.14	0.00	21.02	-33.13
		M(-)	-1220.53	-69.22	0.00	-17.00	26.80
	5	M(+)	2238.80	-114.76	0.00	31.18	-49.15
		M(-)	-972.01	-34.26	0.00	-13.54	21.34
	6	M(+)	2453.49	10.66	0.00	34.17	-53.86
		M(-)	-851.80	-24.02	0.00	-11.86	18.70
	7	M(+)	2150.83	136.08	0.00	29.96	-47.22
		M(-)	-840.84	3.80	0.00	-11.71	18.46
	8	M(+)	1330.81	261.50	0.00	18.54	-29.22
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	674.42	269.96	0.00	9.39	-14.81
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	293.68	-69.22	0.00	4.09	-6.45
		M(-)	-1635.51	409.24	0.00	-22.78	35.91
	11	M(+)	492.69	-69.22	0.00	6.86	-10.82
		M(-)	-2919.31	538.52	0.00	-40.66	64.09
5	1	M(+)	492.69	18.25	0.00	6.86	-10.82
		M(-)	-2919.31	-451.63	0.00	-40.66	64.09
	2	M(+)	528.65	-267.91	0.00	7.36	-11.61
		M(-)	-1576.94	-68.94	0.00	-21.96	34.62
	3	M(+)	1603.22	-199.54	0.00	22.33	-35.20
		M(-)	-1292.57	-68.94	0.00	-18.00	28.38
	4	M(+)	1987.42	-128.27	0.00	27.68	-43.63
		M(-)	-1130.98	-68.94	0.00	-15.75	24.83
	5	M(+)	2204.56	-57.00	0.00	30.70	-48.40
		M(-)	-969.40	-68.94	0.00	-13.50	21.28

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2254.64	14.27	0.00	31.40	-49.50
		M(-)	-807.81	-68.94	0.00	-11.25	17.73
	7	M(+)	2137.68	85.54	0.00	29.77	-46.93
		M(-)	-646.22	-68.94	0.00	-9.00	14.19
	8	M(+)	1853.65	156.80	0.00	25.82	-40.69
		M(-)	-484.63	-68.94	0.00	-6.75	10.64
	9	M(+)	1402.57	228.07	0.00	19.53	-30.79
		M(-)	-323.04	-68.94	0.00	-4.50	7.09
	10	M(+)	784.44	299.34	0.00	10.93	-17.22
		M(-)	-161.45	-68.94	0.00	-2.25	3.54
	11	M(+)	0.00	370.55	0.00	0.00	0.00
		M(-)	0.00	-68.94	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	47.36	0.00	0.00	0.00	0.00
		Q(-)	-243.61	0.00	0.00	0.00	0.00
	2	Q(+)	47.36	-127.86	0.00	1.78	-2.81
		Q(-)	-197.82	595.93	0.00	-8.30	13.08
	3	Q(+)	47.36	-255.73	0.00	3.56	-5.61
		Q(-)	-152.03	1068.22	0.00	-14.88	23.45
	4	Q(+)	47.36	-383.59	0.00	5.34	-8.42
		Q(-)	-106.24	1416.88	0.00	-19.73	31.11
	5	Q(+)	47.36	-511.45	0.00	7.12	-11.23
		Q(-)	-68.92	1644.01	0.00	-22.90	36.09
	6	Q(+)	75.16	530.77	0.00	-7.39	11.65
		Q(-)	-12.68	171.21	0.00	-2.38	3.76
	7	Q(+)	180.24	841.73	0.00	-11.72	18.48
		Q(-)	-12.68	205.46	0.00	-2.86	4.51
	8	Q(+)	217.55	314.04	0.00	-4.37	6.89
		Q(-)	-12.68	239.70	0.00	-3.34	5.26
	9	Q(+)	263.35	-335.17	0.00	4.67	-7.36
		Q(-)	-12.68	273.95	0.00	-3.82	6.01
	10	Q(+)	309.14	-1108.03	0.00	15.43	-24.33
		Q(-)	-12.68	308.19	0.00	-4.29	6.77
	11	Q(+)	354.93	-2004.52	0.00	27.92	-44.01
		Q(-)	-12.68	342.43	0.00	-4.77	7.52
2	1	Q(+)	48.11	342.43	0.00	-4.77	7.52
		Q(-)	-361.77	-2029.42	0.00	28.27	-44.55
	2	Q(+)	48.11	204.11	0.00	-2.84	4.48
		Q(-)	-313.01	-1059.44	0.00	14.76	-23.26
	3	Q(+)	48.11	65.80	0.00	-0.92	1.44
		Q(-)	-264.25	-229.63	0.00	3.20	-5.04
	4	Q(+)	48.11	-54.48	0.00	0.76	-1.20
		Q(-)	-221.85	377.98	0.00	-5.26	8.30
	5	Q(+)	48.11	-252.93	0.00	3.52	-5.55
		Q(-)	-151.89	1148.81	0.00	-16.00	25.22
	6	Q(+)	48.11	-451.39	0.00	6.29	-9.91
		Q(-)	-39.52	956.32	0.00	-13.32	20.99
	7	Q(+)	158.09	1043.75	0.00	-14.54	22.91
		Q(-)	-38.47	-207.73	0.00	2.89	-4.56
	8	Q(+)	228.05	247.32	0.00	-3.44	5.43
		Q(-)	-38.47	-49.06	0.00	0.68	-1.08
	9	Q(+)	270.45	-375.81	0.00	5.23	-8.25
		Q(-)	-38.47	47.10	0.00	-0.66	1.03
	10	Q(+)	319.21	-1223.46	0.00	17.04	-26.86
		Q(-)	-38.47	157.68	0.00	-2.20	3.46
	11	Q(+)	367.97	-2211.29	0.00	30.80	-48.55
		Q(-)	-38.47	268.27	0.00	-3.74	5.89
3	1	Q(+)	47.44	331.29	0.00	-4.61	7.27
		Q(-)	-368.79	-2213.69	0.00	30.83	-48.60
	2	Q(+)	47.44	194.92	0.00	-2.71	4.28
		Q(-)	-320.03	-1223.50	0.00	17.04	-26.86

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	47.44	58.54	0.00	-0.82	1.29
		Q(-)	-271.27	-373.49	0.00	5.20	-8.20
	4	Q(+)	47.44	-60.05	0.00	0.84	-1.32
		Q(-)	-228.87	251.70	0.00	-3.51	5.53
	5	Q(+)	47.44	-255.72	0.00	3.56	-5.61
		Q(-)	-158.91	1051.51	0.00	-14.65	23.08
	6	Q(+)	47.44	880.07	0.00	-12.26	19.32
		Q(-)	-47.44	880.07	0.00	-12.26	19.32
	7	Q(+)	158.91	1051.51	0.00	-14.65	23.08
		Q(-)	-47.44	-255.72	0.00	3.56	-5.61
	8	Q(+)	228.87	251.69	0.00	-3.51	5.53
		Q(-)	-47.44	-60.05	0.00	0.84	-1.32
	9	Q(+)	271.27	-373.49	0.00	5.20	-8.20
		Q(-)	-47.44	58.54	0.00	-0.82	1.29
	10	Q(+)	320.03	-1223.50	0.00	17.04	-26.86
		Q(-)	-47.44	194.92	0.00	-2.71	4.28
	11	Q(+)	368.79	-2213.69	0.00	30.83	-48.60
		Q(-)	-47.44	331.29	0.00	-4.61	7.27
4	1	Q(+)	38.47	268.27	0.00	-3.74	5.89
		Q(-)	-367.97	-2211.29	0.00	30.80	-48.55
	2	Q(+)	38.47	157.68	0.00	-2.20	3.46
		Q(-)	-319.21	-1223.46	0.00	17.04	-26.86
	3	Q(+)	38.47	47.10	0.00	-0.66	1.03
		Q(-)	-270.45	-375.81	0.00	5.23	-8.25
	4	Q(+)	38.47	-49.06	0.00	0.68	-1.08
		Q(-)	-228.05	247.32	0.00	-3.44	5.43
	5	Q(+)	38.47	-207.73	0.00	2.89	-4.56
		Q(-)	-158.09	1043.75	0.00	-14.54	22.91
	6	Q(+)	39.52	956.32	0.00	-13.32	20.99
		Q(-)	-48.11	-451.39	0.00	6.29	-9.91
	7	Q(+)	151.89	1148.81	0.00	-16.00	25.22
		Q(-)	-48.11	-252.93	0.00	3.52	-5.55
	8	Q(+)	221.85	377.98	0.00	-5.26	8.30
		Q(-)	-48.11	-54.48	0.00	0.76	-1.20
	9	Q(+)	264.25	-229.63	0.00	3.20	-5.04
		Q(-)	-48.11	65.80	0.00	-0.92	1.44
	10	Q(+)	313.01	-1059.44	0.00	14.76	-23.26
		Q(-)	-48.11	204.11	0.00	-2.84	4.48
	11	Q(+)	361.77	-2029.42	0.00	28.27	-44.55
		Q(-)	-48.11	342.43	0.00	-4.77	7.52
5	1	Q(+)	12.68	342.43	0.00	-4.77	7.52
		Q(-)	-354.93	-2004.52	0.00	27.92	-44.01
	2	Q(+)	12.68	290.12	0.00	-4.04	6.37
		Q(-)	-284.97	-684.73	0.00	9.54	-15.03
	3	Q(+)	12.68	237.80	0.00	-3.31	5.22
		Q(-)	-215.01	346.48	0.00	-4.83	7.61
	4	Q(+)	12.68	208.07	0.00	-2.90	4.57
		Q(-)	-180.24	804.60	0.00	-11.21	17.66
	5	Q(+)	12.68	178.34	0.00	-2.48	3.92
		Q(-)	-84.69	485.85	0.00	-6.77	10.67

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Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	15.92	1674.53	0.00	-23.32	36.76
		Q(-)	-47.36	-554.92	0.00	7.73	-12.18
	7	Q(+)	84.63	1538.46	0.00	-21.43	33.77
		Q(-)	-47.36	-443.92	0.00	6.18	-9.75
	8	Q(+)	124.38	1293.50	0.00	-18.02	28.40
		Q(-)	-47.36	-332.92	0.00	4.64	-7.31
	9	Q(+)	164.14	955.35	0.00	-13.31	20.97
		Q(-)	-47.36	-221.91	0.00	3.09	-4.87
	10	Q(+)	203.89	524.03	0.00	-7.30	11.50
		Q(-)	-47.36	-110.91	0.00	1.54	-2.43
	11	Q(+)	243.61	0.00	0.00	0.00	0.00
		Q(-)	-47.36	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	595.93	-197.82	0.00	8.30	-13.08
		M(-)	-127.86	47.36	0.00	-1.78	2.81
	3	M(+)	1068.22	-152.03	0.00	14.88	-23.45
		M(-)	-255.73	47.36	0.00	-3.56	5.61
	4	M(+)	1416.88	-106.24	0.00	19.73	-31.11
		M(-)	-383.59	47.36	0.00	-5.34	8.42
	5	M(+)	1644.01	-68.92	0.00	22.90	-36.09
		M(-)	-511.45	47.36	0.00	-7.12	11.23
	6	M(+)	1660.51	37.08	0.00	23.13	-36.45
		M(-)	-639.31	47.36	0.00	-8.90	14.04
	7	M(+)	1443.80	143.08	0.00	20.11	-31.70
		M(-)	-767.18	47.36	0.00	-10.69	16.84
	8	M(+)	1016.45	180.39	0.00	14.16	-22.31
		M(-)	-895.04	47.36	0.00	-12.47	19.65
	9	M(+)	467.58	226.18	0.00	6.51	-10.27
		M(-)	-1022.90	47.36	0.00	-14.25	22.46
	10	M(+)	308.19	-12.68	0.00	4.29	-6.77
		M(-)	-1270.11	258.33	0.00	-17.69	27.88
	11	M(+)	342.43	-12.68	0.00	4.77	-7.52
		M(-)	-2029.42	304.12	0.00	-28.27	44.55
2	1	M(+)	342.43	48.11	0.00	4.77	-7.52
		M(-)	-2029.42	-361.77	0.00	-28.27	44.55
	2	M(+)	204.11	48.11	0.00	2.84	-4.48
		M(-)	-1156.44	-270.60	0.00	-16.11	25.39
	3	M(+)	406.92	-197.64	0.00	5.67	-8.93
		M(-)	-779.90	-38.47	0.00	-10.86	17.12
	4	M(+)	890.78	-193.00	0.00	12.41	-19.56
		M(-)	-683.74	-38.47	0.00	-9.52	15.01
	5	M(+)	1542.60	-123.04	0.00	21.49	-33.87
		M(-)	-525.07	-38.47	0.00	-7.31	11.53
	6	M(+)	1823.08	-1.35	0.00	25.39	-40.02
		M(-)	-451.39	48.11	0.00	-6.29	9.91
	7	M(+)	1553.74	120.34	0.00	21.64	-34.11
		M(-)	-649.85	48.11	0.00	-9.05	14.27
	8	M(+)	913.05	190.30	0.00	12.72	-20.04
		M(-)	-848.30	48.11	0.00	-11.82	18.62
	9	M(+)	419.63	203.85	0.00	5.84	-9.21
		M(-)	-968.58	48.11	0.00	-13.49	21.26
	10	M(+)	294.49	-12.80	0.00	4.10	-6.47
		M(-)	-1343.97	278.13	0.00	-18.72	29.51
	11	M(+)	331.29	-12.80	0.00	4.61	-7.27
		M(-)	-2213.69	326.89	0.00	-30.83	48.60
3	1	M(+)	331.29	47.44	0.00	4.61	-7.27
		M(-)	-2213.69	-368.79	0.00	-30.83	48.60
	2	M(+)	238.63	10.31	0.00	3.32	-5.24
		M(-)	-1340.47	-278.52	0.00	-18.67	29.43

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	426.88	-196.82	0.00	5.95	-9.37
		M(-)	-961.32	-47.44	0.00	-13.39	21.10
	4	M(+)	913.05	-191.65	0.00	12.72	-20.04
		M(-)	-842.73	-47.44	0.00	-11.74	18.50
	5	M(+)	1559.31	-121.69	0.00	21.72	-34.23
		M(-)	-647.06	-47.44	0.00	-9.01	14.21
	6	M(+)	1834.22	0.00	0.00	25.55	-40.27
		M(-)	-451.39	47.44	0.00	-6.29	9.91
	7	M(+)	1559.31	121.69	0.00	21.72	-34.23
		M(-)	-647.06	47.44	0.00	-9.01	14.21
	8	M(+)	913.05	191.65	0.00	12.72	-20.04
		M(-)	-842.73	47.44	0.00	-11.74	18.50
	9	M(+)	426.88	196.82	0.00	5.95	-9.37
		M(-)	-961.32	47.44	0.00	-13.39	21.10
	10	M(+)	238.63	-10.31	0.00	3.32	-5.24
		M(-)	-1340.47	278.52	0.00	-18.67	29.43
	11	M(+)	331.29	-47.44	0.00	4.61	-7.27
		M(-)	-2213.69	368.79	0.00	-30.83	48.60
4	1	M(+)	331.29	12.80	0.00	4.61	-7.27
		M(-)	-2213.69	-326.89	0.00	-30.83	48.60
	2	M(+)	294.49	12.80	0.00	4.10	-6.47
		M(-)	-1343.97	-278.13	0.00	-18.72	29.51
	3	M(+)	419.63	-203.85	0.00	5.84	-9.21
		M(-)	-968.58	-48.11	0.00	-13.49	21.26
	4	M(+)	913.05	-190.30	0.00	12.72	-20.04
		M(-)	-848.30	-48.11	0.00	-11.82	18.62
	5	M(+)	1553.74	-120.34	0.00	21.64	-34.11
		M(-)	-649.85	-48.11	0.00	-9.05	14.27
	6	M(+)	1823.08	1.35	0.00	25.39	-40.02
		M(-)	-451.39	-48.11	0.00	-6.29	9.91
	7	M(+)	1542.60	123.04	0.00	21.49	-33.87
		M(-)	-525.07	38.47	0.00	-7.31	11.53
	8	M(+)	890.78	193.00	0.00	12.41	-19.56
		M(-)	-683.74	38.47	0.00	-9.52	15.01
	9	M(+)	406.92	197.64	0.00	5.67	-8.93
		M(-)	-779.90	38.47	0.00	-10.86	17.12
	10	M(+)	204.11	-48.11	0.00	2.84	-4.48
		M(-)	-1156.44	270.60	0.00	-16.11	25.39
	11	M(+)	342.43	-48.11	0.00	4.77	-7.52
		M(-)	-2029.42	361.77	0.00	-28.27	44.55
5	1	M(+)	342.43	12.68	0.00	4.77	-7.52
		M(-)	-2029.42	-304.12	0.00	-28.27	44.55
	2	M(+)	290.12	12.68	0.00	4.04	-6.37
		M(-)	-1083.28	-47.36	0.00	-15.09	23.78
	3	M(+)	1043.32	-177.85	0.00	14.53	-22.90
		M(-)	-887.93	-47.36	0.00	-12.37	19.49
	4	M(+)	1414.32	-143.08	0.00	19.70	-31.05
		M(-)	-776.93	-47.36	0.00	-10.82	17.06
	5	M(+)	1639.67	-37.08	0.00	22.84	-36.00
		M(-)	-665.93	-47.36	0.00	-9.28	14.62

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
6		M(+)	1674.53	15.92	0.00	23.32	-36.76
		M(-)	-554.92	-47.36	0.00	-7.73	12.18
7		M(+)	1538.46	84.63	0.00	21.43	-33.77
		M(-)	-443.92	-47.36	0.00	-6.18	9.75
8		M(+)	1293.50	124.38	0.00	18.02	-28.40
		M(-)	-332.92	-47.36	0.00	-4.64	7.31
9		M(+)	955.35	164.14	0.00	13.31	-20.97
		M(-)	-221.91	-47.36	0.00	-3.09	4.87
10		M(+)	524.03	203.89	0.00	7.30	-11.50
		M(-)	-110.91	-47.36	0.00	-1.54	2.43
11		M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.94	0.00	0.00	0.00	0.00
		Q(-)	-370.55	0.00	0.00	0.00	0.00
	2	Q(+)	68.94	-186.14	0.00	2.59	-4.09
		Q(-)	-288.46	889.66	0.00	-12.39	19.53
	3	Q(+)	68.94	-372.27	0.00	5.19	-8.17
		Q(-)	-206.37	1557.67	0.00	-21.70	34.20
	4	Q(+)	68.94	-558.41	0.00	7.78	-12.26
		Q(-)	-124.27	2004.03	0.00	-27.91	44.00
	5	Q(+)	68.94	-744.55	0.00	10.37	-16.35
		Q(-)	-68.92	1644.01	0.00	-22.90	36.09
	6	Q(+)	108.04	1312.02	0.00	-18.27	28.80
		Q(-)	-18.25	246.35	0.00	-3.43	5.41
	7	Q(+)	190.14	909.48	0.00	-12.67	19.97
		Q(-)	-18.25	295.63	0.00	-4.12	6.49
	8	Q(+)	272.23	285.28	0.00	-3.97	6.26
		Q(-)	-18.25	344.89	0.00	-4.80	7.57
	9	Q(+)	354.32	-560.57	0.00	7.81	-12.31
		Q(-)	-18.25	394.17	0.00	-5.49	8.65
	10	Q(+)	436.42	-1628.07	0.00	22.68	-35.74
		Q(-)	-18.25	443.44	0.00	-6.18	9.74
	11	Q(+)	518.51	-2917.23	0.00	40.63	-64.04
		Q(-)	-18.25	492.71	0.00	-6.86	10.82
2	1	Q(+)	69.22	492.71	0.00	-6.86	10.82
		Q(-)	-543.94	-2904.66	0.00	40.46	-63.77
	2	Q(+)	69.22	293.69	0.00	-4.09	6.45
		Q(-)	-459.29	-1489.31	0.00	20.74	-32.70
	3	Q(+)	69.22	94.67	0.00	-1.32	2.08
		Q(-)	-372.50	-292.98	0.00	4.08	-6.43
	4	Q(+)	69.22	-78.39	0.00	1.09	-1.72
		Q(-)	-296.49	543.25	0.00	-7.57	11.93
	5	Q(+)	69.22	-363.94	0.00	5.07	-7.99
		Q(-)	-171.07	1507.58	0.00	-21.00	33.10
	6	Q(+)	69.22	-649.48	0.00	9.05	-14.26
		Q(-)	-62.55	1578.56	0.00	-21.99	34.66
	7	Q(+)	182.30	1326.50	0.00	-18.48	29.12
		Q(-)	-51.72	-279.30	0.00	3.89	-6.13
	8	Q(+)	307.72	315.85	0.00	-4.40	6.93
		Q(-)	-51.72	-65.97	0.00	0.92	-1.45
	9	Q(+)	383.73	-548.46	0.00	7.64	-12.04
		Q(-)	-51.72	63.32	0.00	-0.88	1.39
	10	Q(+)	470.52	-1777.49	0.00	24.76	-39.02
		Q(-)	-51.72	212.01	0.00	-2.95	4.65
	11	Q(+)	553.60	-3182.71	0.00	44.33	-69.87
		Q(-)	-51.72	360.70	0.00	-5.02	7.92
3	1	Q(+)	66.61	465.25	0.00	-6.48	10.21
		Q(-)	-554.64	-3184.80	0.00	44.36	-69.92
	2	Q(+)	66.61	273.73	0.00	-3.81	6.01
		Q(-)	-468.84	-1712.28	0.00	23.85	-37.59

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	66.61	82.21	0.00	-1.15	1.80
		Q(-)	-382.05	-488.49	0.00	6.80	-10.72
	4	Q(+)	66.61	-84.33	0.00	1.17	-1.85
		Q(-)	-306.04	371.62	0.00	-5.18	8.16
	5	Q(+)	66.61	-359.12	0.00	5.00	-7.88
		Q(-)	-180.62	1375.34	0.00	-19.16	30.19
	6	Q(+)	72.51	1424.80	0.00	-19.84	31.28
		Q(-)	-72.68	1423.21	0.00	-19.82	31.24
	7	Q(+)	180.61	1375.49	0.00	-19.16	30.20
		Q(-)	-66.61	-359.10	0.00	5.00	-7.88
	8	Q(+)	306.03	371.81	0.00	-5.18	8.16
		Q(-)	-66.61	-84.33	0.00	1.17	-1.85
	9	Q(+)	382.04	-488.27	0.00	6.80	-10.72
		Q(-)	-66.61	82.21	0.00	-1.14	1.80
	10	Q(+)	468.83	-1712.43	0.00	23.85	-37.59
		Q(-)	-66.61	273.72	0.00	-3.81	6.01
	11	Q(+)	554.64	-3184.80	0.00	44.36	-69.92
		Q(-)	-66.61	465.23	0.00	-6.48	10.21
4	1	Q(+)	51.72	360.70	0.00	-5.02	7.92
		Q(-)	-553.60	-3182.71	0.00	44.33	-69.87
	2	Q(+)	51.72	212.01	0.00	-2.95	4.65
		Q(-)	-470.53	-1777.34	0.00	24.75	-39.02
	3	Q(+)	51.72	63.32	0.00	-0.88	1.39
		Q(-)	-383.74	-548.68	0.00	7.64	-12.05
	4	Q(+)	51.72	-65.97	0.00	0.92	-1.45
		Q(-)	-307.73	315.65	0.00	-4.40	6.93
	5	Q(+)	51.72	-279.30	0.00	3.89	-6.13
		Q(-)	-182.31	1326.35	0.00	-18.47	29.12
	6	Q(+)	62.55	1578.56	0.00	-21.99	34.66
		Q(-)	-69.22	-649.46	0.00	9.05	-14.26
	7	Q(+)	171.06	1507.73	0.00	-21.00	33.10
		Q(-)	-69.22	-363.92	0.00	5.07	-7.99
	8	Q(+)	296.48	543.45	0.00	-7.57	11.93
		Q(-)	-69.22	-78.39	0.00	1.09	-1.72
	9	Q(+)	372.49	-292.76	0.00	4.08	-6.43
		Q(-)	-69.22	94.67	0.00	-1.32	2.08
	10	Q(+)	459.28	-1489.47	0.00	20.75	-32.70
		Q(-)	-69.22	293.68	0.00	-4.09	6.45
	11	Q(+)	543.94	-2904.66	0.00	40.46	-63.77
		Q(-)	-69.22	492.69	0.00	-6.86	10.82
5	1	Q(+)	18.25	492.69	0.00	-6.86	10.82
		Q(-)	-518.51	-2917.23	0.00	40.63	-64.04
	2	Q(+)	18.25	417.42	0.00	-5.81	9.16
		Q(-)	-393.09	-1037.05	0.00	14.44	-22.77
	3	Q(+)	18.25	342.14	0.00	-4.77	7.51
		Q(-)	-267.67	325.77	0.00	-4.54	7.15
	4	Q(+)	18.25	299.37	0.00	-4.17	6.57
		Q(-)	-196.40	869.66	0.00	-12.11	19.09
	5	Q(+)	18.25	256.60	0.00	-3.57	5.63
		Q(-)	-125.13	1246.50	0.00	-17.36	27.37

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Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	18.25	213.83	0.00	-2.98	4.69
		Q(-)	-68.94	-807.81	0.00	11.25	-17.73
	7	Q(+)	85.54	2137.68	0.00	-29.77	46.93
		Q(-)	-68.94	-646.22	0.00	9.00	-14.19
	8	Q(+)	156.80	1853.65	0.00	-25.82	40.69
		Q(-)	-68.94	-484.63	0.00	6.75	-10.64
	9	Q(+)	228.07	1402.57	0.00	-19.53	30.79
		Q(-)	-68.94	-323.04	0.00	4.50	-7.09
	10	Q(+)	299.34	784.44	0.00	-10.93	17.22
		Q(-)	-68.94	-161.45	0.00	2.25	-3.54
	11	Q(+)	370.55	0.00	0.00	0.00	0.00
		Q(-)	-68.94	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	889.66	-288.46	0.00	12.39	-19.53
		M(-)	-186.14	68.94	0.00	-2.59	4.09
	3	M(+)	1557.67	-206.37	0.00	21.70	-34.20
		M(-)	-372.27	68.94	0.00	-5.19	8.17
	4	M(+)	2004.03	-124.27	0.00	27.91	-44.00
		M(-)	-558.41	68.94	0.00	-7.78	12.26
	5	M(+)	2228.73	-42.18	0.00	31.04	-48.93
		M(-)	-744.55	68.94	0.00	-10.37	16.35
	6	M(+)	2231.79	39.91	0.00	31.08	-49.00
		M(-)	-930.69	68.94	0.00	-12.96	20.43
	7	M(+)	2013.19	122.01	0.00	28.04	-44.20
		M(-)	-1116.83	68.94	0.00	-15.56	24.52
	8	M(+)	1572.95	204.10	0.00	21.91	-34.53
		M(-)	-1302.96	68.94	0.00	-18.15	28.60
	9	M(+)	911.05	286.19	0.00	12.69	-20.00
		M(-)	-1489.10	68.94	0.00	-20.74	32.69
	10	M(+)	443.44	-18.25	0.00	6.18	-9.74
		M(-)	-1788.73	382.76	0.00	-24.91	39.27
	11	M(+)	492.71	-18.25	0.00	6.86	-10.82
		M(-)	-2917.23	518.51	0.00	-40.63	64.04
2	1	M(+)	492.71	69.22	0.00	6.86	-10.82
		M(-)	-2917.23	-482.39	0.00	-40.63	64.04
	2	M(+)	293.69	69.22	0.00	4.09	-6.45
		M(-)	-1635.51	-409.24	0.00	-22.78	35.91
	3	M(+)	674.41	-269.97	0.00	9.39	-14.81
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1330.83	-261.51	0.00	18.54	-29.22
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2150.89	-136.09	0.00	29.96	-47.22
		M(-)	-840.84	-3.80	0.00	-11.71	18.46
	6	M(+)	2453.60	-10.67	0.00	34.17	-53.87
		M(-)	-850.26	23.86	0.00	-11.84	18.67
	7	M(+)	2241.19	113.40	0.00	31.22	-49.20
		M(-)	-969.78	34.09	0.00	-13.51	21.29
	8	M(+)	1514.72	238.82	0.00	21.10	-33.25
		M(-)	-1220.58	69.22	0.00	-17.00	26.80
	9	M(+)	822.65	314.84	0.00	11.46	-18.06
		M(-)	-1393.64	69.22	0.00	-19.41	30.60
	10	M(+)	413.57	-17.98	0.00	5.76	-9.08
		M(-)	-1895.12	412.01	0.00	-26.40	41.60
	11	M(+)	465.25	-17.98	0.00	6.48	-10.21
		M(-)	-3239.66	549.78	0.00	-45.12	71.12
3	1	M(+)	465.25	66.61	0.00	6.48	-10.21
		M(-)	-3239.66	-492.52	0.00	-45.12	71.12
	2	M(+)	320.84	13.86	0.00	4.47	-7.04
		M(-)	-1928.82	-419.36	0.00	-26.86	42.34

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.23	-320.12	0.00	10.45	-16.47
		M(-)	-1349.97	-66.61	0.00	-18.80	29.64
	4	M(+)	1455.51	-244.10	0.00	20.27	-31.95
		M(-)	-1183.44	-66.61	0.00	-16.48	25.98
	5	M(+)	2205.77	-119.74	0.00	30.72	-48.42
		M(-)	-1028.76	-22.03	0.00	-14.33	22.59
	6	M(+)	2441.12	-5.69	0.00	34.00	-53.59
		M(-)	-958.99	-11.80	0.00	-13.36	21.05
	7	M(+)	2208.07	118.37	0.00	30.75	-48.48
		M(-)	-1026.47	21.86	0.00	-14.30	22.53
	8	M(+)	1461.13	243.79	0.00	20.35	-32.08
		M(-)	-1183.48	66.61	0.00	-16.48	25.98
	9	M(+)	756.64	319.80	0.00	10.54	-16.61
		M(-)	-1350.02	66.61	0.00	-18.80	29.64
	10	M(+)	320.84	-13.86	0.00	4.47	-7.04
		M(-)	-1924.94	419.20	0.00	-26.81	42.26
	11	M(+)	465.23	-66.61	0.00	6.48	-10.21
		M(-)	-3235.29	492.35	0.00	-45.06	71.03
4	1	M(+)	465.23	17.98	0.00	6.48	-10.21
		M(-)	-3235.29	-543.69	0.00	-45.06	71.03
	2	M(+)	413.55	17.98	0.00	5.76	-9.08
		M(-)	-1895.12	-412.01	0.00	-26.40	41.60
	3	M(+)	816.23	-315.15	0.00	11.37	-17.92
		M(-)	-1393.58	-69.22	0.00	-19.41	30.59
	4	M(+)	1509.09	-239.14	0.00	21.02	-33.13
		M(-)	-1220.53	-69.22	0.00	-17.00	26.80
	5	M(+)	2238.80	-114.76	0.00	31.18	-49.15
		M(-)	-972.01	-34.26	0.00	-13.54	21.34
	6	M(+)	2453.49	10.66	0.00	34.17	-53.86
		M(-)	-851.80	-24.02	0.00	-11.86	18.70
	7	M(+)	2150.83	136.08	0.00	29.96	-47.22
		M(-)	-840.84	3.80	0.00	-11.71	18.46
	8	M(+)	1330.81	261.50	0.00	18.54	-29.22
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	674.42	269.96	0.00	9.39	-14.81
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	293.68	-69.22	0.00	4.09	-6.45
		M(-)	-1635.51	409.24	0.00	-22.78	35.91
	11	M(+)	492.69	-69.22	0.00	6.86	-10.82
		M(-)	-2919.31	538.52	0.00	-40.66	64.09
5	1	M(+)	492.69	18.25	0.00	6.86	-10.82
		M(-)	-2919.31	-451.63	0.00	-40.66	64.09
	2	M(+)	528.65	-267.91	0.00	7.36	-11.61
		M(-)	-1576.94	-68.94	0.00	-21.96	34.62
	3	M(+)	1603.22	-199.54	0.00	22.33	-35.20
		M(-)	-1292.57	-68.94	0.00	-18.00	28.38
	4	M(+)	1987.42	-128.27	0.00	27.68	-43.63
		M(-)	-1130.98	-68.94	0.00	-15.75	24.83
	5	M(+)	2204.56	-57.00	0.00	30.70	-48.40
		M(-)	-969.40	-68.94	0.00	-13.50	21.28

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2254.64	14.27	0.00	31.40	-49.50
		M(-)	-807.81	-68.94	0.00	-11.25	17.73
	7	M(+)	2137.68	85.54	0.00	29.77	-46.93
		M(-)	-646.22	-68.94	0.00	-9.00	14.19
	8	M(+)	1853.65	156.80	0.00	25.82	-40.69
		M(-)	-484.63	-68.94	0.00	-6.75	10.64
	9	M(+)	1402.57	228.07	0.00	19.53	-30.79
		M(-)	-323.04	-68.94	0.00	-4.50	7.09
	10	M(+)	784.44	299.34	0.00	10.93	-17.22
		M(-)	-161.45	-68.94	0.00	-2.25	3.54
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	68.94	0.00	0.00	0.00	0.00
		Q(-)	-370.55	0.00	0.00	0.00	0.00
	2	Q(+)	68.94	-186.14	0.00	-2.59	4.09
		Q(-)	-288.46	889.66	0.00	12.39	-19.53
	3	Q(+)	68.94	-372.27	0.00	-5.19	8.17
		Q(-)	-206.37	1557.67	0.00	21.70	-34.20
	4	Q(+)	68.94	-558.41	0.00	-7.78	12.26
		Q(-)	-124.27	2004.03	0.00	27.91	-44.00
	5	Q(+)	68.94	-744.55	0.00	-10.37	16.35
		Q(-)	-68.92	1644.01	0.00	22.90	-36.09
	6	Q(+)	108.04	1312.02	0.00	18.27	-28.80
		Q(-)	-18.25	246.35	0.00	3.43	-5.41
	7	Q(+)	190.14	909.48	0.00	12.67	-19.97
		Q(-)	-18.25	295.63	0.00	4.12	-6.49
	8	Q(+)	272.23	285.28	0.00	3.97	-6.26
		Q(-)	-18.25	344.89	0.00	4.80	-7.57
	9	Q(+)	354.32	-560.57	0.00	-7.81	12.31
		Q(-)	-18.25	394.17	0.00	5.49	-8.65
	10	Q(+)	436.42	-1628.07	0.00	-22.68	35.74
		Q(-)	-18.25	443.44	0.00	6.18	-9.74
	11	Q(+)	518.51	-2917.23	0.00	-40.63	64.04
		Q(-)	-18.25	492.71	0.00	6.86	-10.82
2	1	Q(+)	69.22	492.71	0.00	6.86	-10.82
		Q(-)	-543.94	-2904.66	0.00	-40.46	63.77
	2	Q(+)	69.22	293.69	0.00	4.09	-6.45
		Q(-)	-459.29	-1489.31	0.00	-20.74	32.70
	3	Q(+)	69.22	94.67	0.00	1.32	-2.08
		Q(-)	-372.50	-292.98	0.00	-4.08	6.43
	4	Q(+)	69.22	-78.39	0.00	-1.09	1.72
		Q(-)	-296.49	543.25	0.00	7.57	-11.93
	5	Q(+)	69.22	-363.94	0.00	-5.07	7.99
		Q(-)	-171.07	1507.58	0.00	21.00	-33.10
	6	Q(+)	69.22	-649.48	0.00	-9.05	14.26
		Q(-)	-62.55	1578.56	0.00	21.99	-34.66
	7	Q(+)	182.30	1326.50	0.00	18.48	-29.12
		Q(-)	-51.72	-279.30	0.00	-3.89	6.13
	8	Q(+)	307.72	315.85	0.00	4.40	-6.93
		Q(-)	-51.72	-65.97	0.00	-0.92	1.45
	9	Q(+)	383.73	-548.46	0.00	-7.64	12.04
		Q(-)	-51.72	63.32	0.00	0.88	-1.39
	10	Q(+)	470.52	-1777.49	0.00	-24.76	39.02
		Q(-)	-51.72	212.01	0.00	2.95	-4.65
	11	Q(+)	553.60	-3182.71	0.00	-44.33	69.87
		Q(-)	-51.72	360.70	0.00	5.02	-7.92
3	1	Q(+)	66.61	465.25	0.00	6.48	-10.21
		Q(-)	-554.64	-3184.80	0.00	-44.36	69.92
	2	Q(+)	66.61	273.73	0.00	3.81	-6.01
		Q(-)	-468.84	-1712.28	0.00	-23.85	37.59

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	66.61	82.21	0.00	1.15	-1.80
		Q(-)	-382.05	-488.49	0.00	-6.80	10.72
	4	Q(+)	66.61	-84.33	0.00	-1.17	1.85
		Q(-)	-306.04	371.62	0.00	5.18	-8.16
	5	Q(+)	66.61	-359.12	0.00	-5.00	7.88
		Q(-)	-180.62	1375.34	0.00	19.16	-30.19
	6	Q(+)	72.51	1424.80	0.00	19.84	-31.28
		Q(-)	-72.68	1423.21	0.00	19.82	-31.24
	7	Q(+)	180.61	1375.49	0.00	19.16	-30.20
		Q(-)	-66.61	-359.10	0.00	-5.00	7.88
	8	Q(+)	306.03	371.81	0.00	5.18	-8.16
		Q(-)	-66.61	-84.33	0.00	-1.17	1.85
	9	Q(+)	382.04	-488.27	0.00	-6.80	10.72
		Q(-)	-66.61	82.21	0.00	1.14	-1.80
	10	Q(+)	468.83	-1712.43	0.00	-23.85	37.59
		Q(-)	-66.61	273.72	0.00	3.81	-6.01
	11	Q(+)	554.64	-3184.80	0.00	-44.36	69.92
		Q(-)	-66.61	465.23	0.00	6.48	-10.21
4	1	Q(+)	51.72	360.70	0.00	5.02	-7.92
		Q(-)	-553.60	-3182.71	0.00	-44.33	69.87
	2	Q(+)	51.72	212.01	0.00	2.95	-4.65
		Q(-)	-470.53	-1777.34	0.00	-24.75	39.02
	3	Q(+)	51.72	63.32	0.00	0.88	-1.39
		Q(-)	-383.74	-548.68	0.00	-7.64	12.05
	4	Q(+)	51.72	-65.97	0.00	-0.92	1.45
		Q(-)	-307.73	315.65	0.00	4.40	-6.93
	5	Q(+)	51.72	-279.30	0.00	-3.89	6.13
		Q(-)	-182.31	1326.35	0.00	18.47	-29.12
	6	Q(+)	62.55	1578.56	0.00	21.99	-34.66
		Q(-)	-69.22	-649.46	0.00	-9.05	14.26
	7	Q(+)	171.06	1507.73	0.00	21.00	-33.10
		Q(-)	-69.22	-363.92	0.00	-5.07	7.99
	8	Q(+)	296.48	543.45	0.00	7.57	-11.93
		Q(-)	-69.22	-78.39	0.00	-1.09	1.72
	9	Q(+)	372.49	-292.76	0.00	-4.08	6.43
		Q(-)	-69.22	94.67	0.00	1.32	-2.08
	10	Q(+)	459.28	-1489.47	0.00	-20.75	32.70
		Q(-)	-69.22	293.68	0.00	4.09	-6.45
	11	Q(+)	543.94	-2904.66	0.00	-40.46	63.77
		Q(-)	-69.22	492.69	0.00	6.86	-10.82
5	1	Q(+)	18.25	492.69	0.00	6.86	-10.82
		Q(-)	-518.51	-2917.23	0.00	-40.63	64.04
	2	Q(+)	18.25	417.42	0.00	5.81	-9.16
		Q(-)	-393.09	-1037.05	0.00	-14.44	22.77
	3	Q(+)	18.25	342.14	0.00	4.77	-7.51
		Q(-)	-267.67	325.77	0.00	4.54	-7.15
	4	Q(+)	18.25	299.37	0.00	4.17	-6.57
		Q(-)	-196.40	869.66	0.00	12.11	-19.09
	5	Q(+)	18.25	256.60	0.00	3.57	-5.63
		Q(-)	-125.13	1246.50	0.00	17.36	-27.37

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	18.25	213.83	0.00	2.98	-4.69
		Q(-)	-68.94	-807.81	0.00	-11.25	17.73
	7	Q(+)	85.54	2137.68	0.00	29.77	-46.93
		Q(-)	-68.94	-646.22	0.00	-9.00	14.19
	8	Q(+)	156.80	1853.65	0.00	25.82	-40.69
		Q(-)	-68.94	-484.63	0.00	-6.75	10.64
	9	Q(+)	228.07	1402.57	0.00	19.53	-30.79
		Q(-)	-68.94	-323.04	0.00	-4.50	7.09
	10	Q(+)	299.34	784.44	0.00	10.93	-17.22
		Q(-)	-68.94	-161.45	0.00	-2.25	3.54
	11	Q(+)	370.55	0.00	0.00	0.00	0.00
		Q(-)	-68.94	0.00	0.00	0.00	0.00

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	889.66	-288.46	0.00	12.39	-19.53
		M(-)	-186.14	68.94	0.00	-2.59	4.09
	3	M(+)	1557.67	-206.37	0.00	21.70	-34.20
		M(-)	-372.27	68.94	0.00	-5.19	8.17
	4	M(+)	2004.03	-124.27	0.00	27.91	-44.00
		M(-)	-558.41	68.94	0.00	-7.78	12.26
	5	M(+)	2228.73	-42.18	0.00	31.04	-48.93
		M(-)	-744.55	68.94	0.00	-10.37	16.35
	6	M(+)	2231.79	39.91	0.00	31.08	-49.00
		M(-)	-930.69	68.94	0.00	-12.96	20.43
	7	M(+)	2013.19	122.01	0.00	28.04	-44.20
		M(-)	-1116.83	68.94	0.00	-15.56	24.52
	8	M(+)	1572.95	204.10	0.00	21.91	-34.53
		M(-)	-1302.96	68.94	0.00	-18.15	28.60
	9	M(+)	911.05	286.19	0.00	12.69	-20.00
		M(-)	-1489.10	68.94	0.00	-20.74	32.69
	10	M(+)	443.44	-18.25	0.00	6.18	-9.74
		M(-)	-1788.73	382.76	0.00	-24.91	39.27
	11	M(+)	492.71	-18.25	0.00	6.86	-10.82
		M(-)	-2917.23	518.51	0.00	-40.63	64.04
2	1	M(+)	492.71	69.22	0.00	6.86	-10.82
		M(-)	-2917.23	-482.39	0.00	-40.63	64.04
	2	M(+)	293.69	69.22	0.00	4.09	-6.45
		M(-)	-1635.51	-409.24	0.00	-22.78	35.91
	3	M(+)	674.41	-269.97	0.00	9.39	-14.81
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1330.83	-261.51	0.00	18.54	-29.22
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2150.89	-136.09	0.00	29.96	-47.22
		M(-)	-840.84	-3.80	0.00	-11.71	18.46
	6	M(+)	2453.60	-10.67	0.00	34.17	-53.87
		M(-)	-850.26	23.86	0.00	-11.84	18.67
	7	M(+)	2241.19	113.40	0.00	31.22	-49.20
		M(-)	-969.78	34.09	0.00	-13.51	21.29
	8	M(+)	1514.72	238.82	0.00	21.10	-33.25
		M(-)	-1220.58	69.22	0.00	-17.00	26.80
	9	M(+)	822.65	314.84	0.00	11.46	-18.06
		M(-)	-1393.64	69.22	0.00	-19.41	30.60
	10	M(+)	413.57	-17.98	0.00	5.76	-9.08
		M(-)	-1895.12	412.01	0.00	-26.40	41.60
	11	M(+)	465.25	-17.98	0.00	6.48	-10.21
		M(-)	-3239.66	549.78	0.00	-45.12	71.12
3	1	M(+)	465.25	66.61	0.00	6.48	-10.21
		M(-)	-3239.66	-492.52	0.00	-45.12	71.12
	2	M(+)	320.84	13.86	0.00	4.47	-7.04
		M(-)	-1928.82	-419.36	0.00	-26.86	42.34

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.23	-320.12	0.00	10.45	-16.47
		M(-)	-1349.97	-66.61	0.00	-18.80	29.64
	4	M(+)	1455.51	-244.10	0.00	20.27	-31.95
		M(-)	-1183.44	-66.61	0.00	-16.48	25.98
	5	M(+)	2205.77	-119.74	0.00	30.72	-48.42
		M(-)	-1028.76	-22.03	0.00	-14.33	22.59
	6	M(+)	2441.12	-5.69	0.00	34.00	-53.59
		M(-)	-958.99	-11.80	0.00	-13.36	21.05
	7	M(+)	2208.07	118.37	0.00	30.75	-48.48
		M(-)	-1026.47	21.86	0.00	-14.30	22.53
	8	M(+)	1461.13	243.79	0.00	20.35	-32.08
		M(-)	-1183.48	66.61	0.00	-16.48	25.98
	9	M(+)	756.64	319.80	0.00	10.54	-16.61
		M(-)	-1350.02	66.61	0.00	-18.80	29.64
	10	M(+)	320.84	-13.86	0.00	4.47	-7.04
		M(-)	-1924.94	419.20	0.00	-26.81	42.26
	11	M(+)	465.23	-66.61	0.00	6.48	-10.21
		M(-)	-3235.29	492.35	0.00	-45.06	71.03
4	1	M(+)	465.23	17.98	0.00	6.48	-10.21
		M(-)	-3235.29	-543.69	0.00	-45.06	71.03
	2	M(+)	413.55	17.98	0.00	5.76	-9.08
		M(-)	-1895.12	-412.01	0.00	-26.40	41.60
	3	M(+)	816.23	-315.15	0.00	11.37	-17.92
		M(-)	-1393.58	-69.22	0.00	-19.41	30.59
	4	M(+)	1509.09	-239.14	0.00	21.02	-33.13
		M(-)	-1220.53	-69.22	0.00	-17.00	26.80
	5	M(+)	2238.80	-114.76	0.00	31.18	-49.15
		M(-)	-972.01	-34.26	0.00	-13.54	21.34
	6	M(+)	2453.49	10.66	0.00	34.17	-53.86
		M(-)	-851.80	-24.02	0.00	-11.86	18.70
	7	M(+)	2150.83	136.08	0.00	29.96	-47.22
		M(-)	-840.84	3.80	0.00	-11.71	18.46
	8	M(+)	1330.81	261.50	0.00	18.54	-29.22
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	674.42	269.96	0.00	9.39	-14.81
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	293.68	-69.22	0.00	4.09	-6.45
		M(-)	-1635.51	409.24	0.00	-22.78	35.91
	11	M(+)	492.69	-69.22	0.00	6.86	-10.82
		M(-)	-2919.31	538.52	0.00	-40.66	64.09
5	1	M(+)	492.69	18.25	0.00	6.86	-10.82
		M(-)	-2919.31	-451.63	0.00	-40.66	64.09
	2	M(+)	528.65	-267.91	0.00	7.36	-11.61
		M(-)	-1576.94	-68.94	0.00	-21.96	34.62
	3	M(+)	1603.22	-199.54	0.00	22.33	-35.20
		M(-)	-1292.57	-68.94	0.00	-18.00	28.38
	4	M(+)	1987.42	-128.27	0.00	27.68	-43.63
		M(-)	-1130.98	-68.94	0.00	-15.75	24.83
	5	M(+)	2204.56	-57.00	0.00	30.70	-48.40
		M(-)	-969.40	-68.94	0.00	-13.50	21.28

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2254.64	14.27	0.00	31.40	-49.50
		M(-)	-807.81	-68.94	0.00	-11.25	17.73
	7	M(+)	2137.68	85.54	0.00	29.77	-46.93
		M(-)	-646.22	-68.94	0.00	-9.00	14.19
	8	M(+)	1853.65	156.80	0.00	25.82	-40.69
		M(-)	-484.63	-68.94	0.00	-6.75	10.64
	9	M(+)	1402.57	228.07	0.00	19.53	-30.79
		M(-)	-323.04	-68.94	0.00	-4.50	7.09
	10	M(+)	784.44	299.34	0.00	10.93	-17.22
		M(-)	-161.45	-68.94	0.00	-2.25	3.54
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Cable Numero 1

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	2.050	0.400	1.099	-0.0352

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.700	2.140	0.310	1.189	-0.0295
3	5.400	2.207	0.243	1.256	-0.0197
4	8.100	2.247	0.203	1.296	-0.0099
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000
12	29.875	1.037	1.413	0.086	-0.3206
13	32.750	1.840	0.610	0.889	-0.1577
14	35.250	2.060	0.390	1.109	-0.0800

Cable Numero 2

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
15	39.375	2.260	0.190	1.309	0.0000
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000
22	62.875	1.037	1.413	0.086	-0.3206
23	65.750	1.840	0.610	0.889	-0.1577
24	68.250	2.060	0.390	1.109	-0.0800

Cable Numero 3

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	72.375	2.260	0.190	1.309	0.0000
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000
32	95.875	1.037	1.413	0.086	-0.3206
33	98.750	1.840	0.610	0.889	-0.1577
34	101.250	2.060	0.390	1.109	-0.0800

Cable Numero 4

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Replanteo del cable : 4

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
35	105.375	2.260	0.190	1.309	0.0000
36	109.500	2.260	0.190	1.309	0.0000
37	113.625	2.109	0.341	1.158	0.0727
38	117.750	1.664	0.786	0.713	0.1424
39	120.250	1.257	1.193	0.306	0.1833
40	123.125	0.675	1.775	-0.276	0.1800
41	126.000	0.460	1.990	-0.491	0.0000
42	130.125	1.440	1.010	0.489	-0.3091
43	134.250	2.060	0.390	1.109	-0.0800

Cable Numero 5

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.200	-2.260	0.0000
36	151.650	-2.097	0.0346
37	153.650	-2.027	0.0346

Replanteo del cable : 5

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	134.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	136.594	2.242	0.208	1.291	-0.0484
45	138.938	2.260	0.190	1.309	0.0000
46	141.282	2.260	0.190	1.309	0.0000
47	143.626	2.256	0.194	1.305	0.0052
48	145.970	2.234	0.216	1.283	0.0137
49	148.314	2.192	0.258	1.241	0.0223
50	150.658	2.130	0.320	1.179	0.0309
51	153.000	2.050	0.400	1.099	0.0348

Cable Numero 6

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Replanteo del cable : 6

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.550	0.900	0.599	-0.1191
2	2.700	1.856	0.594	0.905	-0.0997
3	5.400	2.081	0.369	1.130	-0.0664
4	8.100	2.215	0.235	1.264	-0.0332

Se.	X	Y (s)	Y (i)	Exce.	Pend.
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000
12	29.875	0.748	1.702	-0.203	-0.1684
13	32.750	1.244	1.206	0.293	-0.1440
14	35.250	1.550	0.900	0.599	-0.1200

Cable Numero 7

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Replanteo del cable : 7

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.550	0.900	0.599	-0.1200
15	39.375	2.027	0.423	1.076	-0.0997
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727

Se.	X	Y (s)	Y (i)	Exce.	Pend.
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000
22	62.875	0.748	1.702	-0.203	-0.1684
23	65.750	1.244	1.206	0.293	-0.1440
24	68.250	1.550	0.900	0.599	-0.1200

Cable Numero 8

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Replanteo del cable : 8

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.550	0.900	0.599	-0.1200
25	72.375	2.027	0.423	1.076	-0.0997
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727

Se.	X	Y (s)	Y (i)	Exce.	Pend.
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000
32	95.875	0.748	1.702	-0.203	-0.1684
33	98.750	1.244	1.206	0.293	-0.1440
34	101.250	1.550	0.900	0.599	-0.1200

Cable Numero 9

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Replanteo del cable : 9

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	1.550	0.900	0.599	-0.1200
35	105.375	2.027	0.423	1.076	-0.0997
36	109.500	2.260	0.190	1.309	0.0000
37	113.625	2.109	0.341	1.158	0.0727

Se.	X	Y (s)	Y (i)	Exce.	Pend.
38	117.750	1.664	0.786	0.713	0.1424
39	120.250	1.257	1.193	0.306	0.1833
40	123.125	0.675	1.775	-0.276	0.1800
41	126.000	0.460	1.990	-0.491	0.0000
42	130.125	0.971	1.479	0.020	-0.1816
43	134.250	1.550	0.900	0.599	-0.1200

Cable Numero 10

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.200	-2.260	0.0000
32	151.650	-1.708	0.1169
33	153.650	-1.474	0.1169

Replanteo del cable : 10

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	134.250	1.550	0.900	0.599	-0.1200
44	136.594	1.831	0.619	0.880	-0.1193
45	138.938	2.088	0.362	1.137	-0.0940
46	141.282	2.244	0.206	1.293	-0.0334

Se.	X	Y (s)	Y (i)	Exce.	Pend.
47	143.626	2.247	0.203	1.296	0.0176
48	145.970	2.172	0.278	1.221	0.0466
49	148.314	2.029	0.421	1.078	0.0756
50	150.658	1.818	0.632	0.867	0.1046
51	153.000	1.550	0.900	0.599	0.1170

Cable Numero 11

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Replanteo del cable : 11

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.050	1.400	0.099	-0.1661
2	2.700	1.477	0.973	0.526	-0.1390
3	5.400	1.790	0.660	0.839	-0.0926
4	8.100	1.978	0.472	1.027	-0.0463
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333

Se.	X	Y (s)	Y (i)	Exce.	Pend.
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.325	2.125	-0.626	-0.0636
13	32.750	0.630	1.820	-0.321	-0.1521
14	35.250	1.050	1.400	0.099	-0.1700

Cable Numero 12

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Replanteo del cable : 12

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.050	1.400	0.099	-0.1700
15	39.375	1.722	0.728	0.771	-0.1378
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
22	62.875	0.325	2.125	-0.626	-0.0636
23	65.750	0.630	1.820	-0.321	-0.1521
24	68.250	1.050	1.400	0.099	-0.1700

Cable Numero 13

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Replanteo del cable : 13

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.050	1.400	0.099	-0.1700
25	72.375	1.722	0.728	0.771	-0.1378
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
32	95.875	0.325	2.125	-0.626	-0.0636
33	98.750	0.630	1.820	-0.321	-0.1521
34	101.250	1.050	1.400	0.099	-0.1700

Cable Numero 14

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Replanteo del cable : 14

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	1.050	1.400	0.099	-0.1700
35	105.375	1.722	0.728	0.771	-0.1378
36	109.500	2.040	0.410	1.089	0.0000
37	113.625	1.889	0.561	0.938	0.0727
38	117.750	1.444	1.006	0.493	0.1424
39	120.250	1.037	1.413	0.086	0.1833
40	123.125	0.455	1.995	-0.496	0.1800
41	126.000	0.240	2.210	-0.711	0.0000

Se.	X	Y (s)	Y (i)	Exce.	Pend.
42	130.125	0.427	2.023	-0.524	-0.0990
43	134.250	1.050	1.400	0.099	-0.1700

Cable Numero 15

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.200	-2.040	0.0000
28	151.650	-1.270	0.1630
29	153.650	-0.944	0.1630

Replanteo del cable : 15

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	134.250	1.050	1.400	0.099	-0.1700
44	136.594	1.448	1.002	0.497	-0.1681
45	138.938	1.805	0.645	0.854	-0.1292
46	141.282	2.019	0.431	1.068	-0.0452
47	143.626	2.022	0.428	1.071	0.0246
48	145.970	1.917	0.533	0.966	0.0650
49	148.314	1.718	0.732	0.767	0.1054
50	150.658	1.423	1.027	0.472	0.1459

Se.	X	Y (s)	Y (i)	Exce.	Pend.
51	153.000	1.050	1.400	0.099	0.1630

Cable Numero 16

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Replanteo del cable : 16

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.590	1.860	-0.361	-0.2424

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.700	1.215	1.235	0.264	-0.2037
3	5.400	1.673	0.777	0.722	-0.1358
4	8.100	1.948	0.502	0.997	-0.0679
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.240	2.210	-0.711	0.0000
13	32.750	0.264	2.186	-0.687	-0.0662
14	35.250	0.550	1.900	-0.401	-0.1200

Cable Numero 17

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Replanteo del cable : 17

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
15	39.375	1.236	1.214	0.285	-0.2678
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000
22	62.875	0.240	2.210	-0.711	0.0000
23	65.750	0.264	2.186	-0.687	-0.0662
24	68.250	0.550	1.900	-0.401	-0.1200

Cable Numero 18

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Replanteo del cable : 18

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	72.375	1.236	1.214	0.285	-0.2678
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000
32	95.875	0.240	2.210	-0.711	0.0000
33	98.750	0.264	2.186	-0.687	-0.0662
34	101.250	0.550	1.900	-0.401	-0.1200

Cable Numero 19

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 43 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Replanteo del cable : 19

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
35	105.375	1.236	1.214	0.285	-0.2678
36	109.500	2.040	0.410	1.089	0.0000
37	113.625	1.889	0.561	0.938	0.0727
38	117.750	1.444	1.006	0.493	0.1424
39	120.250	1.037	1.413	0.086	0.1833
40	123.125	0.455	1.995	-0.496	0.1800
41	126.000	0.240	2.210	-0.711	0.0000
42	130.125	0.240	2.210	-0.711	0.0000
43	134.250	0.550	1.900	-0.401	-0.1200

Cable Numero 20

Definicion general

Seccion inicial ..... = 43 (134.250) Pasiva
Seccion final ..... = 51 (153.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.850	-1.396	-.2891
35	142.200	-2.040	0.0000
36	151.650	-0.912	0.2387
37	153.650	-0.435	0.2387

Replanteo del cable : 20

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	134.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	136.594	0.839	1.611	-0.112	-0.1620
45	138.938	1.421	1.029	0.470	-0.2888
46	141.282	1.974	0.476	1.023	-0.1361
47	143.626	2.014	0.436	1.063	0.0360
48	145.970	1.860	0.590	0.909	0.0952
49	148.314	1.568	0.882	0.617	0.1545
50	150.658	1.136	1.314	0.185	0.2137
51	153.000	0.590	1.860	-0.361	0.2384

Definicion esfuerzos unitarios cable : 1

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	1075.984	-37.822	1075.319	1181.747	-37.822	1075.319
				-1.971	6.258	-4.701
2	1071.083	-31.564	1070.618			
				-6.844	10.606	-5.573
3	1065.251	-20.959	1065.045			
				-7.242	10.522	-5.651
4	1059.445	-10.436	1059.394			
				-7.493	10.436	-5.729
5	1053.665	0.000	1053.665			
				-18.792	46.198	-14.355
6	1040.336	46.198	1039.310			
				-19.179	44.759	-16.130
7	1027.215	90.957	1023.180			
				-16.840	43.104	-17.744
8	1014.334	134.061	1005.436			
				-11.295	41.267	-19.177
9	1001.722	175.328	986.259			
				-2.225	39.284	-20.410
10	989.405	214.612	965.849			
				8.603	-214.612	-17.580
11	948.269	0.000	948.269			
				102.719	-310.091	19.018
12	1015.776	-310.091	967.287			
				161.922	145.697	75.342
13	1055.510	-164.394	1042.629			
				-50.135	78.588	29.944
14	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 2

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	824.566	-65.755	821.940	911.531	-65.755	821.940
				56.172	65.755	20.935
15	842.875	0.000	842.875			
				5.749	0.000	4.392
16	847.267	0.000	847.267			
				19.040	62.709	15.219
17	864.763	62.709	862.486			
				9.834	61.661	10.641
18	881.940	124.370	873.127			
				2.155	36.445	4.400
19	892.140	160.814	877.526			
				-53.019	0.415	18.237
20	910.158	161.229	895.764			
				13.687	-161.229	52.505
21	948.269	0.000	948.269			
				102.719	-310.092	19.018
22	1015.777	-310.092	967.288			
				161.921	145.698	75.342
23	1055.510	-164.394	1042.629			
				-50.135	78.588	29.944
24	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 3

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	824.566	-65.755	821.940	911.531	-65.755	821.940
				56.172	65.755	20.935
25	842.875	0.000	842.875			
				5.749	0.000	4.392
26	847.267	0.000	847.267			
				19.040	62.709	15.219
27	864.763	62.709	862.486			
				9.834	61.661	10.641
28	881.940	124.370	873.127			
				2.155	36.445	4.400
29	892.140	160.814	877.527			
				-53.019	0.414	18.237
30	910.158	161.229	895.764			
				13.687	-161.229	52.505
31	948.269	0.000	948.269			
				102.719	-310.092	19.018
32	1015.777	-310.092	967.288			
				161.921	145.698	75.342
33	1055.510	-164.394	1042.629			
				-50.135	78.588	29.944
34	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 4

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	34	824.566	-65.755	821.940	911.531	-65.755	821.940
---					56.172	65.755	20.935
	35	842.875	0.000	842.875			
---					5.749	0.000	4.392
	36	847.267	0.000	847.267			
---					19.040	62.709	15.219
	37	864.763	62.709	862.486			
---					9.834	61.661	10.641
	38	881.940	124.370	873.127			
---					2.155	36.445	4.400
	39	892.140	160.814	877.527			
---					-53.019	0.414	18.237
	40	910.158	161.229	895.764			
---					13.687	-161.229	52.505
	41	948.269	0.000	948.269			
---					320.260	-301.879	28.228
	42	1022.095	-301.879	976.497			
---					-87.401	216.073	96.076
	43	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 5

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	43	911.513	-72.689	908.610	1007.648	-72.689	908.610
---					41.573	28.191	10.582
	44	920.268	-44.498	919.192			
---					-18.186	44.498	13.222
	45	932.414	0.000	932.414			
---					3.610	0.000	2.758
	46	935.172	0.000	935.172			
---					7.176	4.865	3.775
	47	938.959	4.865	938.946			
---					5.714	8.086	4.393
	48	943.428	12.952	943.339			
---					5.519	8.196	4.350
	49	947.925	21.148	947.689			
---					5.238	8.306	4.306
	50	952.451	29.454	951.996			
---					1.603	3.794	3.465
	51	956.040	33.248	955.461	-1050.113	-33.248	-955.461

Definicion esfuerzos unitarios cable : 6

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.935	-127.237	1068.385	640.107	-127.237	1068.385
---					7.293	21.272	-5.550
	2	1068.104	-105.965	1062.835			
---					-8.367	35.878	-8.041
	3	1057.120	-70.087	1054.794			
---					-11.160	35.358	-9.149
	4	1046.221	-34.729	1045.645			
---					-13.384	34.729	-10.221
	5	1035.424	0.000	1035.424			
---					-18.466	45.398	-14.106
	6	1022.326	45.398	1021.317			
---					-18.847	43.984	-15.851
	7	1009.432	89.382	1005.467			
---					-16.549	42.358	-17.437
	8	996.774	131.740	988.030			
---					-11.100	40.553	-18.844
	9	984.380	172.293	969.185			
---					-2.187	38.604	-20.057
	10	972.276	210.896	949.128			
---					-31.115	-210.896	63.313
	11	1012.441	0.000	1012.441			
---					35.496	-174.782	25.295
	12	1052.351	-174.782	1037.735			
---					49.661	22.631	18.674
	13	1067.310	-152.151	1056.410			
---					-19.768	23.950	11.926
	14	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 7

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	14	873.075	-104.023	866.856	519.247	-104.023	866.856
---					29.687	16.617	10.134
	15	881.336	-87.406	876.991			
---					60.098	87.406	27.613
	16	904.604	0.000	904.604			
---					20.329	66.952	16.249
	17	923.283	66.952	920.853			
---					10.500	65.834	11.361
	18	941.623	132.786	932.213			
---					2.301	38.911	4.697
	19	952.513	171.697	936.911			
---					-56.607	0.443	19.471
	20	971.750	172.140	956.382			
---					14.613	-172.140	56.058
	21	1012.441	0.000	1012.441			
---					35.496	-174.782	25.295
	22	1052.351	-174.782	1037.735			
---					49.661	22.631	18.674
	23	1067.310	-152.151	1056.410			
---					-19.768	23.950	11.926
	24	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 8

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	873.076	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.135
25	881.336	-87.406	876.991			
				60.098	87.406	27.613
26	904.604	0.000	904.604			
				20.329	66.953	16.249
27	923.283	66.953	920.853			
				10.500	65.834	11.361
28	941.623	132.786	932.213			
				2.301	38.911	4.697
29	952.513	171.697	936.911			
				-56.607	0.442	19.472
30	971.750	172.140	956.382			
				14.613	-172.140	56.058
31	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
32	1052.351	-174.782	1037.735			
				49.660	22.632	18.674
33	1067.310	-152.150	1056.410			
				-19.768	23.950	11.926
34	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 9

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
34	873.076	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.135
35	881.336	-87.406	876.991			
				60.098	87.406	27.613
36	904.604	0.000	904.604			
				20.329	66.953	16.249
37	923.283	66.953	920.853			
				10.500	65.834	11.361
38	941.623	132.786	932.213			
				2.301	38.911	4.697
39	952.513	171.697	936.911			
				-56.607	0.442	19.472
40	971.750	172.140	956.382			
				14.613	-172.140	56.058
41	1012.441	0.000	1012.441			
				128.281	-188.816	27.539
42	1056.981	-188.816	1039.980			
				-34.519	60.616	28.356
43	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 10

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	43	888.571	-105.869	882.242	528.463	-105.869	882.242
---					2.752	0.308	2.820
	44	891.334	-105.561	885.061			
---					16.039	21.447	9.665
	45	898.671	-84.114	894.726			
---					28.246	53.658	17.593
	46	912.828	-30.456	912.320			
---					3.055	46.751	12.919
	47	925.382	16.295	925.239			
---					9.608	27.156	7.527
	48	933.777	43.451	932.765			
---					7.929	27.562	6.793
	49	942.238	71.013	939.558			
---					5.979	27.904	6.038
	50	950.755	98.917	945.596			
---					-4.935	12.210	3.950
	51	956.026	111.127	949.546	-568.810	-111.127	-949.546

Definicion esfuerzos unitarios cable : 11

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.903	-176.333	1061.355	105.157	-176.333	1061.355
---					14.326	29.458	-5.022
	2	1066.495	-146.876	1056.333			
---					-5.806	49.762	-8.117
	3	1052.705	-97.113	1048.216			
---					-9.950	49.060	-10.309
	4	1039.019	-48.054	1037.907			
---					-13.546	48.054	-12.429
	5	1025.478	0.000	1025.478			
---					-15.216	44.962	-13.971
	6	1012.506	44.962	1011.507			
---					-15.213	43.561	-15.698
	7	999.736	88.523	995.809			
---					-12.590	41.951	-17.270
	8	987.199	130.474	978.539			
---					-6.887	40.163	-18.663
	9	974.925	170.638	959.875			
---					0.527	41.589	-4.758
	10	978.412	212.227	955.118			
---					-51.759	-212.227	72.757
	11	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	12	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	13	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	14	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 12

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	14	877.318	-147.035	864.909	85.626	-147.035	864.909
---					38.967	25.865	14.520
	15	887.738	-121.169	879.429			
---					72.457	121.169	38.965
	16	918.394	0.000	918.394			
---					17.010	67.973	16.497
	17	937.359	67.973	934.891			
---					8.122	66.837	11.534
	18	955.978	134.810	946.425			
---					1.287	39.504	4.769
	19	967.034	174.314	951.194			
---					-61.819	0.450	19.768
	20	986.565	174.764	970.962			
---					2.315	-174.764	56.913
	21	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	22	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	23	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	24	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 13

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	877.318	-147.035	864.909	85.626	-147.035	864.909
---					38.967	25.865	14.520
	25	887.738	-121.169	879.429			
---					72.457	121.169	38.965
	26	918.394	0.000	918.394			
---					17.010	67.973	16.497
	27	937.359	67.973	934.891			
---					8.122	66.837	11.534
	28	955.978	134.810	946.425			
---					1.287	39.504	4.769
	29	967.034	174.315	951.194			
---					-61.819	0.449	19.768
	30	986.565	174.764	970.962			
---					2.315	-174.764	56.913
	31	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	32	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	33	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	34	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 14

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
34	877.318	-147.035	864.909	85.626	-147.035	864.909
				38.967	25.865	14.520
35	887.737	-121.169	879.429			
				72.457	121.169	38.965
36	918.394	0.000	918.394			
				17.010	67.973	16.497
37	937.359	67.973	934.891			
				8.122	66.837	11.534
38	955.978	134.810	946.425			
				1.287	39.504	4.769
39	967.034	174.315	951.194			
				-61.819	0.449	19.768
40	986.565	174.764	970.962			
				2.315	-174.764	56.913
41	1027.875	0.000	1027.875			
				-34.027	-103.929	21.860
42	1054.867	-103.929	1049.735			
				69.219	-76.403	11.046
43	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 15

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
43	871.172	-146.005	858.850	85.026	-146.005	858.850
				2.604	1.107	3.145
44	874.089	-144.897	861.995			
				17.739	31.641	14.419
45	883.702	-113.256	876.415			
				32.721	72.521	24.629
46	901.964	-40.735	901.043			
				-0.069	63.295	16.660
47	917.981	22.560	917.703			
				9.249	37.669	8.868
48	928.527	60.228	926.572			
				6.597	38.244	7.407
49	939.156	98.472	933.979			
				3.807	38.639	5.914
50	949.842	137.111	939.894			
				-9.803	16.687	3.654
51	956.000	153.798	943.548	-93.363	-153.798	-943.548

Definicion esfuerzos unitarios cable : 16

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.937	-253.474	1045.654	-377.335	-253.474	1045.654
---					23.632	41.080	-3.052
	2	1064.016	-212.394	1042.603			
---					-3.399	71.657	-6.305
	3	1045.811	-140.737	1036.298			
---					-9.964	71.117	-11.001
	4	1027.657	-69.620	1025.296			
---					-16.997	69.620	-15.608
	5	1009.689	0.000	1009.689			
---					-14.981	44.270	-13.756
	6	996.916	44.270	995.933			
---					-14.978	42.891	-15.457
	7	984.343	87.160	980.476			
---					-12.396	41.305	-17.004
	8	971.999	128.466	963.473			
---					-0.804	42.425	-2.175
	9	976.369	170.891	961.297			
---					-0.411	43.530	3.691
	10	988.524	214.420	964.989			
---					-52.294	-214.420	73.509
	11	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	12	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	13	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	14	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 17

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	14	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.361
	15	871.498	-225.421	841.840			
---					305.216	225.421	86.046
	16	927.886	0.000	927.886			
---					17.185	68.676	16.667
	17	947.046	68.676	944.553			
---					8.206	67.528	11.653
	18	965.858	136.204	956.206			
---					1.300	39.912	4.818
	19	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	20	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	21	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	22	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	23	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	24	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 18

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.362
	25	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	26	927.886	0.000	927.886			
---					17.185	68.676	16.667
	27	947.046	68.676	944.553			
---					8.206	67.528	11.653
	28	965.858	136.204	956.206			
---					1.300	39.912	4.818
	29	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	30	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	31	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	32	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	33	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	34	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 19

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	34	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.362
	35	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	36	927.886	0.000	927.886			
---					17.185	68.676	16.667
	37	947.046	68.676	944.553			
---					8.206	67.528	11.653
	38	965.858	136.204	956.206			
---					1.300	39.912	4.818
	39	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	40	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	41	1038.498	0.000	1038.498			
---					-3.848	0.000	5.412
	42	1043.910	0.000	1043.910			
---					49.404	-128.200	24.426
	43	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 20

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
43	809.816	-96.486	804.048	-322.423	-96.486	804.048
				-35.062	-34.545	4.675
44	819.269	-131.031	808.723			
				44.096	-102.845	1.028
45	842.849	-233.876	809.750			
				90.882	116.291	53.917
46	871.635	-117.584	863.668			
				-20.301	150.216	41.984
47	906.240	32.632	905.652			
				10.661	54.625	10.443
48	920.241	87.257	916.095			
				5.810	55.364	7.284
49	934.329	142.621	923.380			
				1.790	55.539	4.113
50	948.425	198.160	927.493			
				-15.892	23.581	2.487
51	956.050	221.741	929.980	335.672	-221.741	-929.980

Cable Numero 1

Definicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
13	32.750	2.300	0.150	1.349	0.0000
14	35.250	2.300	0.150	1.349	0.0000
15	39.375	2.300	0.150	1.349	0.0000
16	43.500	2.300	0.150	1.349	0.0000
17	47.625	2.300	0.150	1.349	0.0000
18	51.750	2.300	0.150	1.349	0.0000
19	54.250	2.300	0.150	1.349	0.0000

Cable Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
23	65.750	2.300	0.150	1.349	0.0000
24	68.250	2.300	0.150	1.349	0.0000
25	72.375	2.300	0.150	1.349	0.0000
26	76.500	2.300	0.150	1.349	0.0000
27	80.625	2.300	0.150	1.349	0.0000
28	84.750	2.300	0.150	1.349	0.0000
29	87.250	2.300	0.150	1.349	0.0000

Cable Numero 3

Definicion general

Seccion inicial ..... = 33 (98.750) Activa
Seccion final ..... = 39 (120.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	153.000	-2.300	0.0000

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	98.750	2.300	0.150	1.349	0.0000
34	101.250	2.300	0.150	1.349	0.0000
35	105.375	2.300	0.150	1.349	0.0000
36	109.500	2.300	0.150	1.349	0.0000
37	113.625	2.300	0.150	1.349	0.0000
38	117.750	2.300	0.150	1.349	0.0000
39	120.250	2.300	0.150	1.349	0.0000

Definicion esfuerzos unitarios cable : 1

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	13	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	14	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	15	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	16	589.955	0.000	589.955			
---					4.147	0.000	3.074
	17	593.029	0.000	593.029			
---					4.169	0.000	3.090
	18	596.119	0.000	596.119			
---					2.537	0.000	1.881
	19	598.000	0.000	598.000	-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 2

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	23	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	24	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	25	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	26	589.955	0.000	589.955			
---					4.147	0.000	3.074
	27	593.029	0.000	593.029			
---					4.169	0.000	3.090
	28	596.119	0.000	596.119			
---					2.537	0.000	1.881
	29	598.000	0.000	598.000	-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 3

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
33	598.000	0.000	598.000	806.702	0.000	598.000
				-2.537	0.000	-1.881
34	596.119	0.000	596.119			
				-4.169	0.000	-3.090
35	593.029	0.000	593.029			
				-4.147	0.000	-3.074
36	589.955	0.000	589.955			
				4.147	0.000	3.074
37	593.029	0.000	593.029			
				4.169	0.000	3.090
38	596.119	0.000	596.119			
				2.537	0.000	1.881
39	598.000	0.000	598.000	-806.702	0.000	-598.000

Coeficientes para perdidas de pretensado

```
Coef. de retraccion del hormigon ..................... = 0.0003
Coef. de relajacion del acero ........................ = 0.0600
Coef. de fluencia del hormigon ....................... = 2.5000

Coef. medio de perdidas elasticas instantaneas ....... = 0.9903 ( 1.0%)
Coef. medio de perdidas en estado inicial ............ = 0.9580 ( 4.2%)
Coef. medio de perdidas diferidas inicial ............ = 0.9487 ( 5.1%)
Coef. medio de perdidas diferidas .................... = 0.8600 (14.0%)
Coef. medio de perdidas totales ...................... = 0.8517 (14.8%)

Coef. de ponderacion maximo del pretensado ........... = 1.1000
Coef. de ponderacion minimo del pretensado ........... = 0.9000
Coef. de ponderacion para perdidas en estado inicial . = 0.3000
```

Comprobacion de tensiones

```
Estado  1 Pretensado de   1076. tn  Familia  1
Estado  2 Pretensado de   1076. tn  Familia  2
Estado  3 Pretensado de   1076. tn  Familia  3
Estado  4 Pretensado de   1076. tn  Familia  4
Estado  5 Pretensado de    956. tn  Familia  5
Estado  6 Pretensado de   1076. tn  Familia  1
Estado  7 Pretensado de   1076. tn  Familia  2
Estado  8 Pretensado de   1076. tn  Familia  3
Estado  9 Pretensado de   1076. tn  Familia  4
Estado 10 Pretensado de    956. tn  Familia  5
Estado 11 Pretensado de   1076. tn  Familia  1
Estado 12 Pretensado de   1076. tn  Familia  2
Estado 13 Pretensado de   1076. tn  Familia  3
Estado 14 Pretensado de   1076. tn  Familia  4
Estado 15 Pretensado de    956. tn  Familia  5
Estado 16 Pretensado de   1076. tn  Familia  1
Estado 17 Pretensado de   1076. tn  Familia  2
Estado 18 Pretensado de   1076. tn  Familia  3
Estado 19 Pretensado de   1076. tn  Familia  4
Estado 20 Pretensado de    956. tn  Familia  5
Estado  1 Pretensado de    598. tn  (Refuerzo)
Estado  2 Pretensado de    598. tn  (Refuerzo)
Estado  3 Pretensado de    598. tn  (Refuerzo)
```

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9487

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1470.21	517.6	-4032.7	25.13	77.88
		2	-2783.14	424.5	-4015.4	6.64	106.51
	2	2	-2783.14	424.5	-4015.4	6.64	106.51
		3	-3691.19	265.2	-3988.8	-6.30	126.14
	3	3	-3691.19	265.2	-3988.8	-6.30	126.14
		4	-4158.33	107.7	-3954.5	-13.20	136.01
	4	4	-4158.33	107.7	-3954.5	-13.20	136.01
		5	-4191.79	-46.8	-3912.8	-14.14	136.27
	5	5	-4191.79	-46.8	-3912.8	-14.14	136.27
		6	-3769.88	-218.3	-3859.5	-8.86	126.41
	6	6	-3769.88	-218.3	-3859.5	-8.86	126.41
		7	-2891.27	-384.5	-3799.6	2.70	106.44
	7	7	-2891.27	-384.5	-3799.6	2.70	106.44
		8	-1581.51	-544.6	-3733.7	20.19	76.94
	8	8	-1581.51	-544.6	-3733.7	20.19	76.94
		9	128.07	-700.6	-3677.8	43.37	38.78
	9	9	128.07	-700.6	-3677.8	43.37	38.78
		10	2232.53	-855.2	-3638.4	72.24	-7.87
	10	10	2232.53	-855.2	-3638.4	72.24	-7.87
		11	3570.34	-46.8	-3820.6	92.93	-35.18
2	11	11	3570.34	-8.1	-3820.6	92.93	-35.18
		12	2729.69	514.8	-3880.9	81.91	-16.04
	12	12	2729.69	514.8	-3880.9	81.91	-16.04
		13	1149.40	511.1	-3997.9	61.22	19.98
	13	13	384.06	511.1	-4565.2	56.97	43.19
		14	-861.58	487.6	-4616.6	40.21	71.12
	14	14	-553.58	387.6	-3780.9	35.05	54.91
		15	-2208.43	403.6	-3827.3	12.52	91.76
	15	15	-2208.43	403.6	-3827.3	12.52	91.76
		16	-3440.98	-8.1	-3973.3	-2.99	120.47
	16	16	-3440.98	-8.1	-3973.3	-2.99	120.47
		17	-2960.10	-260.8	-4037.6	4.43	110.64
	17	17	-2960.10	-260.8	-4037.6	4.43	110.64
		18	-1410.74	-509.2	-4083.4	26.53	77.15
	18	18	-1410.74	-509.2	-4083.4	26.53	77.15
		19	36.74	-656.0	-4102.9	46.91	45.59
	19	19	802.08	-656.0	-3535.6	51.15	22.37
		20	2912.52	-657.7	-3609.0	81.38	-23.13
	20	20	2912.52	-657.7	-3609.0	81.38	-23.13
		21	3838.41	-8.1	-3820.6	96.67	-41.06
3	21	21	3838.41	1.0	-3820.6	96.67	-41.06
		22	2971.50	524.0	-3880.9	85.27	-21.35
	22	22	2971.50	524.0	-3880.9	85.27	-21.35
		23	1364.95	520.3	-3997.9	64.22	15.24
	23	23	599.62	520.3	-4565.2	59.98	38.46
		24	-668.86	496.8	-4616.6	42.89	66.89
	24	24	-360.85	396.7	-3780.9	37.73	50.68
		25	-2053.38	412.8	-3827.3	14.68	88.36

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9487

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-2053.38	412.8	-3827.3	14.68	88.36
		26	-3323.61	1.0	-3973.4	-1.36	117.90
	26	26	-3323.61	1.0	-3973.4	-1.36	117.90
		27	-2880.39	-251.6	-4037.6	5.54	108.89
	27	27	-2880.39	-251.6	-4037.6	5.54	108.89
		28	-1368.70	-500.1	-4083.4	27.11	76.22
	28	28	-1368.70	-500.1	-4083.4	27.11	76.22
		29	55.95	-646.9	-4102.9	47.18	45.17
	29	29	821.29	-646.9	-3535.6	51.42	21.95
		30	2905.48	-648.6	-3609.0	81.28	-22.97
	30	30	2905.48	-648.6	-3609.0	81.28	-22.97
		31	3805.10	1.0	-3820.6	96.20	-40.33
4	31	31	3805.10	5.0	-3820.6	96.20	-40.33
		32	2926.71	528.0	-3880.9	84.65	-20.37
	32	32	2926.71	528.0	-3880.9	84.65	-20.37
		33	1308.67	524.3	-3997.9	63.44	16.48
	33	33	543.33	524.3	-4565.2	59.19	39.70
		34	-735.14	500.8	-4616.6	41.97	68.35
	34	34	-427.13	400.7	-3780.9	36.81	52.13
		35	-2136.15	416.7	-3827.3	13.53	90.18
	35	35	-2136.15	416.7	-3827.3	13.53	90.18
		36	-3422.87	5.0	-3973.4	-2.74	120.08
	36	36	-3422.87	5.0	-3973.4	-2.74	120.08
		37	-2996.14	-247.6	-4037.6	3.93	111.44
	37	37	-2996.14	-247.6	-4037.6	3.93	111.44
		38	-1500.94	-496.1	-4083.4	25.27	79.13
	38	38	-1500.94	-496.1	-4083.4	25.27	79.13
		39	-86.28	-642.9	-4102.9	45.20	48.29
	39	39	679.05	-642.9	-3535.6	49.44	25.07
		40	2751.75	-644.6	-3609.0	79.14	-19.60
	40	40	2751.75	-644.6	-3609.0	79.14	-19.60
		41	3639.88	5.0	-3820.6	93.90	-36.70
5	41	41	3639.88	49.4	-3820.6	93.90	-36.70
		42	1883.14	613.5	-3899.4	70.32	2.75
	42	42	1883.14	613.5	-3899.4	70.32	2.75
		43	-503.34	545.1	-4051.1	38.80	56.86
	43	43	-306.65	448.8	-3276.7	32.78	43.79
		44	-1375.43	453.5	-3296.8	18.12	67.48
	44	44	-1375.43	453.5	-3296.8	18.12	67.48
		45	-2500.92	458.5	-3333.2	2.86	92.60
	45	45	-2500.92	458.5	-3333.2	2.86	92.60
		46	-3453.51	228.5	-3427.0	-9.35	114.57
	46	46	-3453.51	228.5	-3427.0	-9.35	114.57
		47	-3684.59	-23.1	-3498.5	-11.76	120.45
	47	47	-3684.59	-23.1	-3498.5	-11.76	120.45
		48	-3522.11	-144.1	-3528.1	-9.16	117.22
	48	48	-3522.11	-144.1	-3528.1	-9.16	117.22
		49	-3065.08	-266.8	-3552.6	-2.52	107.46
	49	49	-3065.08	-266.8	-3552.6	-2.52	107.46
		50	-2310.66	-390.5	-3571.9	8.21	91.12

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9487

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	-2310.66	-390.5	-3571.9	8.21	91.12
		51	-1306.03	-443.9	-3584.8	22.35	69.21

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8517

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1319.81	438.3	-3620.2	22.56	69.91
		2	-2427.46	354.8	-3604.6	6.95	94.05
	2	2	-2427.46	354.8	-3604.6	6.95	94.05
		3	-3171.65	211.8	-3580.7	-3.68	110.12
	3	3	-3171.65	211.8	-3580.7	-3.68	110.12
		4	-3520.04	70.4	-3550.0	-8.88	117.42
	4	4	-3520.04	70.4	-3550.0	-8.88	117.42
		5	-3479.10	-68.3	-3512.5	-8.74	116.10
	5	5	-3479.10	-68.3	-3512.5	-8.74	116.10
		6	-3029.38	-222.3	-3464.7	-3.01	105.69
	6	6	-3029.38	-222.3	-3464.7	-3.01	105.69
		7	-2169.68	-371.5	-3410.9	8.35	86.20
	7	7	-2169.68	-371.5	-3410.9	8.35	86.20
		8	-922.94	-515.2	-3351.7	25.05	58.16
	8	8	-922.94	-515.2	-3351.7	25.05	58.16
		9	682.72	-655.2	-3301.6	46.84	22.35
	9	9	682.72	-655.2	-3301.6	46.84	22.35
		10	2642.87	-794.0	-3266.2	73.75	-21.09
	10	10	2642.87	-794.0	-3266.2	73.75	-21.09
		11	3914.79	-68.3	-3429.7	93.31	-47.16
2	11	11	3914.79	11.3	-3429.7	93.31	-47.16
		12	3106.59	480.8	-3483.9	82.67	-28.80
	12	12	3106.59	480.8	-3483.9	82.67	-28.80
		13	1634.41	477.5	-3588.9	63.35	4.70
	13	13	1003.76	477.5	-4056.4	59.85	23.83
		14	-161.20	456.4	-4102.7	44.15	49.93
	14	14	115.30	366.5	-3352.5	39.52	35.38
		15	-1447.39	381.0	-3394.3	18.23	70.16
	15	15	-1447.39	381.0	-3394.3	18.23	70.16
		16	-2630.98	11.3	-3525.6	3.23	97.63
	16	16	-2630.98	11.3	-3525.6	3.23	97.63
		17	-2275.83	-215.5	-3583.1	8.82	90.48
	17	17	-2275.83	-215.5	-3583.1	8.82	90.48
		18	-961.51	-438.5	-3624.0	27.59	62.09
	18	18	-961.51	-438.5	-3624.0	27.59	62.09
		19	291.52	-570.3	-3641.4	45.24	34.78
	19	19	922.16	-570.3	-3173.9	48.74	15.65
		20	2763.16	-571.8	-3239.8	75.12	-24.02
	20	20	2763.16	-571.8	-3239.8	75.12	-24.02
		21	3540.78	11.3	-3429.7	88.10	-38.95
3	21	21	3540.78	-3.2	-3429.7	88.10	-38.95
		22	2774.34	466.3	-3483.9	78.04	-21.51
	22	22	2774.34	466.3	-3483.9	78.04	-21.51
		23	1343.91	462.9	-3588.9	59.30	11.08
	23	23	713.26	462.9	-4056.4	55.81	30.21
		24	-415.39	441.8	-4102.7	40.61	55.51
	24	24	-138.89	352.0	-3352.5	35.98	40.96
		25	-1641.67	366.4	-3394.3	15.52	74.43

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8517

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-1641.67	366.4	-3394.3	15.52	74.43
		26	-2765.35	-3.2	-3525.6	1.35	100.58
	26	26	-2765.35	-3.2	-3525.6	1.35	100.58
		27	-2350.29	-230.0	-3583.1	7.78	92.12
	27	27	-2350.29	-230.0	-3583.1	7.78	92.12
		28	-976.05	-453.0	-3624.0	27.39	62.41
	28	28	-976.05	-453.0	-3624.0	27.39	62.41
		29	313.28	-584.8	-3641.4	45.54	34.30
	29	29	943.93	-584.8	-3173.9	49.04	15.17
		30	2826.69	-586.3	-3239.8	76.01	-25.42
	30	30	2826.69	-586.3	-3239.8	76.01	-25.42
		31	3646.06	-3.2	-3429.7	89.57	-41.26
4	31	31	3646.06	1.5	-3429.7	89.57	-41.26
		32	2866.15	471.0	-3483.9	79.32	-23.53
	32	32	2866.15	471.0	-3483.9	79.32	-23.53
		33	1422.25	467.6	-3588.9	60.39	9.36
	33	33	791.60	467.6	-4056.4	56.90	28.49
		34	-348.77	446.5	-4102.7	41.54	54.05
	34	34	-72.27	356.7	-3352.5	36.90	39.50
		35	-1594.38	371.1	-3394.3	16.18	73.39
	35	35	-1594.38	371.1	-3394.3	16.18	73.39
		36	-2737.38	1.5	-3525.6	1.74	99.96
	36	36	-2737.38	1.5	-3525.6	1.74	99.96
		37	-2341.65	-225.3	-3583.1	7.90	91.93
	37	37	-2341.65	-225.3	-3583.1	7.90	91.93
		38	-986.74	-448.3	-3624.0	27.24	62.64
	38	38	-986.74	-448.3	-3624.0	27.24	62.64
		39	290.88	-580.1	-3641.4	45.23	34.79
	39	39	921.52	-580.1	-3173.9	48.73	15.66
		40	2790.81	-581.6	-3239.8	75.51	-24.63
	40	40	2790.81	-581.6	-3239.8	75.51	-24.63
		41	3596.71	1.5	-3429.8	88.88	-40.18
5	41	41	3596.71	56.5	-3429.8	88.88	-40.18
		42	1969.39	562.9	-3500.5	67.01	-3.65
	42	42	1969.39	562.9	-3500.5	67.01	-3.65
		43	-223.25	501.5	-3636.7	38.02	46.03
	43	43	-46.69	415.1	-2941.5	32.61	34.29
		44	-1034.71	419.3	-2959.5	19.06	56.18
	44	44	-1034.71	419.3	-2959.5	19.06	56.18
		45	-2073.64	423.8	-2992.2	4.96	79.36
	45	45	-2073.64	423.8	-2992.2	4.96	79.36
		46	-2957.36	217.3	-3076.4	-6.40	99.71
	46	46	-2957.36	217.3	-3076.4	-6.40	99.71
		47	-3193.38	-8.5	-3140.6	-8.96	105.62
	47	47	-3193.38	-8.5	-3140.6	-8.96	105.62
		48	-3076.09	-117.1	-3167.2	-7.03	103.35
	48	48	-3076.09	-117.1	-3167.2	-7.03	103.35
		49	-2694.40	-227.3	-3189.2	-1.46	95.22
	49	49	-2694.40	-227.3	-3189.2	-1.46	95.22
		50	-2045.73	-338.4	-3206.5	7.77	81.17

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8517

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	-2045.73	-338.4	-3206.5	7.77	81.17
		51	-1172.42	-386.3	-3218.1	20.06	62.13

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO-I E-4

FECHA

HOJA N.º

COMPROBACION DE TENSIONES

A las tensiones obtenidas mediante el programa de viga continua se sumen las producidas por el gradiente térmico y las fuerzas longitudinales reológicas

Las tensiones pésimas se obtienen en las juntas de construcción en las fases intermedias. Para reducir las tracciones en la zona del anclaje pasivo se tesan los cables al 80% y se anclan al 75%, consiguiendo reducir las pérdidas en esta zona.

Las tracciones son inferiores a la resistencia a tracción del hormigón : $0{,}45 \cdot \sqrt[3]{350^2} = 22{,}4\ kg/cm^2$ en todas las secciones en estudio

A continuación se adjunta :

- Tensiones en construcción y servicio producidas por las sobrecargas + peso propio + c. pretensado
- Tensiones producidas por el gradiente térmico, fuerzas longitudinales reológicas y cables producidos por el frenado.
- Tensiones totales, valores de tracciones y armaduras resultantes con los cables tesados y anclados al 75%
- Tensiones totales, valores de tracciones y armaduras resultantes con los cables tesados al 80%

Tensiones en Construccion (kg/cm2) Estado 1

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	5.	114.	6.	125.	9.	-14.	15.	111.
	3	-10.	137.	-11.	151.	16.	-25.	4.	126.
	4	-19.	151.	-21.	166.	20.	-32.	-1.	134.
	5	-22.	154.	-24.	169.	23.	-36.	-2.	134.
	6	-18.	146.	-20.	161.	23.	-36.	2.	125.
	7	-8.	128.	-9.	141.	20.	-32.	11.	109.
	8	8.	101.	9.	111.	16.	-25.	25.	85.
	9	31.	64.	34.	70.	9.	-15.	43.	55.
	10	59.	18.	65.	20.	1.	-1.	65.	19.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
2	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 2

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	7.	-12.	15.	111.
	3	-7.	132.	-7.	145.	13.	-20.	5.	125.
	4	-14.	142.	-15.	156.	16.	-25.	0.	132.
	5	-15.	142.	-16.	156.	16.	-26.	0.	131.
	6	-9.	132.	-10.	145.	15.	-23.	5.	122.
	7	3.	111.	3.	122.	11.	-17.	14.	105.
	8	21.	80.	23.	88.	5.	-8.	28.	80.
	9	45.	40.	50.	44.	-3.	5.	47.	49.
	10	76.	-8.	83.	-9.	-13.	21.	70.	12.
	11	97.	-37.	107.	-41.	-26.	41.	81.	0.
2	1	97.	-37.	107.	-41.	-26.	41.	81.	0.
	2	84.	-14.	92.	-15.	-11.	18.	81.	3.
	3	60.	27.	66.	29.	1.	-1.	67.	28.
	4	38.	50.	42.	55.	9.	-14.	51.	41.
	5	9.	85.	10.	93.	19.	-30.	29.	64.
	6	-10.	119.	-11.	131.	23.	-37.	13.	94.
	7	-5.	113.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	39.	58.	11.	-17.	49.	40.
	10	65.	8.	71.	9.	1.	-2.	73.	6.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
3	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 3

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	6.	112.	7.	123.	8.	-12.	15.	111.
	3	-8.	133.	-8.	147.	13.	-21.	5.	125.
	4	-15.	144.	-17.	159.	17.	-26.	0.	132.
	5	-17.	145.	-18.	160.	18.	-28.	0.	131.
	6	-12.	136.	-13.	149.	17.	-27.	4.	123.
	7	0.	116.	0.	127.	14.	-21.	14.	106.
	8	18.	86.	19.	94.	8.	-13.	28.	81.
	9	41.	47.	46.	51.	0.	-1.	46.	51.
	10	71.	-1.	78.	-2.	-10.	15.	69.	14.
	11	92.	-29.	101.	-32.	-22.	34.	80.	2.
2	1	92.	-29.	101.	-32.	-22.	34.	80.	2.
	2	81.	-9.	89.	-10.	-9.	14.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	8.	-13.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	5.	98.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	31.	69.	6.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-18.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
3	1	97.	-36.	106.	-40.	-26.	40.	81.	0.
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-1.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	94.
	7	-5.	114.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
4	1	79.	-8.	87.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	16.	-26.	0.	132.
	5	-16.	144.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	16.	-26.	4.	122.
	7	1.	114.	1.	126.	13.	-20.	14.	105.
	8	19.	84.	21.	93.	7.	-12.	28.	81.
	9	43.	45.	47.	49.	-1.	1.	46.	50.
	10	72.	-3.	80.	-4.	-11.	17.	69.	13.
	11	94.	-31.	103.	-34.	-23.	36.	80.	2.
2	1	94.	-31.	103.	-34.	-23.	36.	80.	2.
	2	82.	-11.	90.	-12.	-10.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	89.	17.	-26.	30.	63.
	6	-5.	112.	-5.	123.	19.	-30.	14.	92.
	7	2.	102.	2.	113.	17.	-27.	19.	86.
	8	24.	68.	27.	75.	9.	-15.	36.	61.
	9	45.	36.	50.	40.	2.	-3.	52.	36.
	10	76.	-11.	84.	-12.	-8.	13.	76.	2.
	11	92.	-29.	101.	-32.	-22.	34.	80.	2.
3	1	92.	-29.	101.	-32.	-22.	34.	80.	2.
	2	80.	-9.	89.	-10.	-9.	14.	80.	4.
	3	59.	29.	65.	32.	2.	-3.	66.	29.
	4	39.	49.	43.	54.	9.	-14.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	4.	99.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	30.	70.	7.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-17.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
4	1	97.	-36.	106.	-40.	-26.	40.	81.	0.
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-2.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	94.
	7	-5.	114.	-6.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	87.	-9.	-10.	16.	76.	8.
5	1	79.	-8.	87.	-9.	-10.	16.	76.	8.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	57.	29.	63.	32.	-3.	4.	60.	36.
	3AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 5

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	17.	-26.	0.	132.
	5	-16.	145.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	16.	-26.	4.	123.
	7	1.	115.	1.	126.	13.	-21.	14.	106.
	8	18.	84.	20.	93.	7.	-12.	28.	81.
	9	42.	45.	46.	50.	0.	1.	46.	50.
	10	72.	-3.	79.	-3.	-10.	16.	69.	13.
	11	93.	-31.	103.	-34.	-23.	36.	80.	2.
2	1	93.	-31.	103.	-34.	-23.	36.	80.	2.
	2	81.	-10.	90.	-11.	-9.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	88.	16.	-26.	30.	62.
	6	-5.	111.	-5.	122.	19.	-30.	14.	92.
	7	3.	101.	3.	112.	16.	-26.	19.	86.
	8	25.	67.	28.	74.	9.	-14.	37.	60.
	9	46.	35.	51.	38.	2.	-2.	52.	36.
	10	77.	-12.	85.	-14.	-9.	14.	76.	1.
	11	93.	-30.	102.	-33.	-22.	35.	80.	2.
3	1	93.	-30.	102.	-33.	-22.	35.	80.	2.
	2	81.	-10.	89.	-11.	-9.	14.	80.	3.
	3	59.	28.	65.	31.	2.	-2.	67.	29.
	4	39.	50.	42.	55.	9.	-14.	51.	41.
	5	12.	81.	13.	89.	16.	-26.	29.	63.
	6	-5.	112.	-5.	123.	19.	-30.	13.	93.
	7	2.	102.	3.	112.	16.	-26.	19.	87.
	8	25.	68.	27.	75.	8.	-13.	36.	61.
	9	46.	35.	50.	39.	1.	-2.	51.	37.
	10	77.	-12.	85.	-13.	-10.	15.	75.	3.
	11	93.	-30.	102.	-33.	-23.	36.	79.	4.
4	1	93.	-30.	102.	-33.	-23.	36.	79.	4.
	2	81.	-9.	89.	-10.	-9.	15.	79.	5.
	3	59.	29.	65.	31.	1.	-2.	66.	29.
	4	39.	50.	43.	54.	9.	-14.	51.	41.
	5	12.	80.	13.	88.	17.	-27.	30.	61.
	6	-4.	111.	-5.	122.	20.	-31.	15.	90.
	7	3.	101.	3.	111.	18.	-28.	21.	83.
	8	26.	66.	29.	73.	10.	-16.	39.	57.
	9	47.	33.	52.	37.	3.	-5.	55.	32.
	10	78.	-14.	86.	-15.	-7.	11.	79.	-4.
	11	94.	-32.	104.	-36.	-20.	32.	83.	-4.
5	1	94.	-32.	104.	-36.	-20.	32.	83.	-4.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

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Tensiones en Construccion (kg/cm2) Estado 5

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	70.	8.	77.	9.	-3.	4.	74.	13.
	3	35.	57.	38.	62.	10.	-15.	48.	47.
	4	17.	74.	18.	81.	14.	-22.	32.	59.
	5	1.	100.	1.	110.	17.	-27.	18.	83.
	6	-11.	122.	-13.	134.	19.	-29.	6.	105.
	7	-14.	128.	-15.	141.	18.	-29.	3.	112.
	8	-11.	124.	-12.	136.	16.	-25.	5.	111.
	9	-3.	113.	-4.	125.	12.	-20.	9.	105.
	10	8.	96.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado ultimo

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	8.	-12.	15.	110.
	3	-7.	132.	-7.	145.	13.	-21.	6.	124.
	4	-14.	142.	-15.	156.	17.	-26.	1.	130.
	5	-15.	142.	-16.	156.	18.	-28.	1.	129.
	6	-9.	132.	-10.	145.	16.	-26.	6.	119.
	7	3.	111.	3.	122.	13.	-21.	16.	102.
	8	21.	80.	23.	88.	7.	-12.	31.	77.
	9	45.	40.	50.	45.	0.	1.	49.	45.
	10	75.	-8.	83.	-9.	-10.	16.	73.	7.
	11	97.	-37.	107.	-40.	-23.	36.	84.	-5.
2	1	97.	-37.	107.	-40.	-23.	36.	84.	-5.
	2	85.	-17.	94.	-18.	-9.	15.	85.	-3.
	3	62.	33.	68.	36.	1.	-2.	69.	34.
	4	39.	66.	43.	72.	9.	-13.	52.	59.
	5	13.	96.	14.	105.	16.	-26.	31.	80.
	6	-3.	126.	-3.	138.	19.	-30.	16.	108.
	7	5.	115.	5.	127.	16.	-26.	22.	101.
	8	28.	81.	30.	89.	9.	-14.	39.	75.
	9	51.	35.	56.	39.	2.	-2.	58.	37.
	10	85.	-24.	93.	-27.	-9.	14.	84.	-12.
	11	101.	-43.	111.	-47.	-22.	35.	89.	-12.
3	1	101.	-43.	111.	-47.	-22.	35.	89.	-12.
	2	89.	-22.	98.	-25.	-9.	14.	89.	-10.
	3	65.	28.	71.	31.	2.	-2.	73.	28.
	4	42.	61.	46.	67.	9.	-14.	55.	54.
	5	15.	92.	17.	101.	16.	-26.	33.	76.
	6	-1.	123.	-2.	135.	19.	-30.	17.	106.
	7	6.	114.	6.	125.	16.	-26.	23.	99.
	8	28.	80.	31.	88.	8.	-13.	40.	74.
	9	51.	35.	57.	39.	1.	-2.	58.	37.
	10	85.	-24.	93.	-26.	-10.	15.	84.	-11.
	11	100.	-42.	110.	-46.	-23.	36.	88.	-10.
4	1	100.	-42.	110.	-46.	-23.	36.	88.	-10.
	2	88.	-21.	97.	-23.	-9.	15.	88.	-8.
	3	64.	29.	70.	32.	1.	-2.	72.	30.
	4	41.	63.	45.	69.	9.	-14.	54.	55.
	5	14.	94.	16.	104.	17.	-27.	33.	77.
	6	-3.	125.	-3.	138.	20.	-31.	17.	106.
	7	4.	116.	5.	128.	18.	-28.	22.	100.
	8	26.	83.	29.	91.	10.	-16.	39.	75.
	9	49.	38.	54.	42.	3.	-5.	57.	37.
	10	83.	-20.	91.	-23.	-7.	11.	84.	-11.
	11	98.	-38.	108.	-42.	-20.	32.	88.	-10.
5	1	98.	-38.	108.	-42.	-20.	32.	88.	-10.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado ultimo

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	73.	3.	81.	3.	-3.	4.	78.	8.
	3	37.	53.	41.	58.	10.	-15.	51.	43.
	4	19.	70.	21.	77.	14.	-22.	35.	55.
	5	3.	97.	3.	106.	17.	-27.	20.	79.
	6	-10.	120.	-11.	132.	19.	-29.	8.	102.
	7	-12.	126.	-13.	138.	18.	-29.	5.	110.
	8	-10.	122.	-11.	135.	16.	-25.	6.	109.
	9	-3.	112.	-3.	123.	12.	-20.	10.	104.
	10	9.	95.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	28.	86.	28.	86.	28.	86.	28.	86.	28.	86.
	2	19.	99.	31.	80.	16.	103.	24.	91.	18.	101.
	3	12.	108.	34.	74.	7.	116.	21.	95.	10.	112.
	4	10.	112.	37.	68.	2.	124.	21.	94.	6.	117.
	5	10.	110.	41.	61.	-1.	126.	22.	90.	6.	116.
	6	14.	102.	45.	53.	1.	123.	26.	83.	8.	110.
	7	21.	89.	49.	44.	5.	113.	32.	71.	15.	98.
	8	32.	70.	54.	35.	13.	98.	40.	56.	24.	81.
	9	45.	47.	58.	27.	24.	79.	50.	39.	37.	60.
	10	62.	19.	68.	10.	37.	59.	64.	16.	52.	35.
	11	66.	19.	73.	8.	25.	83.	68.	14.	49.	44.
2	1	66.	19.	73.	8.	25.	83.	68.	14.	49.	44.
	2	73.	9.	78.	2.	51.	45.	75.	6.	64.	23.
	3	64.	36.	74.	21.	50.	59.	68.	30.	59.	45.
	4AI	55.	62.	73.	33.	42.	82.	62.	50.	49.	70.
	4AD	49.	44.	67.	15.	36.	64.	56.	33.	44.	52.
	5	36.	66.	66.	19.	24.	85.	48.	47.	31.	74.
	6	23.	92.	57.	38.	11.	110.	36.	70.	18.	99.
	7	27.	87.	58.	38.	14.	108.	39.	67.	22.	95.
	8	40.	68.	61.	35.	23.	95.	48.	55.	33.	79.
	9	54.	38.	65.	20.	34.	68.	58.	31.	46.	50.
	10	73.	0.	79.	-9.	47.	42.	76.	-3.	63.	17.
	11	70.	12.	77.	1.	25.	83.	73.	7.	52.	40.
3	1	70.	12.	77.	1.	25.	83.	73.	7.	52.	40.
	2	78.	2.	82.	-5.	51.	44.	79.	-1.	67.	19.
	3	68.	30.	78.	14.	49.	60.	72.	23.	60.	42.
	4AI	58.	57.	78.	25.	41.	83.	66.	44.	51.	67.
	4AD	52.	39.	72.	7.	36.	65.	60.	26.	45.	50.
	5	38.	62.	69.	14.	24.	85.	51.	43.	32.	71.
	6	24.	89.	58.	35.	11.	110.	38.	67.	19.	97.
	7	28.	85.	59.	37.	14.	108.	40.	66.	22.	94.
	8	40.	68.	60.	36.	23.	94.	48.	55.	33.	78.
	9	53.	38.	64.	21.	35.	68.	58.	31.	46.	50.
	10	73.	1.	77.	-6.	46.	44.	74.	-2.	62.	18.
	11	69.	13.	76.	3.	24.	84.	72.	9.	51.	42.
4	1	69.	13.	76.	3.	24.	84.	72.	9.	51.	42.
	2	76.	4.	82.	-5.	50.	45.	79.	0.	66.	20.
	3	67.	32.	78.	14.	48.	62.	72.	24.	59.	44.
	4AI	57.	58.	78.	25.	40.	85.	65.	45.	50.	69.
	4AD	51.	41.	72.	7.	34.	67.	60.	27.	44.	51.
	5	38.	64.	69.	14.	24.	85.	50.	44.	32.	72.
	6	24.	90.	58.	36.	12.	108.	38.	68.	19.	97.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	28.	86.	58.	39.	16.	104.	40.	67.	23.	93.
	8	40.	68.	58.	39.	27.	88.	47.	56.	35.	76.
	9	53.	38.	63.	23.	39.	61.	57.	32.	48.	47.
	10	73.	1.	77.	-5.	50.	37.	74.	-1.	63.	16.
	11	69.	13.	76.	2.	29.	77.	72.	9.	53.	39.
5	1	69.	13.	76.	2.	29.	77.	72.	9.	53.	39.
	2	70.	14.	77.	3.	48.	49.	73.	10.	61.	28.
	3AI	54.	44.	77.	9.	36.	72.	63.	30.	47.	55.
	3AD	48.	30.	70.	-6.	30.	58.	57.	16.	41.	41.
	4	39.	44.	67.	1.	23.	69.	50.	27.	33.	54.
	5	27.	64.	58.	16.	13.	86.	39.	45.	22.	73.
	6	16.	85.	47.	35.	5.	103.	28.	65.	11.	92.
	7	13.	92.	43.	45.	4.	106.	25.	73.	9.	97.
	8	13.	92.	39.	52.	6.	103.	23.	76.	10.	97.
	9	15.	90.	35.	59.	11.	97.	23.	78.	13.	93.
	10	19.	84.	30.	67.	17.	88.	24.	77.	18.	86.
	11	25.	76.	25.	76.	25.	76.	25.	76.	25.	76.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	25.	77.	25.	77.	25.	77.	25.	77.	25.	77.
	2	19.	86.	31.	67.	16.	90.	23.	79.	17.	88.
	3	14.	92.	36.	58.	9.	100.	23.	78.	12.	95.
	4	13.	93.	41.	50.	5.	106.	24.	76.	10.	98.
	5	14.	91.	45.	42.	4.	107.	26.	71.	10.	97.
	6	18.	83.	49.	34.	5.	103.	30.	63.	13.	91.
	7	24.	71.	53.	27.	9.	95.	36.	53.	18.	81.
	8	34.	54.	56.	20.	16.	83.	42.	40.	26.	66.
	9	45.	34.	58.	14.	25.	67.	50.	26.	37.	48.
	10	59.	12.	65.	2.	34.	51.	62.	8.	49.	27.
	11	62.	13.	68.	2.	21.	77.	64.	9.	45.	39.
2	1	62.	13.	68.	2.	21.	77.	64.	9.	45.	39.
	2	70.	2.	74.	-5.	47.	38.	71.	-1.	60.	16.
	3	62.	24.	72.	9.	48.	47.	66.	18.	57.	33.
	4AI	54.	46.	73.	17.	41.	66.	62.	34.	49.	54.
	4AD	49.	30.	68.	1.	36.	50.	56.	18.	44.	38.
	5	37.	50.	67.	3.	26.	68.	49.	31.	33.	57.
	6	25.	74.	59.	20.	13.	93.	38.	53.	20.	82.
	7	27.	72.	58.	23.	13.	94.	39.	53.	22.	81.
	8	36.	59.	57.	26.	19.	86.	44.	46.	29.	70.
	9	46.	36.	58.	18.	27.	67.	51.	29.	39.	48.
	10	61.	7.	67.	-2.	35.	49.	64.	3.	51.	24.
	11	56.	22.	62.	12.	11.	93.	59.	18.	38.	50.
3	1	56.	22.	62.	12.	11.	93.	59.	18.	38.	50.
	2	65.	10.	69.	3.	38.	52.	66.	7.	54.	27.
	3	58.	31.	69.	14.	39.	61.	62.	24.	51.	43.
	4AI	50.	52.	71.	20.	34.	78.	58.	39.	44.	63.
	4AD	45.	36.	65.	4.	29.	62.	53.	23.	39.	47.
	5	34.	55.	65.	6.	20.	77.	47.	35.	29.	64.
	6	23.	77.	57.	24.	9.	98.	36.	56.	17.	86.
	7	26.	74.	57.	26.	12.	97.	38.	55.	20.	83.
	8	36.	60.	56.	28.	19.	86.	44.	47.	29.	70.
	9	47.	35.	57.	19.	28.	65.	51.	29.	39.	47.
	10	62.	6.	67.	-1.	36.	48.	64.	3.	52.	22.
	11	57.	19.	64.	9.	12.	90.	60.	15.	39.	48.
4	1	57.	19.	64.	9.	12.	90.	60.	15.	39.	48.
	2	66.	8.	72.	-1.	40.	49.	68.	4.	55.	24.
	3	59.	29.	71.	11.	40.	60.	64.	22.	52.	41.
	4AI	51.	51.	72.	17.	34.	77.	60.	37.	45.	61.
	4AD	46.	35.	67.	1.	29.	61.	55.	21.	39.	45.
	5	35.	53.	66.	4.	22.	75.	48.	34.	30.	62.
	6	23.	77.	57.	23.	11.	95.	37.	55.	18.	84.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

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Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	26.	74.	56.	27.	14.	92.	38.	55.	21.	81.
	8	36.	60.	54.	31.	23.	80.	43.	48.	31.	68.
	9	47.	36.	56.	21.	32.	59.	50.	30.	41.	45.
	10	62.	6.	66.	0.	39.	42.	64.	4.	53.	21.
	11	57.	20.	64.	9.	16.	84.	60.	16.	41.	46.
5	1	57.	20.	64.	9.	16.	84.	60.	16.	41.	46.
	2	61.	17.	68.	5.	39.	51.	64.	12.	52.	31.
	3AI	49.	40.	71.	5.	31.	68.	58.	26.	42.	51.
	3AD	43.	27.	65.	-8.	25.	55.	52.	13.	36.	38.
	4	36.	38.	63.	-5.	20.	63.	47.	21.	29.	48.
	5	26.	55.	56.	7.	12.	77.	38.	36.	20.	64.
	6	16.	73.	48.	24.	5.	91.	29.	53.	12.	80.
	7	14.	79.	43.	32.	5.	93.	26.	60.	10.	85.
	8	14.	80.	39.	39.	7.	91.	24.	64.	11.	84.
	9	15.	78.	35.	47.	11.	85.	23.	66.	13.	81.
	10	18.	74.	29.	57.	16.	78.	23.	67.	17.	76.
	11	22.	68.	22.	68.	22.	68.	22.	68.	22.	68.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	23.	70.	23.	70.	23.	70.	23.	70.	23.	70.
	2	17.	78.	30.	58.	15.	82.	22.	70.	16.	80.
	3	14.	83.	35.	49.	8.	91.	22.	69.	12.	86.
	4	12.	85.	40.	41.	4.	97.	23.	67.	9.	89.
	5	13.	83.	44.	34.	2.	99.	25.	63.	8.	89.
	6	15.	77.	46.	28.	2.	97.	28.	57.	10.	85.
	7	20.	67.	49.	23.	5.	92.	32.	50.	14.	77.
	8	28.	54.	50.	20.	9.	83.	36.	41.	20.	66.
	9	36.	39.	49.	19.	16.	72.	42.	31.	28.	52.
	10	47.	21.	53.	11.	22.	60.	50.	17.	37.	37.
	11	47.	26.	54.	15.	7.	90.	50.	22.	31.	51.
2	1	47.	26.	54.	15.	7.	90.	50.	22.	31.	51.
	2	57.	12.	61.	5.	34.	48.	59.	9.	48.	26.
	3	53.	29.	62.	15.	38.	52.	56.	23.	47.	39.
	4AI	46.	48.	65.	19.	34.	68.	54.	36.	41.	56.
	4AD	42.	33.	60.	4.	29.	53.	49.	22.	37.	41.
	5	33.	48.	63.	1.	22.	66.	45.	29.	29.	55.
	6	23.	68.	57.	14.	11.	86.	37.	46.	19.	75.
	7	26.	65.	57.	15.	13.	86.	39.	45.	21.	73.
	8	34.	53.	56.	20.	17.	80.	43.	40.	28.	64.
	9	44.	31.	55.	13.	24.	62.	48.	24.	36.	43.
	10	57.	5.	63.	-4.	31.	46.	59.	1.	46.	21.
	11	51.	20.	58.	10.	6.	91.	54.	16.	33.	48.
3	1	51.	20.	58.	10.	6.	91.	54.	16.	33.	48.
	2	61.	6.	65.	-1.	34.	49.	62.	4.	50.	23.
	3	56.	25.	66.	8.	37.	54.	60.	18.	48.	36.
	4AI	49.	44.	69.	12.	33.	70.	57.	31.	43.	54.
	4AD	44.	29.	65.	-3.	28.	55.	53.	16.	38.	39.
	5	35.	45.	66.	-4.	21.	67.	48.	25.	30.	54.
	6	25.	65.	59.	12.	11.	86.	38.	44.	19.	74.
	7	27.	64.	58.	15.	13.	86.	39.	44.	21.	73.
	8	35.	53.	55.	21.	18.	79.	43.	40.	28.	63.
	9	44.	31.	54.	15.	25.	61.	48.	25.	36.	43.
	10	56.	6.	61.	-1.	30.	48.	58.	3.	46.	23.
	11	50.	21.	56.	11.	5.	93.	53.	17.	32.	50.
4	1	50.	21.	56.	11.	5.	93.	53.	17.	32.	50.
	2	60.	8.	65.	-1.	33.	50.	62.	4.	49.	25.
	3	55.	26.	66.	8.	35.	57.	59.	19.	47.	38.
	4AI	48.	45.	69.	12.	31.	72.	57.	31.	42.	55.
	4AD	44.	30.	65.	-3.	27.	57.	52.	17.	37.	41.
	5	35.	45.	66.	-4.	21.	67.	47.	26.	29.	54.
	6	24.	66.	59.	12.	13.	84.	38.	44.	20.	73.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	27.	64.	57.	16.	15.	82.	39.	45.	22.	71.
	8	35.	52.	53.	23.	22.	73.	42.	41.	30.	60.
	9	44.	31.	53.	16.	29.	54.	48.	25.	38.	40.
	10	57.	5.	61.	-1.	34.	41.	58.	3.	48.	19.
	11	51.	21.	57.	10.	10.	85.	53.	16.	34.	46.
5	1	51.	21.	57.	10.	10.	85.	53.	16.	34.	46.
	2	56.	14.	63.	2.	34.	49.	59.	9.	47.	28.
	3AI	47.	33.	69.	-2.	29.	61.	56.	19.	39.	44.
	3AD	41.	21.	64.	-14.	23.	49.	50.	7.	34.	32.
	4	35.	31.	63.	-13.	20.	56.	46.	13.	29.	41.
	5	26.	46.	57.	-3.	13.	67.	39.	26.	21.	54.
	6	18.	62.	49.	12.	6.	80.	30.	42.	13.	69.
	7	15.	68.	45.	21.	6.	82.	27.	49.	12.	73.
	8	15.	69.	41.	28.	8.	80.	25.	53.	12.	73.
	9	16.	68.	35.	38.	11.	75.	24.	56.	14.	71.
	10	18.	66.	29.	49.	15.	69.	22.	59.	17.	67.
	11	20.	62.	20.	62.	20.	62.	20.	62.	20.	62.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	20.	63.	20.	63.	20.	63.	20.	63.	20.	63.
	2	17.	68.	30.	48.	15.	72.	22.	60.	16.	69.
	3	15.	70.	37.	36.	10.	78.	24.	56.	13.	73.
	4	15.	70.	43.	26.	7.	82.	26.	52.	12.	75.
	5	16.	67.	47.	19.	5.	84.	28.	48.	11.	74.
	6	18.	62.	49.	13.	5.	82.	31.	42.	13.	70.
	7	23.	53.	51.	9.	7.	78.	34.	36.	17.	63.
	8	29.	43.	51.	8.	11.	71.	37.	29.	21.	54.
	9	36.	30.	49.	10.	15.	63.	41.	22.	28.	43.
	10	44.	16.	51.	6.	19.	55.	47.	12.	34.	31.
	11	43.	22.	50.	12.	2.	86.	46.	18.	27.	48.
2	1	43.	22.	50.	12.	2.	86.	46.	18.	27.	48.
	2	53.	8.	57.	1.	30.	44.	55.	5.	44.	22.
	3	50.	21.	60.	6.	36.	44.	54.	15.	44.	30.
	4AI	45.	36.	64.	7.	32.	56.	53.	25.	40.	44.
	4AD	41.	23.	60.	-6.	28.	43.	49.	11.	36.	31.
	5	34.	36.	64.	-11.	22.	54.	46.	17.	29.	43.
	6	24.	55.	58.	1.	12.	73.	38.	33.	19.	62.
	7	25.	54.	56.	5.	12.	76.	38.	35.	20.	63.
	8	30.	47.	52.	14.	13.	74.	39.	34.	24.	58.
	9	37.	31.	49.	13.	18.	62.	42.	24.	29.	43.
	10	46.	12.	52.	3.	20.	53.	49.	8.	36.	28.
	11	38.	30.	45.	19.	-7.	101.	41.	25.	20.	58.
3	1	38.	30.	45.	19.	-7.	101.	41.	25.	20.	58.
	2	49.	14.	53.	7.	22.	56.	51.	11.	38.	31.
	3	47.	27.	57.	10.	28.	56.	51.	20.	39.	39.
	4AI	42.	41.	62.	9.	26.	67.	50.	28.	36.	51.
	4AD	38.	28.	58.	-4.	22.	54.	46.	15.	31.	38.
	5	31.	40.	62.	-9.	17.	62.	44.	20.	26.	49.
	6	22.	57.	56.	4.	9.	78.	36.	36.	17.	66.
	7	24.	56.	55.	7.	10.	78.	37.	36.	19.	65.
	8	30.	47.	51.	15.	14.	73.	38.	35.	24.	58.
	9	37.	31.	48.	14.	19.	60.	42.	24.	30.	42.
	10	47.	11.	52.	4.	20.	53.	49.	8.	36.	28.
	11	40.	28.	46.	17.	-5.	99.	42.	23.	22.	56.
4	1	40.	28.	46.	17.	-5.	99.	42.	23.	22.	56.
	2	50.	12.	56.	3.	24.	54.	52.	9.	40.	29.
	3	48.	25.	59.	7.	28.	56.	52.	18.	40.	38.
	4AI	43.	40.	64.	7.	26.	67.	51.	27.	36.	51.
	4AD	39.	27.	60.	-6.	22.	53.	47.	13.	32.	37.
	5	32.	39.	63.	-10.	18.	60.	44.	19.	26.	47.
	6	23.	57.	57.	3.	11.	75.	36.	35.	18.	64.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	24.	55.	54.	8.	13.	74.	36.	37.	20.	63.
	8	30.	47.	49.	18.	17.	68.	38.	36.	25.	55.
	9	37.	31.	47.	16.	23.	54.	41.	25.	31.	40.
	10	47.	11.	51.	5.	24.	47.	48.	9.	38.	26.
	11	39.	28.	46.	18.	-2.	92.	42.	24.	23.	54.
5	1	39.	28.	46.	18.	-2.	92.	42.	24.	23.	54.
	2	47.	17.	55.	6.	25.	52.	50.	13.	38.	31.
	3AI	41.	31.	63.	-5.	23.	59.	50.	16.	34.	42.
	3AD	36.	20.	59.	-15.	18.	48.	45.	6.	29.	31.
	4	32.	27.	60.	-16.	16.	52.	43.	10.	26.	37.
	5	25.	40.	55.	-9.	11.	61.	37.	20.	19.	48.
	6	17.	53.	49.	4.	6.	71.	30.	33.	13.	60.
	7	15.	58.	45.	11.	6.	72.	27.	39.	12.	64.
	8	15.	59.	41.	19.	8.	70.	25.	43.	12.	64.
	9	15.	59.	35.	28.	11.	66.	23.	47.	14.	62.
	10	17.	58.	28.	41.	14.	61.	21.	51.	16.	59.
	11	18.	56.	18.	56.	18.	56.	18.	56.	18.	56.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

L.A.V. ZARAGOZA - LERIDA. SOBRANO I
E-4. FUERZAS LONGITUDINALES REOLOGICAS

		TEMPERATURA		RETRAC.		FRENADO	
X	NUDO	F. Sup.	F. Inf.	(t)	(kg/cm2)	(t)	(kg/cm2)
0.000	1	0	0	189	-2.0	644	-7.2
2.700	2	0.85	-1.34	186	-2.0	633	-7.0
5.400	3	1.7	-2.67	182	-2.0	621	-6.9
8.100	4	2.54	-4.01	179	-1.9	610	-6.8
10.800	5	3.39	-5.35	176	-1.9	599	-6.7
13.500	6	4.24	-6.69	172	-1.9	587	-6.5
16.200	7	5.09	-8.02	169	-1.8	576	-6.4
18.900	8	5.94	-9.36	166	-1.8	564	-6.3
21.600	9	6.79	-10.7	162	-1.8	553	-6.1
24.300	10	7.63	-12.03	159	-1.7	542	-6.0
27.000	11	8.48	-13.37	156	-1.7	530	-5.9
27.000	11	8.48	-13.37	156	-1.7	530	-5.9
29.875	12	8.31	-13.1	152	-1.6	518	-5.8
32.750	13	8.14	-12.84	149	-1.6	506	-5.6
35.250	14	8	-12.6	145	-1.6	496	-5.5
35.250	14	8	-12.6	145	-1.6	496	-5.5
39.375	15	7.75	-12.22	140	-1.5	478	-5.3
43.500	16	7.51	-11.83	135	-1.5	461	-5.1
47.625	17	7.26	-11.45	130	-1.4	444	-4.9
51.750	18	7.02	-11.06	125	-1.4	426	-4.7
54.250	19	6.87	-10.83	122	-1.3	416	-4.6
57.125	20	6.7	-10.56	118	-1.3	404	-4.5
60.000	21	6.53	-10.3	115	-1.2	391	-4.3
60.000	21	6.53	-10.3	115	-1.2	391	-4.3
62.875	22	6.53	-10.3	111	-1.2	379	-4.2
65.750	23	6.53	-10.3	108	-1.2	367	-4.1
68.250	24	6.53	-10.3	105	-1.1	357	-4.0
68.250	24	6.53	-10.3	105	-1.1	357	-4.0
72.375	25	6.53	-10.3	100	-1.1	339	-3.8
76.500	26	6.53	-10.29	95	-1.0	322	-3.6
80.625	27	6.53	-10.29	89	-1.0	305	-3.4
84.750	28	6.53	-10.29	84	-0.9	287	-3.2
87.250	29	6.53	-10.29	81	-0.9	277	-3.1
90.125	30	6.53	-10.29	78	-0.8	265	-2.9
93.000	31	6.53	-10.29	74	-0.8	253	-2.8
93.000	31	6.53	-10.29	74	-0.8	253	-2.8
95.875	32	6.7	-10.56	71	-0.8	240	-2.7
98.750	33	6.87	-10.83	67	-0.7	228	-2.5
101.250	34	7.02	-11.06	64	-0.7	218	-2.4
101.250	34	7.02	-11.06	64	-0.7	218	-2.4
105.375	35	7.26	-11.45	59	-0.6	200	-2.2
109.500	36	7.51	-11.84	54	-0.6	183	-2.0
113.625	37	7.75	-12.22	49	-0.5	166	-1.8
117.750	38	8	-12.61	44	-0.5	148	-1.6
120.250	39	8.15	-12.84	40	-0.4	138	-1.5
123.125	40	8.32	-13.11	37	-0.4	126	-1.4
126.000	41	8.49	-13.38	33	-0.4	114	-1.3
126.000	41	8.49	-13.38	33	-0.4	114	-1.3
130.125	42	7.19	-11.33	28	-0.3	96	-1.1
134.250	43	5.89	-9.29	23	-0.3	79	-0.9
134.250	43	5.89	-9.29	23	-0.3	79	-0.9
136.594	44	5.16	-8.13	20	-0.2	69	-0.8
138.938	45	4.42	-6.97	17	-0.2	59	-0.7
141.282	46	3.68	-5.81	14	-0.2	49	-0.5
143.626	47	2.95	-4.64	12	-0.1	39	-0.4
145.970	48	2.21	-3.48	9	-0.1	30	-0.3
148.314	49	1.47	-2.32	6	-0.1	20	-0.2
150.658	50	0.74	-1.16	3	-0.0	10	-0.1
153.000	51	0	0	0	0.0	0	0.0

TOTAL FRENADO: 644 Af: 9.25 l. fr.= 23.7
TOTAL RETRACCIO 189 Ar: 9
L. TOTAL: 153 canto: 2.45

CABLES TESADOS AL 80 %

		M+ FINAL Pret*1.1 SIN TEMPERATURA		M+ FINAL Pret*1.1 CON TEMPERATURA		M- FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 CON TEMPERATURA		M- FREQ. FINAL Pret*1.1 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	26.0	82.0	26.0	82.0	26.0	82.0	26.0	82.0	26.0	82.0	26.0	82.0
2.700	2	31.0	73.0	31.9	71.7	16.0	97.0	24.0	85.0	24.9	83.7	16.0	95.0
5.400	3	36.0	66.0	37.7	63.3	9.0	108.0	23.0	86.0	24.7	83.3	12.0	103.0
8.100	4	40.0	58.0	42.5	54.0	4.0	114.0	23.0	84.0	25.5	80.0	9.0	107.0
10.800	5	44.0	50.0	47.4	44.7	3.0	115.0	26.0	79.0	29.4	73.7	9.0	105.0
13.500	6	49.0	42.0	53.2	35.3	4.0	111.0	30.0	71.0	34.2	64.3	12.0	99.0
16.200	7	53.0	33.0	58.1	25.0	9.0	101.0	36.0	59.0	41.1	51.0	19.0	87.0
18.900	8	57.0	24.0	62.9	14.6	17.0	87.0	44.0	45.0	49.9	35.6	28.0	70.0
21.600	9	61.0	16.0	67.8	5.3	28.0	69.0	53.0	28.0	59.8	17.3	40.0	49.0
24.300	10	70.0	1.0	77.6	-11.0	39.0	50.0	67.0	6.0	74.6	-6.0	54.0	26.0
27.000	11	75.0	-1.0	83.5	-14.4	27.0	74.0	71.0	6.0	79.5	-7.4	52.0	36.0
27.000	11	75.0	-1.0	83.5	-14.4	27.0	74.0	71.0	6.0	79.5	-7.4	52.0	36.0
29.875	12	79.0	-6.0	87.3	-19.1	52.0	36.0	77.0	-2.0	85.3	-15.1	66.0	15.0
32.750	13	76.0	10.0	84.1	-2.8	52.0	48.0	70.0	19.0	78.1	6.2	61.0	34.0
35.250	14	76.0	19.0	84.0	6.4	44.0	69.0	65.0	37.0	73.0	24.4	52.0	57.0
35.250	14	70.0	2.0	78.0	-10.6	39.0	52.0	59.0	20.0	67.0	7.4	47.0	40.0
39.375	15	68.0	7.0	75.8	-5.2	27.0	72.0	50.0	35.0	57.8	22.8	34.0	61.0
43.500	16	59.0	26.0	66.5	14.2	13.0	99.0	38.0	58.0	45.5	46.2	20.0	88.0
47.625	17	59.0	29.0	66.3	17.6	14.0	99.0	40.0	58.0	47.3	46.6	22.0	86.0
51.750	18	59.0	30.0	66.0	18.9	21.0	90.0	46.0	50.0	53.0	38.9	31.0	74.0
54.250	19	61.0	20.0	67.9	9.2	30.0	68.0	54.0	30.0	60.9	19.2	42.0	50.0
57.125	20	72.0	-3.0	78.7	-13.6	40.0	48.0	69.0	2.0	75.7	-6.6	56.0	23.0
60.000	21	68.0	10.0	74.5	-0.3	16.0	91.0	64.0	16.0	70.5	5.7	44.0	48.0
60.000	21	68.0	10.0	74.5	-0.3	16.0	91.0	64.0	16.0	70.5	5.7	44.0	48.0
62.875	22	74.0	2.0	80.5	-8.3	43.0	51.0	71.0	6.0	77.5	-4.3	59.0	26.0
65.750	23	72.0	16.0	78.5	5.7	43.0	62.0	66.0	26.0	72.5	15.7	54.0	44.0
68.250	24	73.0	23.0	79.5	12.7	36.0	81.0	61.0	43.0	67.5	32.7	46.0	66.0
68.250	24	68.0	6.0	74.5	-4.3	31.0	64.0	56.0	26.0	62.5	15.7	41.0	49.0
72.375	25	66.0	11.0	72.5	0.7	21.0	82.0	48.0	40.0	54.5	29.7	30.0	68.0
76.500	26	57.0	30.0	63.5	19.7	9.0	105.0	36.0	62.0	42.5	51.7	17.0	92.0
80.625	27	57.0	31.0	63.5	20.7	12.0	102.0	38.0	60.0	44.5	49.7	20.0	89.0
84.750	28	58.0	31.0	64.5	20.7	21.0	89.0	46.0	51.0	52.5	40.7	31.0	74.0
87.250	29	60.0	21.0	66.5	10.7	31.0	67.0	54.0	31.0	60.5	20.7	42.0	49.0
90.125	30	72.0	-3.0	78.5	-13.3	40.0	47.0	69.0	2.0	75.5	-8.3	56.0	21.0
93.000	31	70.0	7.0	76.5	-3.3	18.0	86.0	66.0	13.0	72.5	2.7	45.0	46.0
93.000	31	70.0	7.0	76.5	-3.3	18.0	86.0	66.0	13.0	72.5	2.7	45.0	46.0
95.875	32	77.0	-2.0	83.7	-12.6	45.0	48.0	73.0	3.0	79.7	-7.6	61.0	23.0
98.750	33	74.0	12.0	80.9	1.2	44.0	61.0	68.0	23.0	74.9	12.2	55.0	43.0
101.250	34	75.0	20.0	82.0	8.9	37.0	80.0	62.0	40.0	69.0	28.9	47.0	64.0
101.250	34	70.0	3.0	77.0	-8.1	32.0	63.0	57.0	23.0	64.0	11.9	42.0	47.0
105.375	35	67.0	9.0	74.3	-2.4	23.0	79.0	49.0	38.0	56.3	26.6	31.0	66.0
109.500	36	57.0	29.0	64.5	17.2	11.0	101.0	37.0	61.0	44.5	49.2	18.0	90.0
113.625	37	56.0	32.0	63.8	19.6	15.0	98.0	39.0	60.0	46.8	47.8	22.0	87.0
117.750	38	56.0	34.0	64.0	21.4	25.0	84.0	45.0	52.0	53.0	39.4	32.0	71.0
120.250	39	59.0	23.0	67.2	10.2	35.0	60.0	53.0	31.0	61.2	18.2	44.0	47.0
123.125	40	71.0	-2.0	79.3	-15.1	44.0	41.0	69.0	2.0	77.3	-11.1	58.0	19.0
126.000	41	70.0	7.0	78.5	-6.4	22.0	82.0	66.0	14.0	74.5	0.6	47.0	43.0
126.000	41	70.0	7.0	78.5	-6.4	22.0	82.0	66.0	14.0	74.5	0.6	47.0	43.0
130.125	42	72.0	5.0	79.2	-6.3	43.0	51.0	68.0	12.0	75.2	0.7	56.0	31.0
134.250	43	74.0	6.0	79.9	-1.3	33.0	72.0	60.0	29.0	65.9	19.7	44.0	55.0
134.250	43	67.0	-6.0	72.9	-15.3	27.0	58.0	54.0	15.0	59.9	5.7	38.0	41.0
136.594	44	65.0	-1.0	70.2	-9.1	21.0	67.0	48.0	25.0	53.2	16.9	31.0	52.0
138.938	45	57.0	13.0	61.4	6.0	12.0	82.0	38.0	42.0	42.4	35.0	21.0	70.0
141.282	46	47.0	31.0	50.7	25.2	4.0	98.0	28.0	61.0	31.7	55.2	11.0	87.0
143.626	47	43.0	40.0	46.0	35.4	4.0	101.0	25.0	66.0	28.0	63.4	9.0	92.0
145.970	48	39.0	47.0	41.2	43.5	6.0	98.0	23.0	71.0	25.2	67.5	10.0	91.0
148.314	49	35.0	54.0	36.5	51.7	11.0	92.0	23.0	73.0	24.5	70.7	13.0	88.0
150.658	50	30.0	63.0	30.7	61.8	16.0	83.0	23.0	73.0	23.7	71.8	18.0	81.0
153.000	51	23.0	73.0	23.0	73.0	23.0	73.0	23.0	73.0	23.0	73.0	23.0	73.0

		M+ FINAL Pret*0.9 SIN TEMPERATURA		M+ FINAL Pret*0.9 CON TEMPERATURA		M- FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 CON TEMPERATURA		M- FREQ. FINAL Pret*0.9 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	22.0	67.0	22.0	67.0	22.0	67.0	22.0	67.0	22.0	67.0	22.0	67.0
2.700	2	30.0	53.0	30.9	51.7	15.0	77.0	22.0	65.0	22.9	63.7	16.0	75.0
5.400	3	37.0	42.0	38.7	39.3	10.0	85.0	24.0	63.0	25.7	60.3	13.0	80.0
8.100	4	42.0	33.0	44.5	29.0	6.0	89.0	25.0	59.0	27.5	55.0	11.0	82.0
10.800	5	46.0	25.0	49.4	19.7	5.0	91.0	27.0	55.0	30.4	49.7	11.0	81.0
13.500	6	49.0	19.0	53.2	12.3	5.0	89.0	31.0	48.0	35.2	41.3	13.0	76.0
16.200	7	51.0	14.0	56.1	6.0	8.0	83.0	34.0	41.0	39.1	33.0	17.0	68.0
18.900	8	52.0	12.0	57.9	2.6	12.0	75.0	39.0	32.0	44.9	22.6	23.0	58.0
21.600	9	51.0	11.0	57.6	0.3	18.0	64.0	44.0	23.0	50.8	12.3	30.0	45.0
24.300	10	55.0	5.0	62.6	-7.0	23.0	54.0	51.0	11.0	58.6	-1.0	38.0	30.0
27.000	11	55.0	9.0	63.5	-4.4	7.0	84.0	51.0	16.0	59.5	2.6	32.0	46.0
27.000	11	55.0	9.0	63.5	-4.4	7.0	84.0	51.0	16.0	59.5	2.6	32.0	46.0
29.875	12	62.0	0.0	70.3	-13.1	35.0	42.0	59.0	4.0	67.3	-9.1	48.0	21.0
32.750	13	63.0	7.0	71.1	-5.6	39.0	45.0	57.0	16.0	65.1	3.2	48.0	31.0
35.250	14	66.0	9.0	74.0	-3.6	35.0	58.0	55.0	27.0	63.0	14.4	43.0	46.0
35.250	14	62.0	-5.0	70.0	-17.6	31.0	45.0	51.0	13.0	59.0	0.4	38.0	32.0
39.375	15	65.0	-8.0	72.8	-20.2	23.0	58.0	47.0	20.0	54.8	7.8	30.0	47.0
43.500	16	58.0	6.0	65.5	-5.8	12.0	78.0	38.0	38.0	45.5	26.2	19.0	67.0
47.625	17	57.0	10.0	64.3	-1.4	12.0	80.0	38.0	39.0	45.3	27.6	20.0	67.0
51.750	18	53.0	17.0	60.0	5.9	15.0	77.0	40.0	37.0	47.0	25.9	25.0	61.0
54.250	19	51.0	14.0	57.9	3.2	20.0	63.0	44.0	26.0	50.9	14.2	32.0	45.0
57.125	20	56.0	2.0	62.7	-6.6	24.0	53.0	53.0	7.0	59.7	-3.6	40.0	28.0
60.000	21	49.0	16.0	55.5	7.7	-2.0	99.0	46.0	24.0	52.5	13.7	25.0	56.0
60.000	21	49.0	16.0	55.5	7.7	-2.0	99.0	46.0	24.0	52.5	13.7	25.0	56.0
62.875	22	58.0	6.0	64.5	-4.3	26.0	56.0	55.0	11.0	61.5	0.7	42.0	30.0
65.750	23	60.0	12.0	66.5	1.7	31.0	58.0	54.0	21.0	60.5	10.7	42.0	40.0
68.250	24	65.0	12.0	71.5	1.7	28.0	70.0	52.0	31.0	58.5	20.7	38.0	54.0
68.250	24	60.0	-2.0	66.5	-12.3	23.0	56.0	48.0	17.0	54.5	6.7	33.0	40.0
72.375	25	63.0	-5.0	69.5	-15.3	18.0	66.0	44.0	24.0	50.5	13.7	26.0	52.0
76.500	26	56.0	9.0	62.5	-1.3	9.0	83.0	36.0	41.0	42.5	30.7	17.0	71.0
80.625	27	55.0	12.0	61.5	1.7	10.0	83.0	37.0	41.0	43.5	30.7	19.0	69.0
84.750	28	52.0	16.0	58.5	7.7	15.0	76.0	40.0	38.0	46.5	27.7	25.0	61.0
87.250	29	50.0	15.0	56.5	4.7	21.0	62.0	44.0	25.0	50.5	14.7	32.0	44.0
90.125	30	56.0	3.0	62.5	-7.3	24.0	52.0	53.0	7.0	59.5	-3.3	40.0	27.0
93.000	31	51.0	16.0	57.5	5.7	-1.0	97.0	47.0	22.0	53.5	11.7	26.0	54.0
93.000	31	51.0	16.0	57.5	5.7	-1.0	97.0	47.0	22.0	53.5	11.7	26.0	54.0
95.875	32	60.0	2.0	66.7	-8.6	26.0	53.0	57.0	8.0	63.7	-2.6	44.0	28.0
98.750	33	62.0	8.0	68.9	-2.8	31.0	57.0	55.0	19.0	61.9	8.2	43.0	39.0
101.250	34	66.0	9.0	73.0	-2.1	28.0	69.0	54.0	29.0	61.0	17.9	38.0	53.0
101.250	34	62.0	-5.0	69.0	-16.1	24.0	55.0	49.0	15.0	56.0	3.9	34.0	39.0
105.375	35	64.0	-7.0	71.3	-18.5	19.0	64.0	45.0	23.0	52.3	11.6	27.0	51.0
109.500	36	57.0	6.0	64.5	-3.6	11.0	80.0	36.0	40.0	43.5	28.2	16.0	69.0
113.625	37	55.0	13.0	62.8	0.8	13.0	78.0	37.0	41.0	44.8	28.8	20.0	67.0
117.750	38	50.0	21.0	58.0	8.4	19.0	70.0	39.0	39.0	47.0	26.4	27.0	58.0
120.250	39	49.0	17.0	57.2	4.2	25.0	55.0	43.0	26.0	51.2	13.2	34.0	41.0
123.125	40	55.0	4.0	63.3	-9.1	28.0	46.0	53.0	7.0	61.3	-6.1	42.0	24.0
126.000	41	51.0	16.0	59.5	2.6	3.0	90.0	47.0	22.0	55.5	8.6	28.0	52.0
126.000	41	51.0	16.0	59.5	2.6	3.0	90.0	47.0	22.0	55.5	8.6	28.0	52.0
130.125	42	56.0	6.0	65.2	-5.3	29.0	52.0	54.0	13.0	61.2	1.7	42.0	31.0
134.250	43	65.0	-2.0	70.9	-11.3	25.0	62.0	52.0	19.0	57.9	9.7	36.0	45.0
134.250	43	60.0	-13.0	65.9	-22.3	20.0	50.0	47.0	8.0	52.9	-1.3	31.0	33.0
136.594	44	61.0	-13.0	66.2	-21.1	17.0	55.0	44.0	13.0	49.2	4.9	27.0	40.0
138.938	45	56.0	-4.0	60.4	-11.0	11.0	65.0	37.0	25.0	41.4	16.0	19.0	53.0
141.282	46	48.0	10.0	51.7	4.2	6.0	77.0	29.0	39.0	32.7	33.2	12.0	66.0
143.626	47	45.0	17.0	48.0	12.4	6.0	78.0	27.0	45.0	30.0	40.4	11.0	70.0
145.970	48	40.0	25.0	42.2	21.5	6.0	76.0	25.0	49.0	27.2	45.5	12.0	69.0
148.314	49	35.0	34.0	36.5	31.7	11.0	72.0	23.0	52.0	24.5	49.7	14.0	66.0
150.658	50	28.0	45.0	28.7	43.8	15.0	66.0	21.0	56.0	21.7	54.8	16.0	64.0
153.000	51	19.0	59.0	19.0	59.0	19.0	59.0	19.0	59.0	19.0	59.0	19.0	59.0

CABLES TESADOS AL 75 %

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt Inf.	F. Sup.	F. Inf.	Vt sup.	Vt Inf.
0.000	1	23.0	75.0	0.0	0.0	23.0	75.0	0.0	0.0
2.700	2	29.8	63.7	0.0	0.0	14.0	88.0	0.0	0.0
5.400	3	35.7	53.4	0.0	0.0	7.0	98.0	0.0	0.0
8.100	4	41.6	44.1	0.0	0.0	3.1	104.1	0.0	0.0
10.800	5	46.5	34.8	0.0	0.0	2.1	105.1	0.0	0.0
13.500	6	51.4	25.4	0.0	0.0	3.1	101.1	0.0	0.0
16.200	7	56.3	17.2	0.0	0.0	7.2	93.2	0.0	0.0
18.900	8	60.1	8.8	0.0	0.0	14.2	81.2	0.0	0.0
21.600	9	63.0	1.5	0.0	0.0	23.2	65.2	0.0	0.0
24.300	10	70.9	-11.7	0.0	-20.5	32.3	49.3	0.0	0.0
27.000	11	74.8	-13.1	0.0	-23.8	19.3	75.3	0.0	0.0
27.000	11	74.8	-13.1	0.0	-23.8	19.3	75.3	0.0	0.0
29.875	12	80.7	-19.7	0.0	-47.6	45.4	36.4	0.0	0.0
32.750	13	78.5	-5.4	0.0	-4.3	46.4	45.4	0.0	0.0
35.250	14	79.4	2.8	0.0	0.0	39.4	64.4	0.0	0.0
35.250	14	74.4	-13.2	0.0	-24.3	34.4	48.4	0.0	0.0
39.375	15	73.2	-10.7	0.0	-16.8	24.5	66.5	0.0	0.0
43.500	16	65.0	6.7	0.0	0.0	11.5	91.5	0.0	0.0
47.625	17	63.9	10.1	0.0	0.0	11.6	92.6	0.0	0.0
51.750	18	62.7	13.6	0.0	0.0	17.6	84.6	0.0	0.0
54.250	19	63.6	5.9	0.0	0.0	25.7	85.7	0.0	0.0
57.125	20	72.4	-13.8	0.0	-27.2	33.7	47.7	0.0	0.0
60.000	21	67.3	0.5	0.0	0.0	9.8	91.8	0.0	0.0
60.000	21	67.3	0.5	0.0	0.0	9.8	91.8	0.0	0.0
62.875	22	74.3	-8.5	0.0	-10.7	36.8	50.8	0.0	0.0
65.750	23	74.4	2.5	0.0	0.0	37.8	59.8	0.0	0.0
68.250	24	76.4	8.6	0.0	0.0	32.9	76.9	0.0	0.0
68.250	24	70.4	-7.4	0.0	-8.7	27.9	60.9	0.0	0.0
72.375	25	70.5	-5.4	0.0	-4.7	18.9	75.9	0.0	0.0
76.500	26	62.5	12.7	0.0	0.0	8.0	97.0	0.0	0.0
80.625	27	62.6	14.7	0.0	0.0	11.0	96.0	0.0	0.0
84.750	28	61.6	16.8	0.0	0.0	18.1	85.1	0.0	0.0
87.250	29	62.7	7.8	0.0	0.0	27.1	64.1	0.0	0.0
90.125	30	72.7	-12.1	0.0	-21.2	35.2	47.2	0.0	0.0
93.000	31	69.7	-2.1	0.0	-0.7	11.2	69.2	0.0	0.0
93.000	31	69.7	-2.1	0.0	-0.7	11.2	69.2	0.0	0.0
95.875	32	77.9	-12.3	0.0	-20.6	39.2	48.2	0.0	0.0
98.750	33	77.1	-0.6	0.0	-0.0	39.3	59.3	0.0	0.0
101.250	34	78.3	6.2	0.0	0.0	33.3	76.3	0.0	0.0
101.250	34	73.3	-10.8	0.0	-16.8	28.3	60.3	0.0	0.0
105.375	35	72.6	-8.1	0.0	-9.9	21.4	74.4	0.0	0.0
109.500	36	63.9	10.6	0.0	0.0	10.4	94.4	0.0	0.0
113.625	37	63.2	14.3	0.0	0.0	13.5	91.5	0.0	0.0
117.750	38	61.5	17.9	0.0	0.0	22.5	79.5	0.0	0.0
120.250	39	63.7	7.7	0.0	0.0	31.6	58.6	0.0	0.0
123.125	40	73.9	-13.5	0.0	-25.6	38.6	41.6	0.0	0.0
126.000	41	72.1	-4.7	0.0	-3.6	15.6	83.6	0.0	0.0
126.000	41	72.1	-4.7	0.0	-3.6	15.6	83.6	0.0	0.0
130.125	42	74.9	-6.6	0.0	-6.6	38.7	50.7	0.0	0.0
134.250	43	76.6	-4.5	0.0	-3.1	30.7	67.7	0.0	0.0
134.250	43	70.6	-17.5	0.0	-42.7	24.7	54.7	0.0	0.0
136.594	44	67.9	-13.3	0.0	-26.9	19.8	62.8	0.0	0.0
138.938	45	60.2	-0.2	0.0	-0.0	11.6	76.6	0.0	0.0
141.282	46	51.5	18.0	0.0	0.0	4.6	90.6	0.0	0.0
143.626	47	45.8	27.2	0.0	0.0	4.9	92.9	0.0	0.0
145.970	48	41.1	35.4	0.0	0.0	6.9	90.9	0.0	0.0
148.314	49	36.4	44.6	0.0	0.0	10.9	84.9	0.0	0.0
150.658	50	29.7	55.6	0.0	0.0	16.0	78.0	0.0	0.0
153.000	51	22.0	68.0	0.0	0.0	22.0	68.0	0.0	0.0

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA				VALORES MAXIMOS			ARMADURAS	
										Vt sup.	Vt Inf.	frenado		
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt Inf.	F. Sup.	F. Inf.	Vt sup.	Vt Inf.	max(t/m)	max(t/m)	(t/m)	As cm2	Al cm2
0.000	1	18.0	61.0	0.0	0.0	18.0	61.0	0.0	0.0	0.0	0.0	27.2	8.82	8.82
2.700	2	28.8	44.7	0.0	0.0	13.0	70.0	0.0	0.0	0.0	0.0	26.7	8.67	8.67
5.400	3	36.7	31.4	0.0	0.0	8.0	76.0	0.0	0.0	0.0	0.0	26.2	8.51	8.51
8.100	4	43.6	20.1	0.0	0.0	5.1	80.1	0.0	0.0	0.0	0.0	25.7	8.36	8.36
10.800	5	48.5	11.8	0.0	0.0	3.1	82.1	0.0	0.0	0.0	0.0	25.3	8.20	8.20
13.500	6	51.4	4.4	0.0	0.0	3.1	80.1	0.0	0.0	0.0	0.0	24.8	8.04	8.04
16.200	7	54.3	-0.8	0.0	-0.2	5.2	76.2	0.0	0.0	0.0	-0.2	24.3	7.89	7.94
18.900	8	55.1	-3.2	0.0	-2.1	9.2	69.2	0.0	0.0	0.0	-2.1	23.8	7.73	8.41
21.600	9	54.0	-2.5	0.0	-1.3	13.2	61.2	0.0	0.0	0.0	-1.3	23.3	7.58	8.00
24.300	10	56.9	-7.7	0.0	-11.4	17.3	53.3	0.0	0.0	0.0	-20.5	22.9	7.42	14.06
27.000	11	56.8	-3.1	0.0	-1.9	0.3	84.3	0.0	0.0	0.0	-23.8	22.4	7.27	14.98
27.000	11	56.8	-3.1	0.0	-1.9	0.3	84.3	0.0	0.0	0.0	-23.8	22.4	7.27	14.98
29.875	12	63.7	-13.7	0.0	-29.9	26.4	42.4	0.0	0.0	0.0	-47.6	21.9	7.10	22.54
32.750	13	66.5	-8.4	0.0	-11.7	34.4	42.4	0.0	0.0	0.0	-11.7	21.4	6.93	10.72
35.250	14	70.4	-7.2	0.0	-6.1	30.4	54.4	0.0	0.0	0.0	-6.1	20.9	6.79	9.43
35.250	14	66.4	-20.2	0.0	-57.6	26.4	41.4	0.0	0.0	0.0	-57.6	20.9	6.79	25.48
39.375	15	70.2	-24.7	0.0	-76.9	20.5	52.5	0.0	0.0	0.0	-76.9	20.2	6.55	32.18
43.500	16	64.0	-12.3	0.0	-24.2	10.5	71.5	0.0	0.0	0.0	-24.2	19.4	6.31	14.19
47.625	17	61.9	-7.9	0.0	-10.8	10.6	74.6	0.0	0.0	0.0	-10.8	18.7	6.08	9.60
51.750	18	57.7	1.6	0.0	0.0	11.6	72.6	0.0	0.0	0.0	0.0	18.0	5.84	5.84
54.250	19	54.6	0.9	0.0	0.0	18.7	60.7	0.0	0.0	0.0	0.0	17.5	5.69	5.69
57.125	20	57.4	-8.8	0.0	-14.4	16.7	51.7	0.0	0.0	0.0	-27.2	17.0	5.53	14.36
60.000	21	50.3	7.5	0.0	0.0	-8.2	99.8	-7.7	0.0	-7.7	0.0	16.5	7.87	5.36
60.000	21	50.3	7.5	0.0	0.0	-8.2	99.8	-7.7	0.0	-7.7	0.0	16.5	7.87	5.36
62.875	22	58.3	-4.5	0.0	-4.0	20.8	54.8	0.0	0.0	0.0	-10.7	16.0	5.20	8.67
65.750	23	62.4	-1.5	0.0	-0.4	26.8	54.8	0.0	0.0	0.0	-0.4	15.5	5.03	5.17
68.250	24	67.4	-2.4	0.0	-1.0	24.9	65.9	0.0	0.0	0.0	-1.0	15.1	4.89	5.22
68.250	24	63.4	-15.4	0.0	-37.0	20.9	52.9	0.0	0.0	0.0	-37.0	15.1	4.89	16.90
72.375	25	67.5	-20.4	0.0	-57.9	15.9	60.9	0.0	0.0	0.0	-57.9	14.3	4.65	23.45
76.500	26	61.5	-7.3	0.0	-9.5	8.0	77.0	0.0	0.0	0.0	-9.5	13.6	4.41	7.50
80.625	27	60.6	-4.3	0.0	-3.4	9.0	77.0	0.0	0.0	0.0	-3.4	12.9	4.17	5.29
84.750	28	56.6	3.8	0.0	0.0	13.1	72.1	0.0	0.0	0.0	0.0	12.1	3.94	3.94
87.250	29	53.7	2.8	0.0	0.0	18.1	59.1	0.0	0.0	0.0	0.0	11.7	3.79	3.79
90.125	30	57.7	-7.1	0.0	-9.6	19.2	52.2	0.0	0.0	0.0	-21.2	11.2	3.63	10.53
93.000	31	51.7	5.9	0.0	0.0	-5.8	98.2	-4.0	0.0	-4.0	-0.7	10.7	4.75	3.70
93.000	31	51.7	5.9	0.0	0.0	-5.8	98.2	-4.0	0.0	-4.0	-0.7	10.7	4.75	3.70
95.875	32	61.9	-8.3	0.0	-12.1	23.2	53.2	0.0	0.0	0.0	-20.6	10.1	3.29	9.99
98.750	33	65.1	-4.6	0.0	-3.6	27.3	55.3	0.0	0.0	0.0	-3.6	9.6	3.13	4.31
101.250	34	70.3	-4.8	0.0	-3.7	25.3	66.3	0.0	0.0	0.0	-3.7	9.2	2.98	4.18
101.250	34	66.3	-17.8	0.0	-45.9	21.3	52.3	0.0	0.0	0.0	-45.9	9.2	2.98	17.89
105.375	35	69.6	-22.1	0.0	-65.2	17.4	59.4	0.0	0.0	0.0	-65.2	8.5	2.75	23.90
109.500	36	63.9	-9.4	0.0	-14.8	10.4	74.4	0.0	0.0	0.0	-14.8	7.7	2.51	7.32
113.625	37	61.2	-4.7	0.0	-4.2	12.5	73.5	0.0	0.0	0.0	-4.2	7.0	2.27	3.63
117.750	38	56.5	4.9	0.0	0.0	16.5	67.5	0.0	0.0	0.0	0.0	6.3	2.03	2.03
120.250	39	54.7	2.7	0.0	0.0	22.6	53.6	0.0	0.0	0.0	0.0	5.8	1.89	1.89
123.125	40	58.9	-8.5	0.0	-13.2	23.6	46.6	0.0	0.0	0.0	-25.6	5.3	1.72	10.03
126.000	41	54.1	4.3	0.0	0.0	-2.4	91.6	-0.7	0.0	-0.7	-3.6	4.8	1.79	2.72
126.000	41	54.1	4.3	0.0	0.0	-2.4	91.6	-0.7	0.0	-0.7	-3.6	4.8	1.79	2.72
130.125	42	61.9	-5.6	0.0	-5.8	24.7	51.7	0.0	0.0	0.0	-6.6	4.1	1.32	3.47
134.250	43	68.6	-14.5	0.0	-31.1	22.7	58.7	0.0	0.0	0.0	-31.1	3.3	1.08	11.19
134.250	43	64.6	-24.5	0.0	-82.7	17.7	47.7	0.0	0.0	0.0	-82.7	3.3	1.08	27.94
136.594	44	64.9	-24.3	0.0	-81.3	15.8	51.8	0.0	0.0	0.0	-81.3	2.9	0.95	27.36
138.938	45	59.2	-16.2	0.0	-42.4	10.8	60.8	0.0	0.0	0.0	-42.4	2.5	0.81	14.59
141.282	46	52.5	-2.0	0.0	-0.9	5.8	70.8	0.0	0.0	0.0	-0.9	2.1	0.68	0.96
143.626	47	47.8	6.2	0.0	0.0	5.9	71.9	0.0	0.0	0.0	0.0	1.7	0.54	0.54
145.970	48	43.1	15.4	0.0	0.0	7.9	69.9	0.0	0.0	0.0	0.0	1.2	0.41	0.41
148.314	49	36.4	25.6	0.0	0.0	10.9	65.9	0.0	0.0	0.0	0.0	0.6	0.27	0.27
150.658	50	28.7	39.8	0.0	0.0	14.0	61.0	0.0	0.0	0.0	0.0	0.4	0.14	0.14
153.000	51	18.0	56.0	0.0	0.0	18.0	56.0	0.0	0.0	0.0	0.0	0.0	0.00	0.00

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M- FINAL Pret*0.9 SIN TEMPERATURA				VALORES MAXIMOS			ARMADURAS	
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	Vt sup. max(t/m)	Vt inf. max(t/m)	frenado (t/m)	As cm2	Al cm2
0.000	1	24.0	80.0	0.0	0.0	24.0	80.0	0.0	0.0	20.0	65.0	0.0	0.0	20.0	65.0	0.0	0.0	0.0	0.0	27.2	8.8	8.8
2.700	2	29.8	69.7	0.0	0.0	14.0	95.0	0.0	0.0	28.8	49.7	0.0	0.0	13.0	75.0	0.0	0.0	0.0	0.0	26.7	8.7	8.7
5.400	3	35.7	61.4	0.0	0.0	7.0	106.0	0.0	0.0	36.7	37.4	0.0	0.0	8.0	83.0	0.0	0.0	0.0	0.0	26.2	8.5	8.5
8.100	4	40.6	52.1	0.0	0.0	2.1	112.1	0.0	0.0	42.6	27.1	0.0	0.0	4.1	87.1	0.0	0.0	0.0	0.0	25.7	8.4	8.4
10.800	5	45.5	42.8	0.0	0.0	1.1	113.1	0.0	0.0	47.5	17.8	0.0	0.0	3.1	89.1	0.0	0.0	0.0	0.0	25.3	8.2	8.2
13.500	6	51.4	33.4	0.0	0.0	2.1	109.1	0.0	0.0	51.4	10.4	0.0	0.0	3.1	87.1	0.0	0.0	0.0	0.0	24.8	8.0	8.0
16.200	7	56.3	23.2	0.0	0.0	7.2	99.2	0.0	0.0	54.3	4.2	0.0	0.0	8.2	81.2	0.0	0.0	0.0	0.0	24.3	7.9	7.9
18.900	8	61.1	12.8	0.0	0.0	15.2	85.2	0.0	0.0	56.1	0.8	0.0	0.0	10.2	73.2	0.0	0.0	0.0	0.0	23.8	7.7	7.7
21.600	9	66.0	3.5	0.0	0.0	26.2	67.2	0.0	0.0	56.0	-1.5	0.0	-0.5	16.2	62.2	0.0	0.0	0.0	-0.5	23.3	7.6	7.7
24.300	10	75.9	-12.7	0.0	-22.5	37.3	48.3	0.0	0.0	60.9	-8.7	0.0	-13.5	21.3	52.3	0.0	0.0	0.0	-22.5	22.9	7.4	14.7
27.000	11	81.8	-16.1	0.0	-32.3	25.3	72.3	0.0	0.0	61.8	-6.1	0.0	-6.6	5.3	82.3	0.0	0.0	0.0	-32.3	22.4	7.3	17.7
27.000	11	81.8	-16.1	0.0	-32.3	25.3	72.3	0.0	0.0	61.8	-6.1	0.0	-6.6	5.3	82.3	0.0	0.0	0.0	-32.3	22.4	7.3	17.7
29.875	12	85.7	-20.7	0.0	-49.5	50.4	34.4	0.0	0.0	68.7	-14.7	0.0	-31.9	33.4	40.4	0.0	0.0	0.0	-49.5	21.9	7.1	23.2
32.750	13	82.5	-4.4	0.0	-2.8	50.4	46.4	0.0	0.0	69.5	-7.4	0.0	-8.8	37.4	43.4	0.0	0.0	0.0	-8.8	21.4	6.9	9.8
35.250	14	82.4	4.8	0.0	0.0	42.4	67.4	0.0	0.0	72.4	-5.2	0.0	-4.2	33.4	56.4	0.0	0.0	0.0	-4.2	20.9	6.8	8.2
35.250	14	78.4	-12.2	0.0	-20.5	37.4	50.4	0.0	0.0	68.4	-19.2	0.0	-51.4	29.4	43.4	0.0	0.0	0.0	-51.4	20.9	6.8	23.5
39.375	15	74.2	-6.7	0.0	-6.9	25.5	70.5	0.0	0.0	71.2	-21.7	0.0	-62.3	21.5	56.5	0.0	0.0	0.0	-62.3	20.2	6.6	26.8
43.500	16	65.0	12.7	0.0	0.0	11.5	97.5	0.0	0.0	64.0	-7.3	0.0	-9.1	10.5	76.5	0.0	0.0	0.0	-9.1	19.4	6.3	9.3
47.625	17	64.9	16.1	0.0	0.0	12.6	97.6	0.0	0.0	62.9	-2.9	0.0	-1.5	10.6	78.6	0.0	0.0	0.0	-1.5	18.7	6.1	6.6
51.750	18	64.7	17.6	0.0	0.0	19.6	88.6	0.0	0.0	58.7	4.6	0.0	0.0	13.6	75.6	0.0	0.0	0.0	0.0	18.0	5.8	5.8
54.250	19	66.6	7.9	0.0	0.0	28.7	66.7	0.0	0.0	56.6	1.9	0.0	0.0	18.7	61.7	0.0	0.0	0.0	0.0	17.5	5.7	5.7
57.125	20	77.4	-14.8	0.0	-29.2	38.7	46.7	0.0	0.0	61.4	-9.8	0.0	-16.6	22.7	51.7	0.0	0.0	0.0	-29.2	17.0	5.5	15.0
60.000	21	73.3	-1.5	0.0	-0.4	14.8	89.8	0.0	0.0	54.3	6.5	0.0	0.0	-3.2	97.8	-1.3	0.0	-1.3	-0.4	16.5	5.8	5.5
60.000	21	73.3	-1.5	0.0	-0.4	14.8	89.8	0.0	0.0	54.3	6.5	0.0	0.0	-3.2	97.8	-1.3	0.0	-1.3	-0.4	16.5	5.8	5.5
62.875	22	79.3	-9.5	0.0	-12.5	41.8	49.8	0.0	0.0	63.3	-5.5	0.0	-5.4	24.8	54.8	0.0	0.0	0.0	-12.5	16.0	5.2	9.2
65.750	23	77.4	4.5	0.0	0.0	41.8	60.8	0.0	0.0	65.4	0.5	0.0	0.0	29.8	56.8	0.0	0.0	0.0	0.0	15.5	5.0	5.0
68.250	24	78.4	11.6	0.0	0.0	34.9	79.9	0.0	0.0	70.4	0.6	0.0	0.0	26.9	66.9	0.0	0.0	0.0	0.0	15.1	4.9	4.9
68.250	24	73.4	-5.4	0.0	-4.6	29.9	62.9	0.0	0.0	65.4	-13.4	0.0	-28.0	21.9	54.9	0.0	0.0	0.0	-28.0	15.1	4.9	14.0
72.375	25	71.5	-0.4	0.0	-0.0	19.9	80.9	0.0	0.0	66.5	-16.4	0.0	-38.7	16.9	64.9	0.0	0.0	0.0	-38.7	14.3	4.6	17.2
76.500	26	62.5	18.7	0.0	0.0	8.0	104.0	0.0	0.0	61.5	-2.3	0.0	-1.0	6.0	82.0	0.0	0.0	0.0	-1.0	13.6	4.4	4.7
80.625	27	62.6	19.7	0.0	0.0	11.0	101.0	0.0	0.0	60.6	0.7	0.0	0.0	9.0	82.0	0.0	0.0	0.0	0.0	12.9	4.2	4.2
84.750	28	63.6	19.8	0.0	0.0	20.1	88.1	0.0	0.0	57.6	6.8	0.0	0.0	14.1	75.1	0.0	0.0	0.0	0.0	12.1	3.9	3.9
87.250	29	65.7	9.8	0.0	0.0	30.1	66.1	0.0	0.0	55.7	3.8	0.0	0.0	20.1	61.1	0.0	0.0	0.0	0.0	11.7	3.8	3.8
90.125	30	77.7	-14.1	0.0	-26.8	39.2	48.2	0.0	0.0	61.7	-8.1	0.0	-11.6	23.2	51.2	0.0	0.0	0.0	-26.6	11.2	3.6	12.3
93.000	31	75.7	-4.1	0.0	-2.6	17.2	87.2	0.0	0.0	56.7	4.9	0.0	0.0	-1.8	96.2	-0.4	0.0	-0.4	-2.6	10.7	3.6	4.3
93.000	31	75.7	-4.1	0.0	-2.6	17.2	87.2	0.0	0.0	56.7	4.9	0.0	0.0	-1.8	96.2	-0.4	0.0	-0.4	-2.6	10.7	3.6	4.3
95.875	32	82.9	-13.3	0.0	-22.6	44.2	47.2	0.0	0.0	65.9	-9.3	0.0	-14.1	27.2	52.2	0.0	0.0	0.0	-22.6	10.1	3.3	10.6
98.750	33	80.1	0.4	0.0	0.0	43.3	60.3	0.0	0.0	68.1	-3.6	0.0	-2.2	30.3	56.3	0.0	0.0	0.0	-2.2	9.6	3.1	3.8
101.250	34	81.3	8.2	0.0	0.0	36.3	79.3	0.0	0.0	72.3	-2.8	0.0	-1.2	27.3	68.3	0.0	0.0	0.0	-1.2	9.2	3.0	3.4
101.250	34	76.3	-6.8	0.0	-11.0	31.3	62.3	0.0	0.0	68.3	-16.8	0.0	-40.4	23.3	54.3	0.0	0.0	0.0	-40.4	9.2	3.0	16.1
105.375	35	73.6	-3.1	0.0	-1.5	22.4	78.4	0.0	0.0	70.6	-19.1	0.0	-49.7	18.4	63.4	0.0	0.0	0.0	-49.7	8.5	2.7	18.9
109.500	36	63.9	16.6	0.0	0.0	10.4	100.4	0.0	0.0	63.9	-4.4	0.0	-3.5	10.4	79.4	0.0	0.0	0.0	-3.5	7.7	2.5	3.6
113.625	37	63.2	19.3	0.0	0.0	14.5	97.5	0.0	0.0	62.2	0.3	0.0	0.0	12.5	77.5	0.0	0.0	0.0	0.0	7.0	2.3	2.3
117.750	38	63.5	20.9	0.0	0.0	24.5	83.5	0.0	0.0	57.5	7.9	0.0	0.0	18.5	69.5	0.0	0.0	0.0	0.0	6.3	2.0	2.0
120.250	39	66.7	9.7	0.0	0.0	34.6	59.6	0.0	0.0	56.7	3.7	0.0	0.0	24.6	54.6	0.0	0.0	0.0	0.0	5.8	1.9	1.9
123.125	40	78.9	-15.5	0.0	-31.2	43.6	40.6	0.0	0.0	62.9	-9.5	0.0	-15.3	27.6	45.6	0.0	0.0	0.0	-31.2	5.3	1.7	11.9
126.000	41	76.1	-6.7	0.0	-6.6	21.6	81.6	0.0	0.0	59.1	2.3	0.0	0.0	2.6	89.6	0.0	0.0	0.0	-6.6	4.8	1.6	3.7
126.000	41	76.1	-6.7	0.0	-6.6	21.6	81.6	0.0	0.0	59.1	2.3	0.0	0.0	2.6	89.6	0.0	0.0	0.0	-6.6	4.8	1.6	3.7
130.125	42	78.9	-6.6	0.0	-6.3	42.7	50.7	0.0	0.0	64.9	-5.6	0.0	-5.5	28.7	51.7	0.0	0.0	0.0	-6.3	4.1	1.3	3.4
134.250	43	79.6	-1.5	0.0	-0.4	32.7	71.7	0.0	0.0	70.6	-11.5	0.0	-19.9	24.7	61.7	0.0	0.0	0.0	-19.9	3.3	1.1	7.5
134.250	43	72.6	-15.5	0.0	-33.5	26.7	57.7	0.0	0.0	65.6	-22.5	0.0	-70.6	19.7	49.7	0.0	0.0	0.0	-70.6	3.3	1.1	24.0
138.594	44	69.9	-9.3	0.0	-13.5	20.8	66.8	0.0	0.0	65.9	-21.3	0.0	-64.0	16.8	54.8	0.0	0.0	0.0	-64.0	2.9	0.9	21.7
138.938	45	61.2	5.8	0.0	0.0	11.8	81.8	0.0	0.0	60.2	-11.2	0.0	-21.4	10.8	64.8	0.0	0.0	0.0	-21.4	2.5	0.8	7.7
141.282	46	50.5	25.0	0.0	0.0	3.8	97.8	0.0	0.0	51.5	4.0	0.0	0.0	5.8	76.8	0.0	0.0	0.0	0.0	2.1	0.7	0.7
143.626	47	45.8	35.2	0.0	0.0	3.9	100.9	0.0	0.0	47.8	12.2	0.0	0.0	5.9	77.9	0.0	0.0	0.0	0.0	1.7	0.5	0.5
145.970	48	41.1	43.4	0.0	0.0	5.9	97.9	0.0	0.0	42.1	21.4	0.0	0.0	7.9	75.9	0.0	0.0	0.0	0.0	1.2	0.4	0.4
148.314	49	36.4	51.6	0.0	0.0	10.9	91.9	0.0	0.0	36.4	31.6	0.0	0.0	10.9	71.9	0.0	0.0	0.0	0.0	0.8	0.3	0.3
150.658	50	30.7	61.8	0.0	0.0	16.0	83.0	0.0	0.0	28.7	43.8	0.0	0.0	15.0	66.0	0.0	0.0	0.0	0.0	0.4	0.1	0.1
153.000	51	23.0	73.0	0.0	0.0	23.0	73.0	0.0	0.0	19.0	59.0	0.0	0.0	19.0	59.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

E-4
CABLES TESADOS AL 80%

PROYECTO L.A.V ZARAGOZA - LLEIDA	FECHA
SUBTRAMO I E-4	
COMPROBACION A ROTURA	HOJA N.º

COMPROBACION A ROTURA POR FLEXION

A continuación se adjuntan para cada sección los momentos mayorados producidos por cargas exteriores, el momento hiperestático de pretensado, la suma de ambos, ponderando el pretensado por 0,9 ó 1.1 y los momentos últimos, tanto positivos como negativos.

En el siguiente cuadro se resumen las secciones de centro de vano y sobre pilas.

SECCION	Md F. exteriores	Md F. exteriores + hiperestático ponderado	M último
V-1	6266.	6994	8794
P-1	-9371	-7997	-9613
P-2 y P-3	-9892	-8564	-9613
V-2, V-3	6337	8064	11229
P-4	-9391	-7733	-9613
V-4	6267	7077	9896

El momento total es inferior al momento último en todas las secciones estudiadas => El coeficiente de seguridad a rotura es superior a 1.6.

Calculo de Comprobacion a Rotura - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio .	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
1	1	(H1)	0.00	0.00	0.00	5896.16	0.4	-5125.26	0.6
	1	(H2)	0.00	0.00	0.00	5896.16	0.4	-5125.26	0.6
	2	(H1)	2672.38	184.20	2875.00	7662.86	0.4	-3430.06	0.5
	2	(H2)	951.11	184.20	1153.72	7662.86	0.4	-3430.06	0.5
	3	(H1)	4607.62	368.40	5012.86	8903.20	0.4	-2171.58	0.4
	3	(H2)	1519.71	368.40	1924.95	8903.20	0.4	-2171.58	0.4
	4	(H1)	5805.72	552.60	6413.58	9647.56	0.4	-1521.57	0.4
	4	(H2)	1705.81	552.60	2313.67	9647.56	0.4	-1521.57	0.4
	5	(H1)	6266.67	736.80	7077.15	9895.61	0.4	-1312.72	0.4
	5	(H2)	1509.41	736.80	2319.90	9895.61	0.4	-1312.72	0.4
	6	(H1)	5990.48	921.00	7003.58	9615.20	0.4	-1519.48	0.4
	6	(H2)	930.51	921.00	1943.62	9615.20	0.4	-1519.48	0.4
	7	(H1)	4977.14	1105.21	6192.87	8773.98	0.4	-2205.77	0.5
	7	(H2)	-30.89	1105.21	963.80	8773.98	0.4	-2205.77	0.5
	8	(H1)	3226.67	1289.41	4645.02	7371.94	0.4	-3514.34	0.5
	8	(H2)	-1374.79	1289.41	-214.32	7371.94	0.4	-3514.34	0.5
	9	(H1)	739.05	1473.61	2360.02	5338.83	0.4	-5478.87	0.6
	9	(H2)	-3101.19	1473.61	-1774.94	5338.83	0.4	-5478.87	0.6
	10	(H1)	-1820.22	1657.82	-328.18	2597.73	0.3	-8133.43	0.8
	10	(H2)	-5391.69	1657.82	-3899.65	2597.73	0.3	-8133.43	0.8
	11	(H1)	-3934.97	1842.02	-2277.15	1361.99	0.3	-9612.65	0.8
	11	(H2)	-9390.86	1842.02	-7733.04	1361.99	0.3	-9612.65	0.8
2	1	(H1)	-3934.97	1842.02	-2277.15	1361.99	0.3	-9612.65	0.8
	1	(H2)	-9390.86	1842.02	-7733.04	1361.99	0.3	-9612.65	0.8
	2	(H1)	-1979.90	1810.09	-350.82	2462.53	0.3	-8423.00	0.7
	2	(H2)	-5066.61	1810.09	-3437.53	2462.53	0.3	-8423.00	0.7
	3	(H1)	469.06	1806.37	2456.07	5759.58	0.4	-6397.17	0.7
	3	(H2)	-2287.76	1806.37	-662.03	5759.58	0.4	-6397.17	0.7
	4AI	(H1)	2766.63	1806.62	4753.91	5865.98	0.4	-5165.44	0.5
	4AI	(H2)	-833.59	1806.62	792.38	5865.98	0.4	-5165.44	0.5
	4AD	(H1)	2766.63	1806.62	4753.91	7099.98	0.4	-5042.35	0.6

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	4AD	(H2)	-833.59	1806.62	792.37	7099.98	0.4	-5042.35	0.6
	5	(H1)	5419.83	1760.53	7356.41	9610.35	0.4	-2713.17	0.5
	5	(H2)	633.07	1760.53	2569.65	9610.35	0.4	-2713.17	0.5
	6	(H1)	6352.46	1714.43	8238.34	11229.09	0.4	-1264.16	0.4
	6	(H2)	1066.29	1714.43	2952.17	11229.09	0.4	-1264.16	0.4
	7	(H1)	5568.10	1668.92	7403.91	10523.40	0.4	-1774.29	0.4
	7	(H2)	430.55	1668.92	2266.36	10523.40	0.4	-1774.29	0.4
	8	(H1)	3068.45	1623.41	4854.20	8445.12	0.4	-3614.72	0.6
	8	(H2)	-1308.03	1623.41	153.04	8445.12	0.4	-3614.72	0.6
	9	(H1)	716.13	1567.63	2440.52	6426.12	0.4	-5431.63	0.7
	9	(H2)	-2829.93	1567.63	-1419.06	6426.12	0.4	-5431.63	0.7
	10	(H1)	-1775.55	1507.51	-418.79	2212.73	0.3	-8541.83	0.8
	10	(H2)	-5469.45	1507.51	-4112.69	2212.73	0.3	-8541.83	0.8
	11	(H1)	-3963.72	1475.59	-2635.69	1361.99	0.3	-9612.65	0.8
	11	(H2)	-9891.57	1475.59	-8563.54	1361.99	0.3	-9612.65	0.8
3	1	(H1)	-3963.72	1475.59	-2635.69	1361.99	0.3	-9612.65	0.8
	1	(H2)	-9891.57	1475.59	-8563.54	1361.99	0.3	-9612.65	0.8
	2	(H1)	-1923.18	1482.32	-589.09	2462.53	0.3	-8423.00	0.7
	2	(H2)	-5522.64	1482.32	-4188.55	2462.53	0.3	-8423.00	0.7
	3	(H1)	601.76	1517.25	2270.73	5759.58	0.4	-6397.17	0.7
	3	(H2)	-2758.57	1517.25	-1393.05	5759.58	0.4	-6397.17	0.7
	4AI	(H1)	2975.84	1551.12	4682.07	5865.98	0.4	-5165.44	0.5
	4AI	(H2)	-1246.47	1551.12	149.54	5865.98	0.4	-5165.44	0.5
	4AD	(H1)	2975.84	1551.12	4682.07	7099.98	0.4	-5042.35	0.6
	4AD	(H2)	-1246.47	1551.12	149.54	7099.98	0.4	-5042.35	0.6
	5	(H1)	5514.65	1560.48	7231.18	9610.35	0.4	-2713.17	0.5
	5	(H2)	339.39	1560.48	2055.92	9610.35	0.4	-2713.17	0.5
	6	(H1)	6336.77	1569.85	8063.61	11229.09	0.4	-1264.16	0.4
	6	(H2)	896.59	1569.85	2623.43	11229.09	0.4	-1264.16	0.4
	7	(H1)	5516.67	1579.80	7254.44	10523.40	0.4	-1774.29	0.4
	7	(H2)	341.40	1579.80	2079.17	10523.40	0.4	-1774.29	0.4

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	8	(H1)	2981.52	1605.48	4747.55	8445.12	0.4	-3614.72	0.6
	8	(H2)	-1249.86	1605.48	195.07	8445.12	0.4	-3614.72	0.6
	9	(H1)	607.69	1584.18	2350.28	6426.12	0.4	-5431.63	0.7
	9	(H2)	-2762.98	1584.18	-1337.22	6426.12	0.4	-5431.63	0.7
	10	(H1)	-1928.66	1563.71	-521.32	2212.73	0.3	-8541.83	0.8
	10	(H2)	-5521.91	1563.71	-4114.57	2212.73	0.3	-8541.83	0.8
	11	(H1)	-3970.39	1571.43	-2556.10	1361.99	0.3	-9612.65	0.8
	11	(H2)	-9891.22	1571.43	-8476.93	1361.99	0.3	-9612.65	0.8
4	1	(H1)	-3970.39	1571.43	-2556.10	1361.99	0.3	-9612.65	0.8
	1	(H2)	-9891.22	1571.43	-8476.93	1361.99	0.3	-9612.65	0.8
	2	(H1)	-1779.60	1567.52	-368.83	2462.53	0.3	-8423.00	0.7
	2	(H2)	-5473.47	1567.52	-4062.70	2462.53	0.3	-8423.00	0.7
	3	(H1)	704.47	1591.80	2455.45	5759.58	0.4	-6397.17	0.7
	3	(H2)	-2831.23	1591.80	-1398.61	5759.58	0.4	-6397.17	0.7
	4AI	(H1)	3060.33	1616.42	4838.40	5865.98	0.4	-5165.44	0.5
	4AI	(H2)	-1307.07	1616.42	147.71	5865.98	0.4	-5165.44	0.5
	4AD	(H1)	3060.33	1616.42	4838.40	7099.98	0.4	-5042.35	0.6
	4AD	(H2)	-1307.07	1616.42	147.71	7099.98	0.4	-5042.35	0.6
	5	(H1)	5568.92	1610.52	7340.49	9610.35	0.4	-2713.17	0.5
	5	(H2)	431.63	1610.52	2203.20	9610.35	0.4	-2713.17	0.5
	6	(H1)	6360.70	1604.62	8125.78	11229.09	0.4	-1264.16	0.4
	6	(H2)	1072.22	1604.62	2837.31	11229.09	0.4	-1264.16	0.4
	7	(H1)	5431.90	1599.30	7191.13	10523.40	0.4	-1774.29	0.4
	7	(H2)	645.23	1599.30	2404.46	10523.40	0.4	-1774.29	0.4
	8	(H1)	2782.53	1593.98	4535.91	8445.12	0.4	-3614.72	0.6
	8	(H2)	-817.66	1593.98	616.92	8445.12	0.4	-3614.72	0.6
	9	(H1)	487.29	1562.57	2206.11	6426.12	0.4	-5431.63	0.7
	9	(H2)	-2269.56	1562.57	-863.25	6426.12	0.4	-5431.63	0.7
	10	(H1)	-1959.09	1530.46	-581.68	2212.73	0.3	-8541.83	0.8
	10	(H2)	-5045.79	1530.46	-3668.38	2212.73	0.3	-8541.83	0.8
	11	(H1)	-3911.56	1526.55	-2537.66	1361.99	0.3	-9612.65	0.8
	11	(H2)	-9370.75	1526.55	-7996.85	1361.99	0.3	-9612.65	0.8

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
5	1	(H1)	-3911.56	1526.55	-2537.66	1361.99	0.3	-9612.65	0.8
	1	(H2)	-9370.75	1526.55	-7996.85	1361.99	0.3	-9612.65	0.8
	2	(H1)	-660.48	1293.33	503.52	3363.19	0.3	-7556.03	0.7
	2	(H2)	-4029.43	1293.33	-2865.43	3363.19	0.3	-7556.03	0.7
	3AI	(H1)	3359.56	1060.10	4525.68	5865.98	0.4	-5165.44	0.5
	3AI	(H2)	-1273.71	1060.10	-319.61	5865.98	0.4	-5165.44	0.5
	3AD	(H1)	3359.56	1060.10	4525.68	5279.82	0.3	-4744.11	0.5
	3AD	(H2)	-1273.71	1060.10	-319.61	5279.82	0.3	-4744.11	0.5
	4	(H1)	4883.84	927.57	5904.17	6499.92	0.3	-3557.16	0.4
	4	(H2)	-105.60	927.57	729.21	6499.92	0.3	-3557.16	0.4
	5	(H1)	5852.54	795.04	6727.09	7836.02	0.4	-2255.34	0.4
	5	(H2)	774.22	795.04	1648.77	7836.02	0.4	-2255.34	0.4
	6	(H1)	6265.68	662.52	6994.45	8793.76	0.4	-1367.69	0.4
	6	(H2)	1365.76	662.52	2094.52	8793.76	0.4	-1367.69	0.4
	7	(H1)	6123.24	529.99	6706.23	8838.73	0.4	-1336.27	0.4
	7	(H2)	1669.00	529.99	2251.99	8838.73	0.4	-1336.27	0.4
	8	(H1)	5425.22	397.46	5862.43	8468.70	0.4	-1650.09	0.4
	8	(H2)	1683.97	397.46	2121.18	8468.70	0.4	-1650.09	0.4
	9	(H1)	4171.63	264.94	4463.07	7764.77	0.4	-2310.61	0.4
	9	(H2)	1410.65	264.94	1702.08	7764.77	0.4	-2310.61	0.4
	10	(H1)	2362.48	132.41	2508.13	6726.85	0.4	-3394.19	0.5
	10	(H2)	849.05	132.41	994.70	6726.85	0.4	-3394.19	0.5
	11	(H1)	0.00	0.00	0.00	5348.33	0.3	-4728.19	0.5
	11	(H2)	0.00	0.00	0.00	5348.33	0.3	-4728.19	0.5

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-4
COMPROBACION A CORTANTE
FECHA
HOJA N.º

COMPROBACION A CORTANTE

Para el cálculo a cortante se ha tomado un ancho bruto de 1,08 m y un ancho neto de 0,86 m

Se ha dividido el tablero en dos zonas de armado:

- Zona de armadura mínima → 2c Φ16/0.20
- Tablero en zonas próximas a riostras de pilas

Amec: $118 - \frac{118 - 56.2}{2.875} \times 1 = 96.5 \text{ cm}^2/\text{m}$ 2c Φ20/0125

A continuación se adjunta un listado con la armadura necesaria en cada sección de cálculo.

Calculo de Comprobacion a Cortante - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio .	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-423.1	0.0	-1319.81	438.3	-3620.2
	1	(H2)	0.00	-1126.3	0.0	-1319.81	438.3	-3620.2
	2	(H1)	951.11	-281.4	0.0	-2427.46	354.8	-3604.6
	2	(H2)	2672.38	-853.3	0.0	-2427.46	354.8	-3604.6
	3	(H1)	1519.71	-139.8	0.0	-3171.65	211.8	-3580.7
	3	(H2)	4607.62	-580.2	0.0	-3171.65	211.8	-3580.7
	4	(H1)	1705.81	1.9	0.0	-3520.03	70.4	-3550.0
	4	(H2)	5805.72	-307.2	0.0	-3520.03	70.4	-3550.0
	5	(H1)	1509.41	143.6	0.0	-3479.10	-68.3	-3512.5
	5	(H2)	5331.12	-77.0	0.0	-3479.10	-68.3	-3512.5
	6	(H1)	4518.86	347.8	0.0	-3029.39	-222.3	-3464.6
	6	(H2)	2813.78	145.7	0.0	-3029.39	-222.3	-3464.6
	7	(H1)	3211.20	620.8	0.0	-2169.68	-371.5	-3410.9
	7	(H2)	2229.04	287.4	0.0	-2169.68	-371.5	-3410.9
	8	(H1)	1166.40	893.8	0.0	-922.94	-515.2	-3351.7
	8	(H2)	1261.79	429.1	0.0	-922.94	-515.2	-3351.7
	9	(H1)	-1615.55	1166.9	0.0	682.72	-655.2	-3301.6
	9	(H2)	-87.96	570.7	0.0	682.72	-655.2	-3301.6
	10	(H1)	-5134.63	1439.9	0.0	2642.87	-794.0	-3266.2
	10	(H2)	-1820.22	712.4	0.0	2642.87	-794.0	-3266.2
	11	(H1)	-9390.86	1712.9	0.0	3914.79	-68.3	-3429.7
	11	(H2)	-3934.97	854.1	0.0	3914.79	-68.3	-3429.7
2	1	(H1)	-3934.97	-755.4	0.0	3914.79	11.3	-3429.7
	1	(H2)	-9370.75	-1736.5	0.0	3914.79	11.3	-3429.7
	2	(H1)	-1979.90	-604.6	0.0	3106.59	480.8	-3483.9
	2	(H2)	-4832.71	-1450.2	0.0	3106.59	480.8	-3483.9
	3	(H1)	-458.52	-453.7	0.0	1319.08	477.5	-3822.6
	3	(H2)	-1078.76	-1160.5	0.0	1319.08	477.5	-3822.6
	4AI	(H1)	511.88	-322.6	0.0	-161.20	456.4	-4102.7
	4AI	(H2)	1506.51	-907.7	0.0	-161.20	456.4	-4102.7
	4AD	(H1)	511.88	-322.6	0.0	115.30	366.5	-3352.5

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	4AD	(H2)	1506.51	-907.7	0.0	115.30	366.5	-3352.5
	5	(H1)	1396.11	-106.1	0.0	-1447.39	381.0	-3394.3
	5	(H2)	4390.54	-490.6	0.0	-1447.39	381.0	-3394.3
	6	(H1)	1387.53	110.3	0.0	-2630.98	11.3	-3525.6
	6	(H2)	4952.40	-100.5	0.0	-2630.98	11.3	-3525.6
	7	(H1)	4104.61	507.7	0.0	-2275.83	-215.5	-3583.1
	7	(H2)	1535.32	133.2	0.0	-2275.83	-215.5	-3583.1
	8	(H1)	1150.25	924.8	0.0	-961.51	-438.5	-3624.0
	8	(H2)	539.35	349.7	0.0	-961.51	-438.5	-3624.0
	9	(H1)	-1477.65	1177.6	0.0	606.84	-570.3	-3407.6
	9	(H2)	-498.79	480.8	0.0	606.84	-570.3	-3407.6
	10	(H1)	-5281.25	1467.3	0.0	2763.16	-571.8	-3239.8
	10	(H2)	-2098.04	631.7	0.0	2763.16	-571.8	-3239.8
	11	(H1)	-9800.46	1751.0	0.0	3540.78	11.3	-3429.7
	11	(H2)	-4131.00	782.5	0.0	3540.78	11.3	-3429.7
3	1	(H1)	-3963.72	-759.0	0.0	3540.78	-3.2	-3429.7
	1	(H2)	-9803.79	-1753.0	0.0	3540.78	-3.2	-3429.7
	2	(H1)	-1998.56	-608.1	0.0	2774.34	466.3	-3483.9
	2	(H2)	-5176.17	-1464.8	0.0	2774.34	466.3	-3483.9
	3	(H1)	-467.08	-457.3	0.0	1028.58	462.9	-3822.6
	3	(H2)	-1380.20	-1175.1	0.0	1028.58	462.9	-3822.6
	4AI	(H1)	512.11	-326.1	0.0	-415.39	441.8	-4102.7
	4AI	(H2)	1241.62	-922.3	0.0	-415.39	441.8	-4102.7
	4AD	(H1)	512.11	-326.1	0.0	-138.89	352.0	-3352.5
	4AD	(H2)	1241.62	-922.3	0.0	-138.89	352.0	-3352.5
	5	(H1)	1410.82	-109.7	0.0	-1641.67	366.4	-3394.3
	5	(H2)	4185.94	-505.2	0.0	-1641.67	366.4	-3394.3
	6	(H1)	4710.66	116.2	0.0	-2765.35	-3.2	-3525.6
	6	(H2)	4708.11	-116.1	0.0	-2765.35	-3.2	-3525.6
	7	(H1)	4184.53	505.6	0.0	-2350.29	-230.0	-3583.1
	7	(H2)	1409.18	110.1	0.0	-2350.29	-230.0	-3583.1

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	8	(H1)	1238.61	922.7	0.0	-976.05	-453.0	-3624.0
	8	(H2)	508.80	326.5	0.0	-976.05	-453.0	-3624.0
	9	(H1)	-1384.17	1175.5	0.0	628.61	-584.8	-3407.6
	9	(H2)	-471.41	457.7	0.0	628.61	-584.8	-3407.6
	10	(H1)	-5181.89	1465.2	0.0	2826.69	-586.3	-3239.8
	10	(H2)	-2004.05	608.5	0.0	2826.69	-586.3	-3239.8
	11	(H1)	-9810.43	1753.4	0.0	3646.06	-3.2	-3429.7
	11	(H2)	-3970.39	759.4	0.0	3646.06	-3.2	-3429.7
4	1	(H1)	-4137.64	-783.5	0.0	3646.06	1.5	-3429.7
	1	(H2)	-9807.10	-1752.0	0.0	3646.06	1.5	-3429.7
	2	(H1)	-2102.06	-632.6	0.0	2866.15	471.0	-3483.9
	2	(H2)	-5285.03	-1468.2	0.0	2866.15	471.0	-3483.9
	3	(H1)	-500.18	-481.8	0.0	1106.92	467.6	-3822.6
	3	(H2)	-1479.39	-1178.5	0.0	1106.92	467.6	-3822.6
	4AI	(H1)	540.23	-350.6	0.0	-348.77	446.5	-4102.7
	4AI	(H2)	1150.83	-925.7	0.0	-348.77	446.5	-4102.7
	4AD	(H1)	540.23	-350.6	0.0	-72.27	356.7	-3352.5
	4AD	(H2)	1150.83	-925.7	0.0	-72.27	356.7	-3352.5
	5	(H1)	1539.96	-134.1	0.0	-1594.38	371.1	-3394.3
	5	(H2)	4109.01	-508.6	0.0	-1594.38	371.1	-3394.3
	6	(H1)	4960.80	99.6	0.0	-2737.38	1.5	-3525.6
	6	(H2)	1395.97	-111.2	0.0	-2737.38	1.5	-3525.6
	7	(H1)	4402.94	489.7	0.0	-2341.65	-225.3	-3583.1
	7	(H2)	1408.30	105.2	0.0	-2341.65	-225.3	-3583.1
	8	(H1)	1522.74	906.8	0.0	-986.74	-448.3	-3624.0
	8	(H2)	527.82	321.7	0.0	-986.74	-448.3	-3624.0
	9	(H1)	-1060.21	1159.6	0.0	606.20	-580.1	-3407.6
	9	(H2)	-440.32	452.8	0.0	606.20	-580.1	-3407.6
	10	(H1)	-4812.13	1449.3	0.0	2790.81	-581.6	-3239.8
	10	(H2)	-1959.09	603.7	0.0	2790.81	-581.6	-3239.8
	11	(H1)	-9347.32	1735.6	0.0	3596.71	1.5	-3429.8
	11	(H2)	-3911.56	754.5	0.0	3596.71	1.5	-3429.8

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
5	1	(H1)	-3911.56	-853.2	0.0	3596.71	56.5	-3429.8
	1	(H2)	-9367.42	-1712.0	0.0	3596.71	56.5	-3429.8
	2	(H1)	-838.46	-636.8	0.0	1969.39	562.9	-3500.5
	2	(H2)	-3165.60	-1294.9	0.0	1969.39	562.9	-3500.5
	3AI	(H1)	1341.84	-420.3	0.0	-223.25	501.5	-3636.7
	3AI	(H2)	1315.65	-877.8	0.0	-223.25	501.5	-3636.7
	3AD	(H1)	1341.84	-420.3	0.0	-46.69	415.1	-2941.5
	3AD	(H2)	1315.64	-877.8	0.0	-46.69	415.1	-2941.5
	4	(H1)	2182.97	-297.3	0.0	-1034.71	419.3	-2959.5
	4	(H2)	3095.44	-640.8	0.0	-1034.71	419.3	-2959.5
	5	(H1)	2735.81	-174.4	0.0	-2073.64	423.8	-2992.2
	5	(H2)	4319.66	-403.8	0.0	-2073.64	423.8	-2992.2
	6	(H1)	3000.37	-51.4	0.0	-2957.36	217.3	-3076.4
	6	(H2)	1365.76	-190.9	0.0	-2957.36	217.3	-3076.4
	7	(H1)	6123.24	179.3	0.0	-3193.38	-8.5	-3140.6
	7	(H2)	1669.00	-67.9	0.0	-3193.38	-8.5	-3140.6
	8	(H1)	5425.22	416.3	0.0	-3076.09	-117.1	-3167.2
	8	(H2)	1683.97	55.1	0.0	-3076.09	-117.1	-3167.2
	9	(H1)	4171.63	653.3	0.0	-2694.40	-227.3	-3189.2
	9	(H2)	1410.65	178.1	0.0	-2694.40	-227.3	-3189.2
	10	(H1)	2362.48	890.3	0.0	-2045.73	-338.4	-3206.5
	10	(H2)	849.05	301.1	0.0	-2045.73	-338.4	-3206.5
	11	(H1)	0.00	1127.2	0.0	-1172.42	-386.3	-3218.1
	11	(H2)	0.00	424.0	0.0	-1172.42	-386.3	-3218.1

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1) AB	1.6828	15.3	1269.0	0.01	157.64	--	12.00
	1	(H2) AB	1.6828	-687.9	1269.0	0.54	157.64	34.74	12.00
	2	(H1) AB	1.6804	73.4	1269.9	0.06	157.64	--	12.00
	2	(H2) AB	1.6804	-498.4	1269.9	0.39	157.64	22.35	12.00
	3	(H1) AB	1.6768	72.1	1271.2	0.06	157.64	--	12.00
	3	(H2) AB	1.6768	-368.4	1271.2	0.29	157.64	13.86	12.00
	4	(H1) AB	1.6722	72.3	1272.8	0.06	157.64	--	12.00
	4	(H2) AB	1.6722	-236.8	1272.8	0.19	157.64	5.22	12.00
	5	(H1) AB	1.6665	75.3	1274.9	0.06	157.64	--	12.00
	5	(H2) AB	1.6665	-145.3	1274.9	0.11	157.64	--	12.00
	6	(H1) AB	1.6592	125.5	1277.5	0.10	157.64	--	12.00
	6	(H2) AB	1.6592	-76.5	1277.5	0.06	157.64	--	12.00
	7	(H1) AB	1.6510	249.3	1280.4	0.19	157.64	6.12	12.00
	7	(H2) AB	1.6510	-84.1	1280.4	0.07	157.64	--	12.00
	8	(H1) AB	1.6419	378.7	1283.7	0.29	157.64	14.84	12.00
	8	(H2) AB	1.6419	-86.1	1283.7	0.07	157.64	--	12.00
	9	(H1) AB	1.6342	511.6	1286.5	0.40	157.64	23.88	12.00
	9	(H2) AB	1.6342	-84.5	1286.5	0.07	157.64	--	12.00
	10	(H1) AB	1.6287	645.8	1288.5	0.50	157.64	33.04	12.00
	10	(H2) AB	1.6287	-81.6	1288.5	0.06	157.64	--	12.00
	11	(H1) C	1.6539	1644.6	1785.2	0.92	0.00	109.61	13.33
	11	(H2) AB	1.6539	785.8	1785.2	0.44	219.96	37.71	13.33
2	1	(H1) AB	1.6539	-744.1	1785.2	0.42	219.96	34.93	13.33
	1	(H2) C	1.6539	-1725.2	1785.2	0.97	0.00	114.98	13.33
	2	(H1) AB	1.6622	-123.8	1276.4	0.10	157.64	--	12.00
	2	(H2) AB	1.6622	-969.4	1276.4	0.76	157.64	53.83	12.00
	3	(H1) AB	1.7130	23.7	1258.1	0.02	157.64	--	12.00
	3	(H2) AB	1.7130	-683.0	1258.1	0.54	157.64	33.81	12.00
	4AI	(H1) AB	1.7538	133.8	1243.4	0.11	157.64	--	12.00
	4AI	(H2) AB	1.7538	-451.3	1243.4	0.36	157.64	18.46	12.00
	4AD	(H1) AB	1.6420	44.0	1283.7	0.03	157.64	--	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	4AD	(H2) AB	1.6420	-541.2	1283.7	0.42	157.64	25.75	12.00
	5	(H1) AB	1.6485	274.8	1281.4	0.21	157.64	7.84	12.00
	5	(H2) C	1.6485	-109.6	1281.4	0.09	157.64	--	12.00
	6	(H1) AB	1.6685	121.6	1274.2	0.10	157.64	--	12.00
	6	(H2) AB	1.6685	-89.2	1274.2	0.07	157.64	--	12.00
	7	(H1) AB	1.6772	292.2	1271.0	0.23	157.64	8.84	12.00
	7	(H2) AB	1.6772	-82.2	1271.0	0.06	157.64	--	12.00
	8	(H1) AB	1.6834	486.3	1268.8	0.38	157.64	21.52	12.00
	8	(H2) AB	1.6834	-88.8	1268.8	0.07	157.64	--	12.00
	9	(H1) AB	1.6505	607.2	1280.6	0.47	157.64	30.03	12.00
	9	(H2) AB	1.6505	-89.5	1280.6	0.07	157.64	--	12.00
	10	(H1) AB	1.6246	895.5	1289.9	0.69	157.64	50.06	12.00
	10	(H2) AB	1.6246	59.9	1289.9	0.05	157.64	--	12.00
	11	(H1) C	1.6539	1762.4	1785.2	0.99	0.00	117.46	13.33
	11	(H2) AB	1.6539	793.9	1785.2	0.44	219.96	38.25	13.33
3	1	(H1) AB	1.6539	-762.2	1785.2	0.43	219.96	36.14	13.33
	1	(H2) C	1.6539	-1756.2	1785.2	0.98	0.00	117.04	13.33
	2	(H1) AB	1.6622	-141.8	1276.4	0.11	157.64	--	12.00
	2	(H2) AB	1.6622	-998.6	1276.4	0.78	157.64	55.77	12.00
	3	(H1) AB	1.7130	5.7	1258.1	0.00	157.64	--	12.00
	3	(H2) AB	1.7130	-712.2	1258.1	0.57	157.64	35.68	12.00
	4AI	(H1) AB	1.7538	115.8	1243.4	0.09	157.64	--	12.00
	4AI	(H2) AB	1.7538	-480.5	1243.4	0.39	157.64	20.29	12.00
	4AD	(H1) AB	1.6421	25.9	1283.7	0.02	157.64	--	12.00
	4AD	(H2) AB	1.6421	-570.3	1283.7	0.44	157.64	27.70	12.00
	5	(H1) AB	1.6485	256.8	1281.4	0.20	157.64	6.63	12.00
	5	(H2) AB	1.6485	-138.8	1281.4	0.11	157.64	--	12.00
	6	(H1) AB	1.6685	113.0	1274.2	0.09	157.64	--	12.00
	6	(H2) AB	1.6685	-119.3	1274.2	0.09	157.64	--	12.00
	7	(H1) AB	1.6772	275.6	1271.0	0.22	157.64	7.75	12.00
	7	(H2) AB	1.6772	-119.9	1271.0	0.09	157.64	--	12.00

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Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	8	(H1) AB	1.6834	469.7	1268.8	0.37	157.64	20.43	12.00
	8	(H2) AB	1.6834	-126.5	1268.8	0.10	157.64	--	12.00
	9	(H1) AB	1.6505	590.7	1280.6	0.46	157.64	28.92	12.00
	9	(H2) AB	1.6505	-127.2	1280.6	0.10	157.64	--	12.00
	10	(H1) AB	1.6246	878.9	1289.9	0.68	157.64	48.94	12.00
	10	(H2) AB	1.6246	22.2	1289.9	0.02	157.64	--	12.00
	11	(H1) C	1.6539	1750.2	1785.2	0.98	0.00	116.65	13.33
	11	(H2) AB	1.6539	756.2	1785.2	0.42	219.96	35.74	13.33
4	1	(H1) AB	1.6539	-782.0	1785.2	0.44	219.96	37.46	13.33
	1	(H2) C	1.6539	-1750.5	1785.2	0.98	0.00	116.66	13.33
	2	(H1) AB	1.6622	-161.6	1276.4	0.13	157.64	0.27	12.00
	2	(H2) AB	1.6622	-997.2	1276.4	0.78	157.64	55.68	12.00
	3	(H1) AB	1.7130	-14.1	1258.1	0.01	157.64	--	12.00
	3	(H2) AB	1.7130	-710.8	1258.1	0.57	157.64	35.60	12.00
	4AI	(H1) AB	1.7538	96.0	1243.4	0.08	157.64	--	12.00
	4AI	(H2) AB	1.7538	-479.2	1243.4	0.39	157.64	20.21	12.00
	4AD	(H1) AB	1.6421	6.1	1283.7	0.00	157.64	--	12.00
	4AD	(H2) AB	1.6421	-569.0	1283.7	0.44	157.64	27.61	12.00
	5	(H1) AB	1.6485	237.0	1281.4	0.18	157.64	5.31	12.00
	5	(H2) AB	1.6485	-137.5	1281.4	0.11	157.64	--	12.00
	6	(H1) AB	1.6685	101.1	1274.2	0.08	157.64	--	12.00
	6	(H2) AB	1.6685	-109.7	1274.2	0.09	157.64	--	12.00
	7	(H1) AB	1.6772	264.4	1271.0	0.21	157.64	7.01	12.00
	7	(H2) AB	1.6772	-120.1	1271.0	0.09	157.64	--	12.00
	8	(H1) AB	1.6834	458.5	1268.8	0.36	157.64	19.70	12.00
	8	(H2) AB	1.6834	-126.7	1268.8	0.10	157.64	--	12.00
	9	(H1) AB	1.6505	579.4	1280.6	0.45	157.64	28.17	12.00
	9	(H2) AB	1.6505	-127.3	1280.6	0.10	157.64	--	12.00
	10	(H1) AB	1.6246	867.7	1289.9	0.67	157.64	48.17	12.00
	10	(H2) AB	1.6246	22.0	1289.9	0.02	157.64	--	12.00
	11	(H1) C	1.6539	1737.1	1785.2	0.97	0.00	115.77	13.33
	11	(H2) AB	1.6539	756.0	1785.2	0.42	219.96	35.73	13.33

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vu1 (t)	Vrd/Vu1	Vcu (t)	Ar cm2/m	Ar.min cm2/m
5	1	(H1) AB	1.6539	-796.7	1785.2	0.45	219.96	38.44	13.33
	1	(H2) C	1.6539	-1655.5	1785.2	0.93	0.00	110.34	13.33
	2	(H1) AB	1.6647	-73.8	1275.5	0.06	157.64	--	12.00
	2	(H2) AB	1.6647	-732.0	1275.5	0.57	157.64	38.03	12.00
	3AI	(H1) AB	1.6853	81.2	1268.1	0.06	157.64	--	12.00
	3AI	(H2) AB	1.6853	-376.3	1268.1	0.30	157.64	14.30	12.00
	3AD	(H1) AB	1.5775	-5.2	1306.7	0.00	157.64	--	12.00
	3AD	(H2) AB	1.5775	-462.7	1306.7	0.35	157.64	21.32	12.00
	4	(H1) AB	1.5803	122.0	1305.7	0.09	157.64	--	12.00
	4	(H2) AB	1.5803	-221.5	1305.7	0.17	157.64	4.45	12.00
	5	(H1) AB	1.5856	249.4	1303.8	0.19	157.64	6.38	12.00
	5	(H2) AB	1.5856	20.0	1303.8	0.02	157.64	--	12.00
	6	(H1) AB	1.5989	165.9	1299.1	0.13	157.64	0.57	12.00
	6	(H2) AB	1.5989	26.4	1299.1	0.02	157.64	--	12.00
	7	(H1) C	1.6091	170.8	1295.5	0.13	157.64	0.90	12.00
	7	(H2) AB	1.6091	-76.4	1295.5	0.06	157.64	--	12.00
	8	(H1) AB	1.6132	299.2	1294.0	0.23	157.64	9.67	12.00
	8	(H2) AB	1.6132	-62.0	1294.0	0.05	157.64	--	12.00
	9	(H1) AB	1.6167	426.0	1292.7	0.33	157.64	18.30	12.00
	9	(H2) AB	1.6167	-49.2	1292.7	0.04	157.64	--	12.00
	10	(H1) AB	1.6194	552.0	1291.8	0.43	157.64	26.84	12.00
	10	(H2) AB	1.6194	-37.3	1291.8	0.03	157.64	--	12.00
	11	(H1) AB	1.6212	740.9	1291.1	0.57	157.64	39.65	12.00
	11	(H2) AB	1.6212	37.7	1291.1	0.03	157.64	--	12.00

PROYECTO L. A.V ZARAGOZA-LERIDA
SUBTRAMO I E-4
FECHA
HOJA N.º

ARMADURA ANCLASES PRETENSADO

Cables principales

Ahorizontal: $538 \cdot 1.6 \cdot 0.3 \cdot \left(\frac{0.746 - 0.43}{0.746}\right) \cdot \frac{1.15}{5.1} = 25\,cm^2/anclaje$

5×2 ⌀12/anclaje

Avertical: $4 \cdot 538 \cdot 1.6 \cdot 0.3 \times \left(\frac{2.62 - 2.15}{2.62}\right) \cdot \frac{1.15}{5.1} = 47\,cm^2$

$\left(\frac{2.74 - 2.01}{2.74}\right) \times 4.15/5.1 = 62.1\,cm^2$ | 5× 2c⌀20

Cables de cosido al estribo

$F_{max} = 644 + 189 = 833\,t$

2 CABLES DE 24 ⌀0.6" TESADOS A 478 t $F_{rot} = 2 \times 638\,t$

$\gamma = \frac{2 \cdot 638}{833} = 1.54$ adimensional

con hipótesis de frenado.

Placa anclaje 0,38 · 0.38

$A_{vert} = 1.6 \times 478 \cdot 0.3 = \frac{1.15}{5.1} \cdot \left(\frac{2 - 0.38}{2}\right) = 42\,cm^2$

$\left(\frac{2.6 - 0.38}{2.6}\right) = 44\,cm^2$

Neopreno → $478 + \frac{833}{2} = 895\,t$ 800×800 $\sigma = 140\,kg/cm^2$

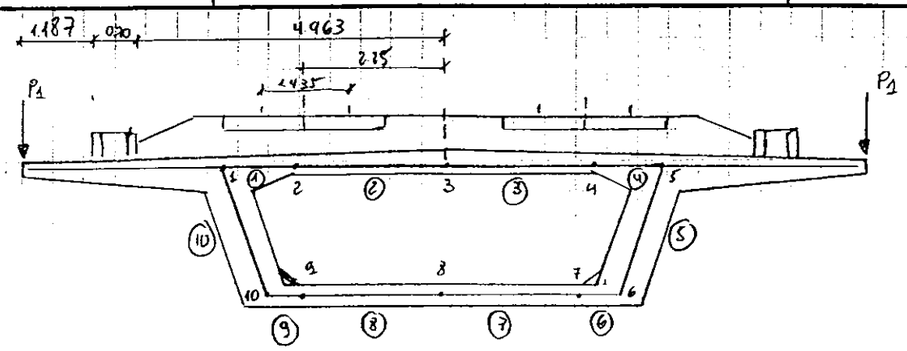
$1.6 \cdot (895) \cdot 0.3 \cdot \frac{1.15}{5.1} \cdot \left(\frac{2 - 0.80}{2}\right) = 58\,cm^2$

$\left(\frac{2.6 - 0.80}{2.6}\right) = 67\,cm^2$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO-1. PUENTES CASON
CALCULO TRANSVERSAL

FECHA

HOJA N.º 1



Coordenadas de los nudos

NUDO	x	Y
1	-3.687	2.10
2	-2.50	2.10
3	0.00	2.10
4	2.50	2.10
5	3.687	2.10
6	3.015	0.00
7	2.50	0.00
8	0.00	0.00
9	-2.50	0.00
10	-3.015	0.00

Características de las barras

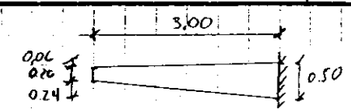
BARRAS	Area (m^2)	Inercia (m^4)	E (t/m^2)
2 y 3	0.325	0,002861	3500000
1 y 4	0.466	0,008433	=
5 y 10	0.54	0,013122	=
6 y 9	0.40	0,005333	=
7 y 8	0,30	0,002250	3.500.000

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 PUENTES CASON
CALCULO TRANSVERSAL

FECHA

HOJA N.º 2

HIPOTESIS DE CARGAS:



- Cargas en extremo de voladizo:

Impuesta: $(0.70 \times 0.30 + 0,08 \times 0,25) \times 2,5 = 0,58\ t/m$

Barandilla: $0.1\ t/m$

TOTAL: $0,68\ t/m$

- Arqueta longitudinal:

$(2 \times 0.40 \times 0.15 + 0.40 \times 0.05) \times 2.5 = 0.35\ t/m$

- Balasto + traviesas + vía: $4,74\ t/m$ por vía $= \frac{4.741}{4.96} = 0,96\ t/m^2$

Cargas en extremo de voladizo:

$V = 0.20 \times 3,00 \times 2,5 + \frac{1}{2} \cdot 0.30 \cdot 3,00 \times 2.50 + 0.68 + 0.35 + 0.96 \times 1.113 = 4,72\ t$

$M = 0,2 \times 2,5 \times \frac{3^2}{2} + \frac{1}{2} 0,3 \times 3 \times 2,5 \times \frac{1}{3} \times 3,00 + 0,68 \times 3 + 0.35 \times 1.463 + 0,91 \cdot \frac{1.113^2}{2} = 6.52\ mt$

HIPOTESIS 1: PESO PROPIO + CARGA PERMANENTE

Nudo 1 P = -4,72 M = 6.52
5 P = -4.72 M = -6.52

Barra 1 p = 2.13 t/m d = 270°
2 1.773
3 1.773
4 2.13
5 1.35
6 1.00
7 0.75
8 0.75
9 1.00
10 1.35

COEFICIENTE IMPACTO:

$$C = \frac{144\sqrt{7.37}}{3.10 - 1.76\sqrt{7.37} + 7.37} = 69 \quad \text{IMPACTO } 1.69$$

Por carril, carga por metro lineal. $p = \frac{15}{1.50} \times 1.69 = 16,9\ t/m$

HIPOTESIS 2: DOS TRENES SIN RIPAR

Barra	1	$P = 16.9$	$a = 0.7195$	$\alpha = 270°$
	2		0.9675	
	3		1.5325	
	4		0.4675	

HIPOTESIS 3: DOS TRENES RIPADOS 0,30 m

Barra	1	$P = 16.9$	$a = 0.4195$	$\alpha = 270°$
	2		0,6675	
	3		1.2325	
	4		0.1675	

HIPOTESIS 4: PEATONES VOLADIZOS

Nudo 1: $p = 04 \times 1.887 = 0.75\ t$ $\quad M = 0.75 \times 2.06 = +1.55$ m t
Nudo 5: 0.75 $\quad -1.55$

Flexión en el voladizo:

Las hipótesis de descarilamiento son determinantes para el voladizo, no para el forjado intermedio entre almas.

CASO Aa) $M = 1.5 \times (2.25 + 2.8 - 3.85) = 1.80$ m t/m

Ab) $M = \frac{10}{t} = 3,2$ m t/m

Ba) $M = 5 \times 1.20 = 6,0$ m t/m

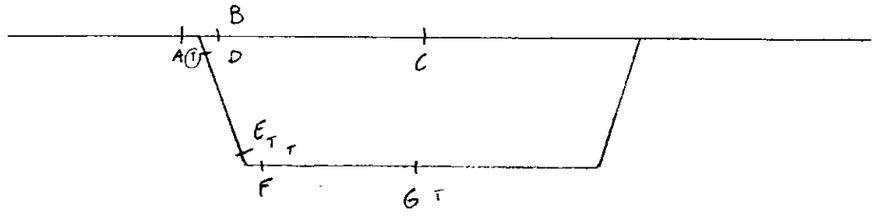
Bb) $M = \frac{22}{t} = 7.0$ m t/m

$M_t = 1.6 \times (6,5 + 1.55) = 12,9$ m t/m

$8,05 + 7,0 = 15,1$ m t/m $\rightarrow$ 6.5

$U_c = \frac{3500}{1.1} \times 1.0 \times 0.45 = 1432$ $A = 7,8\ cm^2/m$

Dimensionamiento por flexión transversal



Sección	M_d (m t/m)	d (m)	A_{nec} (cm^2/m) o A_{min} (cm^2/m)	
A	− 15 1	0 45	7.8	10,8
B	− 78.5	0.55	33,9	13,3
C	+19 7	0.30	15,5	7,2
D	− 67.8	0.50	32.3	12,0
E	+7.9	0.50	3, 6	12,0
F	− 7,8	0.50	3.5	12,0
G	+1,5	0 75	—	6,0

```
L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.
CONTROL
10 10 9 4
:
NUDOS
1 -3.687 2.10
2 -2.50 2.10
3 0 2.10
4 2.50 2.10
5 3.687 2.10
6 3.015 0.0
7 2.50 0
8 0 0
9 -2.50 0
10 -3.015 0.0
:
BARRAS TIPO
5
.325 .002861 3500000
.466 .008433 3500000
.54 .013122 3500000
.40 .005333 3500000
.30 .002250 3500000
:
BARRAS
1 1 2 2
2 2 3 1
3 3 4 1
4 4 5 2
5 5 6 3
6 6 7 4
7 7 8 5
8 8 9 5
9 9 10 4
10 1 10 3
:
APOYOS
2
6 1 1 0
10 0 1 0
:
CARGAS
H-1 PESO PROPIO+CARGA PERMANENTE
2
1 0 -4.72 6.52
5 0 -4.72 -6.52
10
1  2 2.13 270
2  2 1.78 270
3  2 1.78 270
4  2 2.13 270
5  2 1.35 270
6  2 1.00 270
7  2 0.75 270
8  2 0.75 270
9  2 1.00 270
10 2 1.35 270
H-2.DOS TRENES SIN RIPAR
0
```



```
4
1 1 16.9 0.7195 270
2 1 16.9 0.9675 270
3 1 16.9 1.5325 270
4 1 16.9 0.4675 270
H-3 DOS TRENES RIPADOS 30 CM.
0
4
1 1 16.9 0.4195  270
2 1 16.9 0.6675  270
3 1 16.9 1.2325  270
4 1 16.9 0.1675  270
H-4.PEATONES VOLADIZOS
2
1 0 -.75 1.55
5 0 -.75 -1.55
0
:
```

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 1 H-1 PESO PROPIO+CARGA PERMANENTE

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000019	-0.000025
2	0.000001	-0.000214	-0.000258
3	0.000005	-0.000826	-0.000000
4	0.000008	-0.000214	0.000258
5	0.000009	-0.000019	0.000025
6	0.000000	-0.000000	0.000006
7	0.000001	-0.000018	0.000058
8	0.000005	-0.000245	-0.000000
9	0.000008	-0.000018	-0.000058
10	0.000009	-0.000000	-0.000006

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	17.06	-0.00
10	0.00	17.06	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	1.64	-9.46	-6.98
	2	1.64	-2.67	-4.45
2	2	1.64	-2.67	-4.45
	3	1.64	2.89	-0.00
	4	1.64	-2.67	4.45
4	4	1.64	-2.67	4.45
	5	1.64	-9.46	6.98
5	5	-11.64	-2.94	-2.00
	6	-14.48	2.48	-2.91
6	6	-1.64	2.48	2.39
	7	-1.64	1.38	1.87
7	7	-1.64	1.38	1.87
	8	-1.64	-0.96	-0.00
8	8	-1.64	-0.96	-0.00
	9	-1.64	1.38	-1.88
9	9	-1.64	1.38	-1.88
	10	-1.64	2.48	-2.39
10	1	-11.64	2.94	2.00
	10	-14.48	-2.48	2.91

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 2 H-2.DOS TRENES SIN RIPAR

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000001	-0.000021	-0.000642
2	-0.000005	-0.001416	-0.001485
3	-0.000023	-0.004005	-0.000000
4	-0.000041	-0.001416	0.001485
5	-0.000047	-0.000021	0.000642
6	0.000000	-0.000000	-0.000285
7	-0.000003	0.000141	-0.000262
8	-0.000023	0.000469	0.000000
9	-0.000043	0.000141	0.000262
10	-0.000046	-0.000000	0.000285

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	33.80	0.00
10	-0.00	33.80	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.37	-39.46	-33.80
	2	-8.37	-7.24	-16.90
2	2	-8.37	-7.24	-16.90
	3	-8.37	9.11	-0.00
	4	-8.37	-7.24	16.90
4	4	-8.37	-7.24	16.90
	5	-8.37	-39.46	33.80
5	5	-29.64	-39.46	-18.27
	6	-29.64	0.83	-18.27
6	6	8.37	0.83	-0.00
	7	8.37	0.83	-0.00
7	7	8.37	0.83	0.00
	8	8.37	0.83	0.00
8	8	8.37	0.83	0.00
	9	8.37	0.83	0.00
9	9	8.37	0.83	-0.00
	10	8.37	0.83	-0.00
10	1	-29.64	39.46	18.27
	10	-29.64	-0.83	18.27

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 3 H-3 DOS TRENES RIPADOS 30 CM.

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000368	-0.000143	-0.000452
2	-0.000374	-0.001318	-0.001333
3	-0.000392	-0.004033	-0.000235
4	-0.000410	-0.001509	0.001651
5	-0.000416	0.000100	0.000821
6	0.000000	-0.000000	-0.000130
7	-0.000003	0.000072	-0.000147
8	-0.000023	0.000465	-0.000097
9	-0.000042	0.000208	0.000373
10	-0.000045	-0.000000	0.000436

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	30.44	-0.00
10	-0.00	37.16	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.21	-39.43	-36.63
	2	-8.21	-8.92	-19.73
2	2	-8.21	-8.92	-19.73
	3	-8.21	9.44	-2.83
3	3	-8.21	9.44	-2.83
	4	-8.21	-4.89	14.07
4	4	-8.21	-4.89	14.07
	5	-8.21	-38.82	30.97
5	5	-26.99	-38.82	-17.25
	6	-26.99	-0.78	-17.25
6	6	8.21	-0.78	-0.53
	7	8.21	-0.51	-0.53
7	7	8.21	-0.51	-0.53
	8	8.21	0.82	-0.53
8	8	8.21	0.82	-0.53
	9	8.21	2.14	-0.53
9	9	8.21	2.14	-0.53
	10	8.21	2.42	-0.53
10	1	-32.39	39.43	18.98
	10	-32.39	-2.42	18.98

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 4 H-4.PEATONES VOLADIZOS

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000003	0.000026
2	0.000001	0.000026	0.000022
3	0.000003	0.000054	0.000000
4	0.000005	0.000026	-0.000022
5	0.000005	-0.000003	-0.000026
6	0.000000	-0.000000	0.000009
7	0.000000	-0.000004	0.000008
8	0.000003	-0.000014	-0.000000
9	0.000005	-0.000004	-0.000008
10	0.000005	-0.000000	-0.000009

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	0.75	0.00
10	0.00	0.75	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	0.95	-0.09	-0.00
	2	0.95	-0.09	-0.00
2	2	0.95	-0.09	-0.00
	3	0.95	-0.09	-0.00
3	3	0.95	-0.09	0.00
	4	0.95	-0.09	0.00
4	4	0.95	-0.09	0.00
	5	0.95	-0.09	0.00
5	5	-1.00	1.46	0.67
	6	-1.00	-0.02	0.67
6	6	-0.95	-0.02	-0.00
	7	-0.95	-0.02	-0.00
7	7	-0.95	-0.02	-0.00
	8	-0.95	-0.02	-0.00
8	8	-0.95	-0.02	-0.00
	9	-0.95	-0.02	-0.00
9	9	-0.95	-0.02	-0.00
	10	-0.95	-0.02	-0.00
10	1	-1.00	-1.46	-0.67
	10	-1.00	0.02	-0.67

ARMADURA DE RASANTE

Momentos estáticos:

Sección A:

$$M_E = 0{,}20 \times 3{,}0 \times \left(0.95 - 0.237\right) + \frac{1}{2}\,0{,}06 \times 3 \times \left(0.95 - 0137 + \frac{0.06}{3}\right) + \frac{1}{2}\,0.24 \times 3 \times \left(0.95 - 0137 - \frac{0.24}{3}\right)$$

$$= \underline{0.7667\ m^3}$$

Sección B:

$$M_E = 3.249 \times 0285 \times \left(0.95 - 0.065 - \frac{0.285}{2}\right) + \frac{1}{2}\,3.249 \times 0{,}065\left(0.95 - \frac{0{,}065 \times 2}{3}\right) + \frac{1}{2}\,0719 \cdot 0332 \times \left(.95 - .35 - \frac{0332}{3}\right)$$

$$= 0.6875 + 0.0957 + 0.06084 = \underline{0.8441\ m^3}$$

Sección F:

$$M_E = 2.843 \times 0.30 \cdot \left(1.5 - 0.15\right) + \frac{1}{2}\,0.343 \times 020 \times \left(1.5 - 0.30 - \frac{1}{3}\,020\right) =$$

$$1.1514 + 0{,}0389 = \underline{1.1903\ m^3}$$

Armadura: $A_{nec} = \dfrac{Vrd_{un} \times M_E}{I} \times \dfrac{1}{4.2}\ cm^2/m$

SECCION A ⇒ 0,02674 Vrd cm^2/m

B ⇒ 0,02944 Vrd cm^2/m

F ⇒ 0,04151 Vrd cm^2/m

Tomando un valor medio por tramos:

	Vrd	(A)	(B)	(F)
Estribos	528/583	15.6 cm^2/m	17.2 cm^2/m	24.2 cm^2/m
2L/10 Estribos	303/363	9 7	10.7	15,1
2L/10 V. lateral	444/420	11.9	13,1	18.4
P. Lateral	1204/1158	32.2	35.4	49,9
2L/10 V intermedios	640	17.1	18.9	26.6
Pilas intermedios	1234	33.0	36.3	51.2

TORSION

Hipótesis de carga a tener en cuenta:

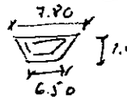
- Dos vías cargadas ripadas 30cm
- Una vía cargada ripada 30cm
- Viento → $0.2 \times (2.45 \times (0.95 - 1.225) + 0.70 \times (0.95+0.35) + 3.50 \times (0.95+1.75) =$
  $= 1.94$ mt/m
- S. aceras → $0.75 \times 5.90 = 4.43$ mt/m

· Respecto a las almas hay que comparar para ver el estado mas desfavorable las acciones debidas a cortante y las debidas a torsión. Suponiendo una carga p t/m y por vía:

a) 2 vías cargadas: Fuerza por alma: $p \times \frac{33}{2} = 16.5\,p$

b) 1 vía cargada: Cortante 8,25 p Fuerza por alma por cortante

Torsión $2.25\,p \times \frac{33}{2} = 37.125$ mt

Area resistente a torsión 

$t_e = 0.30$ $A_e = 14,6\ m^2$

Flujo de fuerza por metro: $f = \frac{37.125}{14.6}\,p = 2.54\,p$

Longitud alma: 2.20 ⇒ Fuerza por alma (por torsión) = $5,6\,p$ t

Total b) ⇒ $5,6 + 8.25 = 13,85\,p$

Para las almas es mas desfavorable cargar las dos vías y para las cabezas superior e inferior cargar una sola vía.

SECCION DE APOYO

Maximas acciones en almas:

$$T_d = 1.6 \times \left[1.24 \times 24 \times 30 \times \frac{18}{33} \times 0.30 + 1.24 \times \frac{1.5}{33} \times 20 \times 3 \times 0.30 + \right.$$

$$\left. + 1.35 \times \frac{33}{2} + 4.43 \times \frac{33}{2} \right] = 1.6 \left[\underbrace{146,1 + 1,0 + 22.3}_{242,5} + 73 \right] = 388 \text{ mt}$$

A transversal: $\frac{388}{2 \times 14.6 \times 42} = 3.2\ cm^2/m$ $A_{long} = 3,0\ cm^2/m$

$T_{u1} = 0.36 \cdot \frac{3500}{1.5} \times 14.6 \times 0.54 = 6622$ mt $\frac{T_d}{T_{u1}} = 0,06$

$\frac{V_{rd}}{V_{u1}} + \frac{T_d}{T_{u1}} < 1$ En el final de la costilla $0.99 - \frac{0.99 - 0.6^2}{2.875} \times 1 + 0.06 = 0.94$

Máximas acciones en losas superior e inferior:

$$T_d = 1.6 \times \left[1.24 \times 12 \times 30 \times \frac{18}{33} \times 2.55 + 1.24 \times 10 \times 3 \times \frac{1.5}{33} \times 2.55 + (1.35 + 1.43) \times \frac{33}{2} \right] =$$

$$= 1.6 \times \left[\underbrace{621 + 4.3 + 22.3}_{720,5} + 73 \right] = 1153 \text{ mt}$$

$A_t = \frac{1153}{2 \times 14.6 \times 4.2} = 9.4\ cm^2/m$ $A_l = 8.9\ cm^2/m$

$T_{u1} = 0.36 \times \frac{3500}{1.5} \times 14.6 \times 0.30 = 3679$ $\frac{T_d}{T_{u1}} = 0.31$

SECCION A CUARTOS DE LUZ

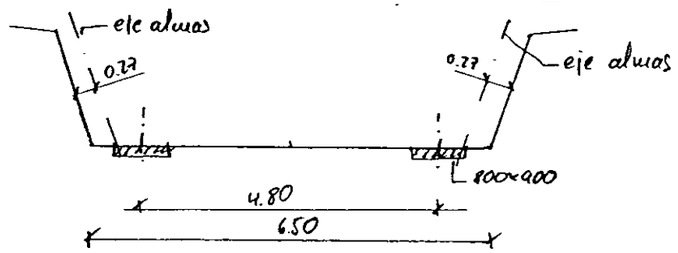
Losa superior e inferior $T_d = 1.6 \times \left[1.24 \times 12 \times 24.75 \times 2.55 \times \frac{17.375}{33} + (1.35 + 1.43) \times \frac{17.37}{33} \right.$

$24.75 = 650$ mt $A_t = 5.3\ cm^2/m$ $A_l = 5.0\ cm^2/m$

COSTILLA SOBRE PILAS

Reacción en apoyos :

$$R_{max} = \frac{1}{2}\left(778 + 352.5 + 4.3 + 840.5 + 14.5\right) + \frac{388}{4.80} = 1076\ t$$



Tracción $F = 1.6 \cdot 1076 \times 0.58 \times \frac{1}{2.30} = 435\ t \rightarrow 100\ cm^2$

Areparto $0.3 \times 1076 \cdot 1.6 \cdot \frac{1.15}{5.1} \cdot \left(\frac{1.70 - 0.8}{1.70}\right) = 54\ cm^2$

$\left(\frac{2.0 - 0.8}{2.0}\right) = 70\ cm^2$

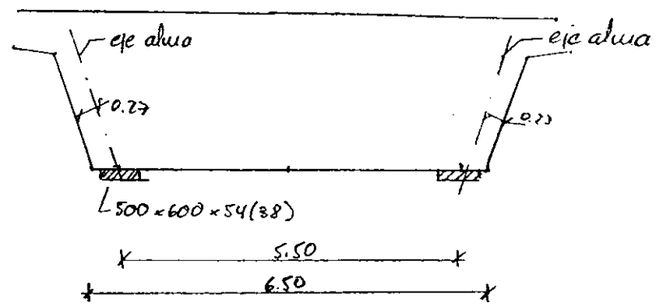
Compresión $\Rightarrow 435 + 1.6 \times 1000 \times 0.305 = 923\ t$

COSTILLA EN ESTRIBO MOVIL

Reacciones en estribo

$$R_{max} = \frac{1}{2}\left(279 + 108 + 23 + 298 + 68\right) + \frac{M_E}{5.50} = 425\ t$$

$$M_E = 1.24 \times 24 \times \frac{27}{2} \times 0.30 + \left(1.35 + 4.43\right) \times \frac{27}{2} = 199$$



Tracción en parte superior $F = 1.6 \cdot 427 \times \frac{1}{2.30} \times 0.23 = 68.3\ t \Rightarrow 16\ cm^2$

Areparto $\Rightarrow 0.3 \times 427 \cdot 1.6 \cdot \frac{1.15}{5.1} \times \left(\frac{2 - 0.60}{2.0}\right) = 32.4\ cm^2$

$\frac{2 - 0.50}{2.0} = 34.7\ cm^2$

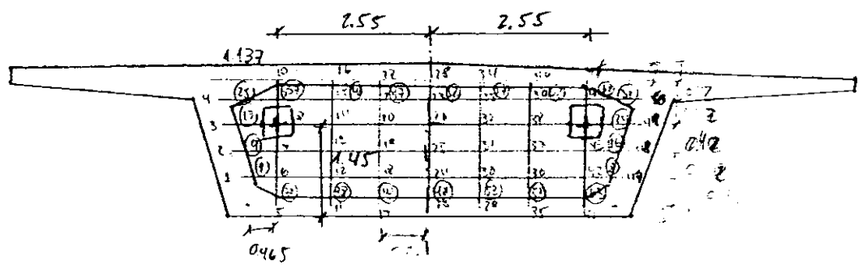
PROYECTO L.A.V. ZARAGOZA - LLEIDA
SUBTRAMO 1. PUENTES CASAO
COSTILLA APOYO EN ESTRIBO FIJO E-4

FECHA

HOJA N.º 17

COSTILLA APOYO EN ESTRIBO FIJO

El tirón debido al frenado + deformaciones diferidas es de:
C45 + 189 = 834 t repartido en 2 puntos de cosido (417)
al estribo situados:



Para distribuir la armadura se usó debía un emparrillado

	x	y
Nudo	1 -3.5526	0.112
	2 -3.4182	0.84
	3 -3.2838	1.26
	4 -3.149	1.68

Barras horizontales → $I = \frac{1}{12} 0{,}42 \cdot 2^3 \rightarrow 0.280\ m^4$ $I = 2I$

verticales $I = \frac{1}{12} 0{,}85 \cdot 2^3 \rightarrow 0.567\ m^4$

Barras verticales $|M| + |T|_{máx} = 124\ mt/m \times 1.6 \rightarrow 24\ cm^2/m$
horizontales $95\ mt/m \times 1.6 \rightarrow 18\ cm^2/m$

cortante → $V_2 = 200 \cdot 1.6\ t/m$
$V_{cu} = 310$
$A_{min} = 11{,}1\ cm^2/m$

COSTIE4 pag. 1

COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-4.
CONTROL
50 67 6 1
:
NUDOS

1	-3.1490	0.420
2	-3.2838	0.840
3	-3.4182	1.260
4	-3.5526	1.680
5	-2.550	0.000
6	-2.550	0.420
7	-2.550	0.840
8	-2.550	1.260
9	-2.550	1.680
10	-2.550	2.100
11	-1.700	0.000
12	-1.700	0.420
13	-1.700	0.840
14	-1.700	1.260
15	-1.700	1.680
16	-1.700	2.100
17	-0.850	0.000
18	-0.850	0.420
19	-0.850	0.840
20	-0.850	1.260
21	-0.850	1.680
22	-0.850	2.100
23	0.000	0.000
24	0.000	0.420
25	0.000	0.840
26	0.000	1.260
27	0.000	1.680
28	0.000	2.100
29	0.850	0.000
30	0.850	0.420
31	0.850	0.840
32	0.850	1.260
33	0.850	1.680
34	0.850	2.100
35	1.700	0.000
36	1.700	0.420
37	1.700	0.840
38	1.700	1.260
39	1.700	1.680
40	1.700	2.100
41	2.550	0.000
42	2.550	0.420
43	2.550	0.840
44	2.550	1.260
45	2.550	1.680
46	2.550	2.100
47	3.149	0.420
48	3.2838	0.840
49	3.4182	1.260
50	3.5526	1.680

:
SECCIONES
2
0.280000 0.560000 3500000 1500000

```
  0.567000   1.134000    3500000    1500000
:
BARRAS
   1    1    6    1
   2    6   12    1
   3   12   18    1
   4   18   24    1
   5   24   30    1
   6   30   36    1
   7   36   42    1
   8   42   47    1
   9    2    7    1
  10    7   13    1
  11   13   19    1
  12   19   25    1
  13   25   31    1
  14   31   37    1
  15   37   43    1
  16   43   48    1
  17    3    8    1
  18    8   14    1
  19   14   20    1
  20   20   26    1
  21   26   32    1
  22   32   38    1
  23   38   44    1
  24   44   49    1
  25    4    9    1
  26    9   15    1
  27   15   21    1
  28   21   27    1
  29   27   33    1
  30   33   39    1
  31   39   45    1
  32   45   50    1
  33    5    6    2
  34    6    7    2
  35    7    8    2
  36    8    9    2
  37    9   10    2
  38   11   12    2
  39   12   13    2
  40   13   14    2
  41   14   15    2
  42   15   16    2
  43   17   18    2
  44   18   19    2
  45   19   20    2
  46   20   21    2
  47   21   22    2
  48   23   24    2
  49   24   25    2
  50   25   26    2
  51   26   27    2
  52   27   28    2
  53   29   30    2
  54   30   31    2
  55   31   32    2
  56   32   33    2
```



```
  57   33   34    2
  58   35   36    2
  59   36   37    2
  60   37   38    2
  61   38   39    2
  62   39   40    2
  63   41   42    2
  64   42   43    2
  65   43   44    2
  66   44   45    2
  67   45   46    2
:
APOYOS
22
   1          0          0          1
   2          0          0          1
   3          0          0          1
   4          0          0          1
   5          0          0          1
  10          0          0          1
  11          0          0          1
  16          0          0          1
  17          0          0          1
  22          0          0          1
  23          0          0          1
  28          0          0          1
  29          0          0          1
  34          0          0          1
  35          0          0          1
  40          0          0          1
  41          0          0          1
  46          0          0          1
  47          0          0          1
  48          0          0          1
  49          0          0          1
  50          0          0          1
:
HIPOTESIS DE CARGA
H-1.TIRON DE 2X417.0 T. ARTICULADO
2
8  0 0 417.0
44 0 0 417.0
0
:
```

COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-4.

Hip. nº 1 H-1.TIRON DE 2X417.0 T. ARTICULADO

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000014	0.000013	0.000000
2	-0.000010	0.000021	0.000000
3	0.000003	0.000021	0.000000
4	0.000018	0.000012	0.000000
5	-0.000015	0.000006	0.000000
6	-0.000014	0.000006	0.000006
7	-0.000010	0.000006	0.000012
8	0.000003	0.000004	0.000014
9	0.000018	0.000003	0.000009
10	0.000022	0.000003	0.000000
11	-0.000014	-0.000005	0.000000
12	-0.000011	-0.000005	0.000005
13	-0.000005	-0.000007	0.000009
14	0.000004	-0.000008	0.000009
15	0.000011	-0.000007	0.000006
16	0.000015	-0.000007	0.000000
17	-0.000004	-0.000003	0.000000
18	-0.000004	-0.000003	0.000002
19	-0.000002	-0.000005	0.000003
20	0.000002	-0.000005	0.000003
21	0.000004	-0.000003	0.000002
22	0.000004	-0.000003	0.000000
23	-0.000001	-0.000000	-0.000000
24	-0.000001	-0.000000	0.000001
25	-0.000001	-0.000000	0.000001
26	0.000001	-0.000000	0.000001
27	0.000001	-0.000000	0.000001
28	0.000001	-0.000000	-0.000000
29	-0.000004	0.000003	0.000000
30	-0.000004	0.000003	0.000002
31	-0.000002	0.000005	0.000003
32	0.000002	0.000005	0.000003
33	0.000004	0.000003	0.000002
34	0.000004	0.000003	0.000000
35	-0.000014	0.000005	0.000000
36	-0.000011	0.000005	0.000005
37	-0.000005	0.000007	0.000009
38	0.000004	0.000008	0.000009
39	0.000011	0.000007	0.000006
40	0.000015	0.000007	0.000000
41	-0.000015	-0.000006	0.000000
42	-0.000014	-0.000006	0.000006
43	-0.000010	-0.000006	0.000012
44	0.000003	-0.000004	0.000014
45	0.000018	-0.000003	0.000009
46	0.000022	-0.000003	0.000000
47	-0.000014	-0.000013	0.000000
48	-0.000010	-0.000021	0.000000
49	0.000003	-0.000021	0.000000
50	0.000018	-0.000012	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	0.00	0.00	36.38
2	0.00	0.00	53.95
3	0.00	0.00	43.98
4	0.00	-0.00	16.85
5	-0.00	0.00	16.18
10	-0.00	0.00	103.57
11	-0.00	0.00	59.89
16	0.00	-0.00	71.49
17	-0.00	0.00	10.55
22	-0.00	0.00	8.83
23	0.00	0.00	-4.53
28	-0.00	-0.00	-4.83
29	0.00	0.00	10.55
34	-0.00	0.00	8.83
35	-0.00	0.00	59.90
40	-0.00	0.00	71.49
41	0.00	0.00	16.18
46	0.00	-0.00	103.57
47	0.00	0.00	36.38
48	-0.00	0.00	53.95
49	0.00	0.00	43.98
50	-0.00	-0.00	16.85

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	0.00	0.00	36.38
	6	0.00	21.79	36.38
2	6	3.31	21.84	-20.57
	12	3.31	4.36	-20.57
3	12	6.94	-3.84	3.48
	18	6.94	-0.88	3.48
4	18	2.49	-5.47	3.69
	24	2.49	-2.33	3.69
5	24	-2.49	-2.33	-3.69
	30	-2.49	-5.47	-3.69
6	30	-6.94	-0.88	-3.48
	36	-6.94	-3.84	-3.48
7	36	-3.31	4.36	20.57
	42	-3.31	21.84	20.57
8	42	0.00	21.79	-36.38
	47	0.00	-0.00	-36.38
9	2	0.00	0.00	53.95
	7	0.00	39.59	53.95
10	7	5.44	33.31	-42.03
	13	5.44	-2.41	-42.03
11	13	3.18	2.36	-13.52
	19	3.18	-9.14	-13.52
12	19	0.94	-4.57	-1.50
	25	0.94	-5.84	-1.50
13	25	-0.94	-5.84	1.50
	31	-0.94	-4.57	1.50
14	31	-3.18	-9.14	13.52
	37	-3.18	2.36	13.52
15	37	-5.44	-2.41	42.03
	43	-5.44	33.31	42.03
16	43	-0.00	39.59	-53.95

	48	-0.00	-0.00	-53.95
17	3	0.00	0.00	43.98
	8	0.00	38.19	43.98
18	8	0.44	38.55	-56.23
	14	0.44	-9.25	-56.23
19	14	-2.11	0.53	-11.50
	20	-2.11	-9.25	-11.50
20	20	-0.94	-4.62	-1.40
	26	-0.94	-5.81	-1.40
21	26	0.94	-5.81	1.40
	32	0.94	-4.62	1.40
22	32	2.11	-9.25	11.50
	38	2.11	0.53	11.50
23	38	-0.44	-9.25	56.23
	44	-0.44	38.55	56.23
24	44	0.00	38.19	-43.98
	49	0.00	-0.00	-43.98
25	4	0.00	-0.00	16.85
	9	0.00	16.89	16.85
26	9	-6.19	22.76	-27.27
	15	-6.19	-0.42	-27.27
27	15	-7.44	-6.77	6.85
	21	-7.44	-0.95	6.85
28	21	-2.51	-5.55	3.89
	27	-2.51	-2.25	3.89
29	27	2.51	-2.25	-3.89
	33	2.51	-5.55	-3.89
30	33	7.44	-0.95	-6.85
	39	7.44	-6.77	-6.85
31	39	6.19	-0.42	27.27
	45	6.19	22.76	27.27
32	45	-0.00	16.89	-16.85
	50	-0.00	0.00	-16.85
33	5	0.00	0.00	16.18
	6	0.00	6.80	16.18
34	6	0.05	3.49	73.13
	7	0.05	34.20	73.13
35	7	-6.23	28.76	169.10
	8	-6.23	99.79	169.10
36	8	-5.87	99.34	-147.69
	9	-5.87	37.31	-147.69
37	9	0.00	43.50	-103.57
	10	0.00	-0.00	-103.57
38	11	0.00	0.00	59.89
	12	0.00	25.16	59.89
39	12	-8.20	21.52	35.84
	13	-8.20	36.58	35.84
40	13	-3.42	38.84	7.34
	14	-3.42	41.92	7.34
41	14	6.35	44.47	-37.38
	15	6.35	28.77	-37.38
42	15	-0.00	30.03	-71.49
	16	-0.00	0.00	-71.49
43	17	0.00	0.00	10.55
	18	0.00	4.43	10.55
44	18	-4.59	8.89	10.34
	19	-4.59	13.23	10.34
45	19	-0.02	15.47	-1.68
	20	-0.02	14.76	-1.68

46	20	4.61	13.59	-11.79
	21	4.61	8.64	-11.79
47	21	0.00	3.71	-8.83
	22	0.00	-0.00	-8.83
48	23	0.00	-0.00	-4.53
	24	0.00	-1.90	-4.53
49	24	-0.00	3.07	2.85
	25	-0.00	4.27	2.85
50	25	-0.00	6.16	-0.15
	26	-0.00	6.09	-0.15
51	26	0.00	4.22	-2.94
	27	0.00	2.99	-2.94
52	27	-0.00	-2.03	4.83
	28	-0.00	-0.00	4.83
53	29	0.00	-0.00	10.55
	30	0.00	4.43	10.55
54	30	4.59	8.89	10.35
	31	4.59	13.23	10.35
55	31	0.02	15.47	-1.68
	32	0.02	14.76	-1.68
56	32	-4.61	13.59	-11.79
	33	-4.61	8.64	-11.79
57	33	0.00	3.71	-8.83
	34	0.00	-0.00	-8.83
58	35	0.00	0.00	59.90
	36	0.00	25.16	59.90
59	36	8.20	21.52	35.84
	37	8.20	36.58	35.84
60	37	3.42	38.84	7.34
	38	3.42	41.92	7.34
61	38	-6.35	44.47	-37.38
	39	-6.35	28.77	-37.38
62	39	0.00	30.03	-71.49
	40	0.00	-0.00	-71.49
63	41	0.00	0.00	16.18
	42	0.00	6.80	16.18
64	42	-0.05	3.49	73.13
	43	-0.05	34.20	73.13
65	43	6.23	28.76	169.10
	44	6.23	99.79	169.10
66	44	5.87	99.34	-147.69
	45	5.87	37.31	-147.69
67	45	-0.00	43.50	-103.57
	46	-0.00	0.00	-103.57

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	2.1120	-0.24937
2	1.1500	1.6132	-0.24937
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	32.0000	2.2100	-0.32700
7	33.2500	2.1400	-0.12000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	0

ALARGAMIENTOS TESADO

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	2.112	0.000	-0.2494	0.0000
2	0.000	1.900	0.000	-0.2494	0.0000
3	1.000	1.651	0.000	-0.2494	0.0000
4	2.000	1.411	0.000	-0.2274	0.0000
5	3.000	1.196	0.000	-0.2016	0.0000
6	4.000	1.007	0.000	-0.1757	0.0000
7	5.000	0.845	0.000	-0.1499	0.0000
8	6.000	0.708	0.000	-0.1240	0.0000
9	7.000	0.597	0.000	-0.0982	0.0000
10	8.000	0.511	0.000	-0.0724	0.0000
11	9.000	0.452	0.000	-0.0465	0.0000
12	10.000	0.418	0.000	-0.0207	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.262	0.000	0.0916	0.0000
31	29.000	2.367	0.000	0.1046	0.0000
32	30.000	2.445	0.000	0.0392	0.0000
33	31.000	2.419	0.000	-0.1046	0.0000
34	32.000	2.210	0.000	-0.3270	0.0000
35	33.000	2.153	0.000	-0.0006	0.0000
36	34.000	2.050	0.000	-0.1200	0.0000
37	35.000	1.930	0.000	-0.1200	0.0000
38	35.250	1.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	556.94	138.89
2	0.000	0.0000	0.0000	0.0000	573.38	556.34	138.76
3	1.000	0.0000	0.0000	0.0000	572.66	555.64	138.57
4	2.000	0.0208	0.0000	0.0208	569.45	555.28	126.27
5	3.000	0.0455	0.0000	0.0455	565.79	554.64	111.79
6	4.000	0.0704	0.0000	0.0704	562.13	553.64	97.29
7	5.000	0.0956	0.0000	0.0956	558.46	552.29	82.78
8	6.000	0.1210	0.0000	0.1210	554.79	550.57	68.29
9	7.000	0.1465	0.0000	0.1465	551.13	548.49	53.86
10	8.000	0.1722	0.0000	0.1722	547.48	546.05	39.51
11	9.000	0.1979	0.0000	0.1979	543.84	543.25	25.27
12	10.000	0.2237	0.0000	0.2237	540.22	540.11	11.17
13	11.000	0.2477	0.0000	0.2477	536.83	536.83	-1.77
14	12.000	0.2641	0.0000	0.2641	534.31	534.20	-10.55
15	13.000	0.2806	0.0000	0.2806	531.79	531.45	-19.25
16	14.000	0.2970	0.0000	0.2970	529.29	528.56	-27.84
17	15.000	0.3134	0.0000	0.3134	526.81	525.56	-36.34
18	16.000	0.3298	0.0000	0.3298	524.34	522.43	-44.72
19	17.000	0.3461	0.0000	0.3461	521.89	519.19	-52.99
20	18.000	0.3624	0.0000	0.3624	519.46	515.85	-61.14
21	19.000	0.3786	0.0000	0.3786	517.04	512.39	-69.16
22	20.000	0.3947	0.0000	0.3947	514.64	508.84	-77.06
23	21.000	0.4107	0.0000	0.4107	512.27	505.19	-84.82
24	22.000	0.4267	0.0000	0.4267	509.91	501.46	-92.45
25	23.000	0.4426	0.0000	0.4426	507.57	497.64	-99.94
26	24.000	0.4583	0.0000	0.4583	505.26	493.74	-107.28
27	25.000	0.5186	0.0000	0.5186	498.28	491.66	-80.93
28	26.000	0.5948	0.0000	0.5948	500.73	499.05	-41.07
29	27.000	0.5127	0.0000	0.5127	510.09	510.09	-0.00
30	28.000	0.6040	0.0000	0.6040	501.03	498.94	-45.68
31	29.000	0.6169	0.0000	0.6169	500.30	497.58	-52.07
32	30.000	0.5519	0.0000	0.5519	507.82	507.43	-19.91
33	31.000	0.4084	0.0000	0.4084	524.01	521.17	54.53
34	32.000	0.1966	0.0000	0.1966	548.53	521.37	170.49
35	33.000	0.1188	0.0000	0.1188	558.27	558.27	0.33
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 258.9 mm. Retesado = 9.6 mm.
Alarg. tesado ext. final = 239.7 mm. Retesado = 28.8 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	1.5410	-0.16569
2	1.1500	1.2090	-0.16569
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	33.2500	1.7400	-0.17000
7	35.2500	1.4000	-0.17000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.541	0.000	-0.1657	0.0000
2	0.000	1.400	0.000	-0.1661	0.0000
3	1.000	1.234	0.000	-0.1658	0.0000
4	2.000	1.074	0.000	-0.1511	0.0000
5	3.000	0.932	0.000	-0.1339	0.0000
6	4.000	0.807	0.000	-0.1167	0.0000
7	5.000	0.699	0.000	-0.0995	0.0000
8	6.000	0.608	0.000	-0.0823	0.0000
9	7.000	0.534	0.000	-0.0652	0.0000
10	8.000	0.477	0.000	-0.0480	0.0000
11	9.000	0.438	0.000	-0.0309	0.0000
12	10.000	0.415	0.000	-0.0137	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.201	0.000	-0.0193	0.0000
31	29.000	2.170	0.000	-0.0416	0.0000
32	30.000	2.116	0.000	-0.0669	0.0000
33	31.000	2.036	0.000	-0.0953	0.0000
34	32.000	1.925	0.000	-0.1266	0.0000
35	33.000	1.781	0.000	-0.1609	0.0000
36	34.000	1.613	0.000	-0.1700	0.0000
37	35.000	1.442	0.000	-0.1700	0.0000
38	35.250	1.400	0.000	-0.1700	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	566.28	93.83
2	0.000	0.0004	0.0000	0.0004	573.33	565.58	93.97
3	1.000	0.0001	0.0000	0.0001	572.65	564.93	93.68
4	2.000	0.0143	0.0000	0.0143	570.23	563.83	85.18
5	3.000	0.0311	0.0000	0.0311	567.50	562.48	75.31
6	4.000	0.0480	0.0000	0.0480	564.78	560.97	65.46
7	5.000	0.0650	0.0000	0.0650	562.06	559.30	55.66
8	6.000	0.0820	0.0000	0.0820	559.35	557.46	45.90
9	7.000	0.0991	0.0000	0.0991	556.64	555.46	36.20
10	8.000	0.1162	0.0000	0.1162	553.95	553.31	26.57
11	9.000	0.1333	0.0000	0.1333	551.27	551.00	17.01
12	10.000	0.1505	0.0000	0.1505	548.59	548.54	7.52
13	11.000	0.1675	0.0000	0.1675	545.95	545.95	-1.80
14	12.000	0.1839	0.0000	0.1839	543.38	543.27	-10.73
15	13.000	0.2004	0.0000	0.2004	540.82	540.47	-19.57
16	14.000	0.2168	0.0000	0.2168	538.28	537.54	-28.32
17	15.000	0.2332	0.0000	0.2332	535.76	534.48	-36.95
18	16.000	0.2496	0.0000	0.2496	533.25	531.30	-45.48
19	17.000	0.2659	0.0000	0.2659	530.75	528.01	-53.89
20	18.000	0.2822	0.0000	0.2822	528.28	524.61	-62.18
21	19.000	0.2984	0.0000	0.2984	525.82	521.10	-70.34
22	20.000	0.3145	0.0000	0.3145	523.38	517.48	-78.37
23	21.000	0.3305	0.0000	0.3305	520.97	513.77	-86.26
24	22.000	0.3465	0.0000	0.3465	518.57	509.97	-94.02
25	23.000	0.3624	0.0000	0.3624	516.19	506.09	-101.63
26	24.000	0.4407	0.0000	0.4407	515.89	504.13	-109.54
27	25.000	0.3805	0.0000	0.3805	523.12	516.17	-84.97
28	26.000	0.2995	0.0000	0.2995	532.77	530.97	-43.70
29	27.000	0.2174	0.0000	0.2174	542.72	542.72	-0.00
30	28.000	0.1981	0.0000	0.1981	545.61	545.51	10.53
31	29.000	0.1758	0.0000	0.1758	548.86	548.39	22.82
32	30.000	0.1505	0.0000	0.1505	552.47	551.24	36.89
33	31.000	0.1224	0.0000	0.1224	556.45	553.94	52.76
34	32.000	0.0914	0.0000	0.0914	560.78	556.34	70.43
35	33.000	0.0578	0.0000	0.0578	565.47	558.29	89.85
36	34.000	0.0490	0.0000	0.0490	567.23	559.21	95.07
37	35.000	0.0490	0.0000	0.0490	567.95	559.92	95.19
38	35.250	0.0490	0.0000	0.0490	568.13	560.09	95.22

Alarg. tesado ext. inicial = 264.2 mm. Retesado = 10.4 mm.
larg. tesado ext. final = 254.6 mm. Retesado = 20.0 mm.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	1.0010	-0.11883
2	1.1500	0.7630	-0.11883
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.9500	1.5110	-0.18190
7	33.2500	1.1400	-0.12000
8	35.2500	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.001	0.000	-0.1188	0.0000
2	0.000	0.900	0.000	-0.1191	0.0000
3	1.000	0.781	0.000	-0.1189	0.0000
4	2.000	0.666	0.000	-0.1083	0.0000
5	3.000	0.564	0.000	-0.0960	0.0000
6	4.000	0.474	0.000	-0.0837	0.0000
7	5.000	0.397	0.000	-0.0714	0.0000
8	6.000	0.332	0.000	-0.0591	0.0000
9	7.000	0.279	0.000	-0.0467	0.0000
10	8.000	0.238	0.000	-0.0344	0.0000
11	9.000	0.210	0.000	-0.0221	0.0000
12	10.000	0.194	0.000	-0.0098	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.948	0.000	-0.0804	0.0000
31	29.000	1.837	0.000	-0.1376	0.0000
32	30.000	1.680	0.000	-0.1714	0.0000
33	31.000	1.502	0.000	-0.1819	0.0000
34	32.000	1.324	0.000	-0.1691	0.0000
35	33.000	1.172	0.000	-0.1327	0.0000
36	34.000	1.050	0.000	-0.1200	0.0000
37	35.000	0.930	0.000	-0.1200	0.0000
38	35.250	0.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	569.99	67.73
2	0.000	0.0002	0.0000	0.0002	573.36	569.33	67.80
3	1.000	0.0000	0.0000	0.0000	572.66	568.65	67.61
4	2.000	0.0104	0.0000	0.0104	570.70	567.38	61.47
5	3.000	0.0226	0.0000	0.0226	568.52	565.92	54.34
6	4.000	0.0348	0.0000	0.0348	566.35	564.38	47.23
7	5.000	0.0470	0.0000	0.0470	564.19	562.75	40.16
8	6.000	0.0593	0.0000	0.0593	562.03	561.05	33.13
9	7.000	0.0716	0.0000	0.0716	559.87	559.26	26.14
10	8.000	0.0839	0.0000	0.0839	557.73	557.40	19.19
11	9.000	0.0961	0.0000	0.0961	555.59	555.45	12.29
12	10.000	0.1084	0.0000	0.1084	553.46	553.43	5.44
13	11.000	0.1216	0.0000	0.1216	551.24	551.24	-1.81
14	12.000	0.1380	0.0000	0.1380	548.65	548.54	-10.84
15	13.000	0.1545	0.0000	0.1545	546.07	545.71	-19.76
16	14.000	0.1709	0.0000	0.1709	543.50	542.75	-28.59
17	15.000	0.1873	0.0000	0.1873	540.95	539.66	-37.31
18	16.000	0.2037	0.0000	0.2037	538.41	536.45	-45.92
19	17.000	0.2200	0.0000	0.2200	535.90	533.13	-54.41
20	18.000	0.2362	0.0000	0.2362	533.40	529.69	-62.78
21	19.000	0.2524	0.0000	0.2524	530.92	526.15	-71.02
22	20.000	0.2686	0.0000	0.2686	528.46	522.50	-79.13
23	21.000	0.2846	0.0000	0.2846	526.01	518.75	-87.10
24	22.000	0.3006	0.0000	0.3006	523.59	514.92	-94.93
25	23.000	0.3165	0.0000	0.3165	521.19	510.99	-102.62
26	24.000	0.3322	0.0000	0.3322	518.82	506.99	-110.16
27	25.000	0.4036	0.0000	0.4036	520.59	513.68	-84.56
28	26.000	0.3226	0.0000	0.3226	530.19	528.40	-43.49
29	27.000	0.2404	0.0000	0.2404	540.09	540.09	-0.00
30	28.000	0.1602	0.0000	0.1602	549.97	548.20	44.10
31	29.000	0.1037	0.0000	0.1037	557.23	552.03	75.94
32	30.000	0.0707	0.0000	0.0707	561.81	553.74	94.90
33	31.000	0.0605	0.0000	0.0605	563.73	554.63	100.87
34	32.000	0.0480	0.0000	0.0480	565.92	558.00	94.33
35	33.000	0.0125	0.0000	0.0125	570.87	565.90	75.12
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 265.4 mm. Retesado = 11.1 mm.
.arg. tesado ext. final = 254.8 mm. Retesado = 21.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	0.4299	-0.03515
2	1.1500	0.3596	-0.03515
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.3500	1.2590	-0.32700
7	33.2500	0.5500	-0.08000
8	35.2500	0.3900	-0.08000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	0.430	0.000	-0.0352	0.0000
2	0.000	0.400	0.000	-0.0352	0.0000
3	1.000	0.365	0.000	-0.0352	0.0000
4	2.000	0.331	0.000	-0.0321	0.0000
5	3.000	0.301	0.000	-0.0284	0.0000
6	4.000	0.274	0.000	-0.0248	0.0000
7	5.000	0.251	0.000	-0.0211	0.0000
8	6.000	0.232	0.000	-0.0175	0.0000
9	7.000	0.216	0.000	-0.0138	0.0000
10	8.000	0.204	0.000	-0.0102	0.0000
11	9.000	0.196	0.000	-0.0066	0.0000
12	10.000	0.191	0.000	-0.0029	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.902	0.000	-0.1663	0.0000
31	29.000	1.677	0.000	-0.2742	0.0000
32	30.000	1.373	0.000	-0.3235	0.0000
33	31.000	1.049	0.000	-0.3144	0.0000
34	32.000	0.764	0.000	-0.2468	0.0000
35	33.000	0.575	0.000	-0.1207	0.0000
36	34.000	0.490	0.000	-0.0800	0.0000
37	35.000	0.410	0.000	-0.0800	0.0000
38	35.250	0.390	0.000	-0.0800	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	573.65	20.16
2	0.000	0.0000	0.0000	0.0000	573.39	573.03	20.14
3	1.000	0.0000	0.0000	0.0000	572.66	572.31	20.12
4	2.000	0.0031	0.0000	0.0031	571.57	571.28	18.31
5	3.000	0.0067	0.0000	0.0067	570.42	570.19	16.20
6	4.000	0.0104	0.0000	0.0104	569.26	569.09	14.10
7	5.000	0.0140	0.0000	0.0140	568.11	567.98	12.00
8	6.000	0.0177	0.0000	0.0177	566.96	566.87	9.91
9	7.000	0.0213	0.0000	0.0213	565.81	565.76	7.83
10	8.000	0.0249	0.0000	0.0249	564.67	564.64	5.76
11	9.000	0.0286	0.0000	0.0286	563.53	563.52	3.69
12	10.000	0.0322	0.0000	0.0322	562.39	562.39	1.64
13	11.000	0.0384	0.0000	0.0384	560.95	560.95	-1.85
14	12.000	0.0549	0.0000	0.0549	558.31	558.20	-11.03
15	13.000	0.0713	0.0000	0.0713	555.68	555.32	-20.11
16	14.000	0.0878	0.0000	0.0878	553.07	552.31	-29.09
17	15.000	0.1042	0.0000	0.1042	550.48	549.17	-37.97
18	16.000	0.1205	0.0000	0.1205	547.90	545.90	-46.73
19	17.000	0.1368	0.0000	0.1368	545.34	542.52	-55.37
20	18.000	0.1531	0.0000	0.1531	542.79	539.02	-63.88
21	19.000	0.1693	0.0000	0.1693	540.27	535.41	-72.27
22	20.000	0.1854	0.0000	0.1854	537.76	531.70	-80.52
23	21.000	0.2015	0.0000	0.2015	535.28	527.89	-88.63
24	22.000	0.2174	0.0000	0.2174	532.81	523.98	-96.60
25	23.000	0.2333	0.0000	0.2333	530.37	519.99	-104.43
26	24.000	0.2491	0.0000	0.2491	527.95	515.92	-112.10
27	25.000	0.3093	0.0000	0.3093	520.66	513.75	-84.57
28	26.000	0.3903	0.0000	0.3903	511.23	509.51	-41.94
29	27.000	0.5522	0.0000	0.5522	505.86	505.86	-0.00
30	28.000	0.3874	0.0000	0.3874	524.34	517.23	86.04
31	29.000	0.2846	0.0000	0.2846	536.45	517.36	141.86
32	30.000	0.2393	0.0000	0.2393	542.26	515.93	166.93
33	31.000	0.2248	0.0000	0.2248	544.61	519.54	163.34
34	32.000	0.1621	0.0000	0.1621	552.52	536.43	132.37
35	33.000	0.0403	0.0000	0.0403	567.56	563.47	67.99
36	34.000	0.0000	0.0000	0.0000	573.10	571.27	45.70
37	35.000	0.0000	0.0000	0.0000	573.82	571.99	45.76
38	35.250	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alarg. tesado ext. inicial = 267.0 mm. Retesado = 9.8 mm.
Alarg. tesado ext. final = 241.8 mm. Retesado = 35.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE 2.

N° de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.7000	1.0570	-0.27428
4	8.2500	0.4100	0.00000
5	21.4500	1.9100	0.22222
6	24.7500	2.2100	0.00000
7	29.7500	2.2100	-0.32700
8	31.0000	2.1400	-0.12000
9	33.0000	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.490	0.000	-0.2138	0.0000
5	4.000	1.247	0.000	-0.2645	0.0000
6	5.000	0.975	0.000	-0.2720	0.0000
7	6.000	0.717	0.000	-0.2367	0.0000
8	7.000	0.516	0.000	-0.1583	0.0000
9	8.000	0.415	0.000	-0.0370	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
20	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.214	0.000	0.0302	0.0000
27	26.000	2.287	0.000	0.1022	0.0000
28	27.000	2.392	0.000	0.0956	0.0000
29	28.000	2.452	0.000	0.0106	0.0000
30	29.000	2.387	0.000	-0.1529	0.0000
31	30.000	2.155	0.000	-0.1248	0.0000
32	31.000	2.140	0.000	-0.1200	0.0000
33	32.000	2.020	0.000	-0.1200	0.0000
34	33.000	1.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	1.3659	0.0000	1.3659	413.31	410.37	49.24
2	1.000	1.3659	0.0000	1.3659	413.83	410.88	49.31
3	2.000	1.3659	0.0000	1.3659	414.35	411.40	49.37
4	3.000	1.2748	0.0000	1.2748	422.90	413.55	88.41
5	4.000	1.2268	0.0000	1.2268	427.71	413.50	109.35
6	5.000	1.2156	0.0000	1.2156	429.26	414.21	112.68
7	6.000	1.1824	0.0000	1.1824	432.82	421.18	99.68
8	7.000	1.1070	0.0000	1.1070	440.27	434.86	68.85
9	8.000	0.9870	0.0000	0.9870	452.08	451.77	16.73
10	9.000	0.9365	0.0000	0.9365	457.47	457.43	-6.15
11	10.000	0.9188	0.0000	0.9188	459.76	459.54	-14.34
12	11.000	0.9012	0.0000	0.9012	462.04	461.49	-22.52
13	12.000	0.8839	0.0000	0.8839	464.31	463.30	-30.68
14	13.000	0.8667	0.0000	0.8667	466.57	464.96	-38.80
15	14.000	0.8498	0.0000	0.8498	468.83	466.48	-46.89
16	15.000	0.8331	0.0000	0.8331	471.07	467.85	-54.94
17	16.000	0.8166	0.0000	0.8166	473.29	469.09	-62.93
18	17.000	0.8004	0.0000	0.8004	475.51	470.20	-70.86
19	18.000	0.7844	0.0000	0.7844	477.71	471.18	-78.72
20	19.000	0.7687	0.0000	0.7687	479.89	472.03	-86.51
21	20.000	0.7533	0.0000	0.7533	482.06	472.76	-94.22
22	21.000	0.7381	0.0000	0.7381	484.21	473.38	-101.84
23	22.000	0.6794	0.0000	0.6794	490.83	484.01	-81.48
24	23.000	0.6001	0.0000	0.6001	499.70	497.79	-43.63
25	24.000	0.5419	0.0000	0.5419	506.49	506.27	-14.79
26	25.000	0.5429	0.0000	0.5429	507.02	506.78	-15.33
27	26.000	0.6145	0.0000	0.6145	500.08	497.49	-50.84
28	27.000	0.6080	0.0000	0.6080	501.39	499.11	-47.74
29	28.000	0.5233	0.0000	0.5233	511.04	511.01	-5.43
30	29.000	0.3610	0.0000	0.3610	529.42	523.34	80.00
31	30.000	0.0047	0.0000	0.0047	571.27	566.87	70.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 220.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 2.

N° de puntos singulares en alzado = 7

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	8.2500	0.4100	0.00000
4	21.4500	1.9100	0.22222
5	24.7500	2.2100	0.00000
6	31.0000	1.7400	-0.17000
7	33.0000	1.4000	-0.17000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.895	0.000	-0.1581	0.0000
5	4.000	0.746	0.000	-0.1404	0.0000
6	5.000	0.617	0.000	-0.1169	0.0000
7	6.000	0.514	0.000	-0.0875	0.0000
8	7.000	0.444	0.000	-0.0522	0.0000
9	8.000	0.411	0.000	-0.0112	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
20	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.209	0.000	-0.0045	0.0000
27	26.000	2.195	0.000	-0.0246	0.0000
28	27.000	2.159	0.000	-0.0477	0.0000
29	28.000	2.099	0.000	-0.0737	0.0000
30	29.000	2.011	0.000	-0.1028	0.0000
31	30.000	1.892	0.000	-0.1349	0.0000
32	31.000	1.740	0.000	-0.1700	0.0000
33	32.000	1.570	0.000	-0.1700	0.0000
34	33.000	1.400	0.000	-0.1700	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.7741	0.0000	0.7741	468.01	461.39	78.44
2	1.000	0.7741	0.0000	0.7741	468.60	461.97	78.53
3	2.000	0.7741	0.0000	0.7741	469.19	462.55	78.63
4	3.000	0.7625	0.0000	0.7625	470.92	465.14	73.55
5	4.000	0.7452	0.0000	0.7452	473.24	468.64	65.80
6	5.000	0.7221	0.0000	0.7221	476.14	472.93	55.26
7	6.000	0.6930	0.0000	0.6930	479.66	477.84	41.79
8	7.000	0.6579	0.0000	0.6579	483.82	483.16	25.24
9	8.000	0.6169	0.0000	0.6169	488.62	488.59	5.46
10	9.000	0.5923	0.0000	0.5923	491.77	491.72	-6.61
11	10.000	0.5745	0.0000	0.5745	494.23	493.99	-15.41
12	11.000	0.5570	0.0000	0.5570	496.68	496.09	-24.21
13	12.000	0.5396	0.0000	0.5396	499.12	498.03	-32.98
14	13.000	0.5225	0.0000	0.5225	501.55	499.82	-41.71
15	14.000	0.5055	0.0000	0.5055	503.98	501.45	-50.41
16	15.000	0.4888	0.0000	0.4888	506.38	502.93	-59.06
17	16.000	0.4724	0.0000	0.4724	508.78	504.26	-67.64
18	17.000	0.4562	0.0000	0.4562	511.16	505.45	-76.17
19	18.000	0.4402	0.0000	0.4402	513.52	506.50	-84.62
20	19.000	0.4245	0.0000	0.4245	515.87	507.42	-92.99
21	20.000	0.4090	0.0000	0.4090	518.20	508.20	-101.28
22	21.000	0.3938	0.0000	0.3938	520.51	508.87	-109.48
23	22.000	0.3352	0.0000	0.3352	527.62	520.30	-87.59
24	23.000	0.2558	0.0000	0.2558	537.17	535.11	-46.90
25	24.000	0.1976	0.0000	0.1976	544.46	544.23	-15.90
26	25.000	0.1638	0.0000	0.1638	549.02	549.02	2.49
27	26.000	0.1438	0.0000	0.1438	552.03	551.87	13.57
28	27.000	0.1208	0.0000	0.1208	555.41	554.78	26.44
29	28.000	0.0948	0.0000	0.0948	559.15	557.64	41.11
30	29.000	0.0659	0.0000	0.0659	563.26	560.31	57.60
31	30.000	0.0343	0.0000	0.0343	567.73	562.63	75.90
32	31.000	0.0000	0.0000	0.0000	572.56	564.46	95.96
33	32.000	0.0000	0.0000	0.0000	573.28	565.17	96.08
34	33.000	0.0000	0.0000	0.0000	574.00	565.88	96.20

Alargamiento = 236.9 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE 2.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	8.2500	0.1900	0.00000
4	21.4500	1.6900	0.22222
5	24.7500	1.9900	0.00000
6	28.7000	1.5110	-0.18190
7	31.0000	1.1400	-0.12000
8	33.0000	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.543	0.000	-0.1131	0.0000
5	4.000	0.435	0.000	-0.1014	0.0000
6	5.000	0.342	0.000	-0.0852	0.0000
7	6.000	0.267	0.000	-0.0642	0.0000
8	7.000	0.215	0.000	-0.0386	0.0000
9	8.000	0.191	0.000	-0.0083	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.987	0.000	-0.0223	0.0000
27	26.000	1.926	0.000	-0.0969	0.0000
28	27.000	1.801	0.000	-0.1482	0.0000
29	28.000	1.637	0.000	-0.1762	0.0000
30	29.000	1.457	0.000	-0.1809	0.0000
31	30.000	1.283	0.000	-0.1622	0.0000
32	31.000	1.140	0.000	-0.1200	0.0000
33	32.000	1.020	0.000	-0.1200	0.0000
34	33.000	0.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.7972	0.0000	0.7972	465.74	462.43	55.49
2	1.000	0.7972	0.0000	0.7972	466.33	463.01	55.56
3	2.000	0.7972	0.0000	0.7972	466.92	463.59	55.63
4	3.000	0.7903	0.0000	0.7903	468.18	465.22	52.60
5	4.000	0.7789	0.0000	0.7789	469.90	467.50	47.43
6	5.000	0.7627	0.0000	0.7627	472.09	470.39	40.06
7	6.000	0.7419	0.0000	0.7419	474.76	473.79	30.42
8	7.000	0.7163	0.0000	0.7163	477.92	477.56	18.43
9	8.000	0.6861	0.0000	0.6861	481.57	481.55	4.00
10	9.000	0.6643	0.0000	0.6643	484.38	484.34	-6.51
11	10.000	0.6466	0.0000	0.6466	486.81	486.57	-15.18
12	11.000	0.6290	0.0000	0.6290	489.22	488.64	-23.84
13	12.000	0.6117	0.0000	0.6117	491.63	490.55	-32.48
14	13.000	0.5945	0.0000	0.5945	494.02	492.31	-41.09
15	14.000	0.5776	0.0000	0.5776	496.41	493.92	-49.65
16	15.000	0.5609	0.0000	0.5609	498.78	495.38	-58.17
17	16.000	0.5444	0.0000	0.5444	501.14	496.69	-66.63
18	17.000	0.5282	0.0000	0.5282	503.48	497.86	-75.02
19	18.000	0.5122	0.0000	0.5122	505.81	498.90	-83.35
20	19.000	0.4965	0.0000	0.4965	508.12	499.80	-91.60
21	20.000	0.4811	0.0000	0.4811	510.42	500.57	-99.76
22	21.000	0.4659	0.0000	0.4659	512.69	501.23	-107.84
23	22.000	0.4072	0.0000	0.4072	519.70	512.49	-86.28
24	23.000	0.3279	0.0000	0.3279	529.10	527.08	-46.20
25	24.000	0.2696	0.0000	0.2696	536.28	536.06	-15.66
26	25.000	0.2181	0.0000	0.2181	542.80	542.66	12.10
27	26.000	0.1438	0.0000	0.1438	552.03	549.46	53.25
28	27.000	0.0933	0.0000	0.0933	558.62	552.59	81.90
29	28.000	0.0660	0.0000	0.0660	562.54	554.01	97.61
30	29.000	0.0595	0.0000	0.0595	564.02	555.02	100.39
31	30.000	0.0414	0.0000	0.0414	566.89	559.58	90.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 234.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE 2.

N° de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	3.2500	0.1900	0.00000
4	8.2500	0.1900	0.00000
5	21.4500	1.6900	0.22222
6	24.7500	1.9900	0.00000
7	28.1000	1.2590	-0.32700
8	31.0000	0.5500	-0.08000
9	33.0000	0.3900	-0.08000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.191	0.000	-0.0083	0.0000
5	4.000	0.190	0.000	0.0000	0.0000
6	5.000	0.190	0.000	0.0000	0.0000
7	6.000	0.190	0.000	0.0000	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0000	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.984	0.000	-0.0471	0.0000
27	26.000	1.856	0.000	-0.1988	0.0000
28	27.000	1.606	0.000	-0.2920	0.0000
29	28.000	1.292	0.000	-0.3267	0.0000
30	29.000	0.972	0.000	-0.3030	0.0000
31	30.000	0.705	0.000	-0.2207	0.0000
32	31.000	0.550	0.000	-0.0800	0.0000
33	32.000	0.470	0.000	-0.0800	0.0000
34	33.000	0.390	0.000	-0.0800	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	1.0694	0.0000	1.0694	439.87	438.47	35.08
2	1.000	1.0694	0.0000	1.0694	440.42	439.02	35.12
3	2.000	1.0694	0.0000	1.0694	440.98	439.57	35.17
4	3.000	0.9979	0.0000	0.9979	448.21	448.20	3.73
5	4.000	0.9896	0.0000	0.9896	449.56	449.56	-0.00
6	5.000	0.9896	0.0000	0.9896	450.13	450.13	-0.00
7	6.000	0.9896	0.0000	0.9896	450.70	450.70	-0.00
8	7.000	0.9896	0.0000	0.9896	451.27	451.27	-0.00
9	8.000	0.9896	0.0000	0.9896	451.83	451.83	-0.00
10	9.000	0.9761	0.0000	0.9761	453.68	453.64	-6.10
11	10.000	0.9584	0.0000	0.9584	455.95	455.73	-14.22
12	11.000	0.9408	0.0000	0.9408	458.21	457.67	-22.33
13	12.000	0.9235	0.0000	0.9235	460.47	459.46	-30.42
14	13.000	0.9063	0.0000	0.9063	462.71	461.11	-38.48
15	14.000	0.8894	0.0000	0.8894	464.94	462.61	-46.51
16	15.000	0.8727	0.0000	0.8727	467.17	463.98	-54.48
17	16.000	0.8562	0.0000	0.8562	469.37	465.21	-62.41
18	17.000	0.8400	0.0000	0.8400	471.57	466.30	-70.27
19	18.000	0.8240	0.0000	0.8240	473.75	467.27	-78.07
20	19.000	0.8083	0.0000	0.8083	475.92	468.12	-85.79
21	20.000	0.7929	0.0000	0.7929	478.07	468.85	-93.44
22	21.000	0.7777	0.0000	0.7777	480.20	469.46	-101.00
23	22.000	0.7190	0.0000	0.7190	486.76	480.01	-80.81
24	23.000	0.6397	0.0000	0.6397	495.56	493.67	-43.27
25	24.000	0.5815	0.0000	0.5815	502.29	502.08	-14.67
26	25.000	0.5052	0.0000	0.5052	511.04	510.48	24.03
27	26.000	0.3560	0.0000	0.3560	527.97	517.84	102.94
28	27.000	0.2681	0.0000	0.2681	538.49	516.90	150.94
29	28.000	0.2364	0.0000	0.2364	542.77	515.92	168.58
30	29.000	0.2144	0.0000	0.2144	545.98	522.52	158.31
31	30.000	0.1374	0.0000	0.1374	555.57	542.51	119.75
32	31.000	0.0000	0.0000	0.0000	572.56	570.73	45.66
33	32.000	0.0000	0.0000	0.0000	573.28	571.45	45.72
34	33.000	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alargamiento = 223.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE ULTIMA.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.6000	1.0540	-0.28911
4	7.9500	0.4100	0.00000
5	17.4000	1.5689	0.24527
6	19.4000	2.0594	0.24527

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	510.000 t.
Area del cable	=	3360 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.483	0.000	-0.2255	0.0000
5	4.000	1.226	0.000	-0.2805	0.0000
6	5.000	0.939	0.000	-0.2847	0.0000
7	6.000	0.673	0.000	-0.2379	0.0000
8	7.000	0.480	0.000	-0.1401	0.0000
9	8.000	0.410	0.000	0.0013	0.0000
10	9.000	0.424	0.000	0.0273	0.0000
11	10.000	0.465	0.000	0.0532	0.0000
12	11.000	0.531	0.000	0.0792	0.0000
13	12.000	0.623	0.000	0.1051	0.0000
14	13.000	0.741	0.000	0.1311	0.0000
15	14.000	0.885	0.000	0.1570	0.0000
16	15.000	1.055	0.000	0.1830	0.0000
17	16.000	1.251	0.000	0.2089	0.0000
18	17.000	1.473	0.000	0.2349	0.0000
19	18.000	1.716	0.000	0.2452	0.0000
20	19.000	1.961	0.000	0.2453	0.0000
21	19.400	2.059	0.000	0.2453	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.6840	0.0000	0.6840	431.10	428.03	51.36
2	1.000	0.6840	0.0000	0.6840	431.64	428.57	51.43
3	2.000	0.6840	0.0000	0.6840	432.19	429.11	51.49
4	3.000	0.5816	0.0000	0.5816	442.14	431.30	97.28
5	4.000	0.5300	0.0000	0.5300	447.52	430.89	120.85
6	5.000	0.5179	0.0000	0.5179	449.22	432.06	122.99
7	6.000	0.4741	0.0000	0.4741	453.94	441.62	105.06
8	7.000	0.3797	0.0000	0.3797	463.61	459.13	64.33
9	8.000	0.2392	0.0000	0.2392	478.10	478.09	-0.62
10	9.000	0.2133	0.0000	0.2133	481.31	481.13	-13.11
11	10.000	0.1874	0.0000	0.1874	484.55	483.87	-25.74
12	11.000	0.1615	0.0000	0.1615	487.80	486.28	-38.49
13	12.000	0.1358	0.0000	0.1358	491.06	488.37	-51.34
14	13.000	0.1102	0.0000	0.1102	494.33	490.14	-64.24
15	14.000	0.0848	0.0000	0.0848	497.60	491.58	-77.19
16	15.000	0.0595	0.0000	0.0595	500.88	492.70	-90.15
17	16.000	0.0346	0.0000	0.0346	504.15	493.49	-103.11
18	17.000	0.0098	0.0000	0.0098	507.41	493.97	-116.03
19	18.000	0.0000	0.0000	0.0000	509.10	494.45	-121.26
20	19.000	0.0000	0.0000	0.0000	509.74	495.07	-121.42
21	19.400	0.0000	0.0000	0.0000	510.00	495.32	-121.49

Alargamiento = 144.6 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE ULTIMA.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	7.9500	0.4100	0.00000
4	17.4000	1.1800	0.16296
5	19.4000	1.5060	0.16296

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	510.000 t.
rea del cable	=	3360 mm2.
od. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.893	0.000	-0.1618	0.0000
5	4.000	0.739	0.000	-0.1453	0.0000
6	5.000	0.606	0.000	-0.1206	0.0000
7	6.000	0.501	0.000	-0.0878	0.0000
8	7.000	0.433	0.000	-0.0467	0.0000
9	8.000	0.410	0.000	0.0009	0.0000
10	9.000	0.420	0.000	0.0181	0.0000
11	10.000	0.446	0.000	0.0354	0.0000
12	11.000	0.490	0.000	0.0526	0.0000
13	12.000	0.551	0.000	0.0698	0.0000
14	13.000	0.630	0.000	0.0871	0.0000
15	14.000	0.726	0.000	0.1043	0.0000
16	15.000	0.839	0.000	0.1216	0.0000
17	16.000	0.969	0.000	0.1388	0.0000
18	17.000	1.116	0.000	0.1561	0.0000
19	18.000	1.278	0.000	0.1630	0.0000
20	19.000	1.441	0.000	0.1630	0.0000
21	19.400	1.506	0.000	0.1630	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3299	0.0000	0.3299	464.37	457.80	77.83
2	1.000	0.3299	0.0000	0.3299	464.96	458.38	77.92
3	2.000	0.3299	0.0000	0.3299	465.54	458.96	78.02
4	3.000	0.3219	0.0000	0.3219	466.91	460.92	74.56
5	4.000	0.3058	0.0000	0.3058	469.08	464.21	67.46
6	5.000	0.2816	0.0000	0.2816	472.07	468.67	56.54
7	6.000	0.2491	0.0000	0.2491	475.91	474.08	41.61
8	7.000	0.2082	0.0000	0.2082	480.62	480.10	22.40
9	8.000	0.1607	0.0000	0.1607	486.05	486.05	-0.42
10	9.000	0.1434	0.0000	0.1434	488.42	488.34	-8.84
11	10.000	0.1262	0.0000	0.1262	490.81	490.51	-17.34
12	11.000	0.1090	0.0000	0.1090	493.21	492.53	-25.91
13	12.000	0.0918	0.0000	0.0918	495.62	494.41	-34.53
14	13.000	0.0747	0.0000	0.0747	498.03	496.15	-43.21
15	14.000	0.0576	0.0000	0.0576	500.45	497.75	-51.93
16	15.000	0.0406	0.0000	0.0406	502.88	499.20	-60.69
17	16.000	0.0236	0.0000	0.0236	505.31	500.51	-69.48
18	17.000	0.0067	0.0000	0.0067	507.74	501.67	-78.29
19	18.000	0.0000	0.0000	0.0000	509.10	502.46	-81.91
20	19.000	0.0000	0.0000	0.0000	509.74	503.10	-82.00
21	19.400	0.0000	0.0000	0.0000	510.00	503.36	-82.03

Alargamiento = 148.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE ULTIMA.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	7.9500	0.1900	0.00000
4	17.4000	0.7420	0.11687
5	19.4000	0.9760	0.11687

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.542	0.000	-0.1158	0.0000
5	4.000	0.431	0.000	-0.1051	0.0000
6	5.000	0.334	0.000	-0.0880	0.0000
7	6.000	0.257	0.000	-0.0644	0.0000
8	7.000	0.207	0.000	-0.0344	0.0000
9	8.000	0.190	0.000	0.0006	0.0000
10	9.000	0.197	0.000	0.0130	0.0000
11	10.000	0.216	0.000	0.0253	0.0000
12	11.000	0.247	0.000	0.0377	0.0000
13	12.000	0.291	0.000	0.0501	0.0000
14	13.000	0.348	0.000	0.0624	0.0000
15	14.000	0.416	0.000	0.0748	0.0000
16	15.000	0.497	0.000	0.0872	0.0000
17	16.000	0.591	0.000	0.0995	0.0000
18	17.000	0.696	0.000	0.1119	0.0000
19	18.000	0.812	0.000	0.1170	0.0000
20	19.000	0.929	0.000	0.1170	0.0000
21	19.400	0.976	0.000	0.1169	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.2358	0.0000	0.2358	473.64	470.27	56.43
2	1.000	0.2358	0.0000	0.2358	474.24	470.86	56.50
3	2.000	0.2358	0.0000	0.2358	474.84	471.46	56.57
4	3.000	0.2316	0.0000	0.2316	475.85	472.70	54.72
5	4.000	0.2210	0.0000	0.2210	477.51	474.90	49.91
6	5.000	0.2041	0.0000	0.2041	479.82	477.97	42.05
7	6.000	0.1807	0.0000	0.1807	482.79	481.79	31.04
8	7.000	0.1508	0.0000	0.1508	486.44	486.16	16.75
9	8.000	0.1157	0.0000	0.1157	490.66	490.66	-0.30
10	9.000	0.1034	0.0000	0.1034	492.55	492.51	-6.39
11	10.000	0.0910	0.0000	0.0910	494.45	494.29	-12.52
12	11.000	0.0787	0.0000	0.0787	496.36	496.01	-18.69
13	12.000	0.0663	0.0000	0.0663	498.28	497.65	-24.91
14	13.000	0.0540	0.0000	0.0540	500.20	499.23	-31.16
15	14.000	0.0417	0.0000	0.0417	502.13	500.73	-37.45
16	15.000	0.0294	0.0000	0.0294	504.06	502.15	-43.77
17	16.000	0.0171	0.0000	0.0171	506.00	503.51	-50.12
18	17.000	0.0049	0.0000	0.0049	507.94	504.79	-56.49
19	18.000	0.0002	0.0000	0.0002	509.08	505.63	-59.18
20	19.000	0.0001	0.0000	0.0001	509.73	506.28	-59.23
21	19.400	0.0000	0.0000	0.0000	510.00	506.55	-59.20

Alargamiento = 149.6 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE ULTIMA.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	6.7000	0.1900	0.00000
4	7.9500	0.1900	0.00000
5	17.4000	0.3530	0.03457
6	19.4000	0.4225	0.03457

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.176	0.000	-0.0313	0.0000
5	4.000	0.162	0.000	0.0002	0.0000
6	5.000	0.171	0.000	0.0147	0.0000
7	6.000	0.185	0.000	0.0120	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0002	0.0000
10	9.000	0.192	0.000	0.0038	0.0000
11	10.000	0.198	0.000	0.0075	0.0000
12	11.000	0.207	0.000	0.0111	0.0000
13	12.000	0.220	0.000	0.0148	0.0000
14	13.000	0.236	0.000	0.0184	0.0000
15	14.000	0.257	0.000	0.0221	0.0000
16	15.000	0.281	0.000	0.0257	0.0000
17	16.000	0.308	0.000	0.0294	0.0000
18	17.000	0.339	0.000	0.0331	0.0000
19	18.000	0.374	0.000	0.0348	0.0000
20	19.000	0.409	0.000	0.0347	0.0000
21	19.400	0.422	0.000	0.0346	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.1144	0.0000	0.1144	485.87	484.32	38.75
2	1.000	0.1144	0.0000	0.1144	486.48	484.94	38.79
3	2.000	0.1144	0.0000	0.1144	487.10	485.55	38.84
4	3.000	0.0659	0.0000	0.0659	492.71	492.46	15.43
5	4.000	0.0348	0.0000	0.0348	496.56	496.56	-0.11
6	5.000	0.0492	0.0000	0.0492	495.68	495.62	-7.28
7	6.000	0.0466	0.0000	0.0466	496.58	496.54	-5.98
8	7.000	0.0346	0.0000	0.0346	498.46	498.46	-0.00
9	8.000	0.0344	0.0000	0.0344	499.11	499.11	-0.09
10	9.000	0.0307	0.0000	0.0307	500.12	500.12	-1.91
11	10.000	0.0271	0.0000	0.0271	501.14	501.12	-3.74
12	11.000	0.0234	0.0000	0.0234	502.15	502.12	-5.58
13	12.000	0.0198	0.0000	0.0198	503.17	503.12	-7.43
14	13.000	0.0161	0.0000	0.0161	504.19	504.11	-9.29
15	14.000	0.0125	0.0000	0.0125	505.22	505.09	-11.15
16	15.000	0.0088	0.0000	0.0088	506.24	506.07	-13.03
17	16.000	0.0051	0.0000	0.0051	507.27	507.05	-14.92
18	17.000	0.0015	0.0000	0.0015	508.30	508.02	-16.81
19	18.000	0.0002	0.0000	0.0002	509.08	508.77	-17.70
20	19.000	0.0002	0.0000	0.0002	509.72	509.42	-17.70
21	19.400	0.0000	0.0000	0.0000	510.00	509.70	-17.62

Alargamiento = 152.0 mm.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	0.5000	-0.17500
2	1.5000	0.2375	-0.17500
3	2.5000	0.1500	0.00000
4	19.0000	0.1500	0.00000
5	20.0000	0.2375	0.17500
6	21.5000	0.5000	0.17500

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	21.5000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 299.000 t.
Area del cable = 2100 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.500	0.000	-0.1750	0.0000
2	1.000	0.325	0.000	-0.1750	0.0000
3	2.000	0.172	0.000	-0.0875	0.0000
4	3.000	0.150	0.000	0.0000	0.0000
5	4.000	0.150	0.000	0.0000	0.0000
6	5.000	0.150	0.000	0.0000	0.0000
7	6.000	0.150	0.000	0.0000	0.0000
8	7.000	0.150	0.000	0.0000	0.0000
9	8.000	0.150	0.000	0.0000	0.0000
10	9.000	0.150	0.000	0.0000	0.0000
11	10.000	0.150	0.000	0.0000	0.0000
12	11.000	0.150	0.000	0.0000	0.0000
13	12.000	0.150	0.000	0.0000	0.0000
14	13.000	0.150	0.000	0.0000	0.0000
15	14.000	0.150	0.000	0.0000	0.0000
16	15.000	0.150	0.000	0.0000	0.0000
17	16.000	0.150	0.000	0.0000	0.0000
18	17.000	0.150	0.000	0.0000	0.0000
19	18.000	0.150	0.000	0.0000	0.0000
20	19.000	0.150	0.000	0.0000	0.0000
21	20.000	0.237	0.000	0.1750	0.0000
22	21.000	0.412	0.000	0.1750	0.0000
23	21.500	0.500	0.000	0.1750	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3465	0.0000	0.3465	270.59	266.54	46.64
2	1.000	0.3465	0.0000	0.3465	270.93	266.87	46.70
3	2.000	0.2605	0.0000	0.2605	276.21	275.16	24.08
4	3.000	0.1732	0.0000	0.1732	281.67	281.67	-0.00
5	4.000	0.1732	0.0000	0.1732	282.03	282.03	-0.00
6	5.000	0.1732	0.0000	0.1732	282.39	282.39	-0.00
7	6.000	0.1732	0.0000	0.1732	282.74	282.74	-0.00
8	7.000	0.1732	0.0000	0.1732	283.10	283.10	-0.00
9	8.000	0.1732	0.0000	0.1732	283.45	283.45	-0.00
10	9.000	0.1732	0.0000	0.1732	283.81	283.81	-0.00
11	10.000	0.1732	0.0000	0.1732	284.17	284.17	-0.00
12	11.000	0.1732	0.0000	0.1732	284.53	284.53	-0.00
13	12.000	0.1732	0.0000	0.1732	284.89	284.89	-0.00
14	13.000	0.1732	0.0000	0.1732	285.25	285.25	-0.00
15	14.000	0.1732	0.0000	0.1732	285.61	285.61	-0.00
16	15.000	0.1732	0.0000	0.1732	285.97	285.97	-0.00
17	16.000	0.1732	0.0000	0.1732	286.33	286.33	-0.00
18	17.000	0.1732	0.0000	0.1732	286.69	286.69	-0.00
19	18.000	0.1732	0.0000	0.1732	287.05	287.05	-0.00
20	19.000	0.1732	0.0000	0.1732	287.41	287.41	-0.00
21	20.000	0.0000	0.0000	0.0000	298.44	293.97	-51.44
22	21.000	0.0000	0.0000	0.0000	298.81	294.34	-51.51
23	21.500	0.0000	0.0000	0.0000	299.00	294.52	-51.54

Alargamiento = 153.3 mm.

2.- CALCULO REACCIONES Y APOYOS

Reacciones y giros acumulados por peso propio

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	237.44	-.000442
11	725.29	0.000136
21	726.96	0.000265
31	736.97	0.000250
41	711.73	0.000327
51	244.06	0.000481

Δr por macizadas

Apoyo 1: $2.00 \times (19.544 - 8.842) \cdot 2.5 = 53.5$ t

Apoyo 51 = $1.30 \cdot (19.544 - 8.842) \cdot 2.5 = 34.8$ t

Apoyos intermedios: $2.00 \cdot (19.544 - 8.842 - 1.4 \cdot 1.8) \cdot 2.5 = 40.9$ t

Reacciones y giros acumulados por peso propio

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	225.10	-.000380
11	736.79	0.000013
21	729.20	0.000021
31	730.02	0.000021
41	735.68	0.000025
51	225.65	0.000383

Reacciones y giros debidos a cargas muertas

Apoyo	Reaccion (t)	Giro (gr)
1	108.27	-.000181
11	356.64	0.000001
21	352.57	0.000000
31	352.57	0.000000
41	356.64	-.000001
51	108.27	0.000181

Reacciones y giros debidos a temperatura

Apoyo	Reaccion (t)	Giro (gr)
1	22.56	0.000160
11	-26.80	-.000048
21	4.24	0.000016
31	4.26	-.000016
41	-26.82	0.000048
51	22.57	-.000160

Reacciones y giros por ferrocarril (RENFE)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	298.831	-55.597	0.0002783	-0.0006674
11	807.180	-70.542	0.0005063	-0.0005566
21	840.559	-68.219	0.0006230	-0.0005998
31	840.626	-68.216	0.0006011	-0.0006217
41	807.180	-70.539	0.0005566	-0.0005063
51	298.831	-55.595	0.0006674	-0.0002783

Reacciones y giros por ferrocarril (UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	229.822	-44.676	0.0002236	-0.0005458
11	636.126	-57.352	0.0003707	-0.0004473
21	656.307	-56.826	0.0004568	-0.0004592
31	656.307	-56.826	0.0004592	-0.0004568
41	636.126	-57.352	0.0004473	-0.0003707
51	229.822	-44.676	0.0005458	-0.0002236

Reacciones y giros por ferrocarril (RENFE/UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(gr) maximo	Giro(gr) minimo
1	298.831	-55.597	0.0002783	-0.0006674
11	807.180	-70.542	0.0005063	-0.0005566
21	840.559	-68.219	0.0006230	-0.0005998
31	840.626	-68.216	0.0006011	-0.0006217
41	807.180	-70.539	0.0005566	-0.0005063
51	298.831	-55.595	0.0006674	-0.0002783

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Reacciones y giros por sobrecarga total

(sobrecarga repartida+carro)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro (gr) maximo	Giro (gr) minimo
1	298.831	-55.597	0.0002783	-0.0006674
11	807.180	-70.542	0.0005063	-0.0005566
21	840.559	-68.219	0.0006230	-0.0005998
31	840.626	-68.216	0.0006011	-0.0006217
41	807.180	-70.539	0.0005566	-0.0005063
51	298.831	-55.595	0.0006674	-0.0002783

Reacciones y giros por pretensado (sin ponderar)

0.9487

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (gr)
1	46.78	0.001673
11	-38.66	-.000535
21	-9.13	-.000306
31	-4.00	-.000261
41	-44.35	-.000343
51	49.36	-.001317

Reacciones y giros por pretensado (sin ponderar)

0.8517

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (gr)
1	68.28	0.001370
11	-79.62	-.000217
21	14.52	-.000046
31	-4.69	-.000083
41	-55.01	-.000082
51	56.50	-.001121

PROYECTO L.A.V ZARAGOZA - LERIDA
SUBTRAMO I
E-4

FECHA

HOJA N.º

REACCIONES VERTICALES (A TODO ANCHO)

	P.P.I	P.P.F	C.M	TEMP	RENFE		PRET. I.	PRET. F.
E-2 (Fijo)	290.9	278.6	108.3	22.6	298.8	-55.6	46.8	68.3
P-4	766.2	777.7	356.6	-26.8	807.2	-70.5	-38.7	-79.6
P-3	767.9	770.1	352.6	4.2	840.6	-68.2	-9.1	14.5
P-2	777.9	770.9	352.6	4.2	840.6	-68.2	-4.0	-4.7
P-1	752.6	776.6	356.6	-26.8	807.2	-70.5	-44.4	-55.0
E-1	278.9	260.5	108.3	22.6	298.8	-55.6	49.4	56.5
Σ	3634 t	3634 t	1635 t	0	-	-	0 t	0 t

APARATOS DE APOYO

Reacciones máximas por apoyo:

E-2: $\frac{1}{2}(290.9 + 108.3 + 22.6 + 298.8 + 68.3) + \frac{298.8 \times 0.30}{5.50} = 410,7$ t

P-4: $\frac{1}{2}(777.7 + 356.6 + 807.2 - 38.7) + \frac{807.2 \times 0.30}{5.20} = 998,0$ t

P-3: $\frac{1}{2}(770,1 + 352.6 + 4.2 + 840.6 + 14.5) + \frac{840.6 \times 0.30}{5.20} = 1039,5$ t

P-2: $\frac{1}{2}(777.9 + 352.6 + 4.2 + 840.6 - 4,0) + \frac{840,6 \times 0.30}{5.20} = 1034,1$ t

P-1: $\frac{1}{2}(776.6 + 356.6 + 807.2 - 44.4) + \frac{807.2 \times 0.30}{5.20} = 994,6$ t

E-1: $\frac{1}{2}(278.4 + 108.3 + 22.6 + 298.8 + 56.5) + \frac{298.9 \times 0.30}{5.50} = 398.7$ t

APOYOS:

E-2	2 ø 500×600×54 (38)	σmáx: 136,9 kg/cm²
P-4	2 ø 800×900×102 (77)	σmáx: 138.6 kg/cm²
P-3	2 ø 800×900×148 (113)	σmáx: 144.4 kg/cm²
P-2	2 ø 800×900×194 (149)	σmáx: 143.6 kg/cm²
P-1	2 ø 800×900×240 (185)	σmáx: 138.1 kg/cm²
E-1	2 ø 500×600×54 (38) + TEFLON	σmáx: 132,9 kg/cm²

PROYECTO

E-4

FECHA

HOJA N.º

REACCIONES HORIZONTALES LONGITUDINALES

- FRENADO: RENFE: $F_H = \frac{1}{8}(30 \times 12.00 + 125.00 \times 10.00) \times 1.9 = 382,4$ t

U.I.C: $F_H = \frac{1}{4}(100 + 148,60 \times 8.00) \times 2 = \underline{644,4}$ t

Esta carga se la lleva íntegra el estribo 1 (fijo)

- DEFORMACIONES DIFERIDAS:
  - RETRACCION: $\varepsilon = -25 \times 10^{-5}$
  - TEMPERATURA: $\varepsilon = \pm 20 \times 10^{-5}$
  - FLUENCIA: $\sigma_{media} = \frac{3600}{8,79} = 410$ t/m² = 41 kg/cm²

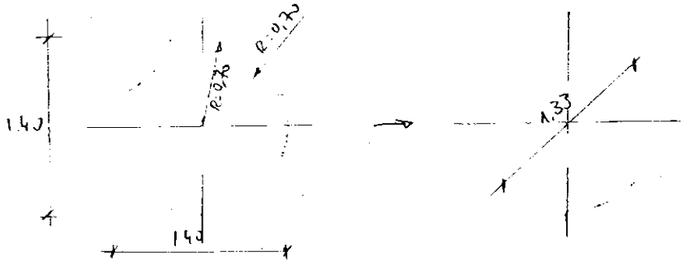
$\varepsilon = -\frac{41}{3,5 \times 10^5} \times 3.5 = -41 \times 10^{-5}$

$\varepsilon_{total} = -86 \times 10^{-5}$.

PILA	
1	-86
2	-84.7
3	-87.50
4	-87.0
5	-21

Cada pila se llevará la correspondiente a su rigidez y desplazamiento.

Sección de pila: 2 fustes.



$A = 2 \cdot \pi \times \frac{1.33^2}{4} = 2.78$ m²

$I = 2\pi \times \frac{1.33^4}{64} = 0,307$ m⁴

Flexibilidad: $\frac{L^3}{3EI} + \frac{ne}{GA} = \frac{L^3}{3\times3.0\times10^6\times0.307} + \frac{ne}{2\times100\times0.72} = \frac{L^3}{2.763\cdot10^6} + \frac{ne}{144}$

$F_{HL} = \frac{\delta}{\text{Flexibilidad}}$

Elemento	L	δ	F_{HL}	Rigidez (t/m)
E-2	–	0	-188.9	∞
P-4	12.05	0,00232	18.9	856
P-3	11.70	0.05082	37.3	733
P-2	11.25	0,0767	49.4	644
P-1	10.80	0.10332	59.4	575
E-1	–	0,12393	23.3	—

$F_{HL\ E-1} = 0,05\times(279 + 108.3 + 27.6 + 56.5) = 23.3\ t$

SISMO LONGITUDINAL

El pueble es rígido al movimiento longitudinal ya que está anclado al estribo 2 => GRADO VII $\delta = 0,08$

Fuerza sobre el ESTRIBO 2:

$F_{HL} = 0,08\cdot(3634 + 1635 + 0,6\times2577.6) = 545\ t$

FUERZAS HORIZONTALES TRANSVERSALES

- Viento

Tablero: $q = 0,2\times(2.45 + 0.70 + 3.50) = 1.33\ t/m$

Pilas $q = 0,2\times1.40 = 0,28\ t/m$

Rigideces transversales de pilas y apoyos:

$F = F_{pila} + \frac{ne}{144}$

La Fpila se halla, como en la E-1, calculando pórticos transversales (ver adjunto)

Elemento	L	ne	Fpila	Rigidez	
E-2	–	–		∞	746
P-4	12.05	0,077	0.0001564	1447	127
P-3	11.70	0.113	0,00014405	1077	16.9
P-2	11.25	0.149	0.0001292	859	13.5
P-1	10.80	0.185	0.00011545	714	6.11
E-1	–	–		∞	794

Barras tablero | $8.84\ m^2$ Area
$100\ m^4$ Inercia

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1.
CONTROL
7 6 2 1
:
NUDOS
1 0 -10.80
2 0 -1.80
3 0 0
4 2.6 -1.80
5 5.2 -10.80
6 5.2 -1.80
7 5.2 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1 2 CARGAS DE 10 T
2
3 10 0 0
7 10 0 0
0
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1.

Hip. n° 1 H-1 2 CARGAS DE 10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.001945	0.000037	-0.000182
3	0.002309	0.000037	-0.000212
4	0.001945	-0.000000	0.000070
5	0.000000	-0.000000	-0.000000
6	0.001945	-0.000037	-0.000182
7	0.002309	-0.000037	-0.000212

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-20.04	55.89
5	-10.00	20.04	55.89

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	20.04	-55.89	-10.00
	2	20.04	34.11	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	0.00	-10.00
3	2	0.00	52.11	20.04
	4	0.00	0.00	20.04
4	4	-0.00	0.00	20.04
	6	-0.00	-52.11	20.04
5	5	-20.04	-55.89	-10.00
	6	-20.04	34.11	-10.00
6	6	0.00	-18.00	-10.00
	7	0.00	-0.00	-10.00

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 2.
CONTROL
7 6 2 1
:
NUDOS
1 0 -11.25
2 0 -1.80
3 0 0
4 2.6 -1.80
5 5.2 -11.25
6 5.2 -1.80
7 5.2 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
.
CARGAS
H-1 2 CARGAS DE 10 T
2
3 10 0 0
7 10 0 0
0
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 2.

Hip. n° 1 H-1 2 CARGAS DE 10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.002205	0.000041	-0.000191
3	0.002584	0.000041	-0.000221
4	0.002205	0.000000	0.000072
5	0.000000	-0.000000	-0.000000
6	0.002205	-0.000041	-0.000191
7	0.002584	-0.000041	-0.000221

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-20.92	58.12
5	-10.00	20.92	58.12

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	20.92	-58.12	-10.00
	2	20.92	36.38	-10.00
2	2	-0.00	-18.00	-10.00
	3	-0.00	0.00	-10.00
3	2	0.00	54.38	20.92
	4	0.00	-0.00	20.92
4	4	0.00	-0.00	20.92
	6	0.00	-54.38	20.92
5	5	-20.92	-58.12	-10.00
	6	-20.92	36.38	-10.00
6	6	0.00	-18.00	-10.00
	7	0.00	-0.00	-10.00

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 3.
CONTROL
7 6 2 1
:
NUDOS
1 0 -11.70
2 0 -1.80
3 0 0
4 2.6 -1.80
5 5.2 -11.70
6 5.2 -1.80
7 5.2 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
.
CARGAS
H-1 2 CARGAS DE 10 T
2
3 10 0 0
7 10 0 0
0
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 3.

Hip. n° 1 H-1 2 CARGAS DE 10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.002486	0.000044	-0.000199
3	0.002881	0.000044	-0.000229
4	0.002486	-0.000000	0.000074
5	0.000000	-0.000000	-0.000000
6	0.002486	-0.000044	-0.000199
7	0.002881	-0.000044	-0.000229

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-21.79	60.35
5	-10.00	21.79	60.35

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	21.79	-60.35	-10.00
	2	21.79	38.65	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	0.00	-10.00
3	2	0.00	56.65	21.79
	4	0.00	0.00	21.79
4	4	0.00	0.00	21.79
	6	0.00	-56.65	21.79
5	5	-21.79	-60.35	-10.00
	6	-21.79	38.65	-10.00
6	6	0.00	-18.00	-10.00
	7	0.00	0.00	-10.00

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4.
CONTROL
7 6 2 1
:
NUDOS
1 0 -12.05
2 0 -1.80
3 0 0
4 2.6 -1.80
5 5.2 -12.05
6 5.2 -1.80
7 5.2 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
.
CARGAS
H-1 2 CARGAS DE 10 T
2
3 10 0 0
7 10 0 0
0
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4.

Hip. n° 1 H-1 2 CARGAS DE 10 T

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.002721	0.000047	-0.000206
3	0.003128	0.000047	-0.000236
4	0.002721	-0.000000	0.000076
5	0.000000	-0.000000	-0.000000
6	0.002721	-0.000047	-0.000206
7	0.003128	-0.000047	-0.000236

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-10.00	-22.47	62.09
5	-10.00	22.47	62.09

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	22.47	-62.09	-10.00
	2	22.47	40.41	-10.00
2	2	0.00	-18.00	-10.00
	3	0.00	-0.00	-10.00
3	2	0.00	58.41	22.47
	4	0.00	0.00	22.47
4	4	-0.00	0.00	22.47
	6	-0.00	-58.41	22.47
5	5	-22.47	-62.09	-10.00
	6	-22.47	40.41	-10.00
6	6	0.00	-18.00	-10.00
	7	0.00	-0.00	-10.00

```
ZARAGOZA-LERIDA.T-1.E-4.VIENTO
CONTROL
6  5 1 1
:
NUDOS
 1   0.00  0.00
 2  27.00  0.00
 3  60.00  0.00
 4  93.00  0.00
 5 126.00  0.00
 6 153.00  0.00
:
SECCIONES
1
8.8400 100.00 4.0E6
:
BARRAS
 1   1   2  1
 2   2   3  1
 3   3   4  1
 4   4   5  1
 5   5   6  1
:
APOYOS
6
1  1       1      0
2  0    1447      0
3  0    1077      0
4  0     859      0
5  0     714      0
6  0       1      0
:
HIPOTESIS DE CARGA
H-1 FUERZA DE VIENTO 1.33t/m
0
5
1  2  1.33  90
2  2  1.33  90
3  2  1.33  90
4  2  1.33  90
5  2  1.33  90
:
```


ZARAGOZA-LERIDA.T-1.E-4.VIENTO

Hip. nº 1 H-1 FUERZA DE VIENTO 1.33t/m

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.000000	0.000346
2	-0.000000	0.008800	0.000289
3	-0.000000	0.015643	0.000113
4	-0.000000	0.015753	-0.000107
5	-0.000000	0.008962	-0.000292
6	-0.000000	0.000000	-0.000353

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.00	-74.58	0.00
2	0.00	-12.73	-0.00
3	0.00	-16.85	0.00
4	0.00	-13.53	-0.00
5	-0.00	-6.40	-0.00
6	-0.00	-79.40	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	-0.00	74.58
	2	-0.00	-1528.95	38.67
2	2	-0.00	-1528.95	51.41
	3	-0.00	-2501.16	7.52
3	3	-0.00	-2501.16	24.36
	4	-0.00	-2580.96	-19.53
4	4	-0.00	-2580.96	-6.00
	5	-0.00	-1658.93	-49.89
5	5	-0.00	-1658.92	-43.49
	6	-0.00	-0.00	-79.40

SISMO TRANSVERSAL

Aplicando la fórmula de Rayleigh para calcular el periodo.

Cargas debidas al P.P + C.P + 60 % Sobrecarga:

$$P = 2.5 \times 8.84 + 9.6 + 0.6 \times 2 \times 10 = 43,7\ t/m$$

Los desplazamientos de los nudos son los de viento multiplicados por $\frac{43.7}{6.33}$

$$T = 2\pi \sqrt{\frac{\varepsilon m u^2}{g \varepsilon m u}}$$

Las masas son las que actúan isostáticamente en cada pila $m = g \cdot 33 \cdot 43,6$

$$T = 2\pi \sqrt{\frac{\varepsilon u^2}{g \varepsilon u}}$$

PILA	u	u^2
P-4	0,28914	0.08360
P-3	0 51938	0.26976
P-2	0.51760	0.26791
P-1	0 29447	0.08671
Σ	1 61519	0.70798

$T = 1.33$ segundos

$$\beta \cdot c \cdot n = \frac{0,08}{2 \times 1.33} \times 1 = 0,0301 \ (\text{GRADO VII})$$

$$S = 2 \times \eta \times \beta \cdot \delta$$

$$\eta = u \cdot \frac{\Sigma Q u}{\Sigma Q u^2} = u \cdot \frac{\Sigma u}{\Sigma u^2} = u \cdot \frac{1.61519}{0.70798}$$

$\beta = 1$

$\delta = 0,7$

PILA	η	S	Ft PILA
P-4	0.65965	0,01390	20,0 t
P-3	1.18492	0.02497	36,0 t
P-2	1.18086	0,02498	35,9 t
P-1	0,67181	0,01415	20,4 t

$$F_{t\,pila} = S \times 33 \times 43,7 = 1442\ S$$

$$F_{T\,E-2} = 0.08 \left(291 + 108.3 + 27.6 + 683 + 0.6 \times 298.8 \right) = 53.6\ t$$

$$F_{T\,E-1} = 0.08 \left(279 + 108.3 + 27.6 + 56.5 + 0.6 \times 299.9 \right) = 51,7\ t$$

3.- CALCULO PILAS

3.1.- CALCULO FUSTES

PROYECTO

E-4

FECHA

HOJA N.º

FUSTES

Combinaciones de cargas:

H-1

1,60 × (Peso propio + c. permanente + Def. diferidas + sobrecarga + + frenado + f. centrífuga + lazo).

H.2

1,44 × (P. propio + c. permanente + sobrecarga + def. diferidas + + frenado + f. centrífuga + lazo + viento)

H-3

1,28 (P. propio + c. permanente + sobrecarga + def. diferidas + 0,25 viento) + sismo transversal

PILA	F(1,44 × viento)	F(0,25 × 1,28 × viento + sismo transversal)
1	9,2	22,4
2	19,4	40,2
3	24,3	41,4
4	18,3	24,0

PROYECTO

E-4

FECHA

HOJA N.º

FUERZAS MAYORADAS EN CABEZAS DE PILAS

PILA	h	Fxd	Fyd	Fzd	Mxd	Myd
1	10,80	47.5	4	1618	0	0
		42.8	8,2	1452	0	0
		38,0	11,7	1286	0	0
2	11,25	39.5	4,0	1627	0	0
		35,6	13,3	1491	0	0
		31,6	20,1	1325	0	0
3	11.70	29.8	4,0	1664	0	0
		26.9	15,8	1498	0	0
		23.9	20.7	1331	0	0
4	12.05	15. 2	4.0	1620	0	0
		13.7	12.8	1454	0	0
		12.2	12,0	1288	0	0

VIADUCTO 4.PILA 1.(32 0 32 + 32 0 32)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 10.80

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66.5	66.5

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
512	512	512	512	512	256.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	47.5	4.00	1618.00	0.00	0.00	0	0.0	0	0.0	1.60
2	42.8	8.20	1452.00	0.00	0.00	0	0.4	0	0.4	1.44
3	38.0	11.20	1286.00	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 4.PILA 1.(32 0 32 + 32 0 32)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	55.94	821.75	1678.02	1.882	27.644
1	0.002	0.000	51.43	767.75	1672.02	1.653	24.670
2	0.006	0.000	46.61	708.96	1666.01	1.456	22.154
3	0.013	0.001	41.50	645.89	1660.01	1.257	19.567
4	0.023	0.002	36.16	579.09	1654.01	1.059	16.968
5	0.034	0.002	30.61	509.07	1648.01	1.527	25.390
6	0.048	0.003	24.78	434.25	1642.01	1.088	19.071
7	0.065	0.004	18.74	355.87	1636.01	0.768	14.590
8	0.083	0.005	12.56	274.82	1630.00	0.498	10.894
9	0.102	0.007	6.30	191.80	1624.00	0.247	7.521
10	0.123	0.008	-0.01	107.48	1618.00	0.247	4.185

Exc. totales result. cabeza 0.06643 -0.00000
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 1.(32 0 32 + 32 0 32)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	134.69	561.99	1506.02	3.955	16.504
1	0.001	0.000	121.05	514.31	1500.61	3.465	14.720
2	0.004	0.001	107.28	464.08	1495.21	2.990	12.932
3	0.008	0.002	93.46	411.60	1489.81	2.538	11.177
4	0.013	0.003	79.67	357.21	1484.41	2.117	9.492
5	0.020	0.005	65.98	301.21	1479.01	2.555	11.662
6	0.028	0.006	52.33	243.23	1473.61	1.989	9.245
7	0.037	0.009	38.82	183.72	1468.20	1.466	6.938
8	0.047	0.011	25.53	123.06	1462.80	0.959	4.623
9	0.057	0.013	12.56	61.67	1457.40	0.470	2.309
10	0.068	0.015	-0.01	-0.05	1452.00	0.470	2.309

Exc. totales result. oabeza -0.00003 -0.00001
Exc. reales ler ord. cabeza 0.00000 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 1.(32 0 32 + 32 0 32)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	149.17	483.72	1334.01	4.253	13.791
1	0.001	0.000	135.63	441.61	1329.21	3.772	12.282
2	0.003	0.001	121.63	397.60	1324.41	3.298	10.780
3	0.007	0.002	107.24	351.94	1319.61	2.838	9.314
4	0.011	0.003	92.54	304.87	1314.81	2.402	7.912
5	0.017	0.005	77.59	256.60	1310.01	2.867	9.480
6	0.023	0.007	62.33	206.92	1305.21	2.274	7.550
7	0.031	0.009	46.85	156.12	1300.40	1.702	5.671
8	0.039	0.012	31.24	104.50	1295.60	1.131	3.784
9	0.047	0.014	15.59	52.35	1290.80	0.563	1.891
10	0.056	0.017	-0.01	-0.05	1286.00	0.563	1.891

Exc. totales result. cabeza -0.00004 -0.00001
Exc. reales 1er ord. cabeza 0.00000 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 2.(32 0 32 + 32 0 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 11.2

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66.5	66.5

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
414.4	414.4	414.4	414.4	414.4	414.4	257.4	257.4	257.4	257.4	257.4

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	39.5	4.00	1627.00	0.00	0.00	0	0.0	0	0.0	1.60
2	35.6	13.30	1491.00	0.00	0.00	0	0.4	0	0.4	1.44
3	31.6	20.10	1325.00	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 4.PILA 2.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	62.76	792.77	1689.24	2.915	36.816
1	0.002	0.000	57.97	744.64	1683.02	2.405	30.897
2	0.008	0.001	52.68	690.01	1676.79	1.992	26.095
3	0.018	0.001	46.97	629.94	1670.57	1.677	22.491
4	0.030	0.002	40.91	565.22	1664.34	1.400	19.338
5	0.045	0.003	34.57	496.55	1658.12	1.133	16.270
6	0.062	0.005	28.00	424.59	1651.90	1.215	18.424
7	0.081	0.006	21.19	348.93	1645.67	0.864	14.225
8	0.102	0.008	14.21	270.46	1639.45	0.563	10.711
9	0.124	0.009	7.12	189.92	1633.22	0.279	7.443
10	0.147	0.011	-0.02	107.99	1627.00	0.279	4.202

Exc. totales result. cabeza 0.06637 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 2.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	220.06	508.12	1547.02	7.464	17.235
1	0.001	0.000	199.68	466.58	1541.41	6.570	15.353
2	0.004	0.002	178.53	422.08	1535.81	5.695	13.464
3	0.009	0.004	156.79	375.01	1530.21	4.857	11.616
4	0.015	0.006	134.64	325.74	1524.61	4.072	9.852
5	0.022	0.010	112.22	274.63	1519.01	3.349	8.195
6	0.031	0.013	89.69	221.99	1513.41	3.430	8.489
7	0.040	0.017	67.03	167.80	1507.80	2.546	6.374
8	0.051	0.021	44.42	112.45	1502.20	1.679	4.251
9	0.061	0.026	22.01	56.36	1496.60	0.829	2.124
10	0.072	0.030	-0.03	-0.06	1491.00	0.829	2.124

Exc. totales result. cabeza -0.00004 -0.00002
Exc. reales 1er ord. cabeza 0.00000 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 2.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	284.04	434.99	1374.79	9.473	14.507
1	0.001	0.001	259.52	398.35	1369.81	8.396	12.887
2	0.003	0.002	233.69	359.50	1364.83	7.323	11.266
3	0.007	0.005	206.74	318.74	1359.85	6.281	9.684
4	0.013	0.008	178.86	276.35	1354.88	5.293	8.178
5	0.019	0.012	150.22	232.60	1349.90	4.374	6.774
6	0.026	0.017	120.99	187.74	1344.92	4.444	6.896
7	0.034	0.022	91.16	141.75	1339.94	3.333	5.183
8	0.042	0.027	60.92	94.93	1334.96	2.219	3.457
9	0.051	0.033	30.47	47.57	1329.98	1.107	1.728
10	0.060	0.039	-0.02	-0.03	1325.00	1.107	1.728

Exc. totales result. cabeza -0.00002 -0.00001
Exc. reales 1er ord. cabeza 0.00000 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 3.(32 0 32 + 32 0 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 11.70

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
413.1	413.1	413.1	413.1	413.1	256.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	29.8	4.00	1664.00	0.00	0.00	0	0.0	0	0.0	1.60
2	26.9	15.80	1498.00	0.00	0.00	0	0.4	0	0.4	1.44
3	23.9	20.70	1331.00	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 4.PILA 3.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	67.06	684.14	1729.01	2.558	26.097
1	0.002	0.000	62.08	646.19	1722.51	2.256	23.487
2	0.007	0.001	56.57	602.72	1716.01	1.992	21.222
3	0.015	0.001	50.59	554.31	1709.51	1.726	18.908
4	0.025	0.002	44.22	501.54	1703.01	1.460	16.556
5	0.038	0.004	37.51	444.98	1696.51	1.683	19.960
6	0.053	0.005	30.42	383.88	1690.01	1.287	16.237
7	0.071	0.007	23.04	319.13	1683.50	0.937	12.977
8	0.091	0.008	15.46	251.51	1677.00	0.619	10.065
9	0.112	0.010	7.75	181.71	1670.50	0.307	7.205
10	0.133	0.012	-0.02	110.41	1664.00	0.307	4.348

Exc. totales result. cabeza 0.06635 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 3.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	283.81	577.45	1556.51	10.242	20.838
1	0.001	0.001	259.03	543.76	1550.66	9.097	19.096
2	0.005	0.003	232.88	506.04	1544.81	7.936	17.244
3	0.012	0.006	205.61	464.69	1538.96	6.784	15.332
4	0.020	0.010	177.48	420.16	1533.11	5.666	13.413
5	0.031	0.014	148.73	372.88	1527.26	6.223	15.602
6	0.043	0.020	119.26	322.39	1521.41	4.751	12.843
7	0.057	0.026	89.39	269.31	1515.55	3.453	10.404
8	0.073	0.033	59.38	214.16	1509.70	2.271	8.190
9	0.090	0.040	29.49	157.41	1503.85	1.121	5.982
10	0.107	0.047	-0.04	99.53	1498.00	1.121	3.766

Exc. totales result. cabeza 0.06644 -0.00003
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 3.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	318.59	484.85	1383.01	11.097	16.888
1	0.001	0.001	292.03	455.29	1377.81	9.905	15.443
2	0.004	0.003	263.73	422.83	1372.61	8.686	13.927
3	0.010	0.006	233.96	387.78	1367.41	7.467	12.376
4	0.016	0.011	202.95	350.44	1362.21	6.274	10.833
5	0.025	0.016	170.92	311.12	1357.01	6.751	12.288
6	0.035	0.022	137.81	269.56	1351.80	5.217	10.205
7	0.046	0.029	103.91	226.17	1346.60	3.840	8.359
8	0.059	0.036	69.47	181.31	1341.40	2.551	6.658
9	0.072	0.044	34.74	135.29	1336.20	1.270	4.947
10	0.087	0.052	-0.05	88.43	1331.00	1.270	3.224

Exc. totales result. cabeza 0.06644 -0.00004
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 4.(32 0 32 + 32 0 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 12.05

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE	CABEZA
"DIAMETRO EXTERIOR (cm):"	133	133
"ESPESOR DE LA PARED(cm):"	66	66

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
413.1	413.1	413.1	413.1	413.1	256.0	256.0	256.0	256.0	256.0	256.0

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec: 0	1	2	3	4	5	6	7	8	9	10
1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	15.20	4.00	1620.00	0.00	0.00	0	0.0	0	0.0	1.60
2	13.70	12.80	1454.00	0.00	0.00	0	0.4	0	0.4	1.44
3	12.20	12.00	1288.00	0.00	0.00	0	0.1	0	0.1	1.28

VIADUCTO 4.PILA 4.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	66.62	425.34	1686.96	2.114	13.496
1	0.001	0.000	61.54	405.38	1680.26	1.934	12.740
2	0.004	0.001	55.99	382.32	1673.57	1.743	11.900
3	0.008	0.001	50.03	356.39	1666.87	1.544	10.997
4	0.015	0.002	43.69	327.83	1660.18	1.339	10.048
5	0.022	0.003	37.04	296.90	1653.48	1.485	11.905
6	0.031	0.005	30.04	263.17	1646.78	1.194	10.464
7	0.042	0.006	22.76	227.00	1640.09	0.900	8.973
8	0.055	0.008	15.28	188.78	1633.39	0.600	7.419
9	0.068	0.009	7.67	148.88	1626.70	0.300	5.822
10	0.082	0.011	-0.01	107.69	1620.00	0.300	4.196

Exc. totales result. cabeza 0.06648 -0.00000
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 4.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	238.96	361.78	1514.26	7.524	11.391
1	0.001	0.001	217.20	344.02	1508.24	6.736	10.670
2	0.003	0.002	194.54	323.94	1502.21	5.945	9.900
3	0.007	0.004	171.18	301.71	1496.18	5.164	9.101
4	0.012	0.008	147.30	277.53	1490.16	4.400	8.290
5	0.018	0.011	123.06	251.60	1484.13	4.717	9.644
6	0.026	0.016	98.42	223.63	1478.11	3.744	8.507
7	0.035	0.021	73.58	193.88	1472.08	2.785	7.338
8	0.045	0.026	48.75	162.62	1466.05	1.838	6.129
9	0.056	0.032	24.15	130.12	1460.03	0.907	4.887
10	0.068	0.038	-0.02	96.65	1454.00	0.907	3.620

Exc. totales result. cabeza 0.06647 -0.00002
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

VIADUCTO 4.PILA 4.(32 0 32 + 32 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	190.15	304.14	1341.57	5.717	9.144
1	0.001	0.000	173.75	288.55	1336.21	5.164	8.576
2	0.003	0.002	156.51	271.30	1330.85	4.603	7.979
3	0.006	0.003	138.52	252.53	1325.50	4.039	7.364
4	0.010	0.006	119.92	232.36	1320.14	3.477	6.737
5	0.015	0.009	100.81	210.91	1314.78	3.691	7.723
6	0.021	0.012	81.15	188.03	1309.43	2.962	6.863
7	0.028	0.016	61.10	163.88	1304.07	2.223	5.962
8	0.036	0.020	40.79	138.64	1298.71	1.480	5.030
9	0.045	0.025	20.38	112.49	1293.36	0.737	4.072
10	0.055	0.029	-0.01	85.63	1288.00	0.737	3.093

Exc. totales result. cabeza 0.06649 -0.00001
Exc. reales 1er ord. cabeza 0.06650 0.00000

Convergencia del equilibrio sin agotamiento

PROYECTO

E-4

FECHA

HOJA N.º

ARMADURA DE APOYO.

$N_{máx} = 1039,5$ t.

$$A = 0,3 \times 1,6 \times 1039,5 \cdot \frac{1,33 - 0,95}{1,33} \times \frac{1,15}{5,1} = 32,2 cm^2$$

PROYECTO TAV ZARAGOZA - LERIDA

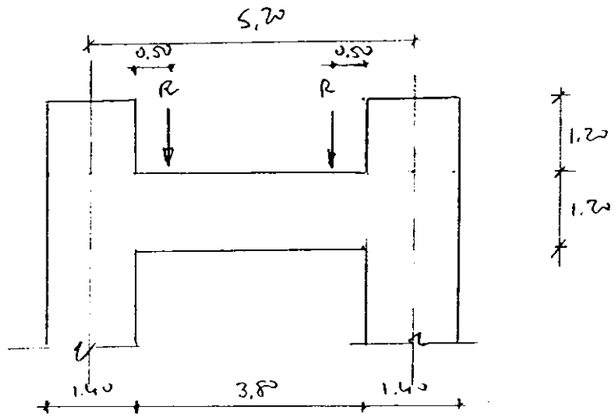
TRAMO 1

E-4

FECHA

HOJA N.º

DISTRIBUCION DE PILAS

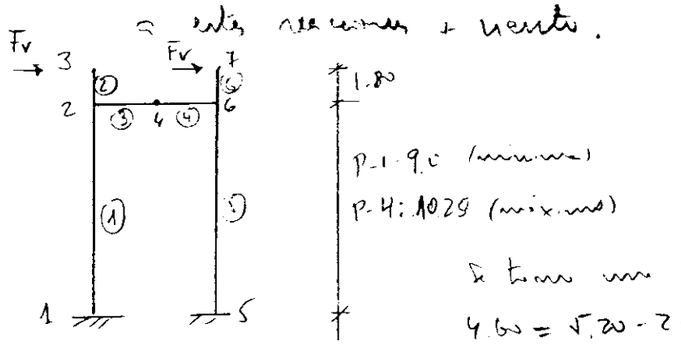


Se comprueba que una pila puede servir de apoyo a los gatos para levantar el puente y cambiar los aparatos de apoyo.

Se considera la reacción de peso propio + permanente + pretensado

$$R_{máx} = 396 + 176 + 11 = 583 \text{ t.}$$

Se calcula la pila aislada con su peso propio y esas reacciones + viento.



$F_v = 3,2$ t (P-1)

$F_v = 6,4$ t (P-4)

Se toma una luz de cálculo de

$4,60 = 5,20 - 2 \cdot 0,30$

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1. RIOSTRA SUPERIOR.
CONTROL
7 6 2 3
:
NUDOS
1 0 -10.80
2 0 -1.80
3 0 0
4 2.3 -1.80
5 4.6 -10.80
6 4.6 -1.80
7 4.6 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1 PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2 VIENTO
2
3 3.2 0 0
7 3.2 0 0
4
1 2 0.28   0
2 2 0.28   0
5 2 0.28   0
6 2 0.28   0
H-3 LEVANTAMIENTO DEL TABLERO
0
2
3 1 583 0.90 270
4 1 583 1.40 270
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1. RIOSTRA SUPERIOR.

Hip. n° 1 H-1 PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000000	-0.000047	-0.000008
3	0.000015	-0.000049	-0.000008
4	0.000000	-0.000064	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000000	-0.000047	0.000008
7	-0.000015	-0.000049	0.000008

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.32	41.29	-0.94
5	-0.32	41.29	0.94

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-41.29	0.94	0.32
	2	-9.97	-1.90	0.32
2	2	-6.26	-0.00	-0.00
	3	-0.00	0.00	-0.00
3	2	-0.32	-1.90	-3.70
	4	-0.32	2.36	0.00
4	4	-0.32	2.36	0.00
	6	-0.32	-1.90	3.70
5	5	-41.29	-0.94	-0.32
	6	-9.97	1.90	-0.32
6	6	-6.26	-0.00	-0.00
	7	-0.00	0.00	-0.00

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1. RIOSTRA SUPERIOR.

Hip. n° 2 H-2 VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.000881	0.000018	-0.000071
3	0.001022	0.000018	-0.000082
4	0.000881	-0.000000	0.000024
5	0.000000	-0.000000	-0.000000
6	0.000881	-0.000018	-0.000071
7	0.001022	-0.000018	-0.000082

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-6.22	-9.73	28.51
5	-6.22	9.73	28.51

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	9.73	-28.51	-6.22
	2	9.73	16.17	-3.70
2	2	-0.00	-6.21	-3.70
	3	-0.00	0.00	-3.20
3	2	-0.00	22.38	9.73
	4	-0.00	0.00	9.73
4	4	-0.00	0.00	9.73
	6	-0.00	-22.38	9.73
5	5	-9.73	-28.51	-6.22
	6	-9.73	16.17	-3.70
6	6	0.00	-6.21	-3.70
	7	0.00	0.00	-3.20

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 1. RIOSTRA SUPERIOR.

Hip. n° 3 H-3 LEVANTAMIENTO DEL TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000048	-0.001079	-0.001188
3	0.002187	-0.001079	-0.001188
4	0.000000	-0.003190	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000048	-0.001079	0.001188
7	-0.002187	-0.001079	0.001188

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	47.02	583.00	-140.43
5	-47.02	583.00	140.43

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-583.00	140.43	47.02
	2	-583.00	-282.78	47.02
2	2	0.00	-0.00	-0.00
	3	0.00	0.00	-0.00
3	2	-47.02	-282.78	-583.00
	4	-47.02	241.92	0.00
4	4	-47.02	241.92	0.00
	6	-47.02	-282.79	583.00
5	5	-583.00	-140.43	-47.02
	6	-583.00	282.78	-47.02
6	6	0.00	-0.00	-0.00
	7	0.00	0.00	-0.00

```
L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4. RIOSTRA SUPERIOR.
CONTROL
7 6 2 3
:
NUDOS
1 0 -12.05
2 0 -1.80
3 0 0
4 2.3 -1.80
5 4.6 -12.05
6 4.6 -1.80
7 4.6 0
:
BARRAS TIPO
2
1.390 0.154 3500000
0.643 0.077 3500000
:
BARRAS
1 1 2 1
2 2 3 1
3 2 4 2
4 4 6 2
5 5 6 1
6 6 7 1
:
APOYOS
2
1 1 1 1
5 1 1 1
:
CARGAS
H-1 PESO PROPIO
0
6
1 2 3.48 270
2 2 3.48 270
5 2 3.48 270
6 2 3.48 270
3 2 1.61 270
4 2 1.61 270
H-2 VIENTO
2
3 6.4 0 0
7 6.4 0 0
4
1 2 0.28   0
2 2 0.28   0
5 2 0.28   0
6 2 0.28   0
H-3 LEVANTAMIENTO DEL TABLERO
0
2
3 1 583 0.90 270
4 1 583 1.40 270
:
```


L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4. RIOSTRA SUPERIOR.

Hip. n° 1 H-1 PESO PROPIO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000000	-0.000059	-0.000009
3	0.000016	-0.000060	-0.000009
4	0.000000	-0.000076	0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000000	-0.000059	0.000009
7	-0.000016	-0.000060	0.000009

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.27	45.64	-0.91
5	-0.27	45.64	0.91

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-45.64	0.91	0.27
	2	-9.97	-1.82	0.27
2	2	-6.26	-0.00	-0.00
	3	-0.00	-0.00	0.00
3	2	-0.27	-1.82	-3.70
	4	-0.27	2.44	0.00
4	4	-0.27	2.44	0.00
	6	-0.27	-1.82	3.70
5	5	-45.64	-0.91	-0.27
	6	-9.97	1.82	-0.27
6	6	-6.26	-0.00	-0.00
	7	-0.00	0.00	-0.00

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4. RIOSTRA SUPERIOR.

Hip. n° 2 H-2 VIENTO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000000	0.000000	-0.000000
2	0.002130	0.000041	-0.000145
3	0.002415	0.000041	-0.000165
4	0.002130	0.000000	0.000046
5	0.000000	-0.000000	-0.000000
6	0.002130	-0.000041	-0.000145
7	0.002415	-0.000041	-0.000165

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	-9.77	-19.41	52.80
5	-9.77	19.41	52.80

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	19.41	-52.80	-9.77
	2	19.41	32.67	-6.90
2	2	-0.00	-11.97	-6.90
	3	-0.00	0.00	-6.40
3	2	0.00	44.65	19.41
	4	0.00	-0.00	19.41
4	4	0.00	-0.00	19.41
	6	0.00	-44.65	19.41
5	5	-19.41	-52.80	-9.77
	6	-19.41	32.67	-6.90
6	6	0.00	-11.97	-6.90
	7	0.00	0.00	-6.40

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO I. E-4. PILA 4. RIOSTRA SUPERIOR.

Hip. n° 3 H-3 LEVANTAMIENTO DEL TABLERO

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000000	0.000000
2	0.000040	-0.001228	-0.001292
3	0.002367	-0.001228	-0.001292
4	-0.000000	-0.003459	-0.000000
5	0.000000	-0.000000	-0.000000
6	-0.000040	-0.001228	0.001292
7	-0.002367	-0.001228	0.001292

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	39.54	583.00	-134.68
5	-39.54	583.00	134.68

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-583.00	134.68	39.54
	2	-583.00	-270.60	39.54
2	2	0.00	0.00	-0.00
	3	0.00	-0.00	-0.00
3	2	-39.54	-270.60	-583.00
	4	-39.54	254.10	-0.00
4	4	-39.54	254.10	-0.00
	6	-39.54	-270.60	583.00
5	5	-583.00	-134.68	-39.54
	6	-583.00	270.60	-39.54
6	6	0.00	0.00	0.00
	7	0.00	0.00	0.00

PROYECTO

E-4

FECHA

HOJA N.°

ARMADURA.

Flexión

P-1 $\begin{cases} Md^- = -1.28(1.90 + 22.4 + 282.8) = -393,0 \text{ mt} \\ Md^+ = 1.28\,(2.4 + 0 - 241,9) = 313 \text{ mt} \end{cases}$

P-3 $\begin{cases} Md^- = -1.28(1.82 + 44,7 + 270.1) = -405 \text{ mt.} \\ Md^+ = 1.28(2.4\,10 + 254) = 328 \text{ mt.} \end{cases}$

$$A = Uc\left[1 - \sqrt{1 - \frac{2Md}{Uc \times 1.15}}\right] \times \frac{1.15}{5.1}$$

$$Uc = \frac{3\text{NO}}{1.5} \times 0.536 \times 1.15 = 1232,8 \text{ t}$$

$A_{sup} = 96,0 \text{ cm}^2$

$A_{inf} = 74,2 \text{ cm}^2 \rightarrow 10 \text{ Ø } 32 = 80 \text{ cm}^2 \rightarrow U_{s_2} = 356,7 \text{ t}$

$$A_{sup} = Uc\left[1 - \sqrt{1 - 2\,\frac{405 - 356.7(1,145 - 0.052)}{Uc \times 1.145}}\right] \times \frac{1.15}{5.1} + 80.0 = 81 \text{ cm}^2 \quad (10 \text{ Ø } 32)$$

Cortante

Al estar situada la carg. a menos de $0.75\,h$ del apoyo, tomaremos como valor de cálculo del cortante:

distancia $= 0,50$ m

$0.75 \cdot h = 0.80$ m

$V = \frac{0.50}{0.80} \cdot V_{calculo}$

$$V_d = 1,28\left(3,70 + 19.40 + \frac{0,50}{0.80} \times 583\right) = 444 \text{ t}$$

$$V_{cu} = 5\sqrt{\frac{3\text{NO}}{1,5}} \times 0,536 \times 1.15 = 43,6 \text{ t}$$

$$A_{sf} = \frac{444 - 436}{0.9 \times 1.15 \times 4.2} = 92,1 \text{ cm}^2/\text{m} \rightarrow 2\text{C Ø } 20/0,125$$

315

3.2.- CALCULO CIMENTACION

PROYECTO TV. ZARAGOZA – LERIDA
TRAMO I
E-4

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N_1 = N_2 = 2.5\,(10.8 \times 1.39 + 1.90 \times 0.536 \times 1.20) = 40.6$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-1 (h = 10.80)	PESO PROPIO	1	428.9	–	–	–	–
		2	428.9	–	–	–	–
	CARGA PERMANENTE	1	178.3	–	–	–	–
		2	178.3	–	–	–	–
	SOBRECARGA MAXIMA	1	450.2	–	–	–	–
		2	357.0	–	–	–	–
	SOBRECARGA MINIMA	1	-39.3	–	–	–	–
		2	-31.2	–	–	–	–
	DEFORMACIONES DIFERIDAS	1	-13.4	29.7	–	320.8	–
		2	-13.4	29.7	–	320.8	–
	FRENADO	1	–	–	–	–	–
		2	–	–	–	–	–
	PRETENSADO INICIAL	1	-22.2	–	–	–	–
		2	-22.2	–	–	–	–
	PRETENSADO FINAL	1	-27.5	–	–	–	–
		2	-27.5	–	–	–	–
	VIENTO	1	9.4	–	6.2	–	29.1
		2	-9.4	–	6.2	–	29.1
	SISMO	1	21.6	–	10.8	–	60.2
		2	-21.6	–	10.8	–	60.2

PROYECTO TV. ZARAGOZA – LERIDA
TRAMO I
E-4

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N_1 = N_2 = 2.5\,(11.25 \times 1.39 + 1.90 \times 0.536 \times 1.20) = 42.1$ t

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-2 (h = 11.25)	PESO PROPIO	1	431.1	–	–	–	–
		2	431.1	–	–	–	–
	CARGA PERMANENTE	1	176.3	–	–	–	–
		2	176.3	–	–	–	–
	SOBRECARGA MAXIMA	1	468.8	–	–	–	–
		2	371.8	–	–	–	–
	SOBRECARGA MINIMA	1	-38.0	–	–	–	–
		2	-30.2		–	–	–
	DEFORMACIONES DIFERIDAS	1	2.1	24.7	–	277.9	–
		2	2.1	24.7	–	277.9	–
	FRENADO	1	–	–	–	–	–
		2	–	–	–	–	–
	PRETENSADO INICIAL	1	-2.0	–	–	–	–
		2	-2.0	–	–	–	–
	PRETENSADO FINAL	1	-2.4	–	–	–	–
		2	-2.4	–	–	–	–
	VIENTO	1	17.4	–	9.9	–	51.4
		2	-17.4	–	9.9	–	51.4
	SISMO	1	39.7	–	19.0	–	110.4
		2	-39.7	–	19.0	–	110.4

PROYECTO IV. ZARAGOZA – LERIDA
TRAMO I
E-4

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ASIENTOS EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso pila = $N_1 = N_2 = 2.5\,(11.7 \times 1.39 + 1.90 \times 0.53 \times 1.20) = 43.7$ t

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-3 (h = 11.70)	PESO PROPIO	1	428.8	—	—	—	—
		2	428,8	—	—	—	—
	CARGA PERMANENTE	1	176.3	—	—	—	—
		2	176.3	—	—	—	—
	SOBRECARGA MAXIMA	1	468.8	—	—	—	—
		2	371.8	—	—	—	—
	SOBRECARGA MINIMA	1	-38.0	—	—	—	—
		2	-30.2	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	2.1	18.7	—	218.8	—
		2	2.1	18.7	—	218.8	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-4.6	—	—	—	—
		2	-4.6	—	—	—	—
	PRETENSADO FINAL	1	+7.3	—	—	—	—
		2	+7.3	—	—	—	—
	VIENTO	1	21.9	—	11.7	—	63.9
		2	-21.9	—	11.7	—	63.9
	SISMO	1	41.6	—	19.1	—	115.2
		2	-41.6	—	19.1	—	115.2

PROYECTO IV. ZARAGOZA – LERIDA
TRAMO I
E-4

FECHA

HOJA N.º

CIMENTACION DE PILAS.

ASIENTOS EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso pila = $N_1 = N_2 = 2.5\,(12.05 \times 1.39 + 1.90 \times 0.53 \times 1.20) = 44.9$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-4 (h = 12.05)	PESO PROPIO	1	433.8	—	—	—	—
		2	433.8	—	—	—	—
	CARGA PERMANENTE	1	178.3	—	—	—	—
		2	178.3	—	—	—	—
	SOBRECARGA MAXIMA	1	450.2	—	—	—	—
		2	357.0	—	—	—	—
	SOBRECARGA MINIMA	1	-39.3	—	—	—	—
		2	-31.2	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-13.4	9.5	—	114.5	—
		2	-13.4	9.5	—	114.5	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-19.4	—	—	—	—
		2	-19.4	—	—	—	—
	PRETENSADO FINAL	1	-39.8	—	—	—	—
		2	-39.8	—	—	—	—
	VIENTO	1	18.1	—	9.7	—	53.4
		2	-18.1	—	9.7	—	53.4
	SISMO	1	23.9	—	10.6	—	66.0
		2	-23.9	—	10.6	—	66.0

PROYECTO .....

FECHA .....

HOJA N.º .....

HIPÓTESIS COMBINADAS

H-1 - PP + RESTO + CIERRAMIENTO + SOBRECARGA MÁXIMA + ACCIONES DIFERIDAS + FRENADO + PRETENSADO

H-2 Como H-1 con sobrecarga mínima

H-3 Como H-1 con viento

H-4 Como H-2 con viento

H-5 - Como H-1 con 1/4 viento + sismo

H-6 Como H-2 con 1/4 viento + sismo

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO 1. E-4. P-1.
ESFUERZOS EN CARA SUPERIOR DE ZAPATA/ENCEPADO

		N	FL	FT	ML	MT
P.P.	1	428.9				
	2	428.9				
C.P.	1	178.3				
	2	178.3				
S. Max.	1	450.2				
	2	357				
S. Min.	1	-39.3				
	2	-31.2				
DEF. DIF.	1	-13.4	29.7		320.8	
	2	-13.4	29.7		320.8	
Pret. i.	1	-22.2				
	2	-22.2				
Pret. F.	1	-27.5				
	2	-27.5				
VIENTO	1	9.4		6.2		29.1
	2	-9.4		6.2		29.1
SISMO	1	21.6		10.8		60.2
	2	-21.6		10.8		60.2
HC-1		1950	59.4	0	641.6	242.3
HC-2		1062	59.4	0	641.6	21.1
HC-3		1950	59.4	12.4	641.6	349.4
HC-4		1062	59.4	12.4	641.6	128.1
HC-5		1950	59.4	24.7	641.6	501.8
HC-6		1062	59.4	24.7	641.6	280.6

LAV ZARAGOZA-LERIDA.TRAMO 1.E-4.ENCEPADO P-1

Dimensiones encepado
Canto = 2.50
Ancho L = 8.20
Ancho T = 8.20

Reacc. pilote máx= 632.51 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 159.26 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.600	2.600
2	2.600	-2.600
3	-2.600	2.600
4	-2.600	-2.600
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1950.0	59.4	0.0	641.6	242.3
H- 2	1062.0	59.4	0.0	641.6	21.1
H- 3	1950.0	59.4	12.4	641.6	349.4
H- 4	1062.0	59.4	12.4	641.6	128.1
H- 5	1950.0	59.4	24.7	641.6	501.8
H- 6	1062.0	59.4	24.7	641.6	280.6

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2370.3	59.4	0.0	790.1	242.3
H- 2	1482.3	59.4	0.0	790.1	21.1
H- 3	2370.3	59.4	12.4	790.1	380.4
H- 4	1482.3	59.4	12.4	790.1	159.1
H- 5	2370.3	59.4	24.7	790.1	563.5
H- 6	1482.3	59.4	24.7	790.1	342.4

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	593.3	546.7	401.4	354.8	474.0
H- 2	394.4	390.4	202.5	198.5	296.5
H- 3	610.8	529.3	418.8	337.3	474.0
H- 4	411.9	372.9	220.0	181.0	296.5
H- 5	632.5	507.5	440.6	315.6	474.0
H- 6	433.6	351.2	241.7	159.3	296.5

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	949.30	567.66	19.01	66.53	0.448	0.268	0.021
H- 2	631.10	317.54	19.01	66.53	0.298	0.150	0.021
H- 3	977.22	539.74	19.42	67.96	0.461	0.255	0.021
H- 4	659.01	289.63	19.42	67.96	0.311	0.137	0.021
H- 5	1012.02	504.94	20.59	72.05	0.477	0.238	0.023
H- 6	693.83	254.81	20.59	72.05	0.327	0.120	0.023

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO 1. E-4. P-2.
ESFUERZOS EN CARA SUPERIOR DE ZAPATA/ENCEPADO

		N	FL	FT	ML	MT
P.P.	1	431.1				
	2	431.1				
C.P.	1	176.3				
	2	176.3				
S. Max.	1	468.8				
	2	371.8				
S. Min.	1	-38				
	2	-30.2				
DEF. DIF.	1	2.1	24.7		277.9	
	2	2.1	27.7		277.9	
Pret. i.	1	-2				
	2	-2				
Pret. F.	1	-2.4				
	2	-2.4				
VIENTO	1	17.4		9.9		51.4
	2	-17.4		9.9		51.4
SISMO	1	39.7		19		110.4
	2	-39.7		19		110.4
HC-1		2056	52.4	0	555.8	252.2
HC-2		1146	52.4	0	555.8	20.3
HC-3		2056	52.4	19.8	555.8	445.5
HC-4		1146	52.4	19.8	555.8	213.6
HC-5		2056	52.4	43.0	555.8	727.8
HC-6		1146	52.4	43.0	555.8	495.8

Dimensiones encepado
Canto = 2.50
Ancho L = 8.20
Ancho T = 8.20

Reacc. pilote máx= 673.71 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 157.10 Pilote: 4 Hipót.: 6

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.600	2.600
2	2.600	-2.600
3	-2.600	2.600
4	-2.600	-2.600
5	0.000	0.000

fuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2056.0	52.4	0.0	555.8	252.2
H- 2	1146.0	52.4	0.0	555.8	20.3
H- 3	2056.0	52.4	19.8	555.8	445.5
H- 4	1146.0	52.4	19.8	555.8	213.6
H- 5	2056.0	52.4	43.0	555.8	727.8
H- 6	1146.0	52.4	43.0	555.8	495.8

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2476.3	52.4	0.0	686.8	252.2
H- 2	1566.3	52.4	0.0	686.8	20.3
H- 3	2476.3	52.4	19.8	686.8	495.0
H- 4	1566.3	52.4	19.8	686.8	263.1
H- 5	2476.3	52.4	43.0	686.8	835.3
H- 6	1566.3	52.4	43.0	686.8	603.3

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	603.2	554.7	435.8	387.3	495.3
H- 2	398.9	395.0	231.5	227.6	313.3
H- 3	633.2	524.7	465.8	357.3	495.3
H- 4	428.9	365.0	261.5	197.6	313.3
H- 5	673.7	484.1	506.4	316.8	495.3
H- 6	469.4	324.4	302.1	157.1	313.3

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	965.08	619.72	16.77	58.69	0.455	0.292	0.018
H- 2	638.20	364.20	16.77	58.69	0.301	0.172	0.018
H- 3	1013.09	571.71	17.93	62.74	0.478	0.270	0.020
H- 4	686.22	316.18	17.93	62.74	0.324	0.149	0.020
H- 5	1077.94	506.86	21.69	75.92	0.509	0.239	0.024
H- 6	751.05	251.35	21.69	75.92	0.354	0.119	0.024

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = 0
A necesaria = 0

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO 1. E-4. P-3.
ESFUERZOS EN CARA SUPERIOR DE ZAPATA/ENCEPADO

		N	FL	FT	ML	MT
P.P.	1	428.8				
	2	128.8				
C.P.	1	176.3				
	2	176.3				
S. Max.	1	468.8				
	2	371.8				
S. Min.	1	-38				
	2	-30.2				
DEF. DIF.	1	2.1	18.7		218.8	
	2	2.1	18.7		218.8	
Pret. i.	1	-4.6				
	2	-4.6				
Pret. F.	1	7.3				
	2	7.3				
VIENTO	1	21.9		11.7		63.9
	2	-21.9		11.7		63.9
SISMO	1	41.6		19.1		115.2
	2	-41.6		19.1		115.2
HC-1		1746	37.4	0	437.6	252.2
HC-2		861	37.4	0	437.6	20.3
HC-3		1746	37.4	23.4	437.6	493.9
HC-4		861	37.4	23.4	437.6	262.0
HC-5		1746	37.4	44.1	437.6	759.3
HC-6		861	37.4	44.1	437.6	527.4

AV ZARAGOZA-LERIDA.TRAMO 1.E-4.ENCEPADO P-3

Reacc. pilote máx= 595.36 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 116.44 Pilote: 4 Hipót.: 6

Dimensiones encepado
Canto = 2.50
Ancho L = 8.20
Ancho T = 8.20

Dimensiones pila
Ancho L = 1.15
Ancho T = 6.35

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.600	2.600
2	2.600	-2.600
3	-2.600	2.600
4	-2.600	-2.600
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	1746.0	37.4	0.0	437.6	252.2
H- 2	861.0	37.4	0.0	437.6	20.3
H- 3	1746.0	37.4	23.4	437.6	493.9
H- 4	861.0	37.4	23.4	437.6	262.0
H- 5	1746.0	37.4	44.1	437.6	759.3
H- 6	861.0	37.4	44.1	437.6	527.4

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2166.3	37.4	0.0	531.1	252.2
H- 2	1281.3	37.4	0.0	531.1	20.3
H- 3	2166.3	37.4	23.4	531.1	552.4
H- 4	1281.3	37.4	23.4	531.1	320.5
H- 5	2166.3	37.4	44.1	531.1	869.5
H- 6	1281.3	37.4	44.1	531.1	637.7

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	521.2	472.7	393.8	345.3	433.3
H- 2	321.9	318.0	194.5	190.6	256.3
H- 3	557.9	435.9	430.6	308.6	433.3
H- 4	358.6	281.2	231.3	153.9	256.3
H- 5	595.4	398.5	468.0	271.1	433.3
H- 6	396.1	243.8	268.8	116.4	256.3

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	833.85	552.55	11.97	41.89	0.393	0.261	0.013
H- 2	514.97	305.03	11.97	41.89	0.243	0.144	0.013
H- 3	892.63	493.77	14.12	49.41	0.421	0.233	0.016
H- 4	573.75	246.25	14.12	49.41	0.271	0.116	0.016
H- 5	952.57	433.83	18.50	64.76	0.449	0.205	0.020
H- 6	633.69	186.31	18.50	64.76	0.299	0.088	0.020

Amin flexión = 70.65
Amin cortante = 8.57

W máxima =
A necesaria =

L.A.V. ZARAGOZA-LERIDA. SUBTRAMO 1. E-4. P-4.
ESFUERZOS EN CARA SUPERIOR DE ZAPATA/ENCEPADO

		N	FL	FT	ML	MT
P.P.	1	433.8				
	2	433.8				
C.P.	1	178.3				
	2	178.3				
S. Max.	1	450.2				
	2	357				
S. Min.	1	-39.3				
	2	-31.2				
DEF. DIF.	1	-13.4	9.5		114.5	
	2	-13.4	9.5		114.5	
Pret. i.	1	-19.4				
	2	-19.4				
Pret. F.	1	-39.8				
	2	-39.8				
VIENTO	1	18.1		9.7		53.4
	2	-18.1		9.7		53.4
SISMO	1	23.9		10.6		66
	2	-23.9		10.6		66
HC-1		1966	19	0	229	242.3
HC-2		1047	19	0	229	21.1
HC-3		1966	19	19.4	229	443.2
HC-4		1047	19	19.4	229	222.0
HC-5		1966	19	26.1	229	548.8
HC-6		1047	19	26.1	229	327.6

TAV ZARAGOZA-LERIDA.TRAMO 1.ZAPATA P-4.

Zapata:
H = 2.000 m
BL = 6.000 m
BT = 8.500 m

Fuste:
AL = 1.150 m
AT = 6.350 m

Materiales:
Hormigón.: Fck = 2500 T/m2 gc = 1.500
Acero....: Fyk = 51000 T/m2 gs = 1.150 r = 0.100 m

Esfuerzos en arranque de fuste: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	1966.00	19.00	0.00	229.00	242.30
2	1047.00	19.00	0.00	229.00	21.10
3	1966.00	19.00	19.40	229.00	443.20
4	1047.00	19.00	19.40	229.00	222.00
5	1966.00	19.00	26.10	229.00	548.80
6	1047.00	19.00	26.10	229.00	327.60

Esfuerzos en cara inferior de zapata: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	1966.00	19.00	0.00	267.00	242.30
2	1047.00	19.00	0.00	267.00	21.10
3	1966.00	19.00	19.40	267.00	482.00
4	1047.00	19.00	19.40	267.00	260.80
5	1966.00	19.00	26.10	267.00	601.00
6	1047.00	19.00	26.10	267.00	379.80

Esfuerzos en hipótesis combinadas: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2221.00	19.00	0.00	267.00	242.30
2	1302.00	19.00	0.00	267.00	21.10
3	2221.00	19.00	19.40	267.00	482.00
4	1302.00	19.00	19.40	267.00	260.80
5	2221.00	19.00	26.10	267.00	601.00
6	1302.00	19.00	26.10	267.00	379.80

Tensiones: (T/m2)

--H--	---T1--	---T2--	---T3--	---T4--	---TC--
1	34.96	41.67	45.43	52.14	46.56
2	20.00	20.59	30.47	31.06	27.51
3	31.64	44.99	42.11	55.46	47.81
4	16.68	23.90	27.16	34.37	28.76
5	30.00	46.63	40.47	57.10	48.45
6	15.04	25.55	25.51	36.02	29.42

Tmáx = 57.10 Tmín = 15.04 TCmáx = 48.45

Armaduras:

Longitudinal:

Uc = 3166.67 T/m Vcu = 238.07 T/m
Md = 273.07 mT/m Hip = 5 gf = 1.60
Vd = 119.92 T/m Hip = 5 gf = 1.60
As = 33.88 cm2/m
0.04*Uc = 28.56 cm2/m 0.0015*Ac = 30.00 cm2/m

Transversal:

Uc = 3166.67 T/m Vcu = 124.69 T/m
Md = 166.99 mT/m Hip = 5 gf = 1.60
Vd = 10.40 T/m Hip = 5 gf = 1.60
As = 20.37 cm2/m
0.04*Uc = 28.56 cm2/m 0.0015*Ac = 30.00 cm2/m

PROYECTO T.A.V. ZARAGOZA-LERIDA. TRAMO 1 ESTRUCTURA 4

FECHA

HOJA N.º

ARMADURA DE ENCEPADOS

f_{ck} = 250 t/m² ; γ_c = 1.50

f_{cd} = 11000 t/m² ; γ_d = 1.15

Hormigón { sin viento : 1.60 / con viento : 1.44 / con sismo : 1.28

Ancho de banda : 3,00 m.

PILAS 1, 2 y 3.

- Flexión

$N_{d\,máx}$ = 965 t (en pila 2)

M_{cd} = 965 × 2.60 = 2509 mt. $U_c = \frac{2500}{1.5} \times 3.00 \times 2.35 = 11750$ t

$A = \frac{1.15}{5.1} U_c \left[1 - \sqrt{1 - \frac{2 \times 2509}{U_c \times 2.35}}\right] = 253$ cm²/banda = 84,3 cm²/m.

Se dispondrán 2 φ25/0,10 en la banda de 3 m.

sobre pilote, φ25/0,10 entre bandas

Transversalmente se dispone una parrilla de φ25/0,15

($A_{min} = 0.04 U_c \times \frac{1}{f_{yd}} = 0.04 \times \frac{2500}{1.5} \times 2,35 \times \frac{1,15}{5.1} = 35,3$ cm²/m)

- Cortante

V_{cd} = 965,0 t.

$V_{cu\,banda} = 5 \times 5 \sqrt{\frac{250}{1.5}} \times 3.00 \times 2.35 = 1365,2$ t > V_{cd}

- Comprobación de esfuerzo:

V_{di} = 965,0 t.

$V_{cu} = 1.20 \times 5 \sqrt{\frac{250}{1.5}} \times (1.50 + 2.35) \times 2.35 = 997,8$ t > V_{di}

PROYECTO E 4

FECHA

HOJA N.º

Armadura superior transversal

$N_{d\,máx}$ = 1.6 × 495 = 792 t

M_{Td} = 792 × $\frac{5.20}{4}$ = 1030 mt.

$U_c = \frac{2500}{1.5} \times 3.00 \times 2,40 = 12000$ t

$A_{sup} = U_c \left[1 - \sqrt{1 - \frac{2 \times 1030}{U_c \times 2,40}}\right] \times \frac{1.15}{5.1} = 98,6$ cm²/3m → 32,9 cm²/m

(φ 25/0,15)

Cercos de suspensión

$A = \frac{1.6 \times 2166,3}{1.5 \times 5 \times 4.2} = 110,0$ cm²

PROYECTO ..... FECHA .....

E-4 HOJA N.° .....

LONGITUD DE PILOTES

De acuerdo con el informe geotécnico se obtienen las longitudes de pilote en cada pila.

Corte estratigráfico según plano geológico

	PILA 1	PILA 2	PILA 3	ROZAMIENTO (t/m²)
LIMO YESÍFERO MARRÓN-BLANCO	0 - 4,00	0 - 7.50	0 - 7.00	4
" " " COMPACTO	4 - 10.00	7,50 - 12,40	7,00 - 10,0	8
GRAVAS YESÍFERAS	10 - 12.50	12,40 - 14,70	10,0 - 14,0	10
YESO MODULAR	100 →	14,70 →	14,0 →	40

Rozamiento negativo (limo colapsable) : $17,30 - \not{\phi} = 17,30 \times 1,50 = \underline{26\ t}$

Pila 1 : $\frac{1}{3}\left[1,00\times4 + 6,00\times8 + 2,30\times10,00\right]\times\pi\times1,50 + \frac{1}{2,5}\times\pi\times1,50\times40\times L - 26 =$

$= 611,0 \rightarrow \quad L = 6,85\text{m} \text{ en yeso} \rightarrow L_{pilote} = 10,00 - 3,00 + 6,85 = \underline{14\text{m}}$

Pila 2 : $\frac{1}{3}\left[4,50\times4 + 4,90\times8 + 2,30\times10\right]\times\pi\times1,50 + \frac{1}{2,5}\times\pi\times1,50\times40\times L - 26 =$

$= 633,2 \rightarrow \quad L = 7,10\text{ m en yeso} \rightarrow L_{pilote} = 44,7 - 3 + 7,10 \simeq \underline{19\text{m}}$

Pila 3 : $\frac{1}{3}\left[4,00\times4 + 3,00\times8 + 4,00\times10\right]\times\pi\times1,50 + \frac{1}{2,5}\times\pi\times1,50\times40\times L - 26 =$

$= 557,9 \rightarrow \quad L = 6,10\text{m en yeso} \rightarrow L_{pilote} = 14,0 - 3 + 6,10 \simeq \underline{17,50\text{m}}$

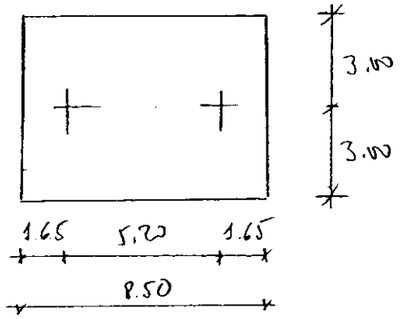
PROYECTO ..... FECHA .....

HOJA N.° .....

ARMADURA DE LA ZAPATA DE P-4

Se calcula como viga flotante. (canto 2,00 m).

NP: 5 NH: 1



$x_1 = 0$
$x_2 = 1,65$
$x_3 = 4,25$
$x_4 = 6,85$
$x_5 = 8,50$

B: 1,00 m
1,000 t/m³

A = 6,00 m

$I = \frac{1,00 \times 2,0^3}{12} = 4,00\ m^4$

$E = 2,5 \times 10^6\ t/m^2$

L = 8,50 m.

$x_1 = 1,65$ F = 1080,4 t ; M = 53,4 m t

$x_2 = 6,85$ F = 951,0 t ; M = 53,4 m t

Q. propio.

$x_1 = 1,65$, $x_2 = 6,85$: $F = 2,5 \times 3,30 \times 2,00 \times 6,00 = 99,0\ t$

$x_3 = 4,25$: $F = 2,5 \times 1,90 \times 2,00 \times 6,00 = 57,0\ t$

VIGA SOBRE FUNDACION ELASTICA.

Coeficiente de balasto.....=	1000.00000
Ancho de la viga.....=	6.00000
Inercia de la viga.....=	4.00000
Módulo de elasticidad de la viga...=	2500000.00000
Longitud de la viga.....=	8.50000

Número de puntos de resultados.....= 5

Punto	Abcisa
1	0.000
2	1.650
3	4.250
4	6.850
5	8.500

Número de hipótesis de carga.....= 1

Hipótesis de carga 1. Número de puntos cargados 3

Punto	Abcisa	Fuerza	Momento
1	1.650	1179.400	53.400
2	4.250	57.000	0.000
3	6.850	1050.000	53.400

----------> RESULTADOS <----------

Hipótesis de carga 1.

		Izquierda		Derecha	
Abcisa	Tensión	Momento	Cortante	Momento	Cortante
0.000	51.058	0.000	0.000	0.000	0.000
1.650	48.615	410.384	493.408	356.985	-685.991
4.250	44.747	-467.081	42.013	-467.081	-14.987
6.850	41.108	376.536	654.489	323.135	-395.511
8.500	38.788	0.000	-0.000	0.000	-0.000

VIGA SOBRE FUNDACION ELASTICA.

Coeficiente de balasto.....=	10000.00000
Ancho de la viga.....=	6.00000
Inercia de la viga.....=	4.00000
Módulo de elasticidad de la viga...=	2500000.00000
Longitud de la viga.....=	8.50000

Número de puntos de resultados.....= 5

Punto	Abcisa
1	0.000
2	1.650
3	4.250
4	6.850
5	8.500

Número de hipótesis de carga.....= 1

Hipótesis de carga 1. Número de puntos cargados 3

Punto	Abcisa	Fuerza	Momento
1	1.650	1179.400	53.400
2	4.250	57.000	0.000
3	6.850	1050.000	53.400

----------> RESULTADOS <----------

Hipótesis de carga 1.

		Izquierda		Derecha	
Abcisa	Tensión	Momento	Cortante	Momento	Cortante
0.000	51.823	0.000	0.000	0.000	0.000
1.650	48.881	415.462	498.767	362.062	-680.633
4.250	44.021	-451.479	41.959	-451.479	-15.041
6.850	41.372	381.564	649.200	328.163	-400.800
8.500	39.553	0.000	-0.000	0.000	-0.000

PROYECTO .....

FECHA .....

HOJA N.° .....

ARMADURAS

FLEXION

LONGITUDINAL

$\sigma_{mf/c} = 48,9$ t/m²

$M_{cd} = 1.6 \times 48.9 \times \frac{3.0^2}{2} = 350,0$ mt/m

$U_c = \frac{2500}{1,5} 1.0 \times 1.90 = 3166$ t/m

$A = U_c \left[1 - \sqrt{1 - \frac{2 M_{cd}}{U_c \times 1.90}}\right] \times \frac{1.15}{5.1} = 42,8 \text{ cm}^2/\text{m} \rightarrow \phi 25/0,10$

TRANSVERSAL

$M_{Td\ max} = 1.6 \times 415.4 = 665$ mt.

$M_{Td\ min} = -1.6 \times 467.1 = -748,6$ mt.

$U_c = \frac{2500}{1.5} \times 6.00 \times 1,90 = 19000$ t.

$A = U_c \left[1 - \sqrt{1 - \frac{2 M_d}{U_c \times 1.90}}\right] \times \frac{1.15}{5.1}$ → $A_{inf} = 79,7$ cm² ; $A_{sup} = 89,8$ cm²

$A'_{inf} = 0,75 \times 79,7 \times \frac{1}{3.00} = 20,0$ cm²/m.

$A_{sup} = 0.75 \times 89,8 \times \frac{1}{3.00} = 22,4$ cm²/m

$A_{min} = 0.04 U_c \times \frac{1.15}{5.1} = 28,60$ cm²/m → $\phi 25/0,15$

CORTANTE

$V_{d\ max} = 1.6 \times 686.0 = 1098$ t

$V_{cu} = 5 \sqrt{\frac{250}{1.5}} \times 6.00 \times 1.90 = 736,1$ t

$A_{Tf} = \frac{1098 - 736}{0.9 \times 1.90 \times 4.2} = 50,4$ cm²/m ($A_{min} = 47,6$ cm²/m **343**

4.- CALCULO ESTRIBOS

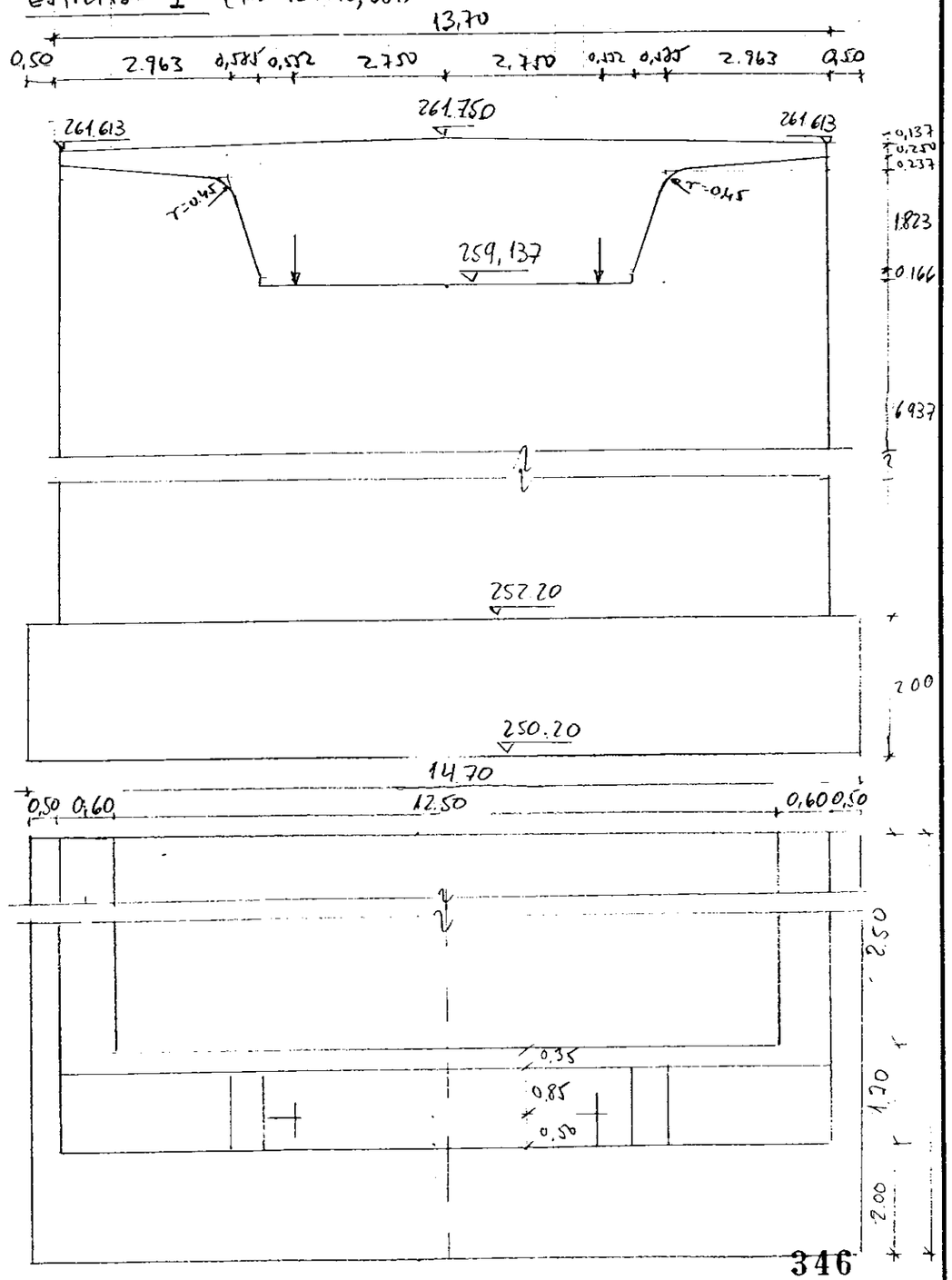
4.1.- ESTRIBO 1 (Móvil)

PROYECTO T.A.V. ZARAGOZA - LERIDA
FURTIANO 1
E-4

FECHA

HOJA N.°

ESTRIBO 1 (P.K 13+090,657)



PROYECTO

E-4

FECHA

HOJA N.°

Reacción de pp + c.p. $N = 278,9 + 108,3 + 22,6 + 56,5 = 466,3$ t

Reacción de sobrecarga $N = 298,8$ t

M sobrecarga $M_T = 298,8 \times 0,30 = 89,5$ mt

F_{H_L} frenado
F_{H_L} def. diferida } $F_{H_L} = 23,3$ t

F_{H_T} viento $F_{H_T} = 79,4$ t

F_{H_T} sismo $F_{H_T} = 51,7$ t

E-4. ESTRIBO 1.

CARACTERISTICAS DEL RELLENO
==========

PESO ESPECIFICO (TN/M3)		=	2.00
ANGULO DE ROZAMIENTO FI		=	35.00
ANGULO ROZAMIENTO TERRENO-MURO		=	.00
SOBRECARGA (TN/M2)		=	3.00
COEFICIENTE SISMICO BASICO	C	=	.080
COEFICIENTE SISMICO	S	=	.080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		=	.293
COEFICIENTE DE EMPUJE ACTIVO		=	.271

CARACTERISTICAS DE LOS MATERIALES
==========

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250. KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.050 M

CARGAS SOBRE EL ESTRIBO
==========

CARGA VERTICAL DE TABLERO PESO PROPIO Y CARGA PERMANENTE	466.3 TN
CARGA VERTICAL DE SOBRECARGAS	298.8 TN
FUERZA LONGITUDINAL DE FRENADO RETRACCION Y TEMPERATURA	23.3 TN
FUERZA TRANSVERSAL DE VIENTO	79.4 TN
MOMENTO TRANSVERSAL DE SOBRECARGAS	89.5 MT
FUERZA LONGITUDINAL DE SISMO	.0 TN
FUERZA TRANSVERSAL DE SISMO	51.7 TN

GEOMETRIA DEL ESTRIBO
==========

ANCHURA DEL ESTRIBO	B	=	13.70
ESVIAJE (GRADOS SEXAGESIMALES)	BETA	=	.00

ALZADO DEL ESTRIBO

ESPESOR DEL FALDON	A3	=	.35
ALTURA DEL FALDON	A6	=	2.60
DISTANCIA DE APOYO A BORDE ESTRIBO	A5	=	.50
ESPESOR DEL ESTRIBO	A2	=	1.70
ESPESOR DE LAS ALETAS	A7	=	.60
ALTURA TOTAL DEL ESTRIBO	H + C	=	11.55
ALTURA DE TIERRAS	H	=	9.55

ZAPATA

VUELO DELANTERO	A1	=	2.00
VUELO TRASERO	A4	=	2.50
LONGITUD TOTAL	L	=	6.20
CANTO	C	=	2.00
RESGUARDO SOBRE ZAPATA		=	0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		=	60.00 TN/M2

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 24.8 CM2/M	(FI 20 A .125 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
	5.2 M. SUPERIORES	AV.= 12.4 CM2/M	(FI 20 A .250 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
INTRADOS		AV.= 5.5 CM2/M	(FI 12 A .200 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
FALDON	TRASDOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 4.1 CM2/M	(FI 12 A .250 M)
	INTRADOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 1.9 CM2/M	(FI 8 A .200 M)
ALETAS	TRASDOS	AV.= 8.3 CM2/M	(FI 16 A .225 M)
		AH.= 8.3 CM2/M	(FI 16 A .225 M)
	INTRADOS	AV.= 4.1 CM2/M	(FI 12 A .250 M)
		AH.= 4.1 CM2/M	(FI 12 A .250 M)

ARMADURA DE ZAPATA

CARA INFERIOR.	A. PRINCIPAL =	29.3 CM2/M	(FI 25 A .150 M)
	A. DE REPARTO =	8.8 CM2/M	(FI 16 A .225 M)
CARA SUPERIOR.	A. PRINCIPAL =	29.3 CM2/M	(FI 25 A .150 M)
	A. DE REPARTO =	8.8 CM2/M	(FI 16 A .225 M)

ESTRIBO CON RELLENO DE TIERRAS Y SIN TABLERO
==========

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 27.4

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S1 = 34.3 SA = 24.4 SB = 16.1 S2 = 3.8

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.50

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.39

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 26.6

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S11 = 39.9 SA1 = 26.5 SB1 = 15.0 S21 = -1.8

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.24

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.01

ESTRIBO CON PUENTE EN SERVICIO
==========

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 44.0

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS1 = 50.9 SSA = 36.2 SSB = 23.6 SS2 = 5.2

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 55.0 SMIN = 1.1

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 2.13

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.88

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 36.4

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS11= 51.0 SSA1= 33.9 SSB1= 19.4 SS21= -1.9

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 54.6 SMIN = -5.6

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.54

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.23

MEDICION DEL ESTRIBO
==========

HORMIGON

ZAPATA		169.88
ALZADO		161.87
FALDON TRASERO		12.47
ALETAS		28.65
TOTAL M3	=	372.86

ARMADURAS

	DIAMETRO	NUMERO	LONGITUD	PESO	PESO TOTAL
FALDON					
	12.	69	7.35	.89	450.59
	12.	10	14.10	.89	125.28
	8.	13	14.10	.39	72.38
ZAPATA					
	25.	91	9.90	3.86	3474.10
	25.	91	9.90	3.86	3474.10
	16.	28	17.40	1.58	769.54
	16.	28	17.40	1.58	769.54
ALZADO					
	20.	109	10.65	2.47	2864.98
	12.	69	8.95	.89	548.68
	20.	39	16.80	2.47	1617.03
	20.	31	16.80	2.47	1285.33
	20.	19	16.80	2.47	787.79
A DEDUCIR					
	20.	54	4.25	2.47	-566.41
	20.	19	16.80	2.47	-787.79
ALETAS					
	16.	22	11.85	1.58	411.78
	16.	86	3.90	1.58	529.77
	12.	20	11.85	.89	210.57
	12.	76	3.90	.89	263.35
				TOTAL KG =	16300.61

PROYECTO L.A.V ZARAGOZA-LERIDA
SUBTRAMO 1
E-4

FECHA

HOJA N.º

Parrillos apoyo E-1:

$R_{vcc} = 399\ t$

$A_{apoyo} \rightarrow 500 \times 600$

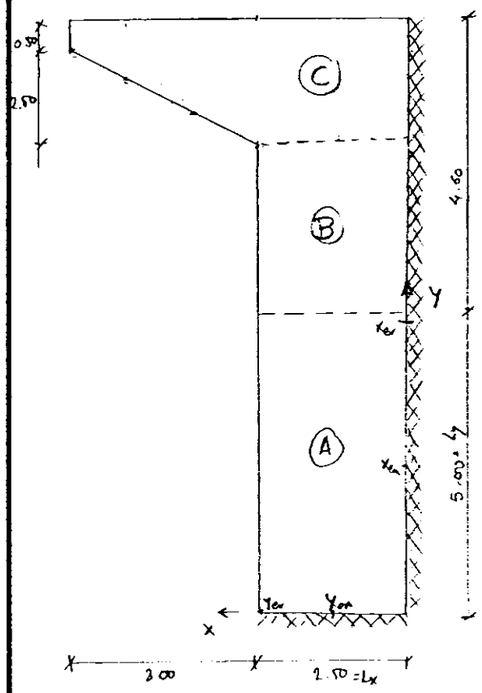
$$A = 0.3 \times 1.6 \times 399 - \frac{1.15}{5\,1} \times \left(1 - \frac{500}{1000}\right) = 216\ cm^2$$

PROYECTO TAV ZARAGOZA - LÉRIDA
TRAMO 1.
E-4

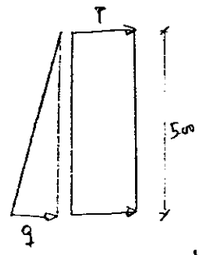
FECHA

HOJA N.º

ARMADURAS MURO EN VUELTA Y ALETAS



ZONA A: $\frac{L_x}{L_y} \geq 2$.



$P = 0'271 \cdot (3 + 4'60 \times 2) =$
$= 3'31\ t/m^2$

$q = 0'271 \times (5 \times 2) = 2'71\ t/m^2$

$K_1 = 3'31 \times 2'5 \times 5'00 = 41'33\ t$

$K_2 = \frac{1}{2}\, 2'71 \times 2'5 \times 5'0 = 16'94\ t.$

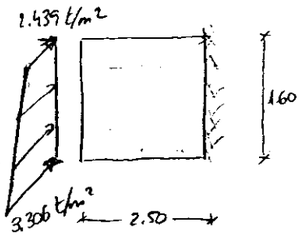
$$M_{xer} = -\frac{41'33}{4,18} - \frac{16'94}{10.30} = -11'53\ mt/m \Rightarrow A_{xi} = 91'66 \times \frac{1'15}{5'1} \cdot \left(1 - \sqrt{1 - \frac{2 \times 11'53 \times 1.}{0'5 \times 91'66}}\right)$$
$$= 7'71\ cm^2/m$$

$$M_{xem} = -\frac{41'33}{5.90} - \frac{16'94}{6'76} = -9'51\ mt/m$$

$$M_{yer} = -\frac{41'33}{4.88} - \frac{16'94}{4.75} = -12'08\ mt/m \Rightarrow A_{int} = 8'05\ cm^2/m$$

$$M_{yem} = -\frac{41'33}{12.40} - \frac{16'94}{10.4} = -4'96\ mt/m$$

ZONA B : Ménsula.



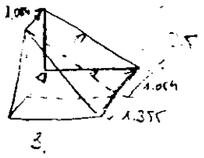
$M_y = 1'6 \times \frac{2'50}{2} \times \left(2'439 + 3'306\right) \frac{1}{2} \times 1'6 \times 2'5 = 22'98$ mt.

$A_{int} = 6'59$ cm²/m

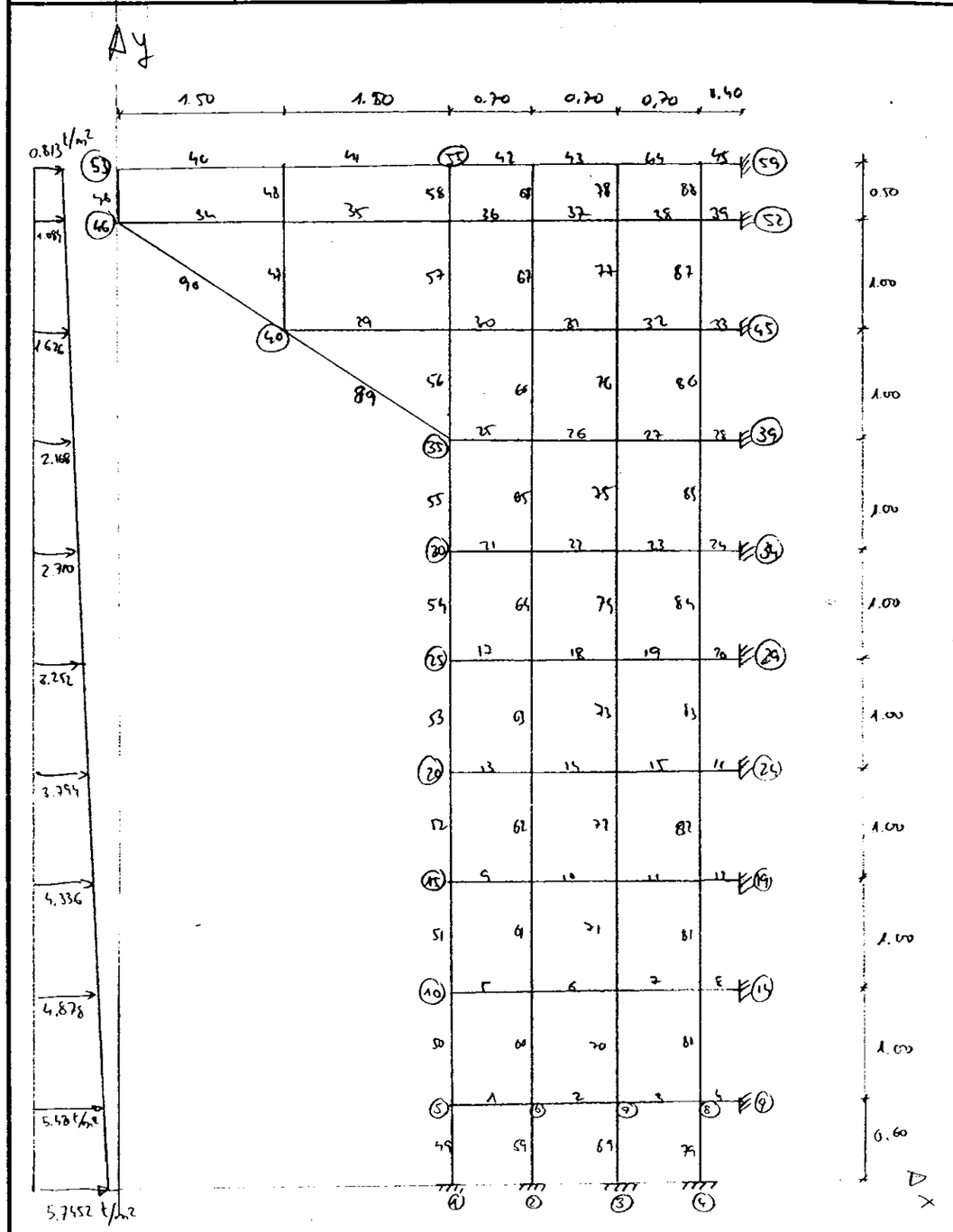
ZONA C : Ménsula

$M_d = 1'6 \times \frac{5'5}{2} \times \left(0'813 + 2'439\right) \times \frac{1}{2} \times 5'5 \times 3 -$

$- 1'6 \times \frac{1}{2} \times 2'5 \times 3 \times 1'084 \times 4'5 = 88'78$ mt



$A_{int} = 916'67 \frac{1'15}{5'1} \cdot \left(1 - \sqrt{1 - 2 \times \frac{35'51}{0'55 \times 916'667}}\right) = 15'11$ cm²/m



TAV ZARAGOZA-LLEIDA. ALETAS ESTR.1

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**control**
59 90  7  1

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  1   3    0
  2   3.7  0
  3   4.4  0
  4   5.1  0
  5   3    0.6
  6   3.7  0.6
  7   4.4  0.6
  8   5.1  0.6
  9   5.5  0.6
 10   3    1.6
 11   3.7  1.6
 12   4.4  1.6
 13   5.1  1.6
 14   5.5  1.6
 15   3    2.6
 16   3.7  2.6
 17   4.4  2.6
 18   5.1  2.6
 19   5.5  2.6
 20   3    3.6
 21   3.7  3.6
 22   4.4  3.6
 23   5.1  3.6
 24   5.5  3.6
 25   3    4.6
 26   3.7  4.6
 27   4.4  4.6
 28   5.1  4.6
 29   5.5  4.6
 30   3    5.6
 31   3.7  5.6
 32   4.4  5.6
 33   5.1  5.6
 34   5.5  5.6
 35   3    6.6
 36   3.7  6.6
 37   4.4  6.6
 38   5.1  6.6
 39   5.5  6.6
 40   1.5  7.6
 41   3    7.6
 42   3.7  7.6
 43   4.4  7.6
 44   5.1  7.6
 45   5.5  7.6
 46   0.0  8.6
 47   1.5  8.6
 48   3    8.6
 49   3.7  8.6
 50   4.4  8.6
 51   5.1  8.6
 52   5.5  8.6
 53   0.0  9.1
 54   1.5  9.1
 55   3    9.1
 56   3.7  9.1
 57   4.4  9.1
 58   5.1  9.1
 59   5.5  9.1

**barras tipo**
10
  0.0144        0.0288        3500000    1500000
```



```
  0.0180        0.0360        3500000    1500000
  0.0135        0.0270        3500000    1500000
  0.0045        0.0090        3500000    1500000
  0.0270        0.0540        3500000    1500000
  0.0063        0.0126        3500000    1500000
  0.0198        0.0396        3500000    1500000
  0.0126        0.0252        3500000    1500000
  0.0099        0.0198        3500000    1500000
  0.0004        0.0008        3500000    1500000
:
**barras**
  1    5    6    1
  2    6    7    1
  3    7    8    1
  4    8    9    1
  5    10   11   2
  6    11   12   2
  7    12   13   2
  8    13   14   2
  9    15   16   2
 10    16   17   2
 11    17   18   2
 12    18   19   2
 13    20   21   2
 14    21   22   2
 15    22   23   2
 16    23   24   2
 17    25   26   2
 18    26   27   2
 19    27   28   2
 20    28   29   2
 21    30   31   2
 22    31   32   2
 23    32   33   2
 24    33   34   2
 25    35   36   2
 26    36   37   2
 27    37   38   2
 28    38   39   2
 29    40   41   2
 30    41   42   2
 31    42   43   2
 32    43   44   2
 33    44   45   2
 34    46   47   3
 35    47   48   3
 36    48   49   3
 37    49   50   3
 38    50   51   3
 39    51   52   3
 40    53   54   4
 41    54   55   4
 42    55   56   4
 43    56   57   4
 44    57   58   4
 45    58   59   4
 46    46   53   3
 47    40   47   5
 48    47   54   5
 49    1    5    6
 50    5    10   6
 51    10   15   6
 52    15   20   6
 53    20   25   6
 54    25   30   6
 55    30   35   6
 56    35   41   7
 57    41   48   7
```

```
58   48   55    7
59   2    6     8
60   6    11    8
61   11   16    8
?    16   21    8
63   21   26    8
64   26   31    8
65   31   36    8
66   36   42    8
67   42   49    8
68   49   56    8
69   3    7     8
70   7    12    8
71   12   17    8
72   17   22    8
73   22   27    8
74   27   32    8
75   32   37    8
76   37   43    8
77   43   50    8
78   50   57    8
79   4    8     9
80   8    13    9
81   13   18    9
82   18   23    9
83   23   28    9
84   28   33    9
85   33   38    9
86   38   44    9
87   44   51    9
88   51   58    9
89   35   40    10
90   40   46    10
:
**apoyos**
14
  1     1    1   1
  2     1    1   1
  3     1    1   1
  4     1    1   1
  9     1    1   1
  14    1    1   1
  19    1    1   1
  24    1    1   1
  29    1    1   1
  34    1    1   1
  39    1    1   1
  45    1    1   1
  52    1    1   1
  59    1    1   1
:
**cargas**
EMPUJE DE TIERRAS
0
45
  1     3   4.336   4.336
  2     3   4.336   4.336
  3     3   4.336   4.336
  4     3   4.336   4.336
  5     3   4.878   4.878
  6     3   4.878   4.878
  7     3   4.878   4.878
  8     3   4.878   4.878
  9     3   4.336   4.336
  10    3   4.336   4.336
  11    3   4.336   4.336
  12    3   4.336   4.336
  13    3   3.794   3.794
```



```
  14    3   3.794   3.794
  15    3   3.794   3.794
  16    3   3.794   3.794
  17    3   3.252   3.252
  18    3   3.252   3.252
  19    3   3.252   3.252
  20    3   3.252   3.252
  21    3   2.710   2.710
  22    3   2.710   2.710
  23    3   2.710   2.710
  24    3   2.710   2.710
  25    3   2.168   2.168
  26    3   2.168   2.168
  27    3   2.168   2.168
  28    3   2.168   2.168
  29    3   1.626   1.626
  30    3   1.626   1.626
  31    3   1.626   1.626
  32    3   1.626   1.626
  33    3   1.626   1.626
  34    3   0.813   0.813
  35    3   0.813   0.813
  36    3   0.813   0.813
  37    3   0.813   0.813
  38    3   0.813   0.813
  39    3   0.813   0.813
  40    3   .2033   .2033
  41    3   .2033   .2033
  42    3   .2033   .2033
  43    3   .2033   .2033
  44    3   .2033   .2033
  45    3   .2033   .2033
:
```

Hip. nº 1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	-0.000000	0.000000
2	-0.000000	-0.000000	0.000000
3	-0.000000	-0.000000	0.000000
4	-0.000000	-0.000000	0.000000
5	-0.000064	-0.000011	0.000024
6	-0.000045	-0.000012	0.000016
7	-0.000023	-0.000012	0.000008
8	-0.000005	-0.000007	0.000002
9	-0.000000	-0.000000	0.000000
10	-0.000076	-0.000050	0.000106
11	-0.000054	-0.000052	0.000070
12	-0.000027	-0.000049	0.000034
13	-0.000006	-0.000028	0.000006
14	-0.000000	-0.000000	0.000000
15	-0.000053	-0.000087	0.000177
16	-0.000036	-0.000088	0.000116
17	-0.000017	-0.000080	0.000056
18	-0.000004	-0.000044	0.000009
19	-0.000000	-0.000000	0.000000
20	-0.000032	-0.000114	0.000223
21	-0.000020	-0.000114	0.000143
22	-0.000008	-0.000100	0.000067
23	-0.000002	-0.000052	0.000011
24	-0.000000	-0.000000	0.000000
25	-0.000022	-0.000134	0.000252
26	-0.000013	-0.000131	0.000159
27	-0.000005	-0.000111	0.000072
28	-0.000001	-0.000055	0.000012
29	-0.000000	-0.000000	0.000000
30	-0.000023	-0.000154	0.000277
31	-0.000012	-0.000147	0.000171
32	-0.000004	-0.000119	0.000076
33	-0.000001	-0.000057	0.000012
34	-0.000000	-0.000000	0.000000
35	-0.000029	-0.000186	0.000307
36	-0.000014	-0.000166	0.000183
37	-0.000004	-0.000127	0.000079
38	-0.000001	-0.000058	0.000012
39	-0.000000	-0.000000	0.000000
40	-0.000035	-0.000259	0.000703
41	-0.000026	-0.000217	0.000337
42	-0.000014	-0.000184	0.000196
43	-0.000005	-0.000136	0.000083
44	-0.000001	-0.000060	0.000012
45	-0.000000	-0.000000	0.000000
46	-0.000034	-0.000275	0.001147
47	-0.000034	-0.000266	0.000738
48	-0.000020	-0.000230	0.000360
49	-0.000013	-0.000198	0.000209
50	-0.000006	-0.000145	0.000088
51	-0.000001	-0.000063	0.000013
52	-0.000000	-0.000000	0.000000
53	-0.000034	-0.000275	0.001164
54	-0.000033	-0.000267	0.000755
55	-0.000020	-0.000234	0.000370
56	-0.000013	-0.000202	0.000216
57	-0.000006	-0.000148	0.000091
58	-0.000001	-0.000065	0.000014
59	-0.000000	-0.000000	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	4.01	0.36	5.51
2	5.08	0.77	5.90
3	2.58	0.73	2.98
4	0.33	0.36	0.08
9	0.57	1.29	2.43
14	0.85	5.69	7.19
19	0.49	8.63	9.28
24	0.22	9.90	9.24
29	0.10	10.27	8.40
34	0.08	10.32	7.36
39	0.09	10.32	6.28
45	0.13	10.49	5.48
52	0.12	8.23	3.92
59	0.04	2.92	1.74

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	5	1.18	-0.38	2.28
	6	1.18	0.15	-0.76
2	6	1.35	-0.57	2.50
	7	1.35	0.12	-0.53
3	7	1.09	-0.55	1.71
	8	1.09	-0.42	-1.32
4	8	0.57	-0.67	-0.69
	9	0.57	-1.29	-2.43
5	10	1.73	0.04	1.48
	11	1.73	-0.12	-1.94
6	11	2.07	-0.00	0.30
	12	2.07	-0.99	-3.11
7	12	1.59	-0.79	-1.94
	13	1.59	-3.34	-5.35
8	13	0.85	-3.21	-5.24
	14	0.85	-5.69	-7.19
9	15	1.35	0.18	0.88
	16	1.35	-0.27	-2.16
10	16	1.47	0.14	-1.42
	17	1.47	-1.92	-4.46
11	17	1.02	-1.45	-4.27
	18	1.02	-5.50	-7.31
12	18	0.49	-5.27	-7.55
	19	0.49	-8.63	-9.28
13	20	0.92	0.14	0.41
	21	0.92	-0.51	-2.25
14	21	0.90	-0.20	-2.12
	22	0.90	-2.62	-4.78
15	22	0.52	-2.30	-4.88
	23	0.52	-6.65	-7.54
16	23	0.22	-6.51	-7.72
	24	0.22	-9.90	-9.24
17	25	0.72	0.00	-0.01
	26	0.72	-0.80	-2.28
18	26	0.63	-0.74	-2.38
	27	0.63	-3.20	-4.66
19	27	0.29	-3.09	-4.76
	28	0.29	-7.22	-7.03
20	28	0.10	-7.17	-7.10
	29	0.10	-10.27	-8.40
21	30	0.87	-0.23	-0.59
	31	0.87	-1.30	-2.49
22	31	0.64	-1.42	-2.54
	32	0.64	-3.86	-4.44
23	32	0.25	-3.86	-4.39
	33	0.25	-7.60	-6.28
24	33	0.08	-7.59	-6.27
	34	0.08	-10.32	-7.36

25	35	1.19	-1.33	-0.94
	36	1.19	-2.52	-2.46
26	36	0.74	-2.49	-2.37
	37	0.74	-4.67	-3.89
27	37	0.29	-4.69	-3.91
	38	0.29	-7.96	-5.43
28	38	0.09	-7.98	-5.42
	39	0.09	-10.32	-6.28
29	40	0.33	-0.61	-0.72
	41	0.33	-3.52	-3.16
30	41	0.96	-2.50	-0.94
	42	0.96	-3.56	-2.07
31	42	0.67	-3.38	-2.33
	43	0.67	-5.41	-3.47
32	43	0.32	-5.42	-3.67
	44	0.32	-8.39	-4.81
33	44	0.13	-8.43	-4.83
	45	0.13	-10.49	-5.48
34	46	0.01	-0.00	0.03
	47	0.01	-0.88	-1.19
35	47	0.37	-0.54	-0.36
	48	0.37	-2.00	-1.58
36	48	0.44	-1.61	-1.55
	49	0.44	-2.89	-2.12
37	49	0.40	-2.71	-2.23
	50	0.40	-4.47	-2.80
38	50	0.27	-4.39	-3.03
	51	0.27	-6.71	-3.60
39	51	0.12	-6.73	-3.59
	52	0.12	-8.23	-3.92
40	53	0.01	-0.00	-0.00
	54	0.01	-0.23	-0.31
41	54	0.12	-0.01	-0.35
	55	0.12	-0.77	-0.66
42	55	0.13	-0.35	-1.00
	56	0.13	-1.10	-1.14
43	56	0.13	-0.78	-1.16
	57	0.13	-1.64	-1.30
44	57	0.10	-1.39	-1.32
	58	0.10	-2.36	-1.46
45	58	0.04	-2.24	-1.65
	59	0.04	-2.92	-1.74
46	46	0.00	0.01	0.00
	53	0.00	0.01	0.00
47	40	-0.56	-0.28	0.78
	47	-0.56	0.50	0.78
48	47	-0.22	0.14	-0.05
	54	-0.22	0.12	-0.05
49	1	-0.36	-4.01	5.51
	5	-0.36	-0.70	5.51
50	5	-0.73	-1.88	3.23
	10	-0.73	1.35	3.23
51	10	-0.69	-0.38	1.76
	15	-0.69	1.38	1.76
52	15	-0.52	0.03	0.88
	20	-0.52	0.91	0.88
53	20	-0.38	-0.01	0.47
	25	-0.38	0.45	0.47
54	25	-0.38	-0.27	0.47
	30	-0.38	0.21	0.47
55	30	-0.61	-0.66	1.06
	35	-0.61	0.40	1.06
56	35	-1.82	-0.74	1.92
	41	-1.82	1.18	1.92
57	41	-0.80	0.55	-0.31
	48	-0.80	0.25	-0.31
58	48	-0.41	0.18	-0.34
	55	-0.41	0.01	-0.34

59	2	-0.77	-5.08	5.90
	6	-0.77	-1.54	5.90
60	6	-1.50	-1.71	2.64
	11	-1.50	0.93	2.64
61	11	-1.38	0.59	0.40
	16	-1.38	0.99	0.40
62	16	-0.96	0.86	-0.33
	21	-0.96	0.53	-0.33
63	21	-0.66	0.55	-0.45
	26	-0.66	0.10	-0.45
64	26	-0.60	0.20	-0.35
	31	-0.60	-0.16	-0.35
65	31	-0.71	0.07	-0.30
	36	-0.71	-0.23	-0.30
66	36	-0.68	0.21	-0.39
	42	-0.68	-0.18	-0.39
67	42	-0.51	0.11	-0.13
	49	-0.51	-0.03	-0.13
68	49	-0.32	0.01	-0.02
	56	-0.32	-0.00	-0.02
69	3	-0.73	-2.58	2.98
	7	-0.73	-0.80	2.98
70	7	-1.40	-0.54	0.73
	12	-1.40	0.19	0.73
71	12	-1.20	0.67	-0.44
	17	-1.20	0.23	-0.44
72	17	-0.73	0.69	-0.63
	22	-0.73	0.06	-0.63
73	22	-0.42	0.43	-0.52
	27	-0.42	-0.09	-0.52
74	27	-0.31	0.24	-0.43
	32	-0.31	-0.18	-0.43
75	32	-0.31	0.21	-0.48
	37	-0.31	-0.26	-0.48
76	37	-0.33	0.19	-0.45
	43	-0.33	-0.26	-0.45
77	43	-0.34	0.09	-0.25
	50	-0.34	-0.16	-0.25
78	50	-0.26	-0.02	-0.02
	57	-0.26	-0.03	-0.02
79	4	-0.36	-0.33	0.08
	8	-0.36	-0.28	0.08
80	8	-0.61	0.24	-0.55
	13	-0.61	-0.31	-0.55
81	13	-0.47	0.43	-0.67
	18	-0.47	-0.24	-0.67
82	18	-0.24	0.28	-0.43
	23	-0.24	-0.14	-0.43
83	23	-0.10	0.16	-0.25
	28	-0.10	-0.09	-0.25
84	28	-0.05	0.10	-0.18
	33	-0.05	-0.08	-0.18
85	33	-0.04	0.09	-0.19
	38	-0.04	-0.10	-0.19
86	38	-0.06	0.09	-0.20
	44	-0.06	-0.11	-0.20
87	44	-0.10	0.08	-0.18
	51	-0.10	-0.10	-0.18
88	51	-0.12	0.04	-0.19
	58	-0.12	-0.05	-0.19
89	35	-0.02	-0.13	0.08
	40	-0.02	0.03	0.08
90	40	-0.01	-0.03	0.03
	46	-0.01	0.01	0.03

PROYECTO TAV ZARAGOZA - LLEIDA
TRAMO 1. E-4
ESTRIBO 1.

FECHA

HOJA N.º

ARMADURA EN MUROS EN VUELTA Y ALETAS

ARMADURA VERTICAL:

$$M_d^2 = 1'6 \times 5'08 \text{ mt.} = 8'13 \text{ mt}$$

$$A_s = \frac{2500}{1.5} \times 0'55 \times \frac{1'15}{5,1} \times \left(1 - \sqrt{1 - \frac{2 \times 8'13}{\frac{2500}{1.5} \times 0'55 \times d^2 \times 0'55}}\right) = 4'82 \text{ cm}^2/\text{m}.$$

ARMADURA HORIZONTAL:

→ 3'6 primeros metros inferiores: $M_d^{24} = 9'90 \times 1'6 = 15'84$ mt

→ 4'5 siguientes metros: $M_d^{39} = 1'6 \times 10'49 = 16'79$ mt

→ Último 1 metro: $M_d = 1'6 \times 8'23 = 13'17$ mt.

3'6 primeros metros inf → $A_s = 6'60 \text{ cm}^2/\text{m}$

4'5 siguientes metros → $A_s = 7 \text{ cm}^2/\text{m}$

1 último metro superior → $A_s = 7'33 \text{ cm}^2/\text{m}$

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4.2.- ESTRIBO 2 (Fijo)

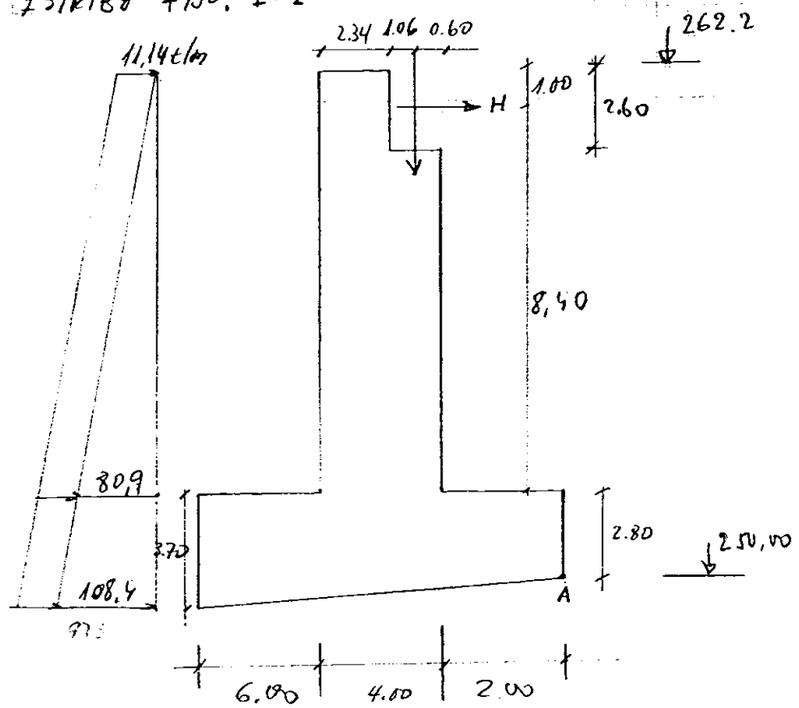
PROYECTO

E-4

FECHA

HOJA N.° 1

ESTRIBO FIJO. E-2



N CARGA PERMANENTE	490 t	
N SOBRECARGA	299 t	-55 t
→ Frenado + Reológica	833 t	= 644 + 189
Empuje de tierra sin sobrecarga	637 t	
Empuje de tierra por sobrecarga.	146 t	

ANCHO DE ZAPATA : 16,30 m

PROYECTO

FECHA

HOJA N.° 2

ACCIONES	PESO PROPIO	PUNTO DELANTERO DE ZAPATA. N	H	M_A
ZAPATA	16,30 × 2,80 × 12 × 2,5	1359 t		8214
	16,30 × 0,45 × 12 × 2,5	220		1760
Muro frontal		1140 t		5089
Aletas		282		2538
Tierras		1320		11878
Sobrecarga		120		1080
C. Permanente tablero		490 t		1274
Sobrecarga tablero		299 t		777
		-55		-143
Empuje tierras (sin sobrecarga)			637 t	-2782
		(reposo)	1003 t	-4378
Empuje tierras por sobrecarga			146 t	-958
		(reposo)	230 t	-1506
Frenado + Reológica		→	833 t	-9330
− Frenado + calentamiento			-682 t	8394

H-1 Peso Propio + Sobrecarga + Frenado + Reológica + Tierras.

$N = 5240\ t \qquad H = 1616\ t$

$$\gamma_d = \frac{5240 \times 0{,}475}{1616} = 1{,}54$$

Si consideramos sobrecarga negativa lo que es incompatible con el máximo frenado

$$\gamma_d = \frac{4766 \times 0{,}475}{1616} = 1{,}40$$

$M_A = 32610 - 13068 = 19542$ mt

$\gamma_V = 2{,}50$

$e_A = 3{,}73$ $\quad M_{CENTRO} = 11898$ mt

$\sigma = \frac{5240}{12 \times 16{,}30} \pm \frac{6 \times 11898}{12^2 \times 16{,}30} = -26{,}8 \pm 30{,}4 \Rightarrow$ $-57{,}2$ / $+3{,}6$ t/

$\sigma_{suelo} = -\frac{2 \times 5240}{18{,}3 \times 11{,}19} = -57{,}5$ t/m²

H-2 Peso Propio + Sobrecarga + Calentamiento – Frenado + E. Reparto

$N = 5240$ t $\quad M_A = 32610 + 2510 = 35120$ mt

$e_A = 6{,}70$ $\quad M_C = 2680$ mt

$\sigma = -26{,}8 \mp 9{,}4 =$ $-17{,}4$ t/m² delantera / $-36{,}2$ t/m² trasera.

ACCIONES SISMICAS

LONGITUDINAL TABLERO. $H = 545$ t, no compatible con fricc.

Incremento de empuje en trasdós.

$H = 0{,}02 \times 2 \times 13{,}1^2 \times 13{,}7 = 94$ t

$M_A = -616$ mt

$N = 5240$ t $\quad H = 1517$ t

$\gamma_d = \frac{5240 \times 0{,}475}{1517} = 1{,}64$

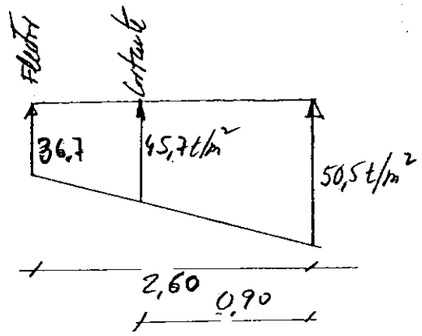
$M_A = 32610 - 12148 = 20462$ mt. $\quad \gamma_r = 2{,}68$

$e_A = 3{,}90$ m $\quad M_{centro} = 10978$ mt

$\sigma = -26{,}8 \pm 28{,}1 =$ $-54{,}9$ t/m² / $1{,}3$ t/m²

$\sigma_{suelo} = -\frac{2 \times 5240}{16{,}3 \times 11{,}70} = -55{,}0$ t/m²

ARMADO ZAPATA. – VUELO DELANTERO.



$M_d = 1{,}6 \times \left[36{,}7 \times \frac{2{,}6^2}{2} + 13{,}8 \times \frac{2{,}6^2}{3}\right] = 248$ mt/m

canto 2,99 $\quad 80$ cm²/m

Mínima 45 cm²/m → Φ32/0,175

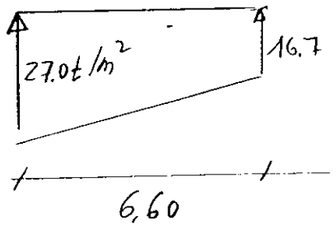
CENTRO $\quad V_d = 1{,}6 \times 48{,}1 \times 0{,}90 = 69$ t $< 2 \times 64{,}5 \times 2{,}87 = 370$ t

CANTO 2.87 $\quad$ NO NECESITA ARMADURA DE CORTANTE

VUELO TRASERO.

ARMADURA INFERIOR. $\quad$ CANTO 3.20

Carga hacia arriba

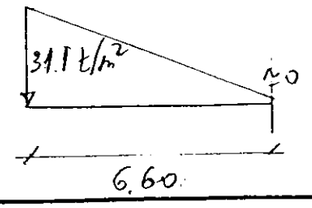


$M_d = 1{,}6\left[16{,}7 \times \frac{6{,}60^2}{2} + 10{,}3 \times \frac{6{,}60^2}{3}\right] = 821{,}3$ mt/m

Canto 3,20 m $\quad 61{,}4$ cm²/m (Φ32/0,125)

Mínima 48 cm²/m

Carga hacia abajo



$M_d = 1{,}6 \times 31{,}1 \times \frac{6{,}60^2}{3} = 723$ mt/m

53,8 cm²/m

Mínima 48. Le dispone Φ32/0,15

CORTANTE. —

$V_d = 1{,}6 \times 6{,}60 \times 21{,}5 = 231\,t \ll 400\,t$

NO NECESITA ARMADURA DE CORTANTE. —

ARMADURA TRANSVERSAL

SUPERIOR. $\phi 25/0.20$ $24{,}6\ cm^2/m$

INFERIOR. $\phi 25/0.20$ $24{,}6\ cm^2/m$

Perimetral $\beta 16/0.20$

ARMADURA DEL CUERPO DE ESTRIBO Y ALETAS.

Armadura trasdós.

$$M_d = \frac{1}{13{,}7} \times 1{,}6 \times \left[11.14 \times \frac{9.4^2}{2} + 69{,}8 \times \frac{9.4^2}{6} + 833 \times 8{,}4\right] = 995\ mt/m$$

Armadura $59\ cm^2/m$ $\phi 32/0.125$

Mínima $60\ cm^2/m$

$1.5 - 12.5\ \frac{60 \times 4.43}{4000 \times 0.167} = 1.003 \rightarrow 1.003 \times 59 = 59.2\ cm^2/m$

$$V_d = \frac{1}{13{,}7} \times 1{,}6 \left[11.14 \times 9{,}4 + 69{,}8 \times \frac{9.4}{2} + 833\right] = 148\ t$$

$$V_{u2} = 0{,}50 \times 64{,}55 \times 3{,}95 \times 1 \left[1 + 50 \times 0{,}002\right] = 140{,}2\ t$$

Se admite una reducción del coeficiente de seguridad del 10% para la actuación de las fuerzas de frenado

$140{,}2 > 133$

NO NECESITA ARMADURA EN CUERCO.

Armadura delantera

$$M_d = \frac{1}{13{,}7} \times 1{,}6 \times \left[69{,}8 \times \frac{9.4^2}{6} - 655 \times 8{,}4\right] = -326\ mt/m$$

$19\ cm^2$, por mínima $25\ cm^2/m$ $\phi 25/0.20$

PROYECTO

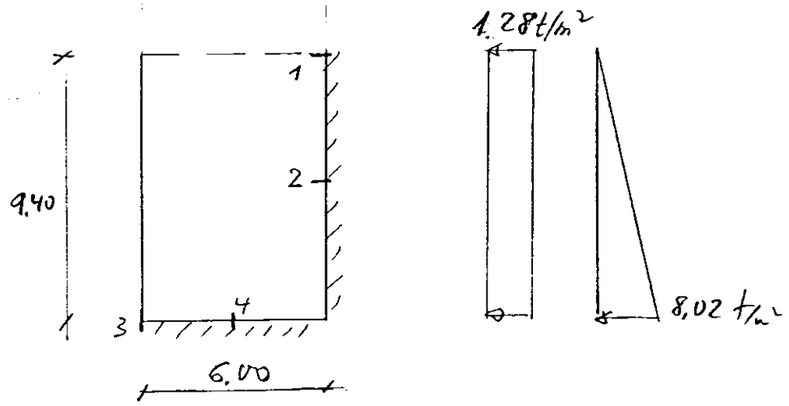
FECHA

HOJA N.° 7

Armadura de aletas.

Empuje al reposo

ESPESOR 1 M.



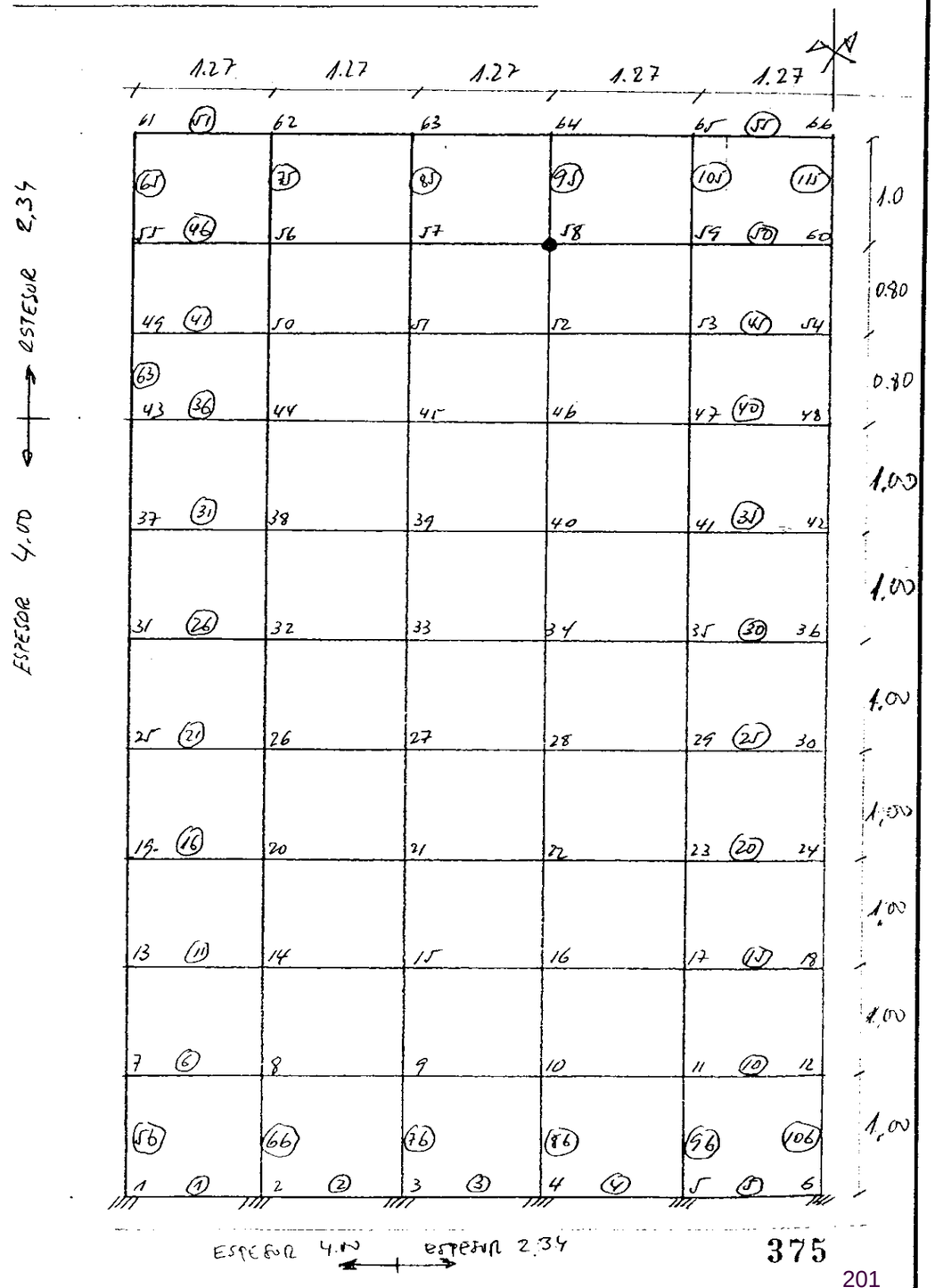
	UNIFORME	TRIANGULAR	TOTAL	ARMADURA
	K = 72,2 t	K = 226,2 t		
Tercio				
1	20,1 mt/m	27,8 mt/m	47,9 mt/m	12,3 cm²/m
2	11,9 "	32,2 "	44,1 "	11,3 cm²/m
3	18,5 "	53,2 "	71,7 "	18,5 cm²/m
4	7,3 "	25,2 "	32,5 "	8,3 cm²/m

PROYECTO I- 4

FECHA

HOJA N.° 8

DIMENSIONADO ZONAL DE ANCLAJE.-



PROYECTO .....

E-4

FECHA .....

HOJA N.º 9

Caracteristicas de barras.

BARRAS	ANCHO	CANTO	I	J
1 a 5	0,50	4.00	2.6667	5.3334
6 a 35	1.00	4.00	5.3333	10.6666
36 a 40	0.50-0.40	4.00-2.34	3.9538	6.1876
41 a 50	0.80	2.34	0.8542	1.7085
51 a 55	0.60	2.34	0.6406	1.2813
56 a 65	1.00	8.00	42.6667	2.6667
66a92; 96a102	1.27	4.00	6.7733	13.5466
93a95; 103a105	1.27	2.34	1.3560	2.7120
106 a 112	0.635	4.00	3.3867	6.7734
113 a 115	0.635	2.34	0.6780	1.3560

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ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-4.
CONTROL
66 115 6 1
:
NUDOS

1	0.000	0.000
2	1.270	0.000
3	2.540	0.000
4	3.810	0.000
5	5.080	0.000
6	6.350	0.000
7	0.000	1.000
8	1.270	1.000
9	2.540	1.000
10	3.810	1.000
11	5.080	1.000
12	6.350	1.000
13	0.000	2.000
14	1.270	2.000
15	2.540	2.000
16	3.810	2.000
17	5.080	2.000
18	6.350	2.000
19	0.000	3.000
20	1.270	3.000
21	2.540	3.000
22	3.810	3.000
23	5.080	3.000
24	6.350	3.000
25	0.000	4.000
26	1.270	4.000
27	2.540	4.000
28	3.810	4.000
29	5.080	4.000
30	6.350	4.000
31	0.000	5.000
32	1.270	5.000
33	2.540	5.000
34	3.810	5.000
35	5.080	5.000
36	6.350	5.000
37	0.000	6.000
38	1.270	6.000
39	2.540	6.000
40	3.810	6.000
41	5.080	6.000
42	6.350	6.000
43	0.000	7.000
44	1.270	7.000
45	2.540	7.000
46	3.810	7.000
47	5.080	7.000
48	6.350	7.000
49	0.000	7.800
50	1.270	7.800
51	2.540	7.800
52	3.810	7.800
53	5.080	7.800
54	6.350	7.800

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```
  55      0.000      8.600
  56      1.270      8.600
  57      2.540      8.600
  58      3.810      8.600
  59      5.080      8.600
  60      6.350      8.600
  61      0.000      9.600
  62      1.270      9.600
  63      2.540      9.600
  64      3.810      9.600
  65      5.080      9.600
  66      6.350      9.600
:
SECCIONES
10
  0.010000   0.010000    3000000    1300000
  5.333333  10.666666    3000000    1300000
  3.093800   6.187600    3000000    1300000
  0.854200   1.708400    3000000    1300000
  0.640600   1.281200    3000000    1300000
  6.773300  13.546600    3000000    1300000
  6.773300  13.546600    3000000    1300000
  1.356000   2.712000    3000000    1300000
  3.386700   6.773400    3000000    1300000
  0.678000   1.356000    3000000    1300000
:
BARRAS
   1    1    2    1
   2    2    3    1
   3    3    4    1
   4    4    5    1
   5    5    6    1
   6    7    8    2
   7    8    9    2
   8    9   10    2
   9   10   11    2
  10   11   12    2
  11   13   14    2
  12   14   15    2
  13   15   16    2
  14   16   17    2
  15   17   18    2
  16   19   20    2
  17   20   21    2
  18   21   22    2
  19   22   23    2
  20   23   24    2
  21   25   26    2
  22   26   27    2
  23   27   28    2
  24   28   29    2
  25   29   30    2
  26   31   32    2
  27   32   33    2
  28   33   34    2
  29   34   35    2
  30   35   36    2
  31   37   38    2
  32   38   39    2
```



```
  33   39   40    2
  34   40   41    2
  35   41   42    2
  36   43   44    3
  37   44   45    3
  38   45   46    3
  39   46   47    3
  40   47   48    3
  41   49   50    4
  42   50   51    4
  43   51   52    4
  44   52   53    4
  45   53   54    4
  46   55   56    4
  47   56   57    4
  48   57   58    4
  49   58   59    4
  50   59   60    4
  51   61   62    5
  52   62   63    5
  53   63   64    5
  54   64   65    5
  55   65   66    5
  56    1    7    6
  57    7   13    6
  58   13   19    6
  59   19   25    6
  60   25   31    6
  61   31   37    6
  62   37   43    6
  63   43   49    6
  64   49   55    6
  65   55   61    6
  66    2    8    7
  67    8   14    7
  68   14   20    7
  69   20   26    7
  70   26   32    7
  71   32   38    7
  72   38   44    7
  73   44   50    7
  74   50   56    7
  75   56   62    7
  76    3    9    7
  77    9   15    7
  78   15   21    7
  79   21   27    7
  80   27   33    7
  81   33   39    7
  82   39   45    7
  83   45   51    7
  84   51   57    7
  85   57   63    7
  86    4   10    7
  87   10   16    7
  88   16   22    7
  89   22   28    7
  90   28   34    7
  91   34   40    7
```

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```
 92   40   46    7
 93   46   52    8
 94   52   58    8
 95   58   64    8
 96    5   11    7
 97   11   17    7
 98   17   23    7
 99   23   29    7
100   29   35    7
101   35   41    7
102   41   47    7
103   47   53    8
104   53   59    8
105   59   65    8
106    6   12    9
107   12   18    9
108   18   24    9
109   24   30    9
110   30   36    9
111   36   42    9
112   42   48    9
113   48   54   10
114   54   60   10
115   60   66   10
:
APOYOS
   16
    1      1.000      1.000      1.000
    2      1.000      1.000      1.000
    3      1.000      1.000      1.000
    4      1.000      1.000      1.000
    5      1.000      1.000      1.000
    6      1.000      1.000      1.000
   12      0.000      1.000      0.000
   18      0.000      1.000      0.000
   24      0.000      1.000      0.000
   30      0.000      1.000      0.000
   36      0.000      1.000      0.000
   42      0.000      1.000      0.000
   48      0.000      1.000      0.000
   54      0.000      1.000      0.000
   60      0.000      1.000      0.000
   66      0.000      1.000      0.000
:
CARGAS
H-1 100 t EN NUDO 58
     1
    58      0.000      0.000    100.000
     0
:
```


e42.001

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-4.

Hip. nº 1 H-1 100 t EN NUDO 58

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	0.000000	0.000000
2	-0.000000	0.000000	0.000000
3	-0.000000	0.000000	0.000000
4	-0.000000	0.000000	0.000000
5	-0.000000	0.000000	0.000000
6	-0.000000	0.000000	0.000000
7	-0.000007	0.000000	0.000003
8	-0.000007	0.000000	0.000004
9	-0.000007	0.000000	0.000004
10	-0.000008	0.000000	0.000004
11	-0.000008	0.000000	0.000004
12	-0.000008	0.000000	0.000004
13	-0.000013	0.000001	0.000013
14	-0.000013	0.000001	0.000014
15	-0.000014	0.000000	0.000014
16	-0.000014	0.000000	0.000015
17	-0.000014	0.000000	0.000015
18	-0.000014	0.000000	0.000015
19	-0.000018	0.000001	0.000028
20	-0.000018	0.000001	0.000030
21	-0.000019	0.000001	0.000031
22	-0.000020	0.000001	0.000032
23	-0.000020	0.000000	0.000032
24	-0.000020	0.000000	0.000032
25	-0.000022	0.000002	0.000048
26	-0.000023	0.000002	0.000050
27	-0.000024	0.000001	0.000052
28	-0.000024	0.000001	0.000054
29	-0.000025	0.000000	0.000054
30	-0.000025	0.000000	0.000055
31	-0.000026	0.000002	0.000072
32	-0.000027	0.000002	0.000075
33	-0.000027	0.000002	0.000078
34	-0.000028	0.000001	0.000080
35	-0.000028	0.000001	0.000081
36	-0.000028	0.000000	0.000081
37	-0.000028	0.000003	0.000099
38	-0.000029	0.000003	0.000103
39	-0.000030	0.000003	0.000107
40	-0.000031	0.000002	0.000109
41	-0.000031	0.000001	0.000111
42	-0.000031	0.000000	0.000111
43	-0.000030	0.000004	0.000129
44	-0.000031	0.000004	0.000133
45	-0.000032	0.000004	0.000138
46	-0.000033	0.000002	0.000141
47	-0.000033	0.000001	0.000143
48	-0.000033	0.000000	0.000143
49	-0.000031	0.000004	0.000153
50	-0.000032	0.000005	0.000158
51	-0.000034	0.000005	0.000164
52	-0.000037	0.000003	0.000169

53	-0.000036	0.000000	0.000171
54	-0.000036	-0.000000	0.000170
55	-0.000031	0.000004	0.000178
56	-0.000032	0.000005	0.000184
57	-0.000034	0.000006	0.000192
58	-0.000036	0.000004	0.000199
59	-0.000037	-0.000000	0.000200
60	-0.000037	-0.000000	0.000200
61	-0.000032	0.000005	0.000209
62	-0.000033	0.000006	0.000217
63	-0.000034	0.000007	0.000226
64	-0.000035	0.000005	0.000234
65	-0.000037	0.000000	0.000237
66	-0.000037	-0.000000	0.000237

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	136.93	-4.22	6.30
2	150.10	-3.13	17.21
3	158.04	-2.33	20.25
4	163.52	-1.59	21.85
5	166.85	-0.81	22.78
6	83.99	-0.00	11.54
12	0.00	-0.34	-0.00
18	0.00	-1.69	0.00
24	0.00	-3.57	0.00
30	-0.00	-5.60	-0.00
36	0.00	-7.15	0.00
42	0.00	-7.03	-0.00
48	-0.00	-1.61	0.00
54	0.00	0.95	0.00
60	0.00	2.01	0.00
66	0.00	0.79	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	-0.00	-0.00	0.00
	2	-0.00	0.00	0.00
2	2	-0.00	0.00	-0.00
	3	-0.00	-0.00	-0.00
3	3	-0.00	0.00	-0.00
	4	-0.00	-0.00	-0.00
4	4	-0.00	0.00	-0.00
	5	-0.00	-0.00	-0.00
5	5	-0.00	0.00	-0.00
	6	0.00	-0.00	-0.00
6	7	-4.15	2.57	-2.83
	8	-4.15	-1.02	-2.83
7	8	-3.45	2.16	-2.50
	9	-3.45	-1.02	-2.50
8	9	-2.51	1.70	-1.84
	10	-2.51	-0.64	-1.84
9	10	-1.54	1.27	-1.12
	11	-1.54	-0.15	-1.12
10	11	-0.52	0.81	-0.37
	12	-0.52	0.34	-0.37
11	13	-5.89	1.77	-1.03

	14	-5.89	0.47	-1.03
12	14	-5.47	2.48	-1.60
	15	-5.47	0.45	-1.60
13	15	-4.21	2.47	-1.29
	16	-4.21	0.83	-1.29
14	16	-2.61	2.28	-0.77
	17	-2.61	1.30	-0.77
15	17	-0.88	2.00	-0.25
	18	-0.88	1.69	-0.25
16	19	-6.98	1.30	-0.04
	20	-6.98	1.26	-0.04
17	20	-6.74	2.71	-0.55
	21	-6.74	2.02	-0.55
18	21	-5.32	3.51	-0.53
	22	-5.32	2.84	-0.53
19	22	-3.27	3.72	-0.25
	23	-3.27	3.41	-0.25
20	23	-1.08	3.65	-0.07
	24	-1.08	3.57	-0.07
21	25	-7.91	1.04	0.47
	26	-7.91	1.64	0.47
22	26	-7.80	3.05	0.29
	27	-7.80	3.42	0.29
23	27	-6.13	4.93	0.31
	28	-6.13	5.33	0.31
24	28	-3.49	5.63	0.25
	29	-3.49	5.95	0.25
25	29	-1.06	5.52	0.06
	30	-1.06	5.60	0.06
26	31	-8.80	0.67	0.73
	32	-8.80	1.59	0.73
27	32	-9.04	3.34	1.08
	33	-9.04	4.72	1.08
28	33	-6.86	6.90	1.66
	34	-6.86	9.01	1.66
29	34	-3.04	8.38	0.27
	35	-3.04	8.73	0.27
30	35	-0.68	7.24	-0.07
	36	-0.68	7.15	-0.07
31	37	-9.66	-0.15	0.47
	38	-9.66	0.44	0.47
32	38	-11.07	2.91	2.53
	39	-11.07	6.12	2.53
33	39	-7.33	10.43	3.72
	40	-7.33	15.15	3.72
34	40	-1.48	12.94	-1.61
	41	-1.48	10.90	-1.61
35	41	0.29	8.49	-1.15
	42	0.29	7.03	-1.15
36	43	-6.18	-1.47	-0.17
	44	-6.18	-1.68	-0.17
37	44	-8.79	-0.67	4.42
	45	-8.79	4.95	4.42
38	45	-3.20	14.61	-2.64
	46	-3.20	11.25	-2.64
39	46	0.45	11.35	-3.76
	47	0.45	6.57	-3.76
40	47	1.13	6.05	-3.50
	48	1.13	1.61	-3.50

41	49	-1.76	-1.36	0.52
	50	-1.76	-0.70	0.52
42	50	-3.09	-1.64	2.10
	51	-3.09	1.02	2.10
43	51	-5.49	0.52	6.14
	52	-5.49	8.32	6.14
44	52	0.63	9.75	-7.47
	53	0.63	0.26	-7.47
45	53	0.83	1.11	-1.62
	54	0.83	-0.95	-1.62
46	55	-1.75	-3.05	2.18
	56	-1.75	-0.28	2.18
47	56	-3.00	-4.72	5.48
	57	-3.00	2.23	5.48
48	57	-3.98	-10.06	23.04
	58	-3.98	19.20	23.04
49	58	-1.45	18.28	-16.48
	59	-1.45	-2.65	-16.48
50	59	-0.07	0.98	-2.36
	60	-0.07	-2.01	-2.36
51	61	-1.28	-5.55	6.03
	62	-1.28	2.11	6.03
52	62	-2.01	-8.94	12.29
	63	-2.01	6.67	12.29
53	63	-0.68	-6.77	15.24
	64	-0.68	12.58	15.24
54	64	-2.89	8.68	-3.40
	65	-2.89	4.37	-3.40
55	65	-0.77	2.03	-2.22
	66	-0.77	-0.79	-2.22
56	1	4.22	-136.93	6.30
	7	4.22	-130.63	6.30
57	7	6.79	-126.48	9.13
	13	6.79	-117.35	9.13
58	13	8.56	-111.45	10.16
	19	8.56	-101.29	10.16
59	19	9.86	-94.31	10.19
	25	9.86	-84.12	10.19
60	25	10.90	-76.20	9.72
	31	10.90	-66.48	9.72
61	31	11.57	-57.68	8.99
	37	11.57	-48.69	8.99
62	37	11.42	-39.03	8.52
	43	11.42	-30.51	8.52
63	43	9.95	-24.34	8.71
	49	9.95	-17.37	8.71
64	49	8.59	-15.61	8.19
	55	8.59	-9.05	8.19
65	55	5.55	-7.31	6.03
	61	5.55	-1.28	6.03
66	2	3.13	-150.10	17.21
	8	3.13	-132.89	17.21
67	8	6.31	-133.60	16.88
	14	6.31	-116.71	16.88
68	14	8.33	-117.13	17.46
	20	8.33	-99.68	17.46
69	20	9.79	-99.92	17.97
	26	9.79	-81.95	17.97
70	26	11.20	-82.07	18.14

	32	11.20	-63.92	18.14
71	32	12.95	-63.68	17.79
	38	12.95	-45.89	17.79
72	38	15.42	-44.48	15.72
	44	15.42	-28.76	15.72
73	44	16.43	-26.15	11.15
	50	16.43	-17.23	11.15
74	50	15.50	-15.91	9.57
	56	15.50	-8.25	9.57
75	56	11.05	-7.00	6.27
	62	11.05	-0.73	6.27
76	3	2.33	-158.04	20.25
	9	2.33	-137.79	20.25
77	9	5.06	-138.72	19.59
	15	5.06	-119.13	19.59
78	15	7.08	-120.40	19.28
	21	7.08	-101.12	19.28
79	21	8.57	-102.54	19.26
	27	8.57	-83.27	19.26
80	27	10.08	-84.94	19.25
	33	10.08	-65.70	19.25
81	33	12.27	-67.88	18.66
	39	12.27	-49.22	18.66
82	39	16.58	-52.96	17.48
	45	16.58	-35.48	17.48
83	45	26.23	-41.07	24.56
	51	26.23	-21.43	24.56
84	51	25.73	-19.02	20.52
	57	25.73	-2.60	20.52
85	57	13.43	-1.63	2.95
	63	13.43	1.33	2.95
86	4	1.59	-163.52	21.85
	10	1.59	-141.67	21.85
87	10	3.50	-142.65	21.13
	16	3.50	-121.52	21.13
88	16	4.95	-123.12	20.60
	22	4.95	-102.52	20.60
89	22	5.84	-104.57	20.32
	28	5.84	-84.24	20.32
90	28	6.14	-86.88	20.38
	34	6.14	-66.50	20.38
91	34	5.51	-70.32	21.77
	40	5.51	-48.54	21.77
92	40	3.30	-54.40	27.11
	46	3.30	-27.30	27.11
93	46	3.40	-30.95	28.22
	52	-3.40	-8.37	28.22
94	52	4.83	-14.50	41.84
	58	4.83	18.97	41.84
95	58	3.90	16.43	-18.63
	64	3.90	-2.20	-18.63
96	5	0.81	-166.85	22.78
	11	0.81	-144.07	22.78
97	11	1.77	-145.09	22.03
	17	1.77	-123.07	22.03
98	17	2.47	-124.80	21.51
	23	2.47	-103.29	21.51
99	23	2.72	-105.49	21.32
	29	2.72	-84.16	21.32

100	29	2.28	-86.60	21.51
	35	2.28	-65.08	21.51
101	35	0.79	-67.45	21.85
	41	0.79	-45.59	21.85
102	41	-1.62	-47.36	21.39
	47	-1.62	-25.97	21.39
103	47	-2.14	-26.64	21.13
	53	-2.14	-9.73	21.13
104	53	-1.30	-9.93	15.30
	59	-1.30	2.31	15.30
105	59	2.34	0.94	1.18
	65	2.34	2.12	1.18
106	6	0.00	-83.99	11.54
	12	0.00	-72.44	11.54
107	12	0.00	-72.96	11.17
	18	0.00	-61.79	11.17
108	18	0.00	-62.67	10.92
	24	0.00	-51.75	10.92
109	24	0.00	-52.82	10.86
	30	0.00	-41.97	10.86
110	30	0.00	-43.03	10.92
	36	0.00	-32.11	10.92
111	36	-0.00	-32.78	10.85
	42	-0.00	-21.93	10.85
112	42	-0.00	-21.64	9.69
	48	-0.00	-11.95	9.69
113	48	-0.00	-10.82	6.19
	54	-0.00	-5.87	6.19
114	54	-0.00	-5.04	4.58
	60	-0.00	-1.38	4.58
115	60	0.00	-1.45	2.22
	66	0.00	0.77	2.22

ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-4.
CONTROL
66 115 6 1
:
NUDOS

1	0.000	0.000
2	1.270	0.000
3	2.540	0.000
4	3.810	0.000
5	5.080	0.000
6	6.350	0.000
7	0.000	1.000
8	1.270	1.000
9	2.540	1.000
10	3.810	1.000
11	5.080	1.000
12	6.350	1.000
13	0.000	2.000
14	1.270	2.000
15	2.540	2.000
16	3.810	2.000
17	5.080	2.000
18	6.350	2.000
19	0.000	3.000
20	1.270	3.000
21	2.540	3.000
22	3.810	3.000
23	5.080	3.000
24	6.350	3.000
25	0.000	4.000
26	1.270	4.000
27	2.540	4.000
28	3.810	4.000
29	5.080	4.000
30	6.350	4.000
31	0.000	5.000
32	1.270	5.000
33	2.540	5.000
34	3.810	5.000
35	5.080	5.000
36	6.350	5.000
37	0.000	6.000
38	1.270	6.000
39	2.540	6.000
40	3.810	6.000
41	5.080	6.000
42	6.350	6.000
43	0.000	7.000
44	1.270	7.000
45	2.540	7.000
46	3.810	7.000
47	5.080	7.000
48	6.350	7.000
49	0.000	7.800
50	1.270	7.800
51	2.540	7.800
52	3.810	7.800
53	5.080	7.800
54	6.350	7.800

```
  55      0.000      8.600
  56      1.270      8.600
  57      2.540      8.600
  58      3.810      8.600
  59      5.080      8.600
  60      6.350      8.600
  61      0.000      9.600
  62      1.270      9.600
  63      2.540      9.600
  64      3.810      9.600
  65      5.080      9.600
  66      6.350      9.600
:
SECCIONES
10
   0.010000    0.010000    3000000    1300000
   5.333333   10.666666    3000000    1300000
   3.093800    6.187600    3000000    1300000
   0.854200    1.708400    3000000    1300000
   0.640600    1.281200    3000000    1300000
  42.666700    2.666700    3000000    1300000
   6.773300   13.546600    3000000    1300000
   1.356000    2.712000    3000000    1300000
   3.386700    6.773400    3000000    1300000
   0.678000    1.356000    3000000    1300000
:
BARRAS
   1    1    2    1
   2    2    3    1
   3    3    4    1
   4    4    5    1
   5    5    6    1
   6    7    8    2
   7    8    9    2
   8    9   10    2
   9   10   11    2
  10   11   12    2
  11   13   14    2
  12   14   15    2
  13   15   16    2
  14   16   17    2
  15   17   18    2
  16   19   20    2
  17   20   21    2
  18   21   22    2
  19   22   23    2
  20   23   24    2
  21   25   26    2
  22   26   27    2
  23   27   28    2
  24   28   29    2
  25   29   30    2
  26   31   32    2
  27   32   33    2
  28   33   34    2
  29   34   35    2
  30   35   36    2
  31   37   38    2
  32   38   39    2
```



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  33   39   40    2
  34   40   41    2
  35   41   42    2
  36   43   44    3
  37   44   45    3
  38   45   46    3
  39   46   47    3
  40   47   48    3
  41   49   50    4
  42   50   51    4
  43   51   52    4
  44   52   53    4
  45   53   54    4
  46   55   56    4
  47   56   57    4
  48   57   58    4
  49   58   59    4
  50   59   60    4
  51   61   62    5
  52   62   63    5
  53   63   64    5
  54   64   65    5
  55   65   66    5
  56    1    7    6
  57    7   13    6
  58   13   19    6
  59   19   25    6
  60   25   31    6
  61   31   37    6
  62   37   43    6
  63   43   49    6
  64   49   55    6
  65   55   61    6
  66    2    8    7
  67    8   14    7
  68   14   20    7
  69   20   26    7
  70   26   32    7
  71   32   38    7
  72   38   44    7
  73   44   50    7
  74   50   56    7
  75   56   62    7
  76    3    9    7
  77    9   15    7
  78   15   21    7
  79   21   27    7
  80   27   33    7
  81   33   39    7
  82   39   45    7
  83   45   51    7
  84   51   57    7
  85   57   63    7
  86    4   10    7
  87   10   16    7
  88   16   22    7
  89   22   28    7
  90   28   34    7
  91   34   40    7
```

```
  92   40   46    7
  93   46   52    8
  94   52   58    8
  95   58   64    8
  96    5   11    7
  97   11   17    7
  98   17   23    7
  99   23   29    7
 100   29   35    7
 101   35   41    7
 102   41   47    7
 103   47   53    8
 104   53   59    8
 105   59   65    8
 106    6   12    9
 107   12   18    9
 108   18   24    9
 109   24   30    9
 110   30   36    9
 111   36   42    9
 112   42   48    9
 113   48   54   10
 114   54   60   10
 115   60   66   10
:
APOYOS
   16
   1       1.000       1.000       1.000
   2       1.000       1.000       1.000
   3       1.000       1.000       1.000
   4       1.000       1.000       1.000
   5       1.000       1.000       1.000
   6       1.000       1.000       1.000
  12       0.000       1.000       0.000
  18       0.000       1.000       0.000
  24       0.000       1.000       0.000
  30       0.000       1.000       0.000
  36       0.000       1.000       0.000
  42       0.000       1.000       0.000
  48       0.000       1.000       0.000
  54       0.000       1.000       0.000
  60       0.000       1.000       0.000
  66       0.000       1.000       0.000
:
CARGAS
H-1 100 t EN NUDO 58
    1
  58       0.000       0.000     100.000
   0
:
```


ZARAGOZA-LERIDA.T-1.ESTRIBO 2 DE E-4.

Hip. n° 1 H-1 100 t EN NUDO 58

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	0.000000	0.000000
2	-0.000000	0.000000	0.000000
3	-0.000000	0.000000	0.000000
4	-0.000000	0.000000	0.000000
5	-0.000000	0.000000	0.000000
6	-0.000000	0.000000	0.000000
7	-0.000003	0.000000	0.000002
8	-0.000004	0.000000	0.000002
9	-0.000004	0.000000	0.000002
10	-0.000005	0.000000	0.000002
11	-0.000005	0.000000	0.000003
12	-0.000005	0.000000	0.000003
13	-0.000006	0.000001	0.000006
14	-0.000007	0.000001	0.000007
15	-0.000008	0.000001	0.000008
16	-0.000009	0.000001	0.000009
17	-0.000009	0.000000	0.000010
18	-0.000010	0.000000	0.000010
19	-0.000008	0.000002	0.000013
20	-0.000010	0.000002	0.000016
21	-0.000011	0.000002	0.000018
22	-0.000012	0.000001	0.000020
23	-0.000013	0.000001	0.000021
24	-0.000013	0.000000	0.000021
25	-0.000010	0.000003	0.000022
26	-0.000012	0.000003	0.000027
27	-0.000014	0.000003	0.000031
28	-0.000015	0.000002	0.000034
29	-0.000016	0.000001	0.000036
30	-0.000016	0.000000	0.000036
31	-0.000012	0.000005	0.000034
32	-0.000014	0.000005	0.000040
33	-0.000016	0.000004	0.000046
34	-0.000017	0.000003	0.000050
35	-0.000018	0.000001	0.000053
36	-0.000018	0.000000	0.000053
37	-0.000013	0.000007	0.000046
38	-0.000016	0.000007	0.000055
39	-0.000018	0.000006	0.000063
40	-0.000019	0.000004	0.000069
41	-0.000020	0.000002	0.000072
42	-0.000020	0.000000	0.000073
43	-0.000014	0.000009	0.000060
44	-0.000017	0.000009	0.000071
45	-0.000019	0.000007	0.000081
46	-0.000021	0.000004	0.000089
47	-0.000021	0.000002	0.000093
48	-0.000021	0.000000	0.000094
49	-0.000014	0.000011	0.000071
50	-0.000017	0.000010	0.000084
51	-0.000020	0.000009	0.000097
52	-0.000024	0.000006	0.000107

53	-0.000024	0.000002	0.000111
54	-0.000024	0.000000	0.000112
55	-0.000014	0.000013	0.000082
56	-0.000017	0.000012	0.000098
57	-0.000020	0.000011	0.000113
58	-0.000023	0.000007	0.000126
59	-0.000024	0.000002	0.000131
60	-0.000025	0.000000	0.000131
61	-0.000014	0.000015	0.000097
62	-0.000017	0.000013	0.000115
63	-0.000020	0.000012	0.000133
64	-0.000021	0.000009	0.000148
65	-0.000024	0.000003	0.000155
66	-0.000024	0.000000	0.000156

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	407.03	-0.95	28.05
2	80.02	-5.72	8.93
3	95.21	-4.73	14.65
4	106.48	-3.31	18.06
5	113.41	-1.69	19.99
6	57.88	-0.00	10.31
12	0.00	-0.70	-0.00
18	0.00	-3.52	0.00
24	-0.00	-7.54	-0.00
30	0.00	-12.20	-0.00
36	0.00	-16.81	-0.00
42	0.00	-20.29	0.00
48	-0.00	-12.11	-0.00
54	-0.00	-2.36	0.00
60	-0.00	-1.85	0.00
66	-0.00	-2.71	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	0.00	0.00	-0.00
	2	0.00	-0.00	-0.00
2	2	-0.00	0.00	-0.00
	3	-0.00	-0.00	-0.00
3	3	-0.00	0.00	-0.00
	4	-0.00	-0.00	-0.00
4	4	-0.00	0.00	-0.00
	5	-0.00	-0.00	-0.00
5	5	0.00	0.00	-0.00
	6	0.00	-0.00	-0.00
6	7	-7.07	1.57	-3.49
	8	-7.07	-2.86	-3.49
7	8	-6.62	3.67	-4.67
	9	-6.62	-2.26	-4.67
8	9	-5.14	3.41	-3.77
	10	-5.14	-1.37	-3.77
9	10	-3.21	2.66	-2.37
	11	-3.21	-0.35	-2.37
10	11	-1.09	1.72	-0.80
	12	-1.09	0.70	-0.80
11	13	-12.42	1.24	-2.40

	14	-12.42	-1.80	-2.40
12	14	-11.28	3.92	-2.96
	15	-11.28	0.15	-2.96
13	15	-8.83	4.88	-2.63
	16	-8.83	1.53	-2.63
14	16	-5.52	4.81	-1.71
	17	-5.52	2.64	-1.71
15	17	-1.87	4.26	-0.58
	18	-1.87	3.52	-0.58
16	19	-16.64	1.01	-0.81
	20	-16.64	-0.02	-0.81
17	20	-14.95	4.81	-1.17
	21	-14.95	3.33	-1.17
18	21	-11.56	7.20	-1.21
	22	-11.56	5.66	-1.21
19	22	-7.13	8.01	-0.83
	23	-7.13	6.95	-0.83
20	23	-2.38	7.92	-0.29
	24	-2.38	7.54	-0.29
21	25	-20.27	0.90	0.93
	26	-20.27	2.08	0.93
22	26	-18.14	6.47	0.52
	27	-18.14	7.12	0.52
23	27	-13.73	10.68	0.10
	28	-13.73	10.81	0.10
24	28	-8.10	12.29	-0.11
	29	-8.10	12.15	-0.11
25	29	-2.61	12.31	-0.09
	30	-2.61	12.20	-0.09
26	31	-23.66	0.84	2.77
	32	-23.66	4.36	2.77
27	32	-21.26	8.57	2.44
	33	-21.26	11.67	2.44
28	33	-15.58	15.55	1.56
	34	-15.58	17.53	1.56
29	34	-8.31	17.90	0.02
	35	-8.31	17.93	0.02
30	35	-2.46	16.99	-0.14
	36	-2.46	16.81	-0.14
31	37	-26.88	0.84	4.58
	38	-26.88	6.66	4.58
32	38	-24.70	10.28	5.36
	39	-24.70	17.09	5.36
33	39	-17.21	22.42	3.83
	40	-17.21	27.29	3.83
34	40	-7.48	25.22	-1.07
	41	-7.48	23.86	-1.07
35	41	-1.74	21.45	-0.91
	42	-1.74	20.29	-0.91
36	43	-17.34	0.71	3.78
	44	-17.34	5.50	3.78
37	44	-16.69	5.18	6.48
	45	-16.69	13.41	6.48
38	45	-10.36	20.05	3.56
	46	-10.36	24.57	3.56
39	46	-3.48	17.82	0.64
	47	-3.48	18.64	0.64
40	47	-0.16	14.69	-2.03
	48	-0.16	12.11	-2.03

41	49	-5.04	0.01	2.23
	50	-5.04	2.84	2.23
42	50	-5.04	-0.06	3.61
	51	-5.04	4.52	3.61
43	51	-6.81	1.91	7.91
	52	-6.81	11.95	7.91
44	52	-0.43	12.68	-7.12
	53	-0.43	3.63	-7.12
45	53	0.45	4.29	-1.52
	54	0.45	2.36	-1.52
46	55	-5.13	-1.42	5.79
	56	-5.13	5.93	5.79
47	56	-4.83	-3.53	8.49
	57	-4.83	7.26	8.49
48	57	-5.10	-8.48	24.58
	58	-5.10	22.73	24.58
49	58	-2.37	21.36	-15.82
	59	-2.37	1.27	-15.82
50	59	-0.42	4.65	-2.20
	60	-0.42	1.85	-2.20
51	61	-3.84	-6.63	14.64
	62	-3.84	11.96	14.64
52	62	-3.36	-10.39	18.87
	63	-3.36	13.58	18.87
53	63	-1.47	-6.47	17.69
	64	-1.47	16.00	17.69
54	64	-3.51	10.64	-1.96
	65	-3.51	8.16	-1.96
55	65	-1.01	4.93	-1.75
	66	-1.01	2.71	-1.75
56	1	0.95	-407.03	28.05
	7	0.95	-378.98	28.05
57	7	2.51	-371.91	31.53
	13	2.51	-340.38	31.53
58	13	3.75	-327.96	33.93
	19	3.75	-294.03	33.93
59	19	4.76	-277.39	34.74
	25	4.76	-242.65	34.74
60	25	5.66	-222.38	33.81
	31	5.66	-188.56	33.81
61	31	6.50	-164.90	31.05
	37	6.50	-133.85	31.05
62	37	7.34	-106.98	26.49
	43	7.34	-80.49	26.49
63	43	8.04	-63.14	22.67
	49	8.04	-45.00	22.67
64	49	-8.05	-39.94	20.42
	55	8.05	-23.61	20.42
65	55	6.63	-18.48	14.65
	61	6.63	-3.83	14.65
66	2	5.72	-80.02	8.93
	8	5.72	-71.09	8.93
67	8	12.25	-71.54	10.12
	14	12.25	-61.43	10.12
68	14	17.97	-62.56	10.68
	20	17.97	-51.88	10.68
69	20	22.80	-53.57	11.05
	26	22.80	-42.52	11.05
70	26	27.19	-44.65	11.46

	32	27.19	-33.20	11.46
71	32	31.41	-35.60	11.79
	38	31.41	-23.81	11.79
72	38	35.03	-25.99	11.01
	44	35.03	-14.99	11.01
73	44	34.71	-15.64	8.31
	50	34.71	-8.99	8.31
74	50	31.80	-9.00	6.93
	56	31.80	-3.45	6.93
75	56	22.35	-3.75	4.22
	62	22.35	0.48	4.22
76	3	4.73	-95.21	14.65
	9	4.73	-80.55	14.65
77	9	10.40	-82.03	13.75
	15	10.40	-68.29	13.75
78	15	15.12	-70.74	13.42
	21	15.12	-57.33	13.42
79	21	18.99	-60.71	13.45
	27	18.99	-47.26	13.45
80	27	22.55	-51.67	13.87
	33	22.55	-37.80	13.87
81	33	26.43	-43.48	14.75
	39	26.43	-28.73	14.75
82	39	31.76	-36.22	16.28
	45	31.76	-19.94	16.28
83	45	38.39	-26.27	19.20
	51	38.39	-10.91	19.20
84	51	35.78	-9.13	14.91
	57	35.78	2.79	14.91
85	57	20.04	3.06	-1.18
	63	20.04	1.88	-1.18
86	4	3.31	-106.48	18.06
	10	3.31	-88.42	18.06
87	10	7.34	-90.35	16.66
	16	7.34	-73.69	16.66
88	16	10.62	-76.99	15.74
	22	10.62	-61.26	15.74
89	22	12.96	-65.69	15.36
	28	12.96	-50.34	15.36
90	28	14.44	-55.97	15.57
	34	14.44	-40.40	15.57
91	34	14.81	-47.67	17.10
	40	14.81	-30.57	17.10
92	40	12.75	-40.30	22.00
	46	12.75	-18.30	22.00
93	46	6.00	-25.18	24.92
	52	-6.00	-5.25	24.92
94	52	6.73	-11.63	39.95
	58	6.73	20.34	39.95
95	58	5.36	17.61	-19.65
	64	5.36	-2.04	-19.65
96	5	1.69	-113.41	19.99
	11	1.69	-93.42	19.99
97	11	3.75	-95.54	18.43
	17	3.75	-77.11	18.43
98	17	5.37	-80.77	17.30
	23	5.37	-63.46	17.30
99	23	6.33	-68.21	16.77
	29	6.33	-51.45	16.77

100	29	6.49	-56.94	16.75
	35	6.49	-40.19	16.75
101	35	5.55	-46.04	16.90
	41	5.55	-29.14	16.90
102	41	3.13	-34.89	16.75
	47	3.13	-18.14	16.75
103	47	-0.82	-21.46	19.42
	53	-0.82	-5.92	19.42
104	53	-0.16	-6.81	13.82
	59	-0.16	4.25	13.82
105	59	3.22	2.30	0.21
	65	3.22	2.51	0.21
106	6	0.00	-57.88	10.31
	12	0.00	-47.56	10.31
107	12	0.00	-48.65	9.51
	18	0.00	-39.13	9.51
108	18	0.00	-41.00	8.93
	24	0.00	-32.07	8.93
109	24	0.00	-34.45	8.64
	30	0.00	-25.81	8.64
110	30	0.00	-28.42	8.55
	36	0.00	-19.87	8.55
111	36	0.00	-22.33	8.41
	42	0.00	-13.92	8.41
112	42	-0.00	-15.65	7.50
	48	-0.00	-8.15	7.50
113	48	-0.00	-8.31	5.47
	54	-0.00	-3.94	5.47
114	54	-0.00	-3.49	3.95
	60	-0.00	-0.32	3.95
115	60	0.00	-0.75	1.75
	66	0.00	1.01	1.75

PROYECTO E-4 FECHA HOJA N.º 10

ARMADURAS

La fuerza de tracción más desfavorable es, realmente, de 833 t, por lo que hay que multiplicar los resultados del cálculo por:

$$\frac{833/2}{100} = 4.165.$$

MOMENTOS HORIZONTALES. -

Canto = 2.34 m

Barra 63: $Md = 1.6 \times 24.34 \times \frac{4.165}{1.27} = 127.7 \text{ mt/m} \rightarrow 13.0 \text{ cm}^2/\text{m}$

Barra 73: $Md = 1.6 \times 26.15 \times \frac{4.165}{1.27} = 137.2 \text{ mt/m} \rightarrow 13.9 \text{ cm}^2/\text{m}$

Barra 83: $Md = 1.6 \times 41.07 \times \frac{4.165}{1.27} = 215.5 \text{ mt/m} \rightarrow 22.0 \text{ cm}^2/\text{m}$

Barra 93: $Md = 1.6 \times 30.93 \times \frac{4.165}{1.27} = 162.3 \text{ mt/m} \rightarrow 16.5 \text{ cm}^2/\text{m}$

Barra 103: $Md = 1.6 \times 26.64 \times \frac{4.165}{1.27} = 139.8 \text{ mt/m} \rightarrow 14.2 \text{ cm}^2/\text{m}$

Barra 113: $Md = 1.6 \times 10.82 \times \frac{4.165}{0.631} = 113.6 \text{ mt/m} \rightarrow 11.5 \text{ cm}^2/\text{m}$

Canto 4.00

Barra 56: $Md = 1.6 \times 136.93 \times \frac{4.165}{1.27} = 718.5 \text{ mt/m} \rightarrow 42.3 \text{ cm}^2/\text{m}$

Barra 66: $Md = 1.6 \times 150.10 \times \frac{4.165}{1.27} = 787.6 \text{ mt/m} \rightarrow 46.4 \text{ cm}^2/\text{m}$

Barra 76: $Md = 1.6 \times 158.44 \times \frac{4.165}{1.27} = 822.3 \text{ mt/m} \rightarrow 48.9 \text{ cm}^2/\text{m}$

Barra 86: $Md = 1.6 \times 163.57 \times \frac{4.165}{1.27} = 858.1 \text{ mt/m} \rightarrow 50.6 \text{ cm}^2/\text{m}$

Barra 96: $Md = 1.6 \times 166.85 \times \frac{4.165}{1.20} = 875.5 \text{ mt/m} \rightarrow 51.6 \text{ cm}^2/\text{m}$

Barra 106: $Md = 1.6 \times 83.97 \times \frac{4.165}{0.631} = 881.4 \text{ mt/m} \rightarrow 52.0 \text{ cm}^2/\text{m}$

PROYECTO ..... FECHA .....

E-4 HOJA N.° 11

CORTANTE EN MUROS. —

Barra 73 $V_d = 1,6 \times 11,15 \times \frac{4165}{1127} = 5,25 \times 11,15 = 58,5$ t/m

83 $V_d = 5,25 \times 24,58 = 128,9$ t/m

93 $V_d = 5,25 \times 28,22 = 148,1$ t/m

103 $V_d = 5,25 \times 21,13 = 110,9$ t/m

113 $V_d = 5,25 \times 12,38 = 65,0$ t/m

$V_d = 148$ t/m

$V_u = 64,5 \times 2,25 = 146$ t/m

$V_{su} = 4$ t/m 1.2 cm²/m/m

mínima: $0,02 \times \frac{2500}{1,5} \times 1,00 \times \frac{1}{4,2} = 7,9$ cm²/m → c ø12/0,25/m

MOMENTOS HORIZONTALES. —

Barra H6 a 50 $M_d = 1,6 \times 22,0 \times \frac{4165}{0,90} = 163$ mt/m 16.6 cm²/m

41 a 45 $M_d = 1,6 \times 12,3 \times \frac{4165}{0,80} = 102$ mt/m 10,4 cm²/m

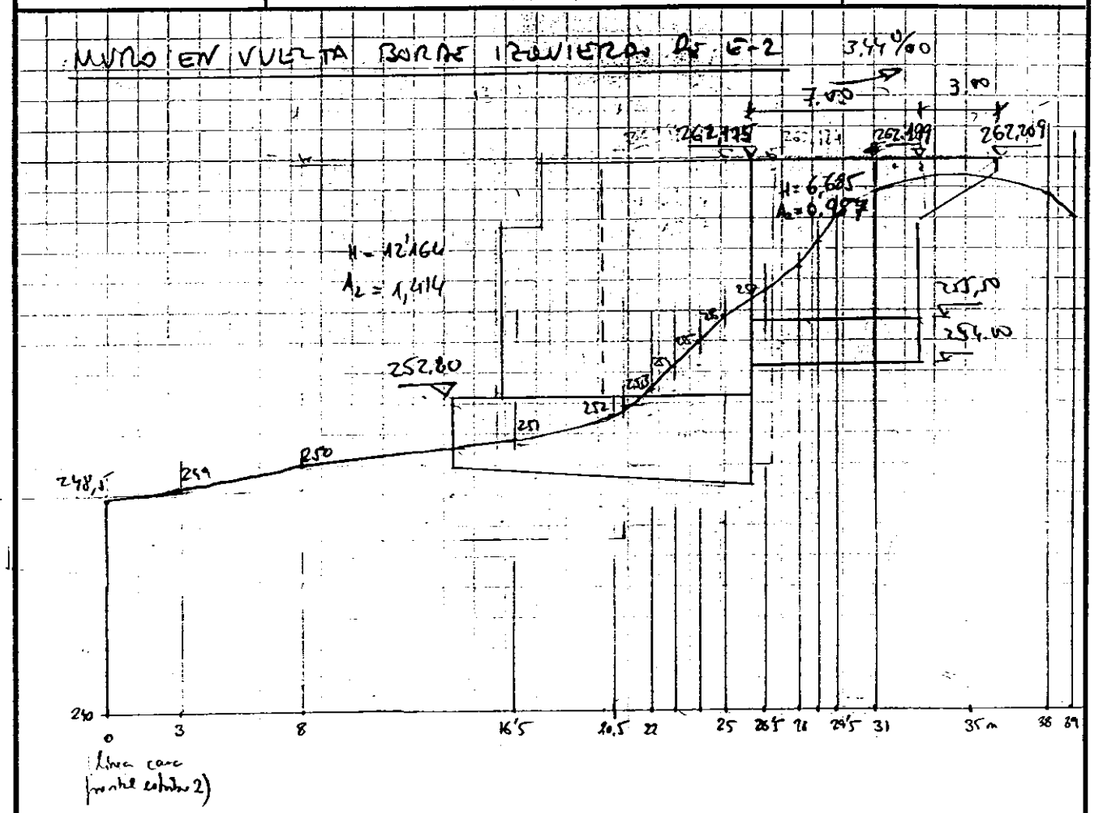
36 a 40 $M_d = 1,6 \times 21,20 \times \frac{4165}{0,90} = 157$ mt/m 16.0 cm²/m

31 a 35 $M_d = 1,6 \times 26,26 \times \frac{4165}{1,00} = 175$ mt/m 10,7 cm²/m

26 a 30 $M_d = 1,6 \times 17,46 \times \frac{4165}{1,00} = 117$ mt/m 6.8 cm²/m

PROYECTO TAV ZARAGOZA-LÉRIDA
SUBTRAMO 1
E-4. Estribo 2. FECHA

HOJA N.° 12



Tensión admisible sobre el terreno: 6 kp/cm².

x	y	x	y
3	249	28	258
8	250	28'7	259
16'5	251	29'5	260
20'5	252	31	261
22	253	38	261
23	254	39	260
24	255		
25	256		
26'5	257		

E-4. ESTRIBO 2. MURO EN VUELTA.

CARACTERISTICAS DEL RELLENO
==========

PESO ESPECIFICO (TN/M3)		=	2.00
ANGULO DE ROZAMIENTO FI		=	35.00
ANGULO ROZAMIENTO TERRENO-MURO		=	.00
ANGULO DE TALUD DEL TERRENO		=	.00
SOBRECARGA (TN/M2)		=	3.00
PENDIENTE DE INCLINACION DEL TRASDOS		=	.0830
COEFICIENTE SISMICO BASICO	C	=	.080
COEFICIENTE SISMICO	S	=	.080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		=	.327
COEFICIENTE DE EMPUJE ACTIVO		=	.303
COEFICIENTE DE EMPUJE ACTIVO VERTICAL		=	.025

CARACTERISTICAS DE LOS MATERIALES
==========

RESISTENCIA CARACTERISTICA DEL HORMIGON		=	250. KG/CM2
LIMITE ELASTICO DEL ACERO		=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS		=	.050 M

GEOMETRIA DEL MURO
==========

ALZADO DEL MURO

ANCHO EN CORONACION	A3	=	.40
ANCHO EN LA BASE	A2	=	.96
INCLINACION DEL TRASDOS	CTG(ALFA)	=	.08300
ALTURA TOTAL	H1	=	7.00
ALTURA DE TIERRAS	H	=	6.70

ZAPATA

VUELO DELANTERO	A1	=	1.50
VUELO TRASERO	A4	=	2.50
LONGITUD TOTAL	L	=	4.96
CANTO	C	=	1.50
RESGUARDO SOBRE ZAPATA		=	0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		=	LIBRE

ARMADURAS DEL ALZADO

TRASDOS. ZONA INFERIOR	AV.= 19.6 CM2/M	(FI 20 A	.150 M)
	AH.= 7.7 CM2/M	(FI 16 A	.250 M)
3.2 M. SUPERIORES	AV.= 9.8 CM2/M	(FI 20 A	.300 M)
	AH.= 6.4 CM2/M	(FI 12 A	.175 M)
INTRADOS	AV.= 3.1 CM2/M	(FI 12 A	.250 M)
	AH.= 7.7 CM2/M	(FI 16 A	.250 M)

ARMADURA DE ZAPATA

CARA INFERIOR.	A. PRINCIPAL =	7.7 CM2/M	(FI 16 A .250 M)
	A. DE REPARTO =	2.3 CM2/M	(FI 12 A .250 M)
CARA SUPERIOR.	A. PRINCIPAL =	12.0 CM2/M	(FI 20 A .250 M)
	A. DE REPARTO =	3.6 CM2/M	(FI 12 A .250 M)

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO. (S. ADM.= 21.08)

S1 = 26.35 SA = 19.79 SB = 15.59 S2 = 4.66

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.60
COEFICIENTE DE SEGURIDAD AL VUELCO = 2.70

TENSIONES EN EL TERRENO (TN/M2) CON SISMO. (S. ADM.= 20.20)

S11= 30.30 SA1= 21.35 SB1= 15.62 S21= .70

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.32
COEFICIENTE DE SEGURIDAD AL VUELCO = 2.27

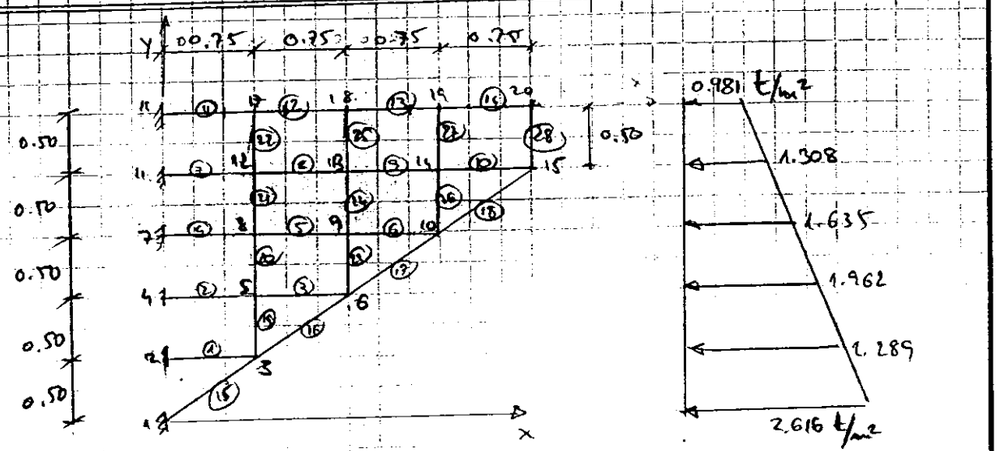
VOLUMEN DE HORMIGON = 12.20 M3. PESO DE ACERO = 393.3 KG

PROYECTO TAV ZARAGOZA - LÉRIDA
SUBTRAMO-1
E-4.

FECHA

HOJA N.º 15

CÁLCULO ALETA MURO EN VUELTA ESTRIBO-2



ARMADURA SUPERIOR:

$M_{2d} = 1'6 \times 0'4 \times 2'5 \times \left[0'5 \times 3 \times 1'5 + \frac{1}{2} \times 2 \times 3 \times \left(\frac{1}{3} \times 3\right)\right] + 3 \cdot 0'4 \times 3 \cdot 1'5 \times 1'6 = 10.34$

$A_S = 0.95\ cm^2 \longrightarrow 3\phi 16$.

ARMADURA HORIZONTAL: CÁLCULO EMPARRILLADO

INTERIOR $M_d = 1'85 \times 1'6 = 2'96\ mt \rightarrow \phi 16\ /0.20$.

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TAV ZARAGOZA-LLEIDA. E-4. ALETA ESTR.2

Hip. nº 1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	0.000000	0.000000
2	-0.000000	0.000000	0.000000
3	-0.000013	0.000068	0.000029
4	-0.000000	0.000000	0.000000
5	-0.000011	0.000084	0.000035
6	-0.000027	0.000129	0.000118
7	-0.000000	0.000000	0.000000
8	-0.000009	0.000095	0.000040
9	-0.000024	0.000140	0.000130
10	-0.000032	0.000159	0.000244
11	-0.000000	0.000000	0.000000
12	-0.000008	0.000104	0.000044
13	-0.000021	0.000148	0.000142
14	-0.000030	0.000163	0.000260
15	-0.000033	0.000167	0.000384
16	-0.000000	0.000000	0.000000
17	-0.000008	0.000110	0.000048
18	-0.000020	0.000154	0.000152
19	-0.000029	0.000167	0.000275
20	-0.000032	0.000167	0.000401

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	0.11	-0.43	0.05
2	0.13	-1.27	1.41
4	0.12	-1.47	1.36
7	0.10	-1.67	1.51
11	0.09	-1.85	1.64
16	0.04	-1.04	1.01

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	2	-0.13	-1.27	1.41
	3	-0.13	-0.53	0.56
2	4	-0.12	-1.47	1.36
	5	-0.12	-0.72	0.63
3	5	-0.16	-0.84	1.01
	6	-0.16	-0.36	0.27
4	7	-0.10	-1.67	1.51
	8	-0.10	-0.77	0.90
5	8	-0.16	-0.82	0.91
	9	-0.16	-0.37	0.30
6	9	-0.09	-0.42	0.68
	10	-0.09	-0.14	0.07
7	11	-0.09	-1.85	1.64
	12	-0.09	-0.80	1.15
8	12	-0.14	-0.87	1.02
	13	-0.14	-0.29	0.53
9	13	-0.10	-0.35	0.58
	14	-0.10	-0.09	0.09
10	14	-0.03	-0.12	0.38
	15	-0.03	-0.02	-0.11
11	16	-0.04	-1.04	1.01
	17	-0.04	-0.36	0.80
12	17	-0.06	-0.51	0.70
	18	-0.06	-0.06	0.49
13	18	-0.05	-0.21	0.43
	19	-0.05	0.03	0.21
14	19	-0.02	-0.05	0.18

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	20	-0.02	0.01	-0.03
15	1	0.14	-0.42	0.05
	3	0.14	-0.37	0.05
16	3	0.12	-0.56	0.44
	6	0.12	-0.17	0.44
17	6	0.06	-0.33	0.33
	10	0.06	-0.03	0.33
18	10	0.02	-0.11	0.15
	15	0.02	0.03	0.15
19	3	0.39	-0.01	0.17
	5	0.39	0.08	0.17
20	5	0.26	0.12	-0.21
	8	0.26	0.01	-0.21
21	8	0.22	0.08	-0.22
	12	0.22	-0.03	-0.22
22	12	0.15	0.02	-0.09
	17	0.15	-0.02	-0.09
23	6	0.26	-0.03	0.38
	9	0.26	0.16	0.38
24	9	0.20	0.09	-0.01
	13	0.20	0.08	-0.01
25	13	0.15	0.05	-0.06
	18	0.15	0.02	-0.06
26	10	0.10	-0.01	0.25
	14	0.10	0.12	0.25
27	14	0.08	0.05	-0.03
	19	0.08	0.03	-0.03
28	15	0.01	0.00	0.03
	20	0.01	0.02	0.03

ESTRUCTURA E-5

ESTRUCTURA E-5

ÍNDICE

4 CÁLCULOS (Continuación)

- Generalidades
- Programa general de puentes continuos

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2. CÁLCULO DE REACCIONES Y APOYOS
3. CÁLCULO DE PILAS
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   - 3.2. Cálculo de la cimentación
4. CÁLCULO DE ESTRIBOS
   - 4.1. Estribo 1 (Móvil)
   - 4.2. Estribo 2 (Fijo)

L.A.V. ZARAGOZA-LLEIDA

SUBTRAMO-I

E-5

GENERALIDADES

1.- **Normativa empleada**

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Union Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril" de 25 de junio de 1975.
- "L.A.V. Zaragoza-Lérida. Proyecto de Estructuras de Puentes de Ferrocarril. Bases del Cálculo" de 29 de julio de 1993.
- "Instrucción EP-93, para el proyecto y ejecución de obras de hormigón pretensado".
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

. Encepados y zapatas..... fck ≥ 250 Kp/cm²
. Pilotes..... fck ≥ 200 Kp/cm²
. Alzados de estribos ..... fck ≥ 250 kp/cm²
. Alzados de pilas ..... fck ≥ 300 Kp/cm²
. Tablero postesado..... fck ≥ 350 kp/cm²
. Coeficiente de seguridad ..... $\gamma_c = 1,5$

Armaduras activas

. Tensión de rotura ≥ 190 Kp/mm²
. Límite elástico ≥ 170 Kp/mm²
. Coeficiente de seguridad $\gamma_s = 1,1$

Armaduras pasivas

. Límite elástico ≥ 5100 Kp/cm²
. Coeficiente de seguridad $\gamma_s = 1,15$

Cargas

Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

3.- Criterios generales de cálculo

Para el cálculo de la estructura se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

El cálculo del viaducto se ha realizado básicamente en las siguientes fases:

- Tablero:
  - Cálculo longitudinal
  - Cálculo transversal
- Reacciones y aparatos de apoyo
- Pilas
- Estribos

La obtención de esfuerzos que permiten realizar el análisis longitudinal del tablero, se ha realizado con la ayuda de un programa de cálculo matricial basado en el método de la rigidez, discretizándose el tablero como viga contínua, sometida a las acciones de peso propio, carga permanente, sobrecarga, gradiente térmico y pretensado, tanto inicial como final, con sus correspondientes coeficientes de ponderación. De este cálculo como viga se obtienen los estados tensionales en servicio y la comprobación a rotura por flexión y cortante.

En el análisis transversal, se ha estudiado la flexión transversal, la armadura necesaria en el voladizo, el rasante y las costillas sobre pilas y estribos, en particular el anclaje del tablero al estribo.

En cuanto al cálculo de pilas y estribos se han tenido en cuenta, además de las acciones verticales, las horizontales debidas a los acortamientos por retracción, fluencia y temperatura, frenado, viento, empuje de tierras y efectos sísmicos.

En la distribución de acciones horizontales en los distintos elementos se han tenido en cuenta las distintas rigideces de éstos, tanto para cargas rápidas como de larga duración.

En la comprobación de las pilas se ha empleado un programa que tiene en cuenta los efectos de 2º orden, considerando la no linealidad, tanto geométrica como del material.

En la comprobación de los elementos de hormigón armado y pretensado, se ha tenido en cuenta lo prescrito en las Instrucciones correspondientes EH-91 y EP-93, respectivamente.

4.- Equipo redactor del proyecto

El cálculo del proyecto ha sido realizado por la oficina **SIEGRIST Y MORENO, S.L.**

Madrid, 25 de junio de 1997

Fdo.: Carlos Siegrist Fernández

PROGRAMA GENERAL DE PUENTES CONTINUOS (VI-0)

- Objeto del programa y campo de aplicación: El programa está diseñado para el cálculo matricial en teoría de primer orden de una viga contínua recta, teniendo en cuenta el proceso constructivo de la estructura. Se aplica a estructuras de varios vanos cuyo comportamiento pueda considerarse tipo viga. Permite la introducción de un coeficiente de excentricidad para tener en cuenta los efectos de cargas locales que hagan que el comportamiento tipo viga no se real.

- Identificación: Este programa ha sido desarrollado en la oficina SIEGRIST Y MORENO S.L. por Juan Moreno Torres y Miguel Angel Utrilla Arroyo. La última revisión del mismo, utilizada en estos calculos, se realizó en enero de 1994.

- Datos de entrada:

  - Definición de **vanos, cargas y características de los materiales** que componen la estructura.
  - Definición de **secciones de cálculo** en la estructura final con sus características geométricas.
  - Definición de **estados de la estructura**. (Proceso constructivo).
  - Definición de los **cables de pretensado** con los puntos singulares del trazado y fuerzas de tesado.

- Resultados:

  - **Esfuerzos** en las secciones de cálculo en las hipótesis:

    . Peso propio estructura en cada uno de los estados constructivos y peso propio de la estructura completa en los estados inicial y final (teniendo en cuenta el reajuste por fluencia). En todos los casos se tiene en cuenta la construcción por fases.
    . Cargas muertas
    . Temperatura
    . Descenso de apoyos
    . Envolvente de cortantes y momentos para sobrecarga tipo renfe y tipo UIC.

  - Definición general de los **cables de pretensado**, con su replanteo.

  - **Esfuerzos unitarios producidos por los cables de pretensado**, tanto en las estructuras parciales como en la completa.

  - **Coeficientes de pérdidas de pretensado** y resumen de familias de cables.

  - Esfuerzos de **pretensado** en estado inicial y final.

  - Tensiones en **construcción** en cada uno de los estados evolutivos. En

cada fase se calculan cuatro hipótesis: Pretensado con pérdidas instantáneas ponderado y sin ponderar; peso propio; y la suma de peso propio y pretensado ponderado.

  - **Tensiones en servicio** en estados inicial y final, ponderando el pretensado con 0,9 y 1,1 y considerando las diferentes envolventes de sobrecarga, así como la sobrecarga frecuente.

  - **Reacciones y giros** en cada una de las hipótesis en que se han dado esfuerzos.

  - **Comprobación a cortante**. En este apartado se detallan inicialmente los esfuerzos, tanto de cargas exteriores (envolvente de esfuerzos máximos y mínimos ponderados) como de pretensado, en cada una de las secciones de cálculo. A partir de estos esfuerzos el programa obtiene de acuerdo con la EP-93 el esfuerzo cortante reducido, así como la armadura necesaria en cada sección. También se obtiene la armadura mínima de las secciones y se comprueba la compresión en el hormigón (Vrd/Vu1).

  - **Comprobación a rotura**. Se calcula el momento de cálculo, (envolventes de momentos máximos y mínimos), el momento hiperestático de pretensado y el momento último de cada sección. En este cálculo se tiene en cuenta tanto el pretensado como la armadura pasiva del tablero. En los momentos totales se suma a los momentos de cálculo el momento hiperestático ponderado por 1.1 o por 0.9 según sea desfavorable o favorable.

1.- CALCULO TABLERO

CALCULO DEL TABLERO

Para el cálculo del tablero se han seguido los siguientes pasos:

- Sección transversal del tablero

- Cálculo longitudinal

  - Cálculo como viga contínua
  - Comprobación de tensiones
  - Comprobación a rotura por flexión
  - Combrobación a cortante
  - Cálculo armadura anclajes pretensado

- Cálculo transversal

  - Flexión transversal y torsión de la losa
  - Armadura de rasante
  - Cálculo a torsión
  - Costilla sobre pilas
  - Costilla apoyo en estribo fijo
  - Costilla apoyo en estribo móvil

- Cálculo de alargamientos de tesado

SECCION TRANSVERSAL

PROYECTO LAV ZARAGOZA - LERIDA
SUBTRAMO 1
PUENTES CAJON (E-3, E-4 y E-5)

FECHA

HOJA N.º

CALCULO DE VIENTO

Según la instrucción de acciones en puentes de ferrocarril.

presión básica: $q_w = 154 (2 - 0.7\lambda) = 200 \text{ kp/m}^2$

$\lambda = \frac{A_u}{A_{tot}} = 1$

Superficie a considerar: $S = 2.45$ (canto tablero) $+ 0.70$ (balasto + carril) $+ 3.50$ (tren) $= 6.65 \text{ m}^2/\text{m}$

Presión sobre el tablero: $0.2 \text{ T/m}^2 \times 6.65 \text{ m}^2/\text{m} = \underline{1.33 \text{ T/m}}$

Postes → E-3 y E-5 $S = \underline{2.40 \text{ m}^2/\text{m}}$ ⇒ Presión = $\underline{0.48 \text{ T/m}}$

E-4 $S = \underline{1.40 \text{ m}^2/\text{m}}$ ⇒ Presión = $\underline{0.28 \text{ T/m}}$

COEFICIENTE DE IMPACTO

- RENFE Según la instrucción:

Tramos apoyados continuos: $I = 65 \frac{\mu}{1 - \mu + \mu^2} = 23.5$ Se toma 24% ⇒ $\underline{I = 1.24}$

$\mu = \frac{V \cdot T}{2L} = 0.2874$

$V = 200 \text{ km/h} = 55.56 \text{ m/s}$ $L = 33 \text{ m}$

$T = \frac{2\pi}{\omega}$ $\omega = \sqrt{\frac{EJ\,\pi^4}{m\,l^4}}$ $EI = 3.5 \cdot 10^6 \times 6.828$

$T = 0.3414$

$m = \frac{1}{9.8} \left(\underbrace{8.84 \times 2.5}_{\text{p. propio}} + \underbrace{10.686}_{\text{c. perm}} + \underbrace{2.4}_{\text{sobrecarga}} \right) = 5.8$

UIC

$L_m = \frac{1}{7} (27 \times 2 + 33 \times 5) = 31.3 \text{ m}$ $L_\phi = 15 + 31.3 = 46.95$

Tomando ϕ_2 para 40-50 → $\underline{\text{IMPACTO} = 1.06}$

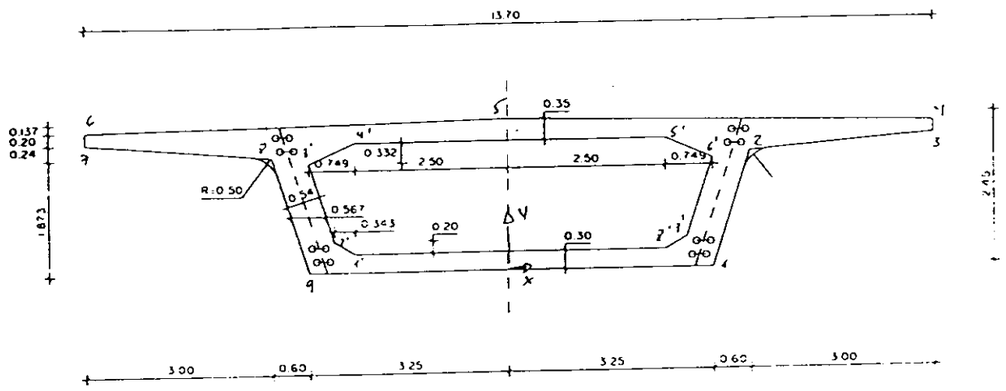
008

PROYECTO LAV ZARAGOZA - LLEIDA
SUBTRAMO - 1. SECCION CAJON

FECHA

HOJA N.º 1/5

SECCION TIPO
ESCALA 1:50
1:100



PUNTO	X	Y
1	3,25	0,0
2	3,85	1.873
3	6,85	2.113
4	6,85	2313
5	0,0	2.45
6	-6,85	2313
7	-6,85	2.113
8	-3 85	1873
9	-3 25	0,0

PUNTO	X	Y
1'	-2 50	0.30
2'	-2 843	0 50
3'	-3.249	1 768
4'	-2 50	2 10
5'	2 50	2 10
6'	3 249	1 768
7'	2 843	0 50
8'	2 50	0.30

Area 8,843 m^2

I_L : 6,828 m^4

I_T 100,99 m^4

$Y_{i\,I}$: 1.499 m

Y_s I: 0,951 m

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION ALIGERADA.

NUM. CONTORNOS 2

NUM. CIRCULOS 0

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

CONTORNO 2 PUNTOS 8	COORD. X	Y
1	-2.500	0.300
2	-2.843	0.500
3	-3.249	1.768
4	-2.500	2.100
5	2.500	2.100
6	3.249	1.768
7	2.843	0.500
8	2.500	0.300

FIBRA INFERIOR X	Y	FIBRA SUPERIOR X	Y
0.000	0.000	0.000	2.450

RESULTADOS

AREA = 8.84283 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.49870

********** EJES ORIGINALES **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 13.2527186	Ixx = 26.6898422	ANG. FI = 0.0000
My = 0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PARALELOS POR G **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

********** EJES PRINCIPALES **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = -0.0000000	Ixx = 6.8280296	ANG. FI = 0.0000
My = -0.0000000	Iyy = 100.9897156	
	Ixy = -0.0000003	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.49870 Ds = 0.95130
Wi = 4.55598 Ws = 7.17756
Radio Giro X-X = 0.87872 Radio Giro Y-Y= 3.37943

SECCION: TAV SUBTRAMO I. CAJON H=2.450m. SECCION MACIZA.

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 9	COORD. X	Y
1	3.250	0.000
2	3.850	1.873
3	6.850	2.113
4	6.850	2.313
5	0.000	2.450
6	-6.850	2.313
7	-6.850	2.113
8	-3.850	1.873
9	-3.250	0.000

FIBRA INFERIOR		FIBRA SUPERIOR	
X	Y	X	Y
0.000	0.000	0.000	2.450

RESULTADOS

AREA = 19.54475 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= 1.34198

********** EJES ORIGINALES **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 26.2286056	Ixx = 45.1849251	ANG. FI = 0.0000
My = 0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

********** EJES PARALELOS POR G **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 0.0000000	Ixx = 9.9867392	ANG. FI = 0.0000
My = -0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

********** EJES PRINCIPALES **********		
MOMENTOS ESTATICOS	INERCIAS	EJES PRINCIPALES
Mx = 0.0000000	Ixx = 9.9867392	ANG. FI = 0.0000
My = -0.0000000	Iyy = 132.8847198	
	Ixy = -0.0000006	

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G

Di = 1.34198 Ds = 1.10802
Wi = 7.44181 Ws = 9.01312
Radio Giro X-X = 0.71482 Radio Giro Y-Y= 2.60749

013

CALCULO LONGITUDINAL

014

CALCULO COMO VIGA CONTINUA

Los datos introducidos en el cálculo como viga contínua son:

- Definición de vanos de la estructura y estados de la misma.
- Hipótesis de cargas actuantes.
- Características de los materiales empleados.
- Características geométricas de las secciones en que se divide el tablero.
- Definición del pretensado (se introduce el cable medio).

A partir de estos datos se obtiene:

- Esfuerzos en las secciones de la viga para las distintas hipótesis de carga consideradas.
- Definición del pretensado, acciones unitarias de los cables y esfuerzos de pretensado
- Reacciones en las distintas hipótesis de cargas
- Tensiones ponderadas en los distintos estados de la estructura
- Cálculo a cortante
- Comprobación a rotura


```
Programa general de puentes continuos (V1-0)
--------------------------------------------


Proyecto : ZARAGOZA-LERIDA.T-1.E-5
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Definicion geometrica de vanos

	Longitud
Vano 1	27.0000 m
Vano 2	33.0000 m
Vano 3	33.0000 m
Vano 4	33.0000 m
Vano 5	33.0000 m
Vano 6	27.0000 m

Definicion de cargas

Cargas muertas (t.I) ..... = 0.780 t/m2
Cargas muertas (t.II)..... = 0.000 t/m

Sobrecarga repartida ..... = 0.000 t/m2

Tanque :

	Coeficientes de excentricidad			
	Flexion		Cortante	
	C.Vano	Apoyos	C.Vano	Apoyos
Vano 1	1.00	1.00	1.00	1.00
Vano 2	1.00	1.00	1.00	1.00
Vano 3	1.00	1.00	1.00	1.00
Vano 4	1.00	1.00	1.00	1.00
Vano 5	1.00	1.00	1.00	1.00
Vano 6	1.00	1.00	1.00	1.00

Ancho de aceras 1.300 m
Coef. de impacto para tren de RENFE 1.240
Coef. de impacto para tren de U.I.C. 1.060
Numero de vias 2

Temperatura :

Coef. de dilatacion termica de 1E-04
Gradiente lineal termico de ..... 5.000 grad

Caracteristicas de los materiales

Resistencia caracteristica del hormigon ..... =	350.00	kg/cm2
Densidad del hormigon ..... =	2.50	t/m3
Modulo de elasticidad del acero de pretensar .. =	19000.00	kg/mm2
Tension de rotura de los cables ..... =	190.00	kg/mm2
Porcentaje a que se tesan los cables ..... =	75.	%
Retraccion del hormigon ..... =	0.00025	
Coeficiente de relajacion del acero ..... =	0.06000	
Coeficiente de fluencia del hormigon ..... =	2.50000	
Coef. de ponderacion maximo del pretensado .... =	1.1000	
Coef. de ponderacion minimo del pretensado .... =	0.9000	
Coef. de perdidas finales en estado inicial ... =	0.3000	

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
1	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.700	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.400	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.100	0.951	1.499	2.45	8.84	6.8280	13.70
	5	10.800	0.951	1.499	2.45	8.84	6.8280	13.70
	6	13.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	16.200	0.951	1.499	2.45	8.84	6.8280	13.70
	8	18.900	0.951	1.499	2.45	8.84	6.8280	13.70
	9	21.600	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.300	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70
2	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
3	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
4	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
5	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	2.875	0.951	1.499	2.45	8.84	6.8280	13.70

Definicion de secciones de la estructura final

Vano	SE	X	Vs	Vi	Canto	Area	Inercia	Ancho
	3	5.750	0.951	1.499	2.45	8.84	6.8280	13.70
	4	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.375	0.951	1.499	2.45	8.84	6.8280	13.70
	6	16.500	0.951	1.499	2.45	8.84	6.8280	13.70
	7	20.625	0.951	1.499	2.45	8.84	6.8280	13.70
	8	24.750	0.951	1.499	2.45	8.84	6.8280	13.70
	9	27.250	0.951	1.499	2.45	8.84	6.8280	13.70
	10	30.125	0.951	1.499	2.45	8.84	6.8280	13.70
	11	33.000	0.951	1.499	2.45	8.84	6.8280	13.70
6	1	0.000	0.951	1.499	2.45	8.84	6.8280	13.70
	2	4.125	0.951	1.499	2.45	8.84	6.8280	13.70
	3	8.250	0.951	1.499	2.45	8.84	6.8280	13.70
	4	10.594	0.951	1.499	2.45	8.84	6.8280	13.70
	5	12.938	0.951	1.499	2.45	8.84	6.8280	13.70
	6	15.282	0.951	1.499	2.45	8.84	6.8280	13.70
	7	17.626	0.951	1.499	2.45	8.84	6.8280	13.70
	8	19.970	0.951	1.499	2.45	8.84	6.8280	13.70
	9	22.314	0.951	1.499	2.45	8.84	6.8280	13.70
	10	24.658	0.951	1.499	2.45	8.84	6.8280	13.70
	11	27.000	0.951	1.499	2.45	8.84	6.8280	13.70

Definicion de estados de la estructura

	Numero de secciones	Numero de secciones activas
Estado 1	14	de 1 a 14
Estado 2	24	de 14 a 24
Estado 3	34	de 24 a 34
Estado 4	44	de 34 a 44
Estado 5	53	de 44 a 53
Estado 6	61	de 53 a 61

Cable Numero 1 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 2 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 3 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 4 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 5 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 6 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Cable Numero 7 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 8 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 9 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 10 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 11 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 12 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Cable Numero 13 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 14 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 15 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 16 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 17 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 18 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Cable Numero 19 (Pertenece a familia 1)

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Numero 20 (Pertenece a familia 2)

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Numero 21 (Pertenece a familia 3)

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Numero 22 (Pertenece a familia 4)

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Numero 23 (Pertenece a familia 5)

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Numero 24 (Pertenece a familia 6)

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200

Puntos Singulares del trazado

Pto.	X	Y	Pend
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Cable Fase Final Numero 1

Definicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Cable Fase Final Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Cable Fase Final Numero 3

Definicion general

Seccion inicial ..... = 33 (98.750) Activa
Seccion final ..... = 39 (120.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Cable Fase Final Numero 4

Definicion general

Seccion inicial ..... = 43 (131.750) Activa
Seccion final ..... = 49 (153.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Esfuerzos acumulados por peso propio

Estado 1

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-270.58	0.00	0.00	0.00
	2	650.00	-210.90	0.00	9.05	-14.27
	3	1138.83	-151.21	0.00	15.86	-25.00
	4	1466.51	-91.51	0.00	20.43	-32.20
	5	1633.02	-31.82	0.00	22.74	-35.85
	6	1638.37	27.86	0.00	22.82	-35.97
	7	1482.55	87.56	0.00	20.65	-32.55
	8	1165.57	147.24	0.00	16.23	-25.59
	9	687.43	206.93	0.00	9.57	-15.09
	10	48.13	266.63	0.00	0.67	-1.06
	11	-752.34	326.32	0.00	-10.48	16.52
2	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 2

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-228.68	0.00	0.00	0.00
	2	536.85	-168.99	0.00	7.48	-11.79
	3	912.54	-109.30	0.00	12.71	-20.03
	4	1127.07	-49.61	0.00	15.70	-24.74
	5	1180.44	10.08	0.00	16.44	-25.91
	6	1072.64	69.77	0.00	14.94	-23.55
	7	803.68	129.46	0.00	11.19	-17.64
	8	373.55	189.15	0.00	5.20	-8.20
	9	-217.73	248.84	0.00	-3.03	4.78
	10	-970.18	308.53	0.00	-13.51	21.30
	11	-1883.80	368.22	0.00	-26.24	41.36
2	1	-1883.80	-399.06	0.00	-26.24	41.36
	2	-827.87	-335.50	0.00	-11.53	18.17
	3	45.33	-271.94	0.00	0.63	-1.00
	4	656.10	-216.67	0.00	9.14	-14.40
	5	1361.79	-125.48	0.00	18.97	-29.90
	6	1691.30	-34.29	0.00	23.56	-37.13
	7	1644.65	56.91	0.00	22.91	-36.11
	8	1221.82	148.10	0.00	17.02	-26.82
	9	782.49	203.37	0.00	10.90	-17.18
	10	106.44	266.93	0.00	1.48	-2.34
	11	-752.34	330.49	0.00	-10.48	16.52
3	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 3

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-239.93	0.00	0.00	0.00
	2	567.23	-180.24	0.00	7.90	-12.45
	3	973.29	-120.55	0.00	13.56	-21.37
	4	1218.20	-60.86	0.00	16.97	-26.74
	5	1301.93	-1.17	0.00	18.13	-28.58
	6	1224.51	58.52	0.00	17.05	-26.88
	7	985.92	118.21	0.00	13.73	-21.64
	8	586.17	177.90	0.00	8.16	-12.87
	9	25.26	237.59	0.00	0.35	-0.55
	10	-696.81	297.28	0.00	-9.71	15.30
	11	-1580.05	356.97	0.00	-22.01	34.69
2	1	-1580.05	-356.39	0.00	-22.01	34.69
	2	-646.82	-292.83	0.00	-9.01	14.20
	3	103.69	-229.27	0.00	1.44	-2.28
	4	607.77	-174.00	0.00	8.47	-13.34
	5	1137.43	-82.80	0.00	15.84	-24.97
	6	1290.91	8.39	0.00	17.98	-28.34
	7	1068.22	99.58	0.00	14.88	-23.45
	8	469.36	190.77	0.00	6.54	-10.30
	9	-76.66	246.04	0.00	-1.07	1.68
	10	-875.40	309.60	0.00	-12.19	19.22
	11	-1856.88	373.16	0.00	-25.86	40.77
3	1	-1856.88	-398.24	0.00	-25.86	40.77
	2	-803.29	-334.68	0.00	-11.19	17.64
	3	67.56	-271.13	0.00	0.94	-1.48
	4	676.29	-215.86	0.00	9.42	-14.85
	5	1378.61	-124.66	0.00	19.20	-30.27
	6	1704.77	-33.47	0.00	23.74	-37.43
	7	1654.75	57.72	0.00	23.05	-36.33
	8	1228.56	148.92	0.00	17.11	-26.97
	9	787.18	204.18	0.00	10.96	-17.28
	10	108.78	267.74	0.00	1.52	-2.39
	11	-752.34	331.30	0.00	-10.48	16.52
4	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-236.91	0.00	0.00	0.00
	2	559.09	-177.22	0.00	7.79	-12.27
	3	957.01	-117.53	0.00	13.33	-21.01
	4	1193.78	-57.84	0.00	16.63	-26.21
	5	1269.37	1.85	0.00	17.68	-27.87
	6	1183.81	61.54	0.00	16.49	-25.99
	7	937.08	121.23	0.00	13.05	-20.57
	8	529.19	180.92	0.00	7.37	-11.62
	9	-39.86	240.61	0.00	-0.56	0.87
	10	-770.07	300.30	0.00	-10.73	16.91
	11	-1661.45	359.99	0.00	-23.14	36.48
2	1	-1661.45	-367.82	0.00	-23.14	36.48
	2	-695.34	-304.26	0.00	-9.68	15.27
	3	88.05	-240.70	0.00	1.23	-1.93
	4	620.72	-185.43	0.00	8.65	-13.63
	5	1197.55	-94.24	0.00	16.68	-26.29
	6	1398.21	-3.05	0.00	19.47	-30.70
	7	1222.69	88.15	0.00	17.03	-26.84
	8	671.01	179.34	0.00	9.35	-14.73
	9	153.58	234.61	0.00	2.14	-3.37
	10	-612.28	298.17	0.00	-8.53	13.44
	11	-1560.88	361.73	0.00	-21.74	34.27
3	1	-1560.88	-355.86	0.00	-21.74	34.27
	2	-629.14	-292.30	0.00	-8.76	13.81
	3	119.86	-228.74	0.00	1.67	-2.63
	4	622.64	-173.47	0.00	8.67	-13.67
	5	1150.14	-82.28	0.00	16.02	-25.25
	6	1301.47	8.91	0.00	18.13	-28.57
	7	1076.62	100.10	0.00	15.00	-23.64
	8	475.61	191.30	0.00	6.62	-10.44
	9	-71.72	246.57	0.00	-1.00	1.57
	10	-871.96	310.13	0.00	-12.14	19.14
	11	-1854.94	373.68	0.00	-25.84	40.72
4	1	-1854.94	-398.18	0.00	-25.84	40.72
	2	-801.52	-334.63	0.00	-11.16	17.60
	3	69.16	-271.07	0.00	0.96	-1.52
	4	677.74	-215.80	0.00	9.44	-14.88
	5	1379.82	-124.60	0.00	19.22	-30.29
	6	1705.73	-33.41	0.00	23.76	-37.45
	7	1655.47	57.78	0.00	23.06	-36.34
	8	1229.04	148.98	0.00	17.12	-26.98
	9	787.52	204.24	0.00	10.97	-17.29
	10	108.95	267.80	0.00	1.52	-2.39
	11	-752.34	331.36	0.00	-10.48	16.52
5	1	-752.34	-182.39	0.00	-10.48	16.52
	2	-319.35	-118.83	0.00	-4.45	7.01

Esfuerzos acumulados por peso propio

Estado 4

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	-69.09	-55.27	0.00	-0.96	1.52
	4	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.72	0.00	0.00	0.00
	2	561.27	-178.03	0.00	7.82	-12.32
	3	961.37	-118.34	0.00	13.39	-21.11
	4	1200.32	-58.65	0.00	16.72	-26.35
	5	1278.10	1.04	0.00	17.80	-28.06
	6	1194.72	60.73	0.00	16.64	-26.23
	7	950.17	120.42	0.00	13.23	-20.86
	8	544.46	180.11	0.00	7.58	-11.95
	9	-22.41	239.80	0.00	-0.31	0.49
	10	-750.44	299.49	0.00	-10.45	16.48
	11	-1639.64	359.18	0.00	-22.84	36.00
2	1	-1639.64	-364.76	0.00	-22.84	36.00
	2	-682.33	-301.20	0.00	-9.50	14.98
	3	92.24	-237.64	0.00	1.28	-2.03
	4	617.25	-182.37	0.00	8.60	-13.55
	5	1181.44	-91.18	0.00	16.46	-25.94
	6	1369.46	0.02	0.00	19.07	-30.06
	7	1181.30	91.21	0.00	16.45	-25.93
	8	616.98	182.40	0.00	8.59	-13.54
	9	91.89	237.67	0.00	1.28	-2.02
	10	-682.79	301.23	0.00	-9.51	14.99
	11	-1640.19	364.79	0.00	-22.84	36.01
3	1	-1640.19	-367.22	0.00	-22.84	36.01
	2	-675.80	-303.66	0.00	-9.41	14.84
	3	105.85	-240.10	0.00	1.47	-2.32
	4	637.01	-184.83	0.00	8.87	-13.98
	5	1211.36	-93.64	0.00	16.87	-26.59
	6	1409.53	-2.44	0.00	19.63	-30.94
	7	1231.53	88.75	0.00	17.15	-27.04
	8	677.36	179.94	0.00	9.43	-14.87
	9	158.42	235.21	0.00	2.21	-3.48
	10	-609.17	298.77	0.00	-8.48	13.37
	11	-1559.50	362.33	0.00	-21.72	34.24
4	1	-1559.50	-355.83	0.00	-21.72	34.24
	2	-627.87	-292.27	0.00	-8.74	13.78
	3	121.03	-228.71	0.00	1.69	-2.66
	4	623.71	-173.44	0.00	8.69	-13.69
	5	1151.05	-82.24	0.00	16.03	-25.27
	6	1302.23	8.95	0.00	18.14	-28.59
	7	1077.23	100.14	0.00	15.00	-23.65
	8	476.06	191.33	0.00	6.63	-10.45
	9	-71.36	246.60	0.00	-0.99	1.57
	10	-871.72	310.16	0.00	-12.14	19.14
	11	-1854.80	373.72	0.00	-25.83	40.72
5	1	-1854.80	-398.18	0.00	-25.83	40.72
	2	-801.40	-334.62	0.00	-11.16	17.59

Esfuerzos acumulados por peso propio

Estado 5

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	69.28	-271.06	0.00	0.96	-1.52
	4	677.85	-215.79	0.00	9.44	-14.88
	5	1379.91	-124.60	0.00	19.22	-30.29
	6	1705.80	-33.41	0.00	23.76	-37.45
	7	1655.52	57.79	0.00	23.06	-36.34
	8	1229.07	148.98	0.00	17.12	-26.98
	9	787.54	204.25	0.00	10.97	-17.29
	10	108.96	267.81	0.00	1.52	-2.39
	11	-752.35	331.37	0.00	-10.48	16.52
6	1	-752.35	-182.39	0.00	-10.48	16.52
	2	-188.09	-91.19	0.00	-2.62	4.13
	3	0.00	0.00	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estado 6

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.58	0.00	0.00	0.00
	2	560.89	-177.89	0.00	7.81	-12.31
	3	960.62	-118.20	0.00	13.38	-21.09
	4	1199.18	-58.51	0.00	16.70	-26.33
	5	1276.58	1.18	0.00	17.78	-28.03
	6	1192.82	60.87	0.00	16.61	-26.19
	7	947.89	120.56	0.00	13.20	-20.81
	8	541.80	180.25	0.00	7.55	-11.89
	9	-25.45	239.94	0.00	-0.35	0.56
	10	-753.86	299.63	0.00	-10.50	16.55
	11	-1643.44	359.32	0.00	-22.89	36.08
2	1	-1643.44	-365.29	0.00	-22.89	36.08
	2	-684.60	-301.73	0.00	-9.54	15.03
	3	91.51	-238.17	0.00	1.27	-2.01
	4	617.86	-182.90	0.00	8.61	-13.56
	5	1184.25	-91.71	0.00	16.49	-26.00
	6	1374.46	-0.52	0.00	19.14	-30.17
	7	1188.51	90.68	0.00	16.55	-26.09
	8	626.39	181.87	0.00	8.72	-13.75
	9	102.63	237.14	0.00	1.43	-2.25
	10	-670.51	300.70	0.00	-9.34	14.72
	11	-1626.38	364.26	0.00	-22.65	35.71
3	1	-1626.38	-365.24	0.00	-22.65	35.71
	2	-667.68	-301.68	0.00	-9.30	14.66
	3	108.29	-238.12	0.00	1.51	-2.38
	4	634.51	-182.85	0.00	8.84	-13.93
	5	1200.70	-91.66	0.00	16.72	-26.36
	6	1390.72	-0.47	0.00	19.37	-30.53
	7	1204.56	90.73	0.00	16.78	-26.44
	8	642.24	181.92	0.00	8.95	-14.10
	9	118.36	237.19	0.00	1.65	-2.60
	10	-654.92	300.75	0.00	-9.12	14.38
	11	-1610.93	364.31	0.00	-22.44	35.37
4	1	-1610.93	-363.20	0.00	-22.44	35.37
	2	-658.10	-299.64	0.00	-9.17	14.45
	3	112.00	-236.08	0.00	1.56	-2.46
	4	633.12	-180.81	0.00	8.82	-13.90
	5	1190.88	-89.62	0.00	16.59	-26.14
	6	1372.48	1.57	0.00	19.12	-30.13
	7	1177.90	92.77	0.00	16.41	-25.86
	8	607.15	183.96	0.00	8.46	-13.33
	9	78.17	239.23	0.00	1.09	-1.72
	10	-700.98	302.79	0.00	-9.76	15.39
	11	-1662.86	366.35	0.00	-23.16	36.51
5	1	-1662.86	-370.66	0.00	-23.16	36.51
	2	-688.59	-307.10	0.00	-9.59	15.12

Esfuerzos acumulados por peso propio

Estado 6

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	102.96	-243.54	0.00	1.43	-2.26
	4	642.72	-188.27	0.00	8.95	-14.11
	5	1231.25	-97.08	0.00	17.15	-27.03
	6	1443.61	-5.88	0.00	20.11	-31.69
	7	1279.80	85.31	0.00	17.82	-28.10
	8	739.82	176.50	0.00	10.30	-16.24
	9	229.48	231.77	0.00	3.20	-5.04
	10	-528.23	295.33	0.00	-7.36	11.60
	11	-1468.66	358.89	0.00	-20.46	32.24
6	1	-1468.66	-352.85	0.00	-20.46	32.24
	2	-201.26	-261.65	0.00	-2.80	4.42
	3	689.97	-170.46	0.00	9.61	-15.15
	4	1028.80	-118.64	0.00	14.33	-22.59
	5	1246.15	-66.82	0.00	17.36	-27.36
	6	1342.05	-15.00	0.00	18.69	-29.46
	7	1316.47	36.82	0.00	18.34	-28.90
	8	1169.43	88.64	0.00	16.29	-25.67
	9	900.92	140.46	0.00	12.55	-19.78
	10	510.95	192.28	0.00	7.12	-11.22
	11	0.00	244.06	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-237.58	0.00	0.00	0.00
	2	560.89	-177.89	0.00	7.81	-12.31
	3	960.62	-118.20	0.00	13.38	-21.09
	4	1199.18	-58.51	0.00	16.70	-26.33
	5	1276.58	1.18	0.00	17.78	-28.03
	6	1192.82	60.87	0.00	16.61	-26.19
	7	947.89	120.56	0.00	13.20	-20.81
	8	541.80	180.25	0.00	7.55	-11.89
	9	-25.45	239.94	0.00	-0.35	0.56
	10	-753.86	299.63	0.00	-10.50	16.55
	11	-1643.44	359.32	0.00	-22.89	36.08
2	1	-1643.44	-365.29	0.00	-22.89	36.08
	2	-684.60	-301.73	0.00	-9.54	15.03
	3	91.51	-238.17	0.00	1.27	-2.01
	4	617.86	-182.90	0.00	8.61	-13.56
	5	1184.25	-91.71	0.00	16.49	-26.00
	6	1374.46	-0.52	0.00	19.14	-30.17
	7	1188.51	90.68	0.00	16.55	-26.09
	8	626.39	181.87	0.00	8.72	-13.75
	9	102.63	237.14	0.00	1.43	-2.25
	10	-670.51	300.70	0.00	-9.34	14.72
	11	-1626.38	364.26	0.00	-22.65	35.71
3	1	-1626.38	-365.24	0.00	-22.65	35.71
	2	-667.68	-301.68	0.00	-9.30	14.66
	3	108.29	-238.12	0.00	1.51	-2.38
	4	634.51	-182.85	0.00	8.84	-13.93
	5	1200.70	-91.66	0.00	16.72	-26.36
	6	1390.72	-0.47	0.00	19.37	-30.53
	7	1204.56	90.73	0.00	16.78	-26.44
	8	642.24	181.92	0.00	8.95	-14.10
	9	118.36	237.19	0.00	1.65	-2.60
	10	-654.92	300.75	0.00	-9.12	14.38
	11	-1610.93	364.31	0.00	-22.44	35.37
4	1	-1610.93	-363.20	0.00	-22.44	35.37
	2	-658.10	-299.64	0.00	-9.17	14.45
	3	112.00	-236.08	0.00	1.56	-2.46
	4	633.12	-180.81	0.00	8.82	-13.90
	5	1190.88	-89.62	0.00	16.59	-26.14
	6	1372.48	1.57	0.00	19.12	-30.13
	7	1177.90	92.77	0.00	16.41	-25.86
	8	607.15	183.96	0.00	8.46	-13.33
	9	78.17	239.23	0.00	1.09	-1.72
	10	-700.98	302.79	0.00	-9.76	15.39
	11	-1662.86	366.35	0.00	-23.16	36.51
5	1	-1662.86	-370.66	0.00	-23.16	36.51
	2	-688.59	-307.10	0.00	-9.59	15.12

Esfuerzos acumulados por peso propio

Estructura completa estado inicial

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	102.96	-243.54	0.00	1.43	-2.26
	4	642.72	-188.27	0.00	8.95	-14.11
	5	1231.25	-97.08	0.00	17.15	-27.03
	6	1443.61	-5.88	0.00	20.11	-31.69
	7	1279.80	85.31	0.00	17.82	-28.10
	8	739.82	176.50	0.00	10.30	-16.24
	9	229.48	231.77	0.00	3.20	-5.04
	10	-528.23	295.33	0.00	-7.36	11.60
	11	-1468.66	358.89	0.00	-20.46	32.24
6	1	-1468.66	-352.85	0.00	-20.46	32.24
	2	-201.26	-261.65	0.00	-2.80	4.42
	3	689.97	-170.46	0.00	9.61	-15.15
	4	1028.80	-118.64	0.00	14.33	-22.59
	5	1246.15	-66.82	0.00	17.36	-27.36
	6	1342.05	-15.00	0.00	18.69	-29.46
	7	1316.47	36.82	0.00	18.34	-28.90
	8	1169.43	88.64	0.00	16.29	-25.67
	9	900.92	140.46	0.00	12.55	-19.78
	10	510.95	192.28	0.00	7.12	-11.22
	11	0.00	244.06	0.00	0.00	0.00

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-225.11	0.00	0.00	0.00
	2	527.22	-165.42	0.00	7.34	-11.57
	3	893.27	-105.73	0.00	12.44	-19.61
	4	1098.16	-46.04	0.00	15.30	-24.11
	5	1141.88	13.65	0.00	15.90	-25.07
	6	1024.45	73.34	0.00	14.27	-22.49
	7	745.85	133.03	0.00	10.39	-16.37
	8	306.08	192.72	0.00	4.26	-6.72
	9	-294.84	252.41	0.00	-4.11	6.47
	10	-1056.93	312.10	0.00	-14.72	23.20
	11	-1980.18	371.79	0.00	-27.58	43.47
2	1	-1980.18	-364.96	0.00	-27.58	43.47
	2	-1022.29	-301.40	0.00	-14.24	22.44
	3	-247.13	-237.84	0.00	-3.44	5.43
	4	278.39	-182.57	0.00	3.88	-6.11
	5	843.42	-91.38	0.00	11.75	-18.52
	6	1032.28	-0.19	0.00	14.38	-22.66
	7	844.96	91.01	0.00	11.77	-18.55
	8	281.48	182.20	0.00	3.92	-6.18
	9	-243.10	237.47	0.00	-3.39	5.34
	10	-1017.19	301.03	0.00	-14.17	22.33
	11	-1974.01	364.59	0.00	-27.49	43.34
3	1	-1974.01	-364.76	0.00	-27.49	43.34
	2	-1016.68	-301.20	0.00	-14.16	22.32
	3	-242.08	-237.64	0.00	-3.37	5.31
	4	282.94	-182.38	0.00	3.94	-6.21
	5	847.16	-91.18	0.00	11.80	-18.60
	6	1035.20	0.01	0.00	14.42	-22.73
	7	847.08	91.20	0.00	11.80	-18.60
	8	282.78	182.40	0.00	3.94	-6.21
	9	-242.29	237.66	0.00	-3.37	5.32
	10	-1016.95	301.22	0.00	-14.16	22.33
	11	-1974.33	364.78	0.00	-27.50	43.34
4	1	-1974.33	-364.69	0.00	-27.50	43.34
	2	-1017.21	-301.13	0.00	-14.17	22.33
	3	-242.82	-237.57	0.00	-3.38	5.33
	4	282.03	-182.31	0.00	3.93	-6.19
	5	845.96	-91.11	0.00	11.78	-18.57
	6	1033.71	0.08	0.00	14.40	-22.69
	7	845.29	91.27	0.00	11.77	-18.56
	8	280.70	182.47	0.00	3.91	-6.16
	9	-244.56	237.74	0.00	-3.41	5.37
	10	-1019.41	301.29	0.00	-14.20	22.38
	11	-1977.00	364.85	0.00	-27.54	43.40
5	1	-1977.00	-365.11	0.00	-27.54	43.40
	2	-1018.67	-301.55	0.00	-14.19	22.36

Esfuerzos acumulados por peso propio

Estructura completa estado final

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	-243.08	-237.99	0.00	-3.39	5.34
	4	282.82	-182.72	0.00	3.94	-6.21
	5	848.47	-91.53	0.00	11.82	-18.63
	6	1037.95	-0.34	0.00	14.46	-22.79
	7	851.26	90.85	0.00	11.86	-18.69
	8	288.40	182.05	0.00	4.02	-6.33
	9	-235.80	237.32	0.00	-3.28	5.18
	10	-1009.46	300.88	0.00	-14.06	22.16
	11	-1965.84	364.44	0.00	-27.38	43.16
6	1	-1965.84	-371.26	0.00	-27.38	43.16
	2	-622.48	-280.07	0.00	-8.67	13.67
	3	344.71	-188.87	0.00	4.80	-7.57
	4	726.70	-137.05	0.00	10.12	-15.95
	5	987.22	-85.23	0.00	13.75	-21.67
	6	1126.27	-33.41	0.00	15.69	-24.73
	7	1143.86	18.41	0.00	15.93	-25.11
	8	1039.98	70.23	0.00	14.48	-22.83
	9	814.64	122.05	0.00	11.35	-17.88
	10	467.83	173.87	0.00	6.52	-10.27
	11	0.00	225.64	0.00	0.00	0.00

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-108.27	0.00	0.00	0.00
	2	253.38	-79.42	0.00	3.53	-5.56
	3	428.86	-50.57	0.00	5.97	-9.42
	4	526.44	-21.72	0.00	7.33	-11.56
	5	546.12	7.14	0.00	7.61	-11.99
	6	487.90	35.99	0.00	6.80	-10.71
	7	351.78	64.84	0.00	4.90	-7.72
	8	137.76	93.69	0.00	1.92	-3.02
	9	-154.16	122.54	0.00	-2.15	3.38
	10	-523.99	151.40	0.00	-7.30	11.50
	11	-971.71	180.25	0.00	-13.53	21.33
2	1	-971.71	-176.39	0.00	-13.53	21.33
	2	-508.74	-145.67	0.00	-7.09	11.17
	3	-134.09	-114.95	0.00	-1.87	2.94
	4	119.89	-88.24	0.00	1.67	-2.63
	5	392.95	-44.16	0.00	5.47	-8.63
	6	484.18	-0.08	0.00	6.74	-10.63
	7	393.58	44.00	0.00	5.48	-8.64
	8	121.15	88.08	0.00	1.69	-2.66
	9	-132.45	114.80	0.00	-1.84	2.91
	10	-506.66	145.52	0.00	-7.06	11.12
	11	-969.20	176.24	0.00	-13.50	21.28
3	1	-969.20	-176.29	0.00	-13.50	21.28
	2	-506.52	-145.57	0.00	-7.05	11.12
	3	-132.16	-114.85	0.00	-1.84	2.90
	4	121.57	-88.13	0.00	1.69	-2.67
	5	394.21	-44.06	0.00	5.49	-8.65
	6	485.02	0.03	0.00	6.76	-10.65
	7	394.00	44.10	0.00	5.49	-8.65
	8	121.15	88.18	0.00	1.69	-2.66
	9	-132.71	114.90	0.00	-1.85	2.91
	10	-507.21	145.62	0.00	-7.06	11.14
	11	-970.04	176.34	0.00	-13.51	21.30
4	1	-970.04	-176.34	0.00	-13.51	21.30
	2	-507.21	-145.62	0.00	-7.06	11.14
	3	-132.71	-114.90	0.00	-1.85	2.91
	4	121.15	-88.18	0.00	1.69	-2.66
	5	394.00	-44.10	0.00	5.49	-8.65
	6	485.02	-0.03	0.00	6.76	-10.65
	7	394.21	44.06	0.00	5.49	-8.65
	8	121.57	88.13	0.00	1.69	-2.67
	9	-132.16	114.85	0.00	-1.84	2.90
	10	-506.52	145.57	0.00	-7.05	11.12
	11	-969.20	176.29	0.00	-13.50	21.28
5	1	-969.20	-176.24	0.00	-13.50	21.28
	2	-506.66	-145.52	0.00	-7.06	11.12

Esfuerzos debidos a cargas muertas

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	-132.45	-114.80	0.00	-1.84	2.91
	4	121.15	-88.08	0.00	1.69	-2.66
	5	393.58	-44.00	0.00	5.48	-8.64
	6	484.18	0.08	0.00	6.74	-10.63
	7	392.95	44.16	0.00	5.47	-8.63
	8	119.89	88.24	0.00	1.67	-2.63
	9	-134.09	114.95	0.00	-1.87	2.94
	10	-508.74	145.67	0.00	-7.09	11.17
	11	-971.71	176.39	0.00	-13.53	21.33
6	1	-971.71	-180.25	0.00	-13.53	21.33
	2	-319.09	-136.17	0.00	-4.44	7.01
	3	151.70	-92.09	0.00	2.11	-3.33
	4	338.20	-67.04	0.00	4.71	-7.42
	5	465.99	-42.00	0.00	6.49	-10.23
	6	535.07	-16.95	0.00	7.45	-11.75
	7	545.44	8.10	0.00	7.60	-11.97
	8	497.09	33.15	0.00	6.92	-10.91
	9	390.04	58.20	0.00	5.43	-8.56
	10	224.27	83.25	0.00	3.12	-4.92
	11	0.00	108.27	0.00	0.00	0.00

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	0.00	-22.67	0.00	0.00	0.00
	2	61.20	-22.67	0.00	0.85	-1.34
	3	122.41	-22.67	0.00	1.70	-2.69
	4	183.61	-22.67	0.00	2.56	-4.03
	5	244.82	-22.67	0.00	3.41	-5.37
	6	306.02	-22.67	0.00	4.26	-6.72
	7	367.23	-22.67	0.00	5.11	-8.06
	8	428.43	-22.67	0.00	5.97	-9.41
	9	489.64	-22.67	0.00	6.82	-10.75
	10	550.84	-22.67	0.00	7.67	-12.09
	11	612.05	-22.67	0.00	8.52	-13.44
2	1	612.05	4.66	0.00	8.52	-13.44
	2	598.64	4.66	0.00	8.34	-13.14
	3	585.22	4.66	0.00	8.15	-12.85
	4	573.56	4.66	0.00	7.99	-12.59
	5	554.32	4.66	0.00	7.72	-12.17
	6	535.08	4.66	0.00	7.45	-11.75
	7	515.83	4.66	0.00	7.18	-11.32
	8	496.59	4.66	0.00	6.92	-10.90
	9	484.93	4.66	0.00	6.75	-10.65
	10	471.51	4.66	0.00	6.57	-10.35
	11	458.10	4.66	0.00	6.38	-10.06
3	1	458.10	-1.56	0.00	6.38	-10.06
	2	462.58	-1.56	0.00	6.44	-10.16
	3	467.05	-1.56	0.00	6.51	-10.25
	4	470.94	-1.56	0.00	6.56	-10.34
	5	477.35	-1.56	0.00	6.65	-10.48
	6	483.77	-1.56	0.00	6.74	-10.62
	7	490.19	-1.56	0.00	6.83	-10.76
	8	496.61	-1.56	0.00	6.92	-10.90
	9	500.50	-1.56	0.00	6.97	-10.99
	10	504.97	-1.56	0.00	7.03	-11.09
	11	509.44	-1.56	0.00	7.10	-11.18
4	1	509.44	1.56	0.00	7.10	-11.18
	2	504.96	1.56	0.00	7.03	-11.09
	3	500.48	1.56	0.00	6.97	-10.99
	4	496.59	1.56	0.00	6.92	-10.90
	5	490.16	1.56	0.00	6.83	-10.76
	6	483.74	1.56	0.00	6.74	-10.62
	7	477.31	1.56	0.00	6.65	-10.48
	8	470.89	1.56	0.00	6.56	-10.34
	9	466.99	1.56	0.00	6.50	-10.25
	10	462.51	1.56	0.00	6.44	-10.15
	11	458.03	1.56	0.00	6.38	-10.06
5	1	458.03	-4.68	0.00	6.38	-10.06
	2	471.47	-4.68	0.00	6.57	-10.35

Esfuerzos debidos a temperatura

V.	SE	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	484.92	-4.68	0.00	6.75	-10.65
	4	496.61	-4.68	0.00	6.92	-10.90
	5	515.89	-4.68	0.00	7.19	-11.33
	6	535.18	-4.68	0.00	7.45	-11.75
	7	554.47	-4.68	0.00	7.72	-12.17
	8	573.75	-4.68	0.00	7.99	-12.60
	9	585.44	-4.68	0.00	8.15	-12.85
	10	598.89	-4.68	0.00	8.34	-13.15
	11	612.33	-4.68	0.00	8.53	-13.44
6	1	612.33	22.68	0.00	8.53	-13.44
	2	518.78	22.68	0.00	7.23	-11.39
	3	425.23	22.68	0.00	5.92	-9.34
	4	372.07	22.68	0.00	5.18	-8.17
	5	318.91	22.68	0.00	4.44	-7.00
	6	265.75	22.68	0.00	3.70	-5.83
	7	212.59	22.68	0.00	2.96	-4.67
	8	159.43	22.68	0.00	2.22	-3.50
	9	106.27	22.68	0.00	1.48	-2.33
	10	53.11	22.68	0.00	0.74	-1.17
	11	0.00	22.68	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	69.17	0.00	0.00	0.00	0.00
		Q(-)	-370.77	0.00	0.00	0.00	0.00
	2	Q(+)	69.17	-186.75	0.00	2.60	-4.10
		Q(-)	-288.68	890.26	0.00	-12.40	19.54
	3	Q(+)	69.17	-373.51	0.00	5.20	-8.20
		Q(-)	-206.59	1558.87	0.00	-21.71	34.22
	4	Q(+)	69.17	-560.26	0.00	7.80	-12.30
		Q(-)	-124.49	2005.83	0.00	-27.94	44.04
	5	Q(+)	69.17	-747.01	0.00	10.40	-16.40
		Q(-)	-42.40	2231.14	0.00	-31.08	48.98
	6	Q(+)	108.27	1308.96	0.00	-18.23	28.74
		Q(-)	-18.47	249.38	0.00	-3.47	5.47
	7	Q(+)	190.37	905.80	0.00	-12.62	19.89
		Q(-)	-18.47	299.25	0.00	-4.17	6.57
	8	Q(+)	272.46	280.99	0.00	-3.91	6.17
		Q(-)	-18.47	349.13	0.00	-4.86	7.66
	9	Q(+)	354.55	-565.47	0.00	7.88	-12.41
		Q(-)	-18.47	399.00	0.00	-5.56	8.76
	10	Q(+)	436.64	-1633.59	0.00	22.75	-35.86
		Q(-)	-18.47	448.88	0.00	-6.25	9.85
	11	Q(+)	518.74	-2923.35	0.00	40.72	-64.18
		Q(-)	-18.47	498.75	0.00	-6.95	10.95
2	1	Q(+)	70.07	498.75	0.00	-6.95	10.95
		Q(-)	-543.95	-2904.71	0.00	40.46	-63.77
	2	Q(+)	70.07	297.29	0.00	-4.14	6.53
		Q(-)	-459.30	-1489.35	0.00	20.74	-32.70
	3	Q(+)	70.07	95.83	0.00	-1.33	2.10
		Q(-)	-372.51	-292.99	0.00	4.08	-6.43
	4	Q(+)	70.07	-79.35	0.00	1.11	-1.74
		Q(-)	-296.49	543.26	0.00	-7.57	11.93
	5	Q(+)	70.07	-368.40	0.00	5.13	-8.09
		Q(-)	-171.07	1507.62	0.00	-21.00	33.10
	6	Q(+)	70.07	-657.45	0.00	9.16	-14.43
		Q(-)	-63.41	1586.63	0.00	-22.10	34.83
	7	Q(+)	183.13	1315.23	0.00	-18.32	28.87
		Q(-)	-51.72	-279.33	0.00	3.89	-6.13
	8	Q(+)	308.55	301.13	0.00	-4.19	6.61
		Q(-)	-51.72	-66.00	0.00	0.92	-1.45
	9	Q(+)	384.57	-565.27	0.00	7.87	-12.41
		Q(-)	-51.72	63.29	0.00	-0.88	1.39
	10	Q(+)	471.36	-1796.69	0.00	25.02	-39.44
		Q(-)	-51.72	211.97	0.00	-2.95	4.65
	11	Q(+)	553.61	-3183.22	0.00	44.34	-69.88
		Q(-)	-51.72	360.65	0.00	-5.02	7.92
3	1	Q(+)	68.74	480.08	0.00	-6.69	10.54
		Q(-)	-554.73	-3185.45	0.00	44.37	-69.93
	2	Q(+)	68.74	282.45	0.00	-3.93	6.20
		Q(-)	-468.94	-1712.69	0.00	23.85	-37.60

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	68.74	84.83	0.00	-1.18	1.86
		Q(-)	-382.15	-488.61	0.00	6.81	-10.73
	4	Q(+)	68.74	-87.02	0.00	1.21	-1.91
		Q(-)	-306.14	371.74	0.00	-5.18	8.16
	5	Q(+)	68.74	-370.56	0.00	5.16	-8.14
		Q(-)	-180.73	923.60	0.00	-12.86	20.28
	6	Q(+)	72.88	1421.33	0.00	-19.80	31.20
		Q(-)	-75.77	1452.64	0.00	-20.23	31.89
	7	Q(+)	183.66	1333.85	0.00	-18.58	29.28
		Q(-)	-66.58	-359.57	0.00	5.01	-7.89
	8	Q(+)	309.08	317.58	0.00	-4.42	6.97
		Q(-)	-66.58	-84.93	0.00	1.18	-1.86
	9	Q(+)	385.09	-550.13	0.00	7.66	-12.08
		Q(-)	-66.58	81.52	0.00	-1.14	1.79
	10	Q(+)	471.88	-1783.06	0.00	24.83	-39.14
		Q(-)	-66.58	272.94	0.00	-3.80	5.99
	11	Q(+)	554.91	-3191.87	0.00	44.46	-70.07
		Q(-)	-66.58	464.35	0.00	-6.47	10.19
4	1	Q(+)	66.58	464.37	0.00	-6.47	10.19
		Q(-)	-554.91	-3191.87	0.00	44.46	-70.07
	2	Q(+)	66.58	272.95	0.00	-3.80	5.99
		Q(-)	-471.89	-1782.92	0.00	24.83	-39.14
	3	Q(+)	66.58	81.53	0.00	-1.14	1.79
		Q(-)	-385.10	-550.35	0.00	7.67	-12.08
	4	Q(+)	66.58	-84.93	0.00	1.18	-1.86
		Q(-)	-309.09	317.39	0.00	-4.42	6.97
	5	Q(+)	66.58	-359.58	0.00	5.01	-7.89
		Q(-)	-183.67	1333.70	0.00	-18.58	29.28
	6	Q(+)	75.60	1454.24	0.00	-20.25	31.93
		Q(-)	-73.04	1419.78	0.00	-19.77	31.17
	7	Q(+)	180.71	1376.02	0.00	-19.17	30.21
		Q(-)	-68.74	-370.55	0.00	5.16	-8.13
	8	Q(+)	306.13	371.94	0.00	-5.18	8.17
		Q(-)	-68.74	-87.01	0.00	1.21	-1.91
	9	Q(+)	382.14	-488.39	0.00	6.80	-10.72
		Q(-)	-68.74	84.83	0.00	-1.18	1.86
	10	Q(+)	468.93	-1712.84	0.00	23.86	-37.60
		Q(-)	-68.74	282.44	0.00	-3.93	6.20
	11	Q(+)	554.73	-3185.45	0.00	44.37	-69.93
		Q(-)	-68.74	480.06	0.00	-6.69	10.54
5	1	Q(+)	51.72	360.65	0.00	-5.02	7.92
		Q(-)	-553.61	-3183.22	0.00	44.34	-69.88
	2	Q(+)	51.72	211.97	0.00	-2.95	4.65
		Q(-)	-471.37	-1796.54	0.00	25.02	-39.44
	3	Q(+)	51.72	63.29	0.00	-0.88	1.39
		Q(-)	-384.58	-565.49	0.00	7.88	-12.41
	4	Q(+)	51.72	-66.00	0.00	0.92	-1.45
		Q(-)	-308.56	300.94	0.00	-4.19	6.61
	5	Q(+)	51.72	-279.33	0.00	3.89	-6.13
		Q(-)	-183.14	1315.08	0.00	-18.32	28.87

Envolvente de cortantes por ferrocarril (RENFE)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	63.41	1586.63	0.00	-22.10	34.83
		Q(-)	-70.07	-657.43	0.00	9.16	-14.43
	7	Q(+)	171.06	1507.77	0.00	-21.00	33.10
		Q(-)	-70.07	-368.39	0.00	5.13	-8.09
	8	Q(+)	296.48	543.45	0.00	-7.57	11.93
		Q(-)	-70.07	-79.35	0.00	1.11	-1.74
	9	Q(+)	372.50	-292.77	0.00	4.08	-6.43
		Q(-)	-70.07	95.83	0.00	-1.33	2.10
	10	Q(+)	459.29	-1489.50	0.00	20.75	-32.70
		Q(-)	-70.07	297.28	0.00	-4.14	6.53
	11	Q(+)	543.95	-2904.71	0.00	40.46	-63.77
		Q(-)	-70.07	498.73	0.00	-6.95	10.95
6	1	Q(+)	18.47	498.73	0.00	-6.95	10.95
		Q(-)	-518.74	-2923.35	0.00	40.72	-64.18
	2	Q(+)	18.47	422.54	0.00	-5.89	9.28
		Q(-)	-393.32	-1042.24	0.00	14.52	-22.88
	3	Q(+)	18.47	346.34	0.00	-4.82	7.60
		Q(-)	-267.90	321.52	0.00	-4.48	7.06
	4	Q(+)	18.47	303.05	0.00	-4.22	6.65
		Q(-)	-196.63	865.94	0.00	-12.06	19.01
	5	Q(+)	18.47	259.75	0.00	-3.62	5.70
		Q(-)	-125.36	1243.31	0.00	-17.32	27.30
	6	Q(+)	18.47	216.45	0.00	-3.01	4.75
		Q(-)	-69.17	-810.48	0.00	11.29	-17.79
	7	Q(+)	85.76	2139.76	0.00	-29.80	46.98
		Q(-)	-69.17	-648.35	0.00	9.03	-14.23
	8	Q(+)	157.03	1855.22	0.00	-25.84	40.73
		Q(-)	-69.17	-486.23	0.00	6.77	-10.67
	9	Q(+)	228.29	1403.62	0.00	-19.55	30.81
		Q(-)	-69.17	-324.11	0.00	4.51	-7.12
	10	Q(+)	299.57	784.97	0.00	-10.93	17.23
		Q(-)	-69.17	-161.99	0.00	2.26	-3.56
	11	Q(+)	370.77	0.00	0.00	0.00	0.00
		Q(-)	-69.17	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-370.77	0.00	0.00	0.00
		M(-)	0.00	69.17	0.00	0.00	0.00
	2	M(+)	890.26	-288.68	0.00	12.40	-19.54
		M(-)	-186.75	69.17	0.00	-2.60	4.10
	3	M(+)	1558.87	-206.59	0.00	21.71	-34.22
		M(-)	-373.51	69.17	0.00	-5.20	8.20
	4	M(+)	2005.83	-124.49	0.00	27.94	-44.04
		M(-)	-560.26	69.17	0.00	-7.80	12.30
	5	M(+)	2231.14	-42.40	0.00	31.08	-48.98
		M(-)	-747.01	69.17	0.00	-10.40	16.40
	6	M(+)	2234.79	39.69	0.00	31.13	-49.06
		M(-)	-933.77	69.17	0.00	-13.01	20.50
	7	M(+)	2016.80	121.79	0.00	28.09	-44.28
		M(-)	-1120.52	69.17	0.00	-15.61	24.60
	8	M(+)	1577.16	203.88	0.00	21.97	-34.62
		M(-)	-1307.27	69.17	0.00	-18.21	28.70
	9	M(+)	915.86	285.97	0.00	12.76	-20.11
		M(-)	-1494.02	69.17	0.00	-20.81	32.80
	10	M(+)	448.88	-18.47	0.00	6.25	-9.85
		M(-)	-1788.78	382.77	0.00	-24.91	39.27
	11	M(+)	498.75	-18.47	0.00	6.95	-10.95
		M(-)	-2923.35	518.74	0.00	-40.72	64.18
2	1	M(+)	498.75	70.07	0.00	6.95	-10.95
		M(-)	-2923.35	-483.25	0.00	-40.72	64.18
	2	M(+)	297.29	70.07	0.00	4.14	-6.53
		M(-)	-1639.16	-410.10	0.00	-22.83	35.99
	3	M(+)	675.55	-269.14	0.00	9.41	-14.83
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1331.81	-262.38	0.00	18.55	-29.24
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2155.43	-136.96	0.00	30.02	-47.32
		M(-)	-845.28	-2.95	0.00	-11.77	18.56
	6	M(+)	2461.71	-11.54	0.00	34.29	-54.04
		M(-)	-854.21	7.28	0.00	-11.90	18.75
	7	M(+)	2252.86	112.54	0.00	31.38	-49.46
		M(-)	-970.26	34.13	0.00	-13.51	21.30
	8	M(+)	1529.95	237.96	0.00	21.31	-33.59
		M(-)	-1235.55	70.07	0.00	-17.21	27.12
	9	M(+)	840.04	313.97	0.00	11.70	-18.44
		M(-)	-1410.73	70.07	0.00	-19.65	30.97
	10	M(+)	426.75	-18.55	0.00	5.94	-9.37
		M(-)	-1895.70	412.03	0.00	-26.40	41.62
	11	M(+)	480.08	-18.55	0.00	6.69	-10.54
		M(-)	-3261.26	550.61	0.00	-45.42	71.60
3	1	M(+)	480.08	68.74	0.00	6.69	-10.54
		M(-)	-3261.26	-495.61	0.00	-45.42	71.60
	2	M(+)	320.81	13.86	0.00	4.47	-7.04
		M(-)	-1941.53	-422.46	0.00	-27.04	42.62

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.08	-320.24	0.00	10.45	-16.47
		M(-)	-1349.93	-66.58	0.00	-18.80	29.64
	4	M(+)	1455.67	-244.23	0.00	20.27	-31.96
		M(-)	-1183.48	-66.58	0.00	-16.48	25.98
	5	M(+)	2206.48	-119.87	0.00	30.73	-48.44
		M(-)	-1046.02	-18.83	0.00	-14.57	22.96
	6	M(+)	2471.07	-8.84	0.00	34.42	-54.25
		M(-)	-989.46	-8.60	0.00	-13.78	21.72
	7	M(+)	2251.00	115.22	0.00	31.35	-49.42
		M(-)	-1033.18	22.35	0.00	-14.39	22.68
	8	M(+)	1517.04	240.64	0.00	21.13	-33.30
		M(-)	-1221.20	68.74	0.00	-17.01	26.81
	9	M(+)	820.42	316.65	0.00	11.43	-18.01
		M(-)	-1393.05	68.74	0.00	-19.40	30.58
	10	M(+)	413.05	-17.85	0.00	5.75	-9.07
		M(-)	-1933.38	419.56	0.00	-26.93	42.44
	11	M(+)	464.37	-17.85	0.00	6.47	-10.19
		M(-)	-3249.03	551.12	0.00	-45.25	71.33
4	1	M(+)	464.37	66.58	0.00	6.47	-10.19
		M(-)	-3249.03	-492.88	0.00	-45.25	71.33
	2	M(+)	413.04	17.85	0.00	5.75	-9.07
		M(-)	-1937.16	-419.72	0.00	-26.98	42.53
	3	M(+)	814.00	-316.97	0.00	11.34	-17.87
		M(-)	-1392.99	-68.74	0.00	-19.40	30.58
	4	M(+)	1511.41	-240.96	0.00	21.05	-33.18
		M(-)	-1221.15	-68.74	0.00	-17.01	26.81
	5	M(+)	2248.70	-116.59	0.00	31.32	-49.37
		M(-)	-1035.41	-22.52	0.00	-14.42	22.73
	6	M(+)	2470.96	8.83	0.00	34.42	-54.25
		M(-)	-987.86	8.43	0.00	-13.76	21.69
	7	M(+)	2208.77	118.50	0.00	30.76	-48.49
		M(-)	-1043.73	18.66	0.00	-14.54	22.91
	8	M(+)	1461.29	243.92	0.00	20.35	-32.08
		M(-)	-1183.53	66.58	0.00	-16.48	25.98
	9	M(+)	756.48	319.93	0.00	10.54	-16.61
		M(-)	-1349.98	66.58	0.00	-18.80	29.64
	10	M(+)	320.81	-13.86	0.00	4.47	-7.04
		M(-)	-1937.65	422.29	0.00	-26.99	42.54
	11	M(+)	480.06	-68.74	0.00	6.69	-10.54
		M(-)	-3256.89	495.44	0.00	-45.36	71.50
5	1	M(+)	480.06	18.55	0.00	6.69	-10.54
		M(-)	-3256.89	-544.53	0.00	-45.36	71.50
	2	M(+)	426.73	18.55	0.00	5.94	-9.37
		M(-)	-1895.70	-412.03	0.00	-26.40	41.62
	3	M(+)	833.62	-314.29	0.00	11.61	-18.30
		M(-)	-1410.68	-70.07	0.00	-19.65	30.97
	4	M(+)	1524.33	-238.28	0.00	21.23	-33.46
		M(-)	-1235.50	-70.07	0.00	-17.21	27.12
	5	M(+)	2250.47	-113.89	0.00	31.34	-49.41
		M(-)	-972.48	-34.29	0.00	-13.54	21.35

Envolvente de momentos por ferrocarril (RENFE)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2461.60	11.53	0.00	34.29	-54.04
		M(-)	-854.21	-7.28	0.00	-11.90	18.75
	7	M(+)	2155.37	136.95	0.00	30.02	-47.32
		M(-)	-845.28	2.95	0.00	-11.77	18.56
	8	M(+)	1331.79	262.37	0.00	18.55	-29.24
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	675.56	269.13	0.00	9.41	-14.83
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	297.28	-70.07	0.00	4.14	-6.53
		M(-)	-1639.16	410.10	0.00	-22.83	35.99
	11	M(+)	498.73	-70.07	0.00	6.95	-10.95
		M(-)	-2923.35	483.25	0.00	-40.72	64.18
6	1	M(+)	498.73	18.47	0.00	6.95	-10.95
		M(-)	-2923.35	-518.74	0.00	-40.72	64.18
	2	M(+)	528.86	-267.90	0.00	7.37	-11.61
		M(-)	-1582.15	-69.17	0.00	-22.04	34.73
	3	M(+)	1607.40	-199.32	0.00	22.39	-35.29
		M(-)	-1296.84	-69.17	0.00	-18.06	28.47
	4	M(+)	1991.07	-128.05	0.00	27.73	-43.71
		M(-)	-1134.72	-69.17	0.00	-15.80	24.91
	5	M(+)	2207.69	-56.78	0.00	30.75	-48.47
		M(-)	-972.60	-69.17	0.00	-13.55	21.35
	6	M(+)	2257.25	14.49	0.00	31.44	-49.56
		M(-)	-810.48	-69.17	0.00	-11.29	17.79
	7	M(+)	2139.76	85.76	0.00	29.80	-46.98
		M(-)	-648.35	-69.17	0.00	-9.03	14.23
	8	M(+)	1855.22	157.03	0.00	25.84	-40.73
		M(-)	-486.23	-69.17	0.00	-6.77	10.67
	9	M(+)	1403.62	228.29	0.00	19.55	-30.81
		M(-)	-324.11	-69.17	0.00	-4.51	7.12
	10	M(+)	784.97	299.57	0.00	10.93	-17.23
		M(-)	-161.99	-69.17	0.00	-2.26	3.56
	11	M(+)	0.00	370.77	0.00	0.00	0.00
		M(-)	0.00	-69.17	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	47.36	0.00	0.00	0.00	0.00
		Q(-)	-243.61	0.00	0.00	0.00	0.00
	2	Q(+)	47.36	-127.87	0.00	1.78	-2.81
		Q(-)	-197.82	595.93	0.00	-8.30	13.08
	3	Q(+)	47.36	-255.74	0.00	3.56	-5.61
		Q(-)	-152.03	1068.23	0.00	-14.88	23.45
	4	Q(+)	47.36	-383.60	0.00	5.34	-8.42
		Q(-)	-106.24	1416.88	0.00	-19.73	31.11
	5	Q(+)	47.36	-511.47	0.00	7.12	-11.23
		Q(-)	-68.92	1644.02	0.00	-22.90	36.09
	6	Q(+)	75.17	530.75	0.00	-7.39	11.65
		Q(-)	-12.69	171.30	0.00	-2.39	3.76
	7	Q(+)	180.24	841.72	0.00	-11.72	18.48
		Q(-)	-12.69	205.56	0.00	-2.86	4.51
	8	Q(+)	217.55	314.02	0.00	-4.37	6.89
		Q(-)	-12.69	239.82	0.00	-3.34	5.27
	9	Q(+)	263.35	-335.20	0.00	4.67	-7.36
		Q(-)	-12.69	274.08	0.00	-3.82	6.02
	10	Q(+)	309.14	-1108.05	0.00	15.43	-24.33
		Q(-)	-12.69	308.34	0.00	-4.29	6.77
	11	Q(+)	354.93	-2004.54	0.00	27.92	-44.01
		Q(-)	-12.69	342.61	0.00	-4.77	7.52
2	1	Q(+)	48.13	342.61	0.00	-4.77	7.52
		Q(-)	-361.77	-2029.46	0.00	28.27	-44.55
	2	Q(+)	48.13	204.22	0.00	-2.84	4.48
		Q(-)	-313.01	-1059.46	0.00	14.76	-23.26
	3	Q(+)	48.13	65.83	0.00	-0.92	1.45
		Q(-)	-264.25	-229.64	0.00	3.20	-5.04
	4	Q(+)	48.13	-54.51	0.00	0.76	-1.20
		Q(-)	-221.85	377.99	0.00	-5.26	8.30
	5	Q(+)	48.13	-253.06	0.00	3.52	-5.56
		Q(-)	-151.89	1148.83	0.00	-16.00	25.22
	6	Q(+)	48.13	-451.62	0.00	6.29	-9.91
		Q(-)	-39.53	956.35	0.00	-13.32	21.00
	7	Q(+)	158.11	1043.58	0.00	-14.53	22.91
		Q(-)	-38.46	-207.75	0.00	2.89	-4.56
	8	Q(+)	228.07	247.10	0.00	-3.44	5.42
		Q(-)	-38.46	-49.09	0.00	0.68	-1.08
	9	Q(+)	270.47	-376.07	0.00	5.24	-8.26
		Q(-)	-38.46	47.07	0.00	-0.66	1.03
	10	Q(+)	319.23	-1223.75	0.00	17.04	-26.87
		Q(-)	-38.46	157.65	0.00	-2.20	3.46
	11	Q(+)	367.99	-2211.62	0.00	30.80	-48.55
		Q(-)	-38.46	268.23	0.00	-3.74	5.89
3	1	Q(+)	47.77	333.65	0.00	-4.65	7.32
		Q(-)	-368.87	-2214.19	0.00	30.84	-48.61
	2	Q(+)	47.77	196.30	0.00	-2.73	4.31
		Q(-)	-320.11	-1223.79	0.00	17.04	-26.87

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	47.77	58.96	0.00	-0.82	1.29
		Q(-)	-271.35	-373.58	0.00	5.20	-8.20
	4	Q(+)	47.77	-60.48	0.00	0.84	-1.33
		Q(-)	-228.95	251.79	0.00	-3.51	5.53
	5	Q(+)	47.77	-257.54	0.00	3.59	-5.65
		Q(-)	-158.99	1051.89	0.00	-14.65	23.09
	6	Q(+)	47.77	-454.60	0.00	6.33	-9.98
		Q(-)	-47.48	880.52	0.00	-12.26	19.33
	7	Q(+)	159.09	1049.13	0.00	-14.61	23.03
		Q(-)	-47.41	-256.05	0.00	3.57	-5.62
	8	Q(+)	229.05	248.59	0.00	-3.46	5.46
		Q(-)	-47.41	-60.48	0.00	0.84	-1.33
	9	Q(+)	271.45	-377.03	0.00	5.25	-8.28
		Q(-)	-47.41	58.05	0.00	-0.81	1.27
	10	Q(+)	320.21	-1227.54	0.00	17.10	-26.95
		Q(-)	-47.41	194.36	0.00	-2.71	4.27
	11	Q(+)	368.97	-2218.23	0.00	30.90	-48.70
		Q(-)	-47.41	330.67	0.00	-4.61	7.26
4	1	Q(+)	47.41	330.67	0.00	-4.61	7.26
		Q(-)	-368.97	-2218.23	0.00	30.90	-48.70
	2	Q(+)	47.41	194.36	0.00	-2.71	4.27
		Q(-)	-320.21	-1227.54	0.00	17.10	-26.95
	3	Q(+)	47.41	58.05	0.00	-0.81	1.27
		Q(-)	-271.45	-377.03	0.00	5.25	-8.28
	4	Q(+)	47.41	-60.48	0.00	0.84	-1.33
		Q(-)	-229.05	248.59	0.00	-3.46	5.46
	5	Q(+)	47.41	-256.05	0.00	3.57	-5.62
		Q(-)	-159.09	1049.13	0.00	-14.61	23.03
	6	Q(+)	47.48	880.52	0.00	-12.26	19.33
		Q(-)	-47.77	-454.60	0.00	6.33	-9.98
	7	Q(+)	158.99	1051.90	0.00	-14.65	23.09
		Q(-)	-47.77	-257.54	0.00	3.59	-5.65
	8	Q(+)	228.95	251.79	0.00	-3.51	5.53
		Q(-)	-47.77	-60.48	0.00	0.84	-1.33
	9	Q(+)	271.35	-373.58	0.00	5.20	-8.20
		Q(-)	-47.77	58.96	0.00	-0.82	1.29
	10	Q(+)	320.11	-1223.79	0.00	17.04	-26.87
		Q(-)	-47.77	196.30	0.00	-2.73	4.31
	11	Q(+)	368.87	-2214.19	0.00	30.84	-48.61
		Q(-)	-47.77	333.65	0.00	-4.65	7.32
5	1	Q(+)	38.46	268.24	0.00	-3.74	5.89
		Q(-)	-367.99	-2211.62	0.00	30.80	-48.55
	2	Q(+)	38.46	157.65	0.00	-2.20	3.46
		Q(-)	-319.23	-1223.75	0.00	17.04	-26.87
	3	Q(+)	38.46	47.07	0.00	-0.66	1.03
		Q(-)	-270.47	-376.07	0.00	5.24	-8.26
	4	Q(+)	38.46	-49.09	0.00	0.68	-1.08
		Q(-)	-228.07	247.10	0.00	-3.44	5.42
	5	Q(+)	38.46	-207.75	0.00	2.89	-4.56
		Q(-)	-158.11	1043.58	0.00	-14.53	22.91

Envolvente de cortantes por ferrocarril (UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	39.53	956.35	0.00	-13.32	21.00
		Q(-)	-48.13	-451.62	0.00	6.29	-9.91
	7	Q(+)	151.89	1148.83	0.00	-16.00	25.22
		Q(-)	-48.13	-253.06	0.00	3.52	-5.56
	8	Q(+)	221.85	377.98	0.00	-5.26	8.30
		Q(-)	-48.13	-54.51	0.00	0.76	-1.20
	9	Q(+)	264.25	-229.64	0.00	3.20	-5.04
		Q(-)	-48.13	65.83	0.00	-0.92	1.45
	10	Q(+)	313.01	-1059.46	0.00	14.76	-23.26
		Q(-)	-48.13	204.22	0.00	-2.84	4.48
	11	Q(+)	361.77	-2029.46	0.00	28.27	-44.55
		Q(-)	-48.13	342.61	0.00	-4.77	7.52
6	1	Q(+)	12.69	342.61	0.00	-4.77	7.52
		Q(-)	-354.93	-2004.54	0.00	27.92	-44.01
	2	Q(+)	12.69	290.26	0.00	-4.04	6.37
		Q(-)	-284.97	-684.75	0.00	9.54	-15.03
	3	Q(+)	12.69	237.92	0.00	-3.31	5.22
		Q(-)	-215.01	346.46	0.00	-4.83	7.61
	4	Q(+)	12.69	208.18	0.00	-2.90	4.57
		Q(-)	-180.24	804.59	0.00	-11.21	17.66
	5	Q(+)	12.69	178.43	0.00	-2.49	3.92
		Q(-)	-84.70	485.83	0.00	-6.77	10.67
	6	Q(+)	15.92	1674.53	0.00	-23.32	36.76
		Q(-)	-47.36	-554.94	0.00	7.73	-12.18
	7	Q(+)	84.63	1538.46	0.00	-21.43	33.77
		Q(-)	-47.36	-443.93	0.00	6.18	-9.75
	8	Q(+)	124.38	1293.50	0.00	-18.02	28.40
		Q(-)	-47.36	-332.93	0.00	4.64	-7.31
	9	Q(+)	164.14	955.35	0.00	-13.31	20.97
		Q(-)	-47.36	-221.92	0.00	3.09	-4.87
	10	Q(+)	203.89	524.03	0.00	-7.30	11.50
		Q(-)	-47.36	-110.91	0.00	1.54	-2.43
	11	Q(+)	243.61	0.00	0.00	0.00	0.00
		Q(-)	-47.36	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	595.93	-197.82	0.00	8.30	-13.08
		M(-)	-127.87	47.36	0.00	-1.78	2.81
	3	M(+)	1068.23	-152.03	0.00	14.88	-23.45
		M(-)	-255.74	47.36	0.00	-3.56	5.61
	4	M(+)	1416.88	-106.24	0.00	19.73	-31.11
		M(-)	-383.60	47.36	0.00	-5.34	8.42
	5	M(+)	1644.02	-68.92	0.00	22.90	-36.09
		M(-)	-511.47	47.36	0.00	-7.12	11.23
	6	M(+)	1660.51	37.08	0.00	23.13	-36.45
		M(-)	-639.34	47.36	0.00	-8.90	14.04
	7	M(+)	1443.80	143.08	0.00	20.11	-31.70
		M(-)	-767.20	47.36	0.00	-10.69	16.84
	8	M(+)	1016.45	180.39	0.00	14.16	-22.31
		M(-)	-895.07	47.36	0.00	-12.47	19.65
	9	M(+)	467.59	226.18	0.00	6.51	-10.27
		M(-)	-1022.94	47.36	0.00	-14.25	22.46
	10	M(+)	308.34	-12.69	0.00	4.29	-6.77
		M(-)	-1270.14	258.33	0.00	-17.69	27.88
	11	M(+)	342.61	-12.69	0.00	4.77	-7.52
		M(-)	-2029.46	304.13	0.00	-28.27	44.55
2	1	M(+)	342.61	48.13	0.00	4.77	-7.52
		M(-)	-2029.46	-361.77	0.00	-28.27	44.55
	2	M(+)	204.22	48.13	0.00	2.84	-4.48
		M(-)	-1156.45	-270.61	0.00	-16.11	25.39
	3	M(+)	406.93	-197.63	0.00	5.67	-8.93
		M(-)	-779.90	-38.46	0.00	-10.86	17.12
	4	M(+)	890.78	-193.01	0.00	12.41	-19.56
		M(-)	-683.74	-38.46	0.00	-9.52	15.01
	5	M(+)	1542.64	-123.04	0.00	21.49	-33.87
		M(-)	-525.08	-38.46	0.00	-7.31	11.53
	6	M(+)	1823.14	-1.36	0.00	25.39	-40.02
		M(-)	-451.62	48.13	0.00	-6.29	9.91
	7	M(+)	1553.83	120.33	0.00	21.64	-34.11
		M(-)	-650.17	48.13	0.00	-9.06	14.27
	8	M(-)	913.17	190.29	0.00	12.72	-20.05
		M(-)	-848.73	48.13	0.00	-11.82	18.63
	9	M(+)	419.74	203.84	0.00	5.85	-9.21
		M(-)	-969.07	48.13	0.00	-13.50	21.27
	10	M(+)	296.59	-12.89	0.00	4.13	-6.51
		M(-)	-1344.41	278.15	0.00	-18.72	29.51
	11	M(+)	333.65	-12.89	0.00	4.65	-7.32
		M(-)	-2214.19	326.91	0.00	-30.84	48.61
3	1	M(+)	333.65	47.77	0.00	4.65	-7.32
		M(-)	-2214.19	-368.87	0.00	-30.84	48.61
	2	M(+)	238.60	10.31	0.00	3.32	-5.24
		M(-)	-1340.66	-278.56	0.00	-18.67	29.43

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	427.09	-196.65	0.00	5.95	-9.38
		M(-)	-961.29	-47.41	0.00	-13.39	21.10
	4	M(+)	913.17	-191.74	0.00	12.72	-20.05
		M(-)	-842.76	-47.41	0.00	-11.74	18.50
	5	M(+)	1559.80	-121.78	0.00	21.72	-34.24
		M(-)	-647.19	-47.41	0.00	-9.01	14.21
	6	M(+)	1835.08	-0.09	0.00	25.56	-40.29
		M(-)	-454.60	47.77	0.00	-6.33	9.98
	7	M(+)	1560.54	121.60	0.00	21.74	-34.26
		M(-)	-651.67	47.77	0.00	-9.08	14.31
	8	M(+)	914.66	191.56	0.00	12.74	-20.08
		M(-)	-848.73	47.77	0.00	-11.82	18.63
	9	M(+)	428.33	196.75	0.00	5.97	-9.40
		M(-)	-968.16	47.77	0.00	-13.48	21.25
	10	M(+)	294.13	-12.71	0.00	4.10	-6.46
		M(-)	-1346.64	278.78	0.00	-18.76	29.56
	11	M(+)	330.67	-47.41	0.00	4.61	-7.26
		M(-)	-2218.23	368.97	0.00	-30.90	48.70
4	1	M(+)	330.67	12.71	0.00	4.61	-7.26
		M(-)	-2218.23	-327.54	0.00	-30.90	48.70
	2	M(+)	294.13	12.71	0.00	4.10	-6.46
		M(-)	-1346.64	-278.78	0.00	-18.76	29.56
	3	M(+)	428.33	-196.75	0.00	5.97	-9.40
		M(-)	-968.16	-47.77	0.00	-13.48	21.25
	4	M(+)	914.66	-191.56	0.00	12.74	-20.08
		M(-)	-848.73	-47.77	0.00	-11.82	18.63
	5	M(+)	1560.54	-121.60	0.00	21.74	-34.26
		M(-)	-651.67	-47.77	0.00	-9.08	14.31
	6	M(+)	1835.08	0.09	0.00	25.56	-40.29
		M(-)	-454.60	-47.77	0.00	-6.33	9.98
	7	M(+)	1559.80	121.78	0.00	21.72	-34.24
		M(-)	-647.19	47.41	0.00	-9.01	14.21
	8	M(+)	913.17	191.74	0.00	12.72	-20.05
		M(-)	-842.76	47.41	0.00	-11.74	18.50
	9	M(+)	427.09	196.65	0.00	5.95	-9.38
		M(-)	-961.29	47.41	0.00	-13.39	21.10
	10	M(+)	238.60	-10.31	0.00	3.32	-5.24
		M(-)	-1340.66	278.56	0.00	-18.67	29.43
	11	M(+)	333.65	-47.77	0.00	4.65	-7.32
		M(-)	-2214.19	368.87	0.00	-30.84	48.61
5	1	M(+)	333.65	12.89	0.00	4.65	-7.32
		M(-)	-2214.19	-326.91	0.00	-30.84	48.61
	2	M(+)	296.59	12.89	0.00	4.13	-6.51
		M(-)	-1344.41	-278.15	0.00	-18.72	29.51
	3	M(+)	419.74	-203.84	0.00	5.85	-9.21
		M(-)	-969.07	-48.13	0.00	-13.50	21.27
	4	M(+)	913.17	-190.29	0.00	12.72	-20.05
		M(-)	-848.73	-48.13	0.00	-11.82	18.63
	5	M(+)	1553.82	-120.33	0.00	21.64	-34.11
		M(-)	-650.17	-48.13	0.00	-9.06	14.27

Envolvente de momentos por ferrocarril (UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	1823.13	1.36	0.00	25.39	-40.02
		M(-)	-451.62	-48.13	0.00	-6.29	9.91
	7	M(+)	1542.63	123.04	0.00	21.49	-33.87
		M(-)	-525.08	38.46	0.00	-7.31	11.53
	8	M(+)	890.78	193.00	0.00	12.41	-19.56
		M(-)	-683.74	38.46	0.00	-9.52	15.01
	9	M(+)	406.93	197.63	0.00	5.67	-8.93
		M(-)	-779.90	38.46	0.00	-10.86	17.12
	10	M(+)	204.22	-48.13	0.00	2.84	-4.48
		M(-)	-1156.45	270.61	0.00	-16.11	25.39
	11	M(+)	342.61	-48.13	0.00	4.77	-7.52
		M(-)	-2029.46	361.77	0.00	-28.27	44.55
6	1	M(+)	342.61	12.69	0.00	4.77	-7.52
		M(-)	-2029.46	-304.13	0.00	-28.27	44.55
	2	M(+)	290.26	12.69	0.00	4.04	-6.37
		M(-)	-1083.32	-47.36	0.00	-15.09	23.78
	3	M(+)	1043.32	-177.85	0.00	14.53	-22.90
		M(-)	-887.97	-47.36	0.00	-12.37	19.49
	4	M(+)	1414.33	-143.08	0.00	19.70	-31.05
		M(-)	-776.96	-47.36	0.00	-10.82	17.06
	5	M(+)	1639.67	-37.08	0.00	22.84	-36.00
		M(-)	-665.95	-47.36	0.00	-9.28	14.62
	6	M(+)	1674.53	15.92	0.00	23.32	-36.76
		M(-)	-554.94	-47.36	0.00	-7.73	12.18
	7	M(+)	1538.46	84.63	0.00	21.43	-33.77
		M(-)	-443.93	-47.36	0.00	-6.18	9.75
	8	M(+)	1293.50	124.38	0.00	18.02	-28.40
		M(-)	-332.93	-47.36	0.00	-4.64	7.31
	9	M(+)	955.35	164.14	0.00	13.31	-20.97
		M(-)	-221.92	-47.36	0.00	-3.09	4.87
	10	M(+)	524.03	203.89	0.00	7.30	-11.50
		M(-)	-110.91	-47.36	0.00	-1.54	2.43
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	69.17	0.00	0.00	0.00	0.00
		Q(-)	-370.77	0.00	0.00	0.00	0.00
	2	Q(+)	69.17	-186.75	0.00	2.60	-4.10
		Q(-)	-288.68	890.26	0.00	-12.40	19.54
	3	Q(+)	69.17	-373.51	0.00	5.20	-8.20
		Q(-)	-206.59	1558.87	0.00	-21.71	34.22
	4	Q(+)	69.17	-560.26	0.00	7.80	-12.30
		Q(-)	-124.49	2005.83	0.00	-27.94	44.04
	5	Q(+)	69.17	-747.01	0.00	10.40	-16.40
		Q(-)	-68.92	1644.02	0.00	-22.90	36.09
	6	Q(+)	108.27	1308.96	0.00	-18.23	28.74
		Q(-)	-18.47	249.38	0.00	-3.47	5.47
	7	Q(+)	190.37	905.80	0.00	-12.62	19.89
		Q(-)	-18.47	299.25	0.00	-4.17	6.57
	8	Q(+)	272.46	280.99	0.00	-3.91	6.17
		Q(-)	-18.47	349.13	0.00	-4.86	7.66
	9	Q(+)	354.55	-565.47	0.00	7.88	-12.41
		Q(-)	-18.47	399.00	0.00	-5.56	8.76
	10	Q(+)	436.64	-1633.59	0.00	22.75	-35.86
		Q(-)	-18.47	448.88	0.00	-6.25	9.85
	11	Q(+)	518.74	-2923.35	0.00	40.72	-64.18
		Q(-)	-18.47	498.75	0.00	-6.95	10.95
2	1	Q(+)	70.07	498.75	0.00	-6.95	10.95
		Q(-)	-543.95	-2904.71	0.00	40.46	-63.77
	2	Q(+)	70.07	297.29	0.00	-4.14	6.53
		Q(-)	-459.30	-1489.35	0.00	20.74	-32.70
	3	Q(+)	70.07	95.83	0.00	-1.33	2.10
		Q(-)	-372.51	-292.99	0.00	4.08	-6.43
	4	Q(+)	70.07	-79.35	0.00	1.11	-1.74
		Q(-)	-296.49	543.26	0.00	-7.57	11.93
	5	Q(+)	70.07	-368.40	0.00	5.13	-8.09
		Q(-)	-171.07	1507.62	0.00	-21.00	33.10
	6	Q(+)	70.07	-657.45	0.00	9.16	-14.43
		Q(-)	-63.41	1586.63	0.00	-22.10	34.83
	7	Q(+)	183.13	1315.23	0.00	-18.32	28.87
		Q(-)	-51.72	-279.33	0.00	3.89	-6.13
	8	Q(+)	308.55	301.13	0.00	-4.19	6.61
		Q(-)	-51.72	-66.00	0.00	0.92	-1.45
	9	Q(+)	384.57	-565.27	0.00	7.87	-12.41
		Q(-)	-51.72	63.29	0.00	-0.88	1.39
	10	Q(+)	471.36	-1796.69	0.00	25.02	-39.44
		Q(-)	-51.72	211.97	0.00	-2.95	4.65
	11	Q(+)	553.61	-3183.22	0.00	44.34	-69.88
		Q(-)	-51.72	360.65	0.00	-5.02	7.92
3	1	Q(+)	68.74	480.08	0.00	-6.69	10.54
		Q(-)	-554.73	-3185.45	0.00	44.37	-69.93
	2	Q(+)	68.74	282.45	0.00	-3.93	6.20
		Q(-)	-468.94	-1712.69	0.00	23.85	-37.60

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	68.74	84.83	0.00	-1.18	1.86
		Q(-)	-382.15	-488.61	0.00	6.81	-10.73
	4	Q(+)	68.74	-87.02	0.00	1.21	-1.91
		Q(-)	-306.14	371.74	0.00	-5.18	8.16
	5	Q(+)	68.74	-370.56	0.00	5.16	-8.14
		Q(-)	-180.73	923.60	0.00	-12.86	20.28
	6	Q(+)	72.88	1421.33	0.00	-19.80	31.20
		Q(-)	-75.77	1452.64	0.00	-20.23	31.89
	7	Q(+)	183.66	1333.85	0.00	-18.58	29.28
		Q(-)	-66.58	-359.57	0.00	5.01	-7.89
	8	Q(+)	309.08	317.58	0.00	-4.42	6.97
		Q(-)	-66.58	-84.93	0.00	1.18	-1.86
	9	Q(+)	385.09	-550.13	0.00	7.66	-12.08
		Q(-)	-66.58	81.52	0.00	-1.14	1.79
	10	Q(+)	471.88	-1783.06	0.00	24.83	-39.14
		Q(-)	-66.58	272.94	0.00	-3.80	5.99
	11	Q(+)	554.91	-3191.87	0.00	44.46	-70.07
		Q(-)	-66.58	464.35	0.00	-6.47	10.19
4	1	Q(+)	66.58	464.37	0.00	-6.47	10.19
		Q(-)	-554.91	-3191.87	0.00	44.46	-70.07
	2	Q(+)	66.58	272.95	0.00	-3.80	5.99
		Q(-)	-471.89	-1782.92	0.00	24.83	-39.14
	3	Q(+)	66.58	81.53	0.00	-1.14	1.79
		Q(-)	-385.10	-550.35	0.00	7.67	-12.08
	4	Q(+)	66.58	-84.93	0.00	1.18	-1.86
		Q(-)	-309.09	317.39	0.00	-4.42	6.97
	5	Q(+)	66.58	-359.58	0.00	5.01	-7.89
		Q(-)	-183.67	1333.70	0.00	-18.58	29.28
	6	Q(+)	75.60	1454.24	0.00	-20.25	31.93
		Q(-)	-73.04	1419.78	0.00	-19.77	31.17
	7	Q(+)	180.71	1376.02	0.00	-19.17	30.21
		Q(-)	-68.74	-370.55	0.00	5.16	-8.13
	8	Q(+)	306.13	371.94	0.00	-5.18	8.17
		Q(-)	-68.74	-87.01	0.00	1.21	-1.91
	9	Q(+)	382.14	-488.39	0.00	6.80	-10.72
		Q(-)	-68.74	84.83	0.00	-1.18	1.86
	10	Q(+)	468.93	-1712.84	0.00	23.86	-37.60
		Q(-)	-68.74	282.44	0.00	-3.93	6.20
	11	Q(+)	554.73	-3185.45	0.00	44.37	-69.93
		Q(-)	-68.74	480.06	0.00	-6.69	10.54
5	1	Q(+)	51.72	360.65	0.00	-5.02	7.92
		Q(-)	-553.61	-3183.22	0.00	44.34	-69.88
	2	Q(+)	51.72	211.97	0.00	-2.95	4.65
		Q(-)	-471.37	-1796.54	0.00	25.02	-39.44
	3	Q(+)	51.72	63.29	0.00	-0.88	1.39
		Q(-)	-384.58	-565.49	0.00	7.88	-12.41
	4	Q(+)	51.72	-66.00	0.00	0.92	-1.45
		Q(-)	-308.56	300.94	0.00	-4.19	6.61
	5	Q(+)	51.72	-279.33	0.00	3.89	-6.13
		Q(-)	-183.14	1315.08	0.00	-18.32	28.87

Envolvente de cortantes por ferrocarril (RENFE/UIC)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	63.41	1586.63	0.00	-22.10	34.83
		Q(-)	-70.07	-657.43	0.00	9.16	-14.43
	7	Q(+)	171.06	1507.77	0.00	-21.00	33.10
		Q(-)	-70.07	-368.39	0.00	5.13	-8.09
	8	Q(+)	296.48	543.45	0.00	-7.57	11.93
		Q(-)	-70.07	-79.35	0.00	1.11	-1.74
	9	Q(+)	372.50	-292.77	0.00	4.08	-6.43
		Q(-)	-70.07	95.83	0.00	-1.33	2.10
	10	Q(+)	459.29	-1489.50	0.00	20.75	-32.70
		Q(-)	-70.07	297.28	0.00	-4.14	6.53
	11	Q(+)	543.95	-2904.71	0.00	40.46	-63.77
		Q(-)	-70.07	498.73	0.00	-6.95	10.95
6	1	Q(+)	18.47	498.73	0.00	-6.95	10.95
		Q(-)	-518.74	-2923.35	0.00	40.72	-64.18
	2	Q(+)	18.47	422.54	0.00	-5.89	9.28
		Q(-)	-393.32	-1042.24	0.00	14.52	-22.88
	3	Q(+)	18.47	346.34	0.00	-4.82	7.60
		Q(-)	-267.90	321.52	0.00	-4.48	7.06
	4	Q(+)	18.47	303.05	0.00	-4.22	6.65
		Q(-)	-196.63	865.94	0.00	-12.06	19.01
	5	Q(+)	18.47	259.75	0.00	-3.62	5.70
		Q(-)	-125.36	1243.31	0.00	-17.32	27.30
	6	Q(+)	18.47	216.45	0.00	-3.01	4.75
		Q(-)	-69.17	-810.48	0.00	11.29	-17.79
	7	Q(+)	85.76	2139.76	0.00	-29.80	46.98
		Q(-)	-69.17	-648.35	0.00	9.03	-14.23
	8	Q(+)	157.03	1855.22	0.00	-25.84	40.73
		Q(-)	-69.17	-486.23	0.00	6.77	-10.67
	9	Q(+)	228.29	1403.62	0.00	-19.55	30.81
		Q(-)	-69.17	-324.11	0.00	4.51	-7.12
	10	Q(+)	299.57	784.97	0.00	-10.93	17.23
		Q(-)	-69.17	-161.99	0.00	2.26	-3.56
	11	Q(+)	370.77	0.00	0.00	0.00	0.00
		Q(-)	-69.17	0.00	0.00	0.00	0.00

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	890.26	-288.68	0.00	12.40	-19.54
		M(-)	-186.75	69.17	0.00	-2.60	4.10
	3	M(+)	1558.87	-206.59	0.00	21.71	-34.22
		M(-)	-373.51	69.17	0.00	-5.20	8.20
	4	M(+)	2005.83	-124.49	0.00	27.94	-44.04
		M(-)	-560.26	69.17	0.00	-7.80	12.30
	5	M(+)	2231.14	-42.40	0.00	31.08	-48.98
		M(-)	-747.01	69.17	0.00	-10.40	16.40
	6	M(+)	2234.79	39.69	0.00	31.13	-49.06
		M(-)	-933.77	69.17	0.00	-13.01	20.50
	7	M(+)	2016.80	121.79	0.00	28.09	-44.28
		M(-)	-1120.52	69.17	0.00	-15.61	24.60
	8	M(+)	1577.16	203.88	0.00	21.97	-34.62
		M(-)	-1307.27	69.17	0.00	-18.21	28.70
	9	M(+)	915.86	285.97	0.00	12.76	-20.11
		M(-)	-1494.02	69.17	0.00	-20.81	32.80
	10	M(+)	448.88	-18.47	0.00	6.25	-9.85
		M(-)	-1788.78	382.77	0.00	-24.91	39.27
	11	M(+)	498.75	-18.47	0.00	6.95	-10.95
		M(-)	-2923.35	518.74	0.00	-40.72	64.18
2	1	M(+)	498.75	70.07	0.00	6.95	-10.95
		M(-)	-2923.35	-483.25	0.00	-40.72	64.18
	2	M(+)	297.29	70.07	0.00	4.14	-6.53
		M(-)	-1639.16	-410.10	0.00	-22.83	35.99
	3	M(+)	675.55	-269.14	0.00	9.41	-14.83
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1331.81	-262.38	0.00	18.55	-29.24
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2155.43	-136.96	0.00	30.02	-47.32
		M(-)	-845.28	-2.95	0.00	-11.77	18.56
	6	M(+)	2461.71	-11.54	0.00	34.29	-54.04
		M(-)	-854.21	7.28	0.00	-11.90	18.75
	7	M(+)	2252.86	112.54	0.00	31.38	-49.46
		M(-)	-970.26	34.13	0.00	-13.51	21.30
	8	M(+)	1529.95	237.96	0.00	21.31	-33.59
		M(-)	-1235.55	70.07	0.00	-17.21	27.12
	9	M(+)	840.04	313.97	0.00	11.70	-18.44
		M(-)	-1410.73	70.07	0.00	-19.65	30.97
	10	M(+)	426.75	-18.55	0.00	5.94	-9.37
		M(-)	-1895.70	412.03	0.00	-26.40	41.62
	11	M(+)	480.08	-18.55	0.00	6.69	-10.54
		M(-)	-3261.26	550.61	0.00	-45.42	71.60
3	1	M(+)	480.08	68.74	0.00	6.69	-10.54
		M(-)	-3261.26	-495.61	0.00	-45.42	71.60
	2	M(+)	320.81	13.86	0.00	4.47	-7.04
		M(-)	-1941.53	-422.46	0.00	-27.04	42.62

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.08	-320.24	0.00	10.45	-16.47
		M(-)	-1349.93	-66.58	0.00	-18.80	29.64
	4	M(+)	1455.67	-244.23	0.00	20.27	-31.96
		M(-)	-1183.48	-66.58	0.00	-16.48	25.98
	5	M(+)	2206.48	-119.87	0.00	30.73	-48.44
		M(-)	-1046.02	-18.83	0.00	-14.57	22.96
	6	M(+)	2471.07	-8.84	0.00	34.42	-54.25
		M(-)	-989.46	-8.60	0.00	-13.78	21.72
	7	M(+)	2251.00	115.22	0.00	31.35	-49.42
		M(-)	-1033.18	22.35	0.00	-14.39	22.68
	8	M(+)	1517.04	240.64	0.00	21.13	-33.30
		M(-)	-1221.20	68.74	0.00	-17.01	26.81
	9	M(+)	820.42	316.65	0.00	11.43	-18.01
		M(-)	-1393.05	68.74	0.00	-19.40	30.58
	10	M(+)	413.05	-17.85	0.00	5.75	-9.07
		M(-)	-1933.38	419.56	0.00	-26.93	42.44
	11	M(+)	464.37	-17.85	0.00	6.47	-10.19
		M(-)	-3249.03	551.12	0.00	-45.25	71.33
4	1	M(+)	464.37	66.58	0.00	6.47	-10.19
		M(-)	-3249.03	-492.88	0.00	-45.25	71.33
	2	M(+)	413.04	17.85	0.00	5.75	-9.07
		M(-)	-1937.16	-419.72	0.00	-26.98	42.53
	3	M(+)	814.00	-316.97	0.00	11.34	-17.87
		M(-)	-1392.99	-68.74	0.00	-19.40	30.58
	4	M(+)	1511.41	-240.96	0.00	21.05	-33.18
		M(-)	-1221.15	-68.74	0.00	-17.01	26.81
	5	M(+)	2248.70	-116.59	0.00	31.32	-49.37
		M(-)	-1035.41	-22.52	0.00	-14.42	22.73
	6	M(+)	2470.96	8.83	0.00	34.42	-54.25
		M(-)	-987.86	8.43	0.00	-13.76	21.69
	7	M(+)	2208.77	118.50	0.00	30.76	-48.49
		M(-)	-1043.73	18.66	0.00	-14.54	22.91
	8	M(+)	1461.29	243.92	0.00	20.35	-32.08
		M(-)	-1183.53	66.58	0.00	-16.48	25.98
	9	M(+)	756.48	319.93	0.00	10.54	-16.61
		M(-)	-1349.98	66.58	0.00	-18.80	29.64
	10	M(+)	320.81	-13.86	0.00	4.47	-7.04
		M(-)	-1937.65	422.29	0.00	-26.99	42.54
	11	M(+)	480.06	-68.74	0.00	6.69	-10.54
		M(-)	-3256.89	495.44	0.00	-45.36	71.50
5	1	M(+)	480.06	18.55	0.00	6.69	-10.54
		M(-)	-3256.89	-544.53	0.00	-45.36	71.50
	2	M(+)	426.73	18.55	0.00	5.94	-9.37
		M(-)	-1895.70	-412.03	0.00	-26.40	41.62
	3	M(+)	833.62	-314.29	0.00	11.61	-18.30
		M(-)	-1410.68	-70.07	0.00	-19.65	30.97
	4	M(+)	1524.33	-238.28	0.00	21.23	-33.46
		M(-)	-1235.50	-70.07	0.00	-17.21	27.12
	5	M(+)	2250.47	-113.89	0.00	31.34	-49.41
		M(-)	-972.48	-34.29	0.00	-13.54	21.35

Envolvente de momentos por ferrocarril (RENFE/UIC)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2461.60	11.53	0.00	34.29	-54.04
		M(-)	-854.21	-7.28	0.00	-11.90	18.75
	7	M(+)	2155.37	136.95	0.00	30.02	-47.32
		M(-)	-845.28	2.95	0.00	-11.77	18.56
	8	M(+)	1331.79	262.37	0.00	18.55	-29.24
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	675.56	269.13	0.00	9.41	-14.83
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	297.28	-70.07	0.00	4.14	-6.53
		M(-)	-1639.16	410.10	0.00	-22.83	35.99
	11	M(+)	498.73	-70.07	0.00	6.95	-10.95
		M(-)	-2923.35	483.25	0.00	-40.72	64.18
6	1	M(+)	498.73	18.47	0.00	6.95	-10.95
		M(-)	-2923.35	-518.74	0.00	-40.72	64.18
	2	M(+)	528.86	-267.90	0.00	7.37	-11.61
		M(-)	-1582.15	-69.17	0.00	-22.04	34.73
	3	M(+)	1607.40	-199.32	0.00	22.39	-35.29
		M(-)	-1296.84	-69.17	0.00	-18.06	28.47
	4	M(+)	1991.07	-128.05	0.00	27.73	-43.71
		M(-)	-1134.72	-69.17	0.00	-15.80	24.91
	5	M(+)	2207.69	-56.78	0.00	30.75	-48.47
		M(-)	-972.60	-69.17	0.00	-13.55	21.35
	6	M(+)	2257.25	14.49	0.00	31.44	-49.56
		M(-)	-810.48	-69.17	0.00	-11.29	17.79
	7	M(+)	2139.76	85.76	0.00	29.80	-46.98
		M(-)	-648.35	-69.17	0.00	-9.03	14.23
	8	M(+)	1855.22	157.03	0.00	25.84	-40.73
		M(-)	-486.23	-69.17	0.00	-6.77	10.67
	9	M(+)	1403.62	228.29	0.00	19.55	-30.81
		M(-)	-324.11	-69.17	0.00	-4.51	7.12
	10	M(+)	784.97	299.57	0.00	10.93	-17.23
		M(-)	-161.99	-69.17	0.00	-2.26	3.56
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	Q(+)	69.17	0.00	0.00	0.00	0.00
		Q(-)	-370.77	0.00	0.00	0.00	0.00
	2	Q(+)	69.17	-186.75	0.00	-2.60	4.10
		Q(-)	-288.68	890.26	0.00	12.40	-19.54
	3	Q(+)	69.17	-373.51	0.00	-5.20	8.20
		Q(-)	-206.59	1558.87	0.00	21.71	-34.22
	4	Q(+)	69.17	-560.26	0.00	-7.80	12.30
		Q(-)	-124.49	2005.83	0.00	27.94	-44.04
	5	Q(+)	69.17	-747.01	0.00	-10.40	16.40
		Q(-)	-68.92	1644.02	0.00	22.90	-36.09
	6	Q(+)	108.27	1308.96	0.00	18.23	-28.74
		Q(-)	-18.47	249.38	0.00	3.47	-5.47
	7	Q(+)	190.37	905.80	0.00	12.62	-19.89
		Q(-)	-18.47	299.25	0.00	4.17	-6.57
	8	Q(+)	272.46	280.99	0.00	3.91	-6.17
		Q(-)	-18.47	349.13	0.00	4.86	-7.66
	9	Q(+)	354.55	-565.47	0.00	-7.88	12.41
		Q(-)	-18.47	399.00	0.00	5.56	-8.76
	10	Q(+)	436.64	-1633.59	0.00	-22.75	35.86
		Q(-)	-18.47	448.88	0.00	6.25	-9.85
	11	Q(+)	518.74	-2923.35	0.00	-40.72	64.18
		Q(-)	-18.47	498.75	0.00	6.95	-10.95
2	1	Q(+)	70.07	498.75	0.00	6.95	-10.95
		Q(-)	-543.95	-2904.71	0.00	-40.46	63.77
	2	Q(+)	70.07	297.29	0.00	4.14	-6.53
		Q(-)	-459.30	-1489.35	0.00	-20.74	32.70
	3	Q(+)	70.07	95.83	0.00	1.33	-2.10
		Q(-)	-372.51	-292.99	0.00	-4.08	6.43
	4	Q(+)	70.07	-79.35	0.00	-1.11	1.74
		Q(-)	-296.49	543.26	0.00	7.57	-11.93
	5	Q(+)	70.07	-368.40	0.00	-5.13	8.09
		Q(-)	-171.07	1507.62	0.00	21.00	-33.10
	6	Q(+)	70.07	-657.45	0.00	-9.16	14.43
		Q(-)	-63.41	1586.63	0.00	22.10	-34.83
	7	Q(+)	183.13	1315.23	0.00	18.32	-28.87
		Q(-)	-51.72	-279.33	0.00	-3.89	6.13
	8	Q(+)	308.55	301.13	0.00	4.19	-6.61
		Q(-)	-51.72	-66.00	0.00	-0.92	1.45
	9	Q(+)	384.57	-565.27	0.00	-7.87	12.41
		Q(-)	-51.72	63.29	0.00	0.88	-1.39
	10	Q(+)	471.36	-1796.69	0.00	-25.02	39.44
		Q(-)	-51.72	211.97	0.00	2.95	-4.65
	11	Q(+)	553.61	-3183.22	0.00	-44.34	69.88
		Q(-)	-51.72	360.65	0.00	5.02	-7.92
3	1	Q(+)	68.74	480.08	0.00	6.69	-10.54
		Q(-)	-554.73	-3185.45	0.00	-44.37	69.93
	2	Q(+)	68.74	282.45	0.00	3.93	-6.20
		Q(-)	-468.94	-1712.69	0.00	-23.85	37.60

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	Q(+)	68.74	84.83	0.00	1.18	-1.86
		Q(-)	-382.15	-488.61	0.00	-6.81	10.73
	4	Q(+)	68.74	-87.02	0.00	-1.21	1.91
		Q(-)	-306.14	371.74	0.00	5.18	-8.16
	5	Q(+)	68.74	-370.56	0.00	-5.16	8.14
		Q(-)	-180.73	923.60	0.00	12.86	-20.28
	6	Q(+)	72.88	1421.33	0.00	19.80	-31.20
		Q(-)	-75.77	1452.64	0.00	20.23	-31.89
	7	Q(+)	183.66	1333.85	0.00	18.58	-29.28
		Q(-)	-66.58	-359.57	0.00	-5.01	7.89
	8	Q(+)	309.08	317.58	0.00	4.42	-6.97
		Q(-)	-66.58	-84.93	0.00	-1.18	1.86
	9	Q(+)	385.09	-550.13	0.00	-7.66	12.08
		Q(-)	-66.58	81.52	0.00	1.14	-1.79
	10	Q(+)	471.88	-1783.06	0.00	-24.83	39.14
		Q(-)	-66.58	272.94	0.00	3.80	-5.99
	11	Q(+)	554.91	-3191.87	0.00	-44.46	70.07
		Q(-)	-66.58	464.35	0.00	6.47	-10.19
4	1	Q(+)	66.58	464.37	0.00	6.47	-10.19
		Q(-)	-554.91	-3191.87	0.00	-44.46	70.07
	2	Q(+)	66.58	272.95	0.00	3.80	-5.99
		Q(-)	-471.89	-1782.92	0.00	-24.83	39.14
	3	Q(+)	66.58	81.53	0.00	1.14	-1.79
		Q(-)	-385.10	-550.35	0.00	-7.67	12.08
	4	Q(+)	66.58	-84.93	0.00	-1.18	1.86
		Q(-)	-309.09	317.39	0.00	4.42	-6.97
	5	Q(+)	66.58	-359.58	0.00	-5.01	7.89
		Q(-)	-183.67	1333.70	0.00	18.58	-29.28
	6	Q(+)	75.60	1454.24	0.00	20.25	-31.93
		Q(-)	-73.04	1419.78	0.00	19.77	-31.17
	7	Q(+)	180.71	1376.02	0.00	19.17	-30.21
		Q(-)	-68.74	-370.55	0.00	-5.16	8.13
	8	Q(+)	306.13	371.94	0.00	5.18	-8.17
		Q(-)	-68.74	-87.01	0.00	-1.21	1.91
	9	Q(+)	382.14	-488.39	0.00	-6.80	10.72
		Q(-)	-68.74	84.83	0.00	1.18	-1.86
	10	Q(+)	468.93	-1712.84	0.00	-23.86	37.60
		Q(-)	-68.74	282.44	0.00	3.93	-6.20
	11	Q(+)	554.73	-3185.45	0.00	-44.37	69.93
		Q(-)	-68.74	480.06	0.00	6.69	-10.54
5	1	Q(+)	51.72	360.65	0.00	5.02	-7.92
		Q(-)	-553.61	-3183.22	0.00	-44.34	69.88
	2	Q(+)	51.72	211.97	0.00	2.95	-4.65
		Q(-)	-471.37	-1796.54	0.00	-25.02	39.44
	3	Q(+)	51.72	63.29	0.00	0.88	-1.39
		Q(-)	-384.58	-565.49	0.00	-7.88	12.41
	4	Q(+)	51.72	-66.00	0.00	-0.92	1.45
		Q(-)	-308.56	300.94	0.00	4.19	-6.61
	5	Q(+)	51.72	-279.33	0.00	-3.89	6.13
		Q(-)	-183.14	1315.08	0.00	18.32	-28.87

Envolvente de cortantes por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Cortante (t)	Momento (m x t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	Q(+)	63.41	1586.63	0.00	22.10	-34.83
		Q(-)	-70.07	-657.43	0.00	-9.16	14.43
	7	Q(+)	171.06	1507.77	0.00	21.00	-33.10
		Q(-)	-70.07	-368.39	0.00	-5.13	8.09
	8	Q(+)	296.48	543.45	0.00	7.57	-11.93
		Q(-)	-70.07	-79.35	0.00	-1.11	1.74
	9	Q(+)	372.50	-292.77	0.00	-4.08	6.43
		Q(-)	-70.07	95.83	0.00	1.33	-2.10
	10	Q(+)	459.29	-1489.50	0.00	-20.75	32.70
		Q(-)	-70.07	297.28	0.00	4.14	-6.53
	11	Q(+)	543.95	-2904.71	0.00	-40.46	63.77
		Q(-)	-70.07	498.73	0.00	6.95	-10.95
6	1	Q(+)	18.47	498.73	0.00	6.95	-10.95
		Q(-)	-518.74	-2923.35	0.00	-40.72	64.18
	2	Q(+)	18.47	422.54	0.00	5.89	-9.28
		Q(-)	-393.32	-1042.24	0.00	-14.52	22.88
	3	Q(+)	18.47	346.34	0.00	4.82	-7.60
		Q(-)	-267.90	321.52	0.00	4.48	-7.06
	4	Q(+)	18.47	303.05	0.00	4.22	-6.65
		Q(-)	-196.63	865.94	0.00	12.06	-19.01
	5	Q(+)	18.47	259.75	0.00	3.62	-5.70
		Q(-)	-125.36	1243.31	0.00	17.32	-27.30
	6	Q(+)	18.47	216.45	0.00	3.01	-4.75
		Q(-)	-69.17	-810.48	0.00	-11.29	17.79
	7	Q(+)	85.76	2139.76	0.00	29.80	-46.98
		Q(-)	-69.17	-648.35	0.00	-9.03	14.23
	8	Q(+)	157.03	1855.22	0.00	25.84	-40.73
		Q(-)	-69.17	-486.23	0.00	-6.77	10.67
	9	Q(+)	228.29	1403.62	0.00	19.55	-30.81
		Q(-)	-69.17	-324.11	0.00	-4.51	7.12
	10	Q(+)	299.57	784.97	0.00	10.93	-17.23
		Q(-)	-69.17	-161.99	0.00	-2.26	3.56
	11	Q(+)	370.77	0.00	0.00	0.00	0.00
		Q(-)	-69.17	0.00	0.00	0.00	0.00

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	M(+)	0.00	-243.61	0.00	0.00	0.00
		M(-)	0.00	47.36	0.00	0.00	0.00
	2	M(+)	890.26	-288.68	0.00	12.40	-19.54
		M(-)	-186.75	69.17	0.00	-2.60	4.10
	3	M(+)	1558.87	-206.59	0.00	21.71	-34.22
		M(-)	-373.51	69.17	0.00	-5.20	8.20
	4	M(+)	2005.83	-124.49	0.00	27.94	-44.04
		M(-)	-560.26	69.17	0.00	-7.80	12.30
	5	M(+)	2231.14	-42.40	0.00	31.08	-48.98
		M(-)	-747.01	69.17	0.00	-10.40	16.40
	6	M(+)	2234.79	39.69	0.00	31.13	-49.06
		M(-)	-933.77	69.17	0.00	-13.01	20.50
	7	M(+)	2016.80	121.79	0.00	28.09	-44.28
		M(-)	-1120.52	69.17	0.00	-15.61	24.60
	8	M(+)	1577.16	203.88	0.00	21.97	-34.62
		M(-)	-1307.27	69.17	0.00	-18.21	28.70
	9	M(+)	915.86	285.97	0.00	12.76	-20.11
		M(-)	-1494.02	69.17	0.00	-20.81	32.80
	10	M(+)	448.88	-18.47	0.00	6.25	-9.85
		M(-)	-1788.78	382.77	0.00	-24.91	39.27
	11	M(+)	498.75	-18.47	0.00	6.95	-10.95
		M(-)	-2923.35	518.74	0.00	-40.72	64.18
2	1	M(+)	498.75	70.07	0.00	6.95	-10.95
		M(-)	-2923.35	-483.25	0.00	-40.72	64.18
	2	M(+)	297.29	70.07	0.00	4.14	-6.53
		M(-)	-1639.16	-410.10	0.00	-22.83	35.99
	3	M(+)	675.55	-269.14	0.00	9.41	-14.83
		M(-)	-1048.60	-51.72	0.00	-14.60	23.02
	4	M(+)	1331.81	-262.38	0.00	18.55	-29.24
		M(-)	-919.31	-51.72	0.00	-12.80	20.18
	5	M(+)	2155.43	-136.96	0.00	30.02	-47.32
		M(-)	-845.28	-2.95	0.00	-11.77	18.56
	6	M(+)	2461.71	-11.54	0.00	34.29	-54.04
		M(-)	-854.21	7.28	0.00	-11.90	18.75
	7	M(+)	2252.86	112.54	0.00	31.38	-49.46
		M(-)	-970.26	34.13	0.00	-13.51	21.30
	8	M(+)	1529.95	237.96	0.00	21.31	-33.59
		M(-)	-1235.55	70.07	0.00	-17.21	27.12
	9	M(+)	840.04	313.97	0.00	11.70	-18.44
		M(-)	-1410.73	70.07	0.00	-19.65	30.97
	10	M(+)	426.75	-18.55	0.00	5.94	-9.37
		M(-)	-1895.70	412.03	0.00	-26.40	41.62
	11	M(-)	480.08	-18.55	0.00	6.69	-10.54
		M(-)	-3261.26	550.61	0.00	-45.42	71.60
3	1	M(+)	480.08	68.74	0.00	6.69	-10.54
		M(-)	-3261.26	-495.61	0.00	-45.42	71.60
	2	M(+)	320.81	13.86	0.00	4.47	-7.04
		M(-)	-1941.53	-422.46	0.00	-27.04	42.62

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	3	M(+)	750.08	-320.24	0.00	10.45	-16.47
		M(-)	-1349.93	-66.58	0.00	-18.80	29.64
	4	M(+)	1455.67	-244.23	0.00	20.27	-31.96
		M(-)	-1183.48	-66.58	0.00	-16.48	25.98
	5	M(+)	2206.48	-119.87	0.00	30.73	-48.44
		M(-)	-1046.02	-18.83	0.00	-14.57	22.96
	6	M(+)	2471.07	-8.84	0.00	34.42	-54.25
		M(-)	-989.46	-8.60	0.00	-13.78	21.72
	7	M(+)	2251.00	115.22	0.00	31.35	-49.42
		M(-)	-1033.18	22.35	0.00	-14.39	22.68
	8	M(+)	1517.04	240.64	0.00	21.13	-33.30
		M(-)	-1221.20	68.74	0.00	-17.01	26.81
	9	M(+)	820.42	316.65	0.00	11.43	-18.01
		M(-)	-1393.05	68.74	0.00	-19.40	30.58
	10	M(+)	413.05	-17.85	0.00	5.75	-9.07
		M(-)	-1933.38	419.56	0.00	-26.93	42.44
	11	M(+)	464.37	-17.85	0.00	6.47	-10.19
		M(-)	-3249.03	551.12	0.00	-45.25	71.33
4	1	M(+)	464.37	66.58	0.00	6.47	-10.19
		M(-)	-3249.03	-492.88	0.00	-45.25	71.33
	2	M(+)	413.04	17.85	0.00	5.75	-9.07
		M(-)	-1937.16	-419.72	0.00	-26.98	42.53
	3	M(+)	814.00	-316.97	0.00	11.34	-17.87
		M(-)	-1392.99	-68.74	0.00	-19.40	30.58
	4	M(+)	1511.41	-240.96	0.00	21.05	-33.18
		M(-)	-1221.15	-68.74	0.00	-17.01	26.81
	5	M(+)	2248.70	-116.59	0.00	31.32	-49.37
		M(-)	-1035.41	-22.52	0.00	-14.42	22.73
	6	M(+)	2470.96	8.83	0.00	34.42	-54.25
		M(-)	-987.86	8.43	0.00	-13.76	21.69
	7	M(+)	2208.77	118.50	0.00	30.76	-48.49
		M(-)	-1043.73	18.66	0.00	-14.54	22.91
	8	M(+)	1461.29	243.92	0.00	20.35	-32.08
		M(-)	-1183.53	66.58	0.00	-16.48	25.98
	9	M(+)	756.48	319.93	0.00	10.54	-16.61
		M(-)	-1349.98	66.58	0.00	-18.80	29.64
	10	M(+)	320.81	-13.86	0.00	4.47	-7.04
		M(-)	-1937.65	422.29	0.00	-26.99	42.54
	11	M(+)	480.06	-68.74	0.00	6.69	-10.54
		M(-)	-3256.89	495.44	0.00	-45.36	71.50
5	1	M(+)	480.06	18.55	0.00	6.69	-10.54
		M(-)	-3256.89	-544.53	0.00	-45.36	71.50
	2	M(+)	426.73	18.55	0.00	5.94	-9.37
		M(-)	-1895.70	-412.03	0.00	-26.40	41.62
	3	M(+)	833.62	-314.29	0.00	11.61	-18.30
		M(-)	-1410.68	-70.07	0.00	-19.65	30.97
	4	M(+)	1524.33	-238.28	0.00	21.23	-33.46
		M(-)	-1235.50	-70.07	0.00	-17.21	27.12
	5	M(+)	2250.47	-113.89	0.00	31.34	-49.41
		M(-)	-972.48	-34.29	0.00	-13.54	21.35

Envolvente de momentos por sobrecarga total

(sobrecarga repartida+carro)

V.	SE		Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	6	M(+)	2461.60	11.53	0.00	34.29	-54.04
		M(-)	-854.21	-7.28	0.00	-11.90	18.75
	7	M(+)	2155.37	136.95	0.00	30.02	-47.32
		M(-)	-845.28	2.95	0.00	-11.77	18.56
	8	M(+)	1331.79	262.37	0.00	18.55	-29.24
		M(-)	-919.31	51.72	0.00	-12.80	20.18
	9	M(+)	675.56	269.13	0.00	9.41	-14.83
		M(-)	-1048.60	51.72	0.00	-14.60	23.02
	10	M(+)	297.28	-70.07	0.00	4.14	-6.53
		M(-)	-1639.16	410.10	0.00	-22.83	35.99
	11	M(+)	498.73	-70.07	0.00	6.95	-10.95
		M(-)	-2923.35	483.25	0.00	-40.72	64.18
6	1	M(+)	498.73	18.47	0.00	6.95	-10.95
		M(-)	-2923.35	-518.74	0.00	-40.72	64.18
	2	M(+)	528.86	-267.90	0.00	7.37	-11.61
		M(-)	-1582.15	-69.17	0.00	-22.04	34.73
	3	M(+)	1607.40	-199.32	0.00	22.39	-35.29
		M(-)	-1296.84	-69.17	0.00	-18.06	28.47
	4	M(+)	1991.07	-128.05	0.00	27.73	-43.71
		M(-)	-1134.72	-69.17	0.00	-15.80	24.91
	5	M(+)	2207.69	-56.78	0.00	30.75	-48.47
		M(-)	-972.60	-69.17	0.00	-13.55	21.35
	6	M(+)	2257.25	14.49	0.00	31.44	-49.56
		M(-)	-810.48	-69.17	0.00	-11.29	17.79
	7	M(+)	2139.76	85.76	0.00	29.80	-46.98
		M(-)	-648.35	-69.17	0.00	-9.03	14.23
	8	M(+)	1855.22	157.03	0.00	25.84	-40.73
		M(-)	-486.23	-69.17	0.00	-6.77	10.67
	9	M(+)	1403.62	228.29	0.00	19.55	-30.81
		M(-)	-324.11	-69.17	0.00	-4.51	7.12
	10	M(+)	784.97	299.57	0.00	10.93	-17.23
		M(-)	-161.99	-69.17	0.00	-2.26	3.56
	11	M(+)	0.00	243.61	0.00	0.00	0.00
		M(-)	0.00	-47.36	0.00	0.00	0.00

Cable Numero 1

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	2.050	0.400	1.099	-0.0352

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.700	2.140	0.310	1.189	-0.0295
3	5.400	2.207	0.243	1.256	-0.0197
4	8.100	2.247	0.203	1.296	-0.0099
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000
12	29.875	1.037	1.413	0.086	-0.3206
13	32.750	1.840	0.610	0.889	-0.1577
14	35.250	2.060	0.390	1.109	-0.0800

Cable Numero 2

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
15	39.375	2.260	0.190	1.309	0.0000
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000
22	62.875	1.037	1.413	0.086	-0.3206
23	65.750	1.840	0.610	0.889	-0.1577
24	68.250	2.060	0.390	1.109	-0.0800

Cable Numero 3

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	72.375	2.260	0.190	1.309	0.0000
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000
32	95.875	1.037	1.413	0.086	-0.3206
33	98.750	1.840	0.610	0.889	-0.1577
34	101.250	2.060	0.390	1.109	-0.0800

Cable Numero 4

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 4

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
35	105.375	2.260	0.190	1.309	0.0000
36	109.500	2.260	0.190	1.309	0.0000
37	113.625	2.109	0.341	1.158	0.0727
38	117.750	1.664	0.786	0.713	0.1424
39	120.250	1.257	1.193	0.306	0.1833
40	123.125	0.675	1.775	-0.276	0.1800
41	126.000	0.460	1.990	-0.491	0.0000
42	128.875	1.037	1.413	0.086	-0.3206
43	131.750	1.840	0.610	0.889	-0.1577
44	134.250	2.060	0.390	1.109	-0.0800

Cable Numero 5

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 5

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	134.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
45	138.375	2.260	0.190	1.309	0.0000
46	142.500	2.260	0.190	1.309	0.0000
47	146.625	2.109	0.341	1.158	0.0727
48	150.750	1.664	0.786	0.713	0.1424
49	153.250	1.257	1.193	0.306	0.1833
50	156.125	0.675	1.775	-0.276	0.1800
51	159.000	0.460	1.990	-0.491	0.0000
52	163.125	1.440	1.010	0.489	-0.3091
53	167.250	2.060	0.390	1.109	-0.0800

Cable Numero 6

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-2.020	-.0351
2	1.150	-2.090	-.0351
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.350	-1.191	-.3270
7	33.250	-1.900	-.0800
8	35.250	-2.060	-.0800
9	37.250	-2.220	-.0800
10	38.500	-2.260	0.0000
11	43.500	-2.260	0.0000
12	56.700	-0.760	0.2222
13	60.000	-0.460	0.0000
14	63.350	-1.191	-.3270
15	66.250	-1.900	-.0800
16	68.250	-2.060	-.0800
17	70.250	-2.220	-.0800
18	71.500	-2.260	0.0000
19	76.500	-2.260	0.0000
20	89.700	-0.760	0.2222
21	93.000	-0.460	0.0000
22	96.350	-1.191	-.3270
23	99.250	-1.900	-.0800
24	101.250	-2.060	-.0800
25	103.250	-2.220	-.0800
26	104.500	-2.260	0.0000
27	109.500	-2.260	0.0000
28	122.700	-0.760	0.2222
29	126.000	-0.460	0.0000
30	129.350	-1.191	-.3270
31	132.250	-1.900	-.0800
32	134.250	-2.060	-.0800
33	136.250	-2.220	-.0800
34	137.500	-2.260	0.0000
35	142.500	-2.260	0.0000
36	155.700	-0.760	0.2222
37	159.000	-0.460	0.0000
38	162.350	-1.191	-.3270
39	165.250	-1.900	-.0800
40	167.250	-2.060	-.0800
41	169.250	-2.220	-.0800
42	170.500	-2.260	0.0000
43	175.200	-2.260	0.0000
44	184.650	-2.097	0.0346
45	186.650	-2.027	0.0346

Replanteo del cable : 6

Se.	X	Y (s)	Y (i)	Exce.	Pend.
53	167.250	2.060	0.390	1.109	-0.0800

Se.	X	Y (s)	Y (i)	Exce.	Pend.
54	169.594	2.242	0.208	1.291	-0.0484
55	171.938	2.260	0.190	1.309	0.0000
56	174.282	2.260	0.190	1.309	0.0000
57	176.626	2.256	0.194	1.305	0.0052
58	178.970	2.234	0.216	1.283	0.0137
59	181.314	2.192	0.258	1.241	0.0223
60	183.658	2.130	0.320	1.179	0.0309
61	186.000	2.050	0.400	1.099	0.0348

Cable Numero 7

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 7

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.550	0.900	0.599	-0.1191

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.700	1.856	0.594	0.905	-0.0997
3	5.400	2.081	0.369	1.130	-0.0664
4	8.100	2.215	0.235	1.264	-0.0332
5	10.800	2.260	0.190	1.309	0.0000
6	13.500	2.200	0.250	1.249	0.0445
7	16.200	2.020	0.430	1.069	0.0889
8	18.900	1.720	0.730	0.769	0.1333
9	21.600	1.300	1.150	0.349	0.1778
10	24.300	0.760	1.690	-0.191	0.2222
11	27.000	0.460	1.990	-0.491	0.0000
12	29.875	0.748	1.702	-0.203	-0.1684
13	32.750	1.244	1.206	0.293	-0.1440
14	35.250	1.550	0.900	0.599	-0.1200

Cable Numero 8

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 8

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.550	0.900	0.599	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
15	39.375	2.027	0.423	1.076	-0.0997
16	43.500	2.260	0.190	1.309	0.0000
17	47.625	2.109	0.341	1.158	0.0727
18	51.750	1.664	0.786	0.713	0.1424
19	54.250	1.257	1.193	0.306	0.1833
20	57.125	0.675	1.775	-0.276	0.1800
21	60.000	0.460	1.990	-0.491	0.0000
22	62.875	0.748	1.702	-0.203	-0.1684
23	65.750	1.244	1.206	0.293	-0.1440
24	68.250	1.550	0.900	0.599	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	72.375	2.027	0.423	1.076	-0.0997
26	76.500	2.260	0.190	1.309	0.0000
27	80.625	2.109	0.341	1.158	0.0727
28	84.750	1.664	0.786	0.713	0.1424
29	87.250	1.257	1.193	0.306	0.1833
30	90.125	0.675	1.775	-0.276	0.1800
31	93.000	0.460	1.990	-0.491	0.0000
32	95.875	0.748	1.702	-0.203	-0.1684
33	98.750	1.244	1.206	0.293	-0.1440
34	101.250	1.550	0.900	0.599	-0.1200

Cable Numero 9

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 9

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.550	0.900	0.599	-0.1200

Cable Numero 10

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 10

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	1.550	0.900	0.599	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
35	105.375	2.027	0.423	1.076	-0.0997
36	109.500	2.260	0.190	1.309	0.0000
37	113.625	2.109	0.341	1.158	0.0727
38	117.750	1.664	0.786	0.713	0.1424
39	120.250	1.257	1.193	0.306	0.1833
40	123.125	0.675	1.775	-0.276	0.1800
41	126.000	0.460	1.990	-0.491	0.0000
42	128.875	0.748	1.702	-0.203	-0.1684
43	131.750	1.244	1.206	0.293	-0.1440
44	134.250	1.550	0.900	0.599	-0.1200

Cable Numero 11

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 11

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	134.250	1.550	0.900	0.599	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
45	138.375	2.027	0.423	1.076	-0.0997
46	142.500	2.260	0.190	1.309	0.0000
47	146.625	2.109	0.341	1.158	0.0727
48	150.750	1.664	0.786	0.713	0.1424
49	153.250	1.257	1.193	0.306	0.1833
50	156.125	0.675	1.775	-0.276	0.1800
51	159.000	0.460	1.990	-0.491	0.0000
52	163.125	0.971	1.479	0.020	-0.1816
53	167.250	1.550	0.900	0.599	-0.1200

Cable Numero 12

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-1.449	-.1188
2	1.150	-1.687	-.1188
3	10.800	-2.260	0.0000
4	24.300	-0.760	0.2222
5	27.000	-0.460	0.0000
6	30.950	-0.939	-.1819
7	33.250	-1.310	-.1200
8	35.250	-1.550	-.1200
9	37.250	-1.790	-.1200
10	43.500	-2.260	0.0000
11	56.700	-0.760	0.2222
12	60.000	-0.460	0.0000
13	63.950	-0.939	-.1819
14	66.250	-1.310	-.1200
15	68.250	-1.550	-.1200
16	70.250	-1.790	-.1200
17	76.500	-2.260	0.0000
18	89.700	-0.760	0.2222
19	93.000	-0.460	0.0000
20	96.950	-0.939	-.1819
21	99.250	-1.310	-.1200
22	101.250	-1.550	-.1200
23	103.250	-1.790	-.1200
24	109.500	-2.260	0.0000
25	122.700	-0.760	0.2222
26	126.000	-0.460	0.0000
27	129.950	-0.939	-.1819
28	132.250	-1.310	-.1200
29	134.250	-1.550	-.1200
30	136.250	-1.790	-.1200
31	142.500	-2.260	0.0000
32	155.700	-0.760	0.2222
33	159.000	-0.460	0.0000
34	162.950	-0.939	-.1819
35	165.250	-1.310	-.1200
36	167.250	-1.550	-.1200
37	169.250	-1.790	-.1200
38	175.200	-2.260	0.0000
39	184.650	-1.708	0.1169
40	186.650	-1.474	0.1169

Replanteo del cable : 12

Se.	X	Y (s)	Y (i)	Exce.	Pend.
53	167.250	1.550	0.900	0.599	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
54	169.594	1.831	0.619	0.880	-0.1193
55	171.938	2.088	0.362	1.137	-0.0940
56	174.282	2.244	0.206	1.293	-0.0334
57	176.626	2.247	0.203	1.296	0.0176
58	178.970	2.172	0.278	1.221	0.0466
59	181.314	2.029	0.421	1.078	0.0756
60	183.658	1.818	0.632	0.867	0.1046
61	186.000	1.550	0.900	0.599	0.1170

Cable Numero 13

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 13

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	1.050	1.400	0.099	-0.1661
2	2.700	1.477	0.973	0.526	-0.1390

Se.	X	Y (s)	Y (i)	Exce.	Pend.
3	5.400	1.790	0.660	0.839	-0.0926
4	8.100	1.978	0.472	1.027	-0.0463
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.325	2.125	-0.626	-0.0636
13	32.750	0.630	1.820	-0.321	-0.1521
14	35.250	1.050	1.400	0.099	-0.1700

Cable Numero 14

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 14

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	1.050	1.400	0.099	-0.1700
15	39.375	1.722	0.728	0.771	-0.1378

Se.	X	Y (s)	Y (i)	Exce.	Pend.
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000
22	62.875	0.325	2.125	-0.626	-0.0636
23	65.750	0.630	1.820	-0.321	-0.1521
24	68.250	1.050	1.400	0.099	-0.1700

Cable Numero 15

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 15

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	1.050	1.400	0.099	-0.1700
25	72.375	1.722	0.728	0.771	-0.1378

Se.	X	Y (s)	Y (i)	Exce.	Pend.
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000
32	95.875	0.325	2.125	-0.626	-0.0636
33	98.750	0.630	1.820	-0.321	-0.1521
34	101.250	1.050	1.400	0.099	-0.1700

Cable Numero 16

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 16

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	1.050	1.400	0.099	-0.1700
35	105.375	1.722	0.728	0.771	-0.1378

Se.	X	Y (s)	Y (i)	Exce.	Pend.
36	109.500	2.040	0.410	1.089	0.0000
37	113.625	1.889	0.561	0.938	0.0727
38	117.750	1.444	1.006	0.493	0.1424
39	120.250	1.037	1.413	0.086	0.1833
40	123.125	0.455	1.995	-0.496	0.1800
41	126.000	0.240	2.210	-0.711	0.0000
42	128.875	0.325	2.125	-0.626	-0.0636
43	131.750	0.630	1.820	-0.321	-0.1521
44	134.250	1.050	1.400	0.099	-0.1700

Cable Numero 17

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 17

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	134.250	1.050	1.400	0.099	-0.1700
45	138.375	1.722	0.728	0.771	-0.1378

Se.	X	Y (s)	Y (i)	Exce.	Pend.
46	142.500	2.040	0.410	1.089	0.0000
47	146.625	1.889	0.561	0.938	0.0727
48	150.750	1.444	1.006	0.493	0.1424
49	153.250	1.037	1.413	0.086	0.1833
50	156.125	0.455	1.995	-0.496	0.1800
51	159.000	0.240	2.210	-0.711	0.0000
52	163.125	0.427	2.023	-0.524	-0.0990
53	167.250	1.050	1.400	0.099	-0.1700

Cable Numero 18

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.909	-.1657
2	1.150	-1.241	-.1657
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	33.250	-0.710	-.1700
7	35.250	-1.050	-.1700
8	37.250	-1.390	-.1700
9	43.500	-2.040	0.0000
10	56.700	-0.540	0.2222
11	60.000	-0.240	0.0000
12	66.250	-0.710	-.1700
13	68.250	-1.050	-.1700
14	70.250	-1.390	-.1700
15	76.500	-2.040	0.0000
16	89.700	-0.540	0.2222
17	93.000	-0.240	0.0000
18	99.250	-0.710	-.1700
19	101.250	-1.050	-.1700
20	103.250	-1.390	-.1700
21	109.500	-2.040	0.0000
22	122.700	-0.540	0.2222
23	126.000	-0.240	0.0000
24	132.250	-0.710	-.1700
25	134.250	-1.050	-.1700
26	136.250	-1.390	-.1700
27	142.500	-2.040	0.0000
28	155.700	-0.540	0.2222
29	159.000	-0.240	0.0000
30	165.250	-0.710	-.1700
31	167.250	-1.050	-.1700
32	169.250	-1.390	-.1700
33	175.200	-2.040	0.0000
34	184.650	-1.270	0.1630
35	186.650	-0.944	0.1630

Replanteo del cable : 18

Se.	X	Y (s)	Y (i)	Exce.	Pend.
53	167.250	1.050	1.400	0.099	-0.1700
54	169.594	1.448	1.002	0.497	-0.1681

Se.	X	Y (s)	Y (i)	Exce.	Pend.
55	171.938	1.805	0.645	0.854	-0.1292
56	174.282	2.019	0.431	1.068	-0.0452
57	176.626	2.022	0.428	1.071	0.0246
58	178.970	1.917	0.533	0.966	0.0650
59	181.314	1.718	0.732	0.767	0.1054
60	183.658	1.423	1.027	0.472	0.1459
61	186.000	1.050	1.400	0.099	0.1630

Cable Numero 19

Definicion general

Seccion inicial ..... = 1 (0.000) Activa
Seccion final ..... = 14 (35.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 19

Se.	X	Y (s)	Y (i)	Exce.	Pend.
1	0.000	0.590	1.860	-0.361	-0.2424

Se.	X	Y (s)	Y (i)	Exce.	Pend.
2	2.700	1.215	1.235	0.264	-0.2037
3	5.400	1.673	0.777	0.722	-0.1358
4	8.100	1.948	0.502	0.997	-0.0679
5	10.800	2.040	0.410	1.089	0.0000
6	13.500	1.980	0.470	1.029	0.0445
7	16.200	1.800	0.650	0.849	0.0889
8	18.900	1.500	0.950	0.549	0.1333
9	21.600	1.080	1.370	0.129	0.1778
10	24.300	0.540	1.910	-0.411	0.2222
11	27.000	0.240	2.210	-0.711	0.0000
12	29.875	0.240	2.210	-0.711	0.0000
13	32.750	0.264	2.186	-0.687	-0.0662
14	35.250	0.550	1.900	-0.401	-0.1200

Cable Numero 20

Definicion general

Seccion inicial ..... = 14 (35.250) Pasiva
Seccion final ..... = 24 (68.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 20

Se.	X	Y (s)	Y (i)	Exce.	Pend.
14	35.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
15	39.375	1.236	1.214	0.285	-0.2678
16	43.500	2.040	0.410	1.089	0.0000
17	47.625	1.889	0.561	0.938	0.0727
18	51.750	1.444	1.006	0.493	0.1424
19	54.250	1.037	1.413	0.086	0.1833
20	57.125	0.455	1.995	-0.496	0.1800
21	60.000	0.240	2.210	-0.711	0.0000
22	62.875	0.240	2.210	-0.711	0.0000
23	65.750	0.264	2.186	-0.687	-0.0662
24	68.250	0.550	1.900	-0.401	-0.1200

Cable Numero 21

Definicion general

Seccion inicial ..... = 24 (68.250) Pasiva
Seccion final ..... = 34 (101.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 21

Se.	X	Y (s)	Y (i)	Exce.	Pend.
24	68.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
25	72.375	1.236	1.214	0.285	-0.2678
26	76.500	2.040	0.410	1.089	0.0000
27	80.625	1.889	0.561	0.938	0.0727
28	84.750	1.444	1.006	0.493	0.1424
29	87.250	1.037	1.413	0.086	0.1833
30	90.125	0.455	1.995	-0.496	0.1800
31	93.000	0.240	2.210	-0.711	0.0000
32	95.875	0.240	2.210	-0.711	0.0000
33	98.750	0.264	2.186	-0.687	-0.0662
34	101.250	0.550	1.900	-0.401	-0.1200

Cable Numero 22

Definicion general

Seccion inicial ..... = 34 (101.250) Pasiva
Seccion final ..... = 44 (134.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 22

Se.	X	Y (s)	Y (i)	Exce.	Pend.
34	101.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
35	105.375	1.236	1.214	0.285	-0.2678
36	109.500	2.040	0.410	1.089	0.0000
37	113.625	1.889	0.561	0.938	0.0727
38	117.750	1.444	1.006	0.493	0.1424
39	120.250	1.037	1.413	0.086	0.1833
40	123.125	0.455	1.995	-0.496	0.1800
41	126.000	0.240	2.210	-0.711	0.0000
42	128.875	0.240	2.210	-0.711	0.0000
43	131.750	0.264	2.186	-0.687	-0.0662
44	134.250	0.550	1.900	-0.401	-0.1200

Cable Numero 23

Definicion general

Seccion inicial ..... = 44 (134.250) Pasiva
Seccion final ..... = 53 (167.250) Activa

Fuerza de Pretensado ..... = 1076.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 23

Se.	X	Y (s)	Y (i)	Exce.	Pend.
44	134.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
45	138.375	1.236	1.214	0.285	-0.2678
46	142.500	2.040	0.410	1.089	0.0000
47	146.625	1.889	0.561	0.938	0.0727
48	150.750	1.444	1.006	0.493	0.1424
49	153.250	1.037	1.413	0.086	0.1833
50	156.125	0.455	1.995	-0.496	0.1800
51	159.000	0.240	2.210	-0.711	0.0000
52	163.125	0.240	2.210	-0.711	0.0000
53	167.250	0.550	1.900	-0.401	-0.1200

Cable Numero 24

Definicion general

Seccion inicial ..... = 53 (167.250) Pasiva
Seccion final ..... = 61 (186.000) Activa

Fuerza de Pretensado ..... = 956.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	-0.850	-0.384	-.2427
2	1.150	-0.869	-.2427
3	10.800	-2.040	0.0000
4	24.300	-0.540	0.2222
5	27.000	-0.240	0.0000
6	32.000	-0.240	0.0000
7	33.250	-0.310	-.1200
8	35.250	-0.550	-.1200
9	37.250	-0.790	-.1200
10	39.950	-1.393	-.2743
11	43.500	-2.040	0.0000
12	56.700	-0.540	0.2222
13	60.000	-0.240	0.0000
14	65.000	-0.240	0.0000
15	66.250	-0.310	-.1200
16	68.250	-0.550	-.1200
17	70.250	-0.790	-.1200
18	72.950	-1.393	-.2743
19	76.500	-2.040	0.0000
20	89.700	-0.540	0.2222
21	93.000	-0.240	0.0000
22	98.000	-0.240	0.0000
23	99.250	-0.310	-.1200
24	101.250	-0.550	-.1200
25	103.250	-0.790	-.1200
26	105.950	-1.393	-.2743
27	109.500	-2.040	0.0000
28	122.700	-0.540	0.2222
29	126.000	-0.240	0.0000
30	131.000	-0.240	0.0000
31	132.250	-0.310	-.1200
32	134.250	-0.550	-.1200
33	136.250	-0.790	-.1200
34	138.950	-1.393	-.2743
35	142.500	-2.040	0.0000
36	155.700	-0.540	0.2222
37	159.000	-0.240	0.0000
38	164.000	-0.240	0.0000
39	165.250	-0.310	-.1200
40	167.250	-0.550	-.1200
41	169.250	-0.790	-.1200
42	171.850	-1.396	-.2891
43	175.200	-2.040	0.0000
44	184.650	-0.912	0.2387
45	186.650	-0.435	0.2387

Replanteo del cable : 24

Se.	X	Y (s)	Y (i)	Exce.	Pend.
53	167.250	0.550	1.900	-0.401	-0.1200

Se.	X	Y (s)	Y (i)	Exce.	Pend.
54	169.594	0.839	1.611	-0.112	-0.1620
55	171.938	1.421	1.029	0.470	-0.2888
56	174.282	1.974	0.476	1.023	-0.1361
57	176.626	2.014	0.436	1.063	0.0360
58	178.970	1.860	0.590	0.909	0.0952
59	181.314	1.568	0.882	0.617	0.1545
60	183.658	1.136	1.314	0.185	0.2137
61	186.000	0.590	1.860	-0.361	0.2384

Definicion esfuerzos unitarios cable : 1

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	1	1075.984	-37.822	1075.319	1181.747	-37.822	1075.319
---					-1.971	6.258	-4.701
	2	1071.083	-31.564	1070.618			
---					-6.844	10.606	-5.573
	3	1065.251	-20.959	1065.045			
---					-7.242	10.522	-5.651
	4	1059.445	-10.436	1059.394			
---					-7.493	10.436	-5.729
	5	1053.665	0.000	1053.665			
---					-18.792	46.198	-14.355
	6	1040.336	46.198	1039.310			
---					-19.179	44.759	-16.130
	7	1027.215	90.957	1023.180			
---					-16.840	43.104	-17.744
	8	1014.334	134.061	1005.436			
---					-11.295	41.267	-19.177
	9	1001.722	175.328	986.259			
---					-2.225	39.284	-20.410
	10	989.405	214.612	965.849			
---					8.603	-214.612	-17.580
	11	948.269	0.000	948.269			
---					102.719	-310.091	19.018
	12	1015.776	-310.091	967.287			
---					161.922	145.697	75.342
	13	1055.510	-164.394	1042.629			
---					-50.135	78.588	29.944
	14	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 2

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	14	824.566	-65.755	821.940	911.531	-65.755	821.940
---					56.172	65.755	20.935
	15	842.875	0.000	842.875			
---					5.749	0.000	4.392
	16	847.267	0.000	847.267			
---					19.040	62.709	15.219
	17	864.763	62.709	862.486			
---					9.834	61.661	10.641
	18	881.940	124.370	873.127			
---					2.155	36.445	4.400
	19	892.140	160.814	877.526			
---					-53.019	0.415	18.237
	20	910.158	161.229	895.764			
---					13.687	-161.229	52.505
	21	948.269	0.000	948.269			
---					102.719	-310.092	19.018
	22	1015.777	-310.092	967.288			
---					161.921	145.698	75.342
	23	1055.510	-164.394	1042.629			
---					-50.135	78.588	29.944
	24	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 3

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	824.566	-65.755	821.940	911.531	-65.755	821.940
---					56.172	65.755	20.935
	25	842.875	0.000	842.875			
---					5.749	0.000	4.392
	26	847.267	0.000	847.267			
---					19.040	62.709	15.219
	27	864.763	62.709	862.486			
---					9.834	61.661	10.641
	28	881.940	124.370	873.127			
---					2.155	36.445	4.400
	29	892.140	160.814	877.527			
---					-53.019	0.414	18.237
	30	910.158	161.229	895.764			
---					13.687	-161.229	52.505
	31	948.269	0.000	948.269			
---					102.719	-310.092	19.018
	32	1015.777	-310.092	967.288			
---					161.921	145.698	75.342
	33	1055.510	-164.394	1042.629			
---					-50.135	78.588	29.944
	34	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 4

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	34	824.566	-65.755	821.940	911.531	-65.755	821.940
---					56.172	65.755	20.935
	35	842.875	0.000	842.875			
---					5.749	0.000	4.392
	36	847.267	0.000	847.267			
---					19.040	62.709	15.219
	37	864.763	62.709	862.486			
---					9.834	61.661	10.641
	38	881.940	124.370	873.127			
---					2.155	36.445	4.400
	39	892.140	160.814	877.527			
---					-53.019	0.414	18.237
	40	910.158	161.229	895.764			
---					13.687	-161.229	52.505
	41	948.269	0.000	948.269			
---					102.717	-310.091	19.018
	42	1015.776	-310.091	967.288			
---					161.922	145.696	75.341
	43	1055.510	-164.395	1042.629			
---					-50.135	78.589	29.944
	44	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 5

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	44	824.566	-65.755	821.940	911.531	-65.755	821.940
---					56.172	65.755	20.935
	45	842.875	0.000	842.875			
---					5.749	0.000	4.392
	46	847.267	0.000	847.267			
---					19.041	62.709	15.219
	47	864.763	62.709	862.486			
---					9.834	61.661	10.641
	48	881.940	124.370	873.127			
---					2.155	36.445	4.400
	49	892.140	160.814	877.526			
---					-53.019	0.414	18.237
	50	910.158	161.229	895.764			
---					13.687	-161.229	52.505
	51	948.269	0.000	948.269			
---					320.260	-301.879	28.228
	52	1022.095	-301.879	976.497			
---					-87.401	216.073	96.076
	53	1076.000	-85.806	1072.573	-1189.484	85.806	-1072.573

Definicion esfuerzos unitarios cable : 6

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	53	911.513	-72.689	908.610	1007.648	-72.689	908.610
---					41.573	28.191	10.582
	54	920.268	-44.498	919.192			
---					-18.186	44.498	13.222
	55	932.414	0.000	932.414			
---					3.610	0.000	2.758
	56	935.172	0.000	935.172			
---					7.176	4.865	3.775
	57	938.959	4.865	938.946			
---					5.714	8.086	4.393
	58	943.428	12.952	943.339			
---					5.519	8.196	4.350
	59	947.925	21.148	947.689			
---					5.238	8.306	4.306
	60	952.451	29.454	951.996			
---					1.603	3.794	3.465
	61	956.040	33.248	955.461	-1050.113	-33.248	-955.461

Definicion esfuerzos unitarios cable : 7

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	1075.935	-127.237	1068.385	640.107	-127.237	1068.385
				7.293	21.272	-5.550
2	1068.104	-105.965	1062.835			
				-8.367	35.878	-8.041
3	1057.120	-70.087	1054.794			
				-11.160	35.358	-9.149
4	1046.221	-34.729	1045.645			
				-13.384	34.729	-10.221
5	1035.424	0.000	1035.424			
				-18.466	45.398	-14.106
6	1022.326	45.398	1021.317			
				-18.847	43.984	-15.851
7	1009.432	89.382	1005.467			
				-16.549	42.358	-17.437
8	996.774	131.740	988.030			
				-11.100	40.553	-18.844
9	984.380	172.293	969.185			
				-2.187	38.604	-20.057
10	972.276	210.896	949.128			
				-31.115	-210.896	63.313
11	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
12	1052.351	-174.782	1037.735			
				49.661	22.631	18.674
13	1067.310	-152.151	1056.410			
				-19.768	23.950	11.926
14	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 8

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	873.075	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.134
15	881.336	-87.406	876.991			
				60.098	87.406	27.613
16	904.604	0.000	904.604			
				20.329	66.952	16.249
17	923.283	66.952	920.853			
				10.500	65.834	11.361
18	941.623	132.786	932.213			
				2.301	38.911	4.697
19	952.513	171.697	936.911			
				-56.607	0.443	19.471
20	971.750	172.140	956.382			
				14.613	-172.140	56.058
21	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
22	1052.351	-174.782	1037.735			
				49.661	22.631	18.674
23	1067.310	-152.151	1056.410			
				-19.768	23.950	11.926
24	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 9

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
24	873.076	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.135
25	881.336	-87.406	876.991			
				60.098	87.406	27.613
26	904.604	0.000	904.604			
				20.329	66.953	16.249
27	923.283	66.953	920.853			
				10.500	65.834	11.361
28	941.623	132.786	932.213			
				2.301	38.911	4.697
29	952.513	171.697	936.911			
				-56.607	0.442	19.472
30	971.750	172.140	956.382			
				14.613	-172.140	56.058
31	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
32	1052.351	-174.782	1037.735			
				49.660	22.632	18.674
33	1067.310	-152.150	1056.410			
				-19.768	23.950	11.926
34	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 10

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
34	873.076	-104.023	866.856	519.247	-104.023	866.856
				29.687	16.617	10.135
35	881.336	-87.406	876.991			
				60.098	87.406	27.613
36	904.604	0.000	904.604			
				20.329	66.953	16.249
37	923.283	66.953	920.853			
				10.500	65.834	11.361
38	941.623	132.786	932.213			
				2.301	38.911	4.697
39	952.513	171.697	936.911			
				-56.607	0.442	19.472
40	971.750	172.140	956.382			
				14.613	-172.140	56.058
41	1012.441	0.000	1012.441			
				35.496	-174.782	25.295
42	1052.351	-174.782	1037.735			
				49.660	22.632	18.674
43	1067.310	-152.150	1056.410			
				-19.768	23.950	11.926
44	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 11

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	44	873.076	-104.023	866.856	519.247	-104.023	866.856
---					29.687	16.617	10.135
	45	881.336	-87.406	876.991			
---					60.098	87.406	27.613
	46	904.604	0.000	904.604			
---					20.329	66.953	16.249
	47	923.283	66.953	920.853			
---					10.500	65.834	11.361
	48	941.623	132.786	932.213			
---					2.301	38.911	4.697
	49	952.513	171.697	936.911			
---					-56.607	0.442	19.472
	50	971.750	172.140	956.382			
---					14.613	-172.140	56.058
	51	1012.441	0.000	1012.441			
---					128.281	-188.816	27.539
	52	1056.981	-188.816	1039.980			
---					-34.519	60.616	28.356
	53	1076.000	-128.200	1068.335	-639.933	128.200	-1068.335

Definicion esfuerzos unitarios cable : 12

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	53	888.571	-105.869	882.242	528.463	-105.869	882.242
---					2.752	0.308	2.820
	54	891.334	-105.561	885.061			
---					16.039	21.447	9.665
	55	898.671	-84.114	894.726			
---					28.246	53.658	17.593
	56	912.828	-30.456	912.320			
---					3.055	46.751	12.919
	57	925.382	16.295	925.239			
---					9.608	27.156	7.527
	58	933.777	43.451	932.765			
---					7.929	27.562	6.793
	59	942.238	71.013	939.558			
---					5.979	27.904	6.038
	60	950.755	98.917	945.596			
---					-4.935	12.210	3.950
	61	956.026	111.127	949.545	-568.810	-111.127	-949.545

Definicion esfuerzos unitarios cable : 13

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	1075.903	-176.333	1061.355	105.157	-176.333	1061.355
				14.326	29.458	-5.022
2	1066.495	-146.876	1056.333			
				-5.806	49.762	-8.117
3	1052.705	-97.113	1048.216			
				-9.950	49.060	-10.309
4	1039.019	-48.054	1037.907			
				-13.546	48.054	-12.429
5	1025.478	0.000	1025.478			
				-15.216	44.962	-13.971
6	1012.506	44.962	1011.507			
				-15.213	43.561	-15.698
7	999.736	88.523	995.809			
				-12.590	41.951	-17.270
8	987.199	130.474	978.539			
				-6.887	40.163	-18.663
9	974.925	170.638	959.875			
				0.527	41.589	-4.758
10	978.412	212.227	955.118			
				-51.759	-212.227	72.757
11	1027.875	0.000	1027.875			
				-17.222	-66.351	15.473
12	1045.456	-66.351	1043.348			
				-13.345	-94.320	13.192
13	1068.687	-160.671	1056.540			
				18.427	-19.662	4.241
14	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 14

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	877.318	-147.035	864.909	85.626	-147.035	864.909
				38.967	25.865	14.520
15	887.738	-121.169	879.429			
				72.457	121.169	38.965
16	918.394	0.000	918.394			
				17.010	67.973	16.497
17	937.359	67.973	934.891			
				8.122	66.837	11.534
18	955.978	134.810	946.425			
				1.287	39.504	4.769
19	967.034	174.314	951.194			
				-61.819	0.450	19.768
20	986.565	174.764	970.962			
				2.315	-174.764	56.913
21	1027.875	0.000	1027.875			
				-17.222	-66.351	15.473
22	1045.456	-66.351	1043.348			
				-13.345	-94.320	13.192
23	1068.687	-160.671	1056.540			
				18.427	-19.662	4.241
24	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 15

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	877.318	-147.035	864.909	85.626	-147.035	864.909
---					38.967	25.865	14.520
	25	887.738	-121.169	879.429			
---					72.457	121.169	38.965
	26	918.394	0.000	918.394			
---					17.010	67.973	16.497
	27	937.359	67.973	934.891			
---					8.122	66.837	11.534
	28	955.978	134.810	946.425			
---					1.287	39.504	4.769
	29	967.034	174.315	951.194			
---					-61.819	0.449	19.768
	30	986.565	174.764	970.962			
---					2.315	-174.764	56.913
	31	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	32	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	33	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	34	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 16

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	34	877.318	-147.035	864.909	85.626	-147.035	864.909
---					38.967	25.865	14.520
	35	887.737	-121.169	879.429			
---					72.457	121.169	38.965
	36	918.394	0.000	918.394			
---					17.010	67.973	16.497
	37	937.359	67.973	934.891			
---					8.122	66.837	11.534
	38	955.978	134.810	946.425			
---					1.287	39.504	4.769
	39	967.034	174.315	951.194			
---					-61.819	0.449	19.768
	40	986.565	174.764	970.962			
---					2.315	-174.764	56.913
	41	1027.875	0.000	1027.875			
---					-17.222	-66.351	15.473
	42	1045.456	-66.351	1043.348			
---					-13.345	-94.320	13.192
	43	1068.687	-160.671	1056.540			
---					18.427	-19.662	4.241
	44	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 17

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	44	877.318	-147.035	864.909	85.626	-147.035	864.909
---					38.967	25.865	14.520
	45	887.737	-121.169	879.429			
---					72.457	121.169	38.965
	46	918.394	0.000	918.394			
---					17.010	67.973	16.497
	47	937.359	67.973	934.891			
---					8.122	66.837	11.534
	48	955.978	134.810	946.425			
---					1.287	39.504	4.769
	49	967.034	174.315	951.194			
---					-61.819	0.449	19.768
	50	986.565	174.764	970.962			
---					2.315	-174.764	56.913
	51	1027.875	0.000	1027.875			
---					-34.027	-103.929	21.860
	52	1054.867	-103.929	1049.735			
---					69.219	-76.403	11.046
	53	1076.000	-180.333	1060.781	-105.017	180.333	-1060.781

Definicion esfuerzos unitarios cable : 18

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	53	871.172	-146.005	858.850	85.026	-146.005	858.850
---					2.604	1.107	3.145
	54	874.089	-144.897	861.995			
---					17.739	31.641	14.419
	55	883.702	-113.256	876.415			
---					32.721	72.521	24.629
	56	901.964	-40.735	901.043			
---					-0.069	63.295	16.660
	57	917.981	22.560	917.703			
---					9.249	37.669	8.868
	58	928.527	60.228	926.572			
---					6.597	38.244	7.407
	59	939.156	98.472	933.979			
---					3.807	38.639	5.915
	60	949.842	137.111	939.894			
---					-9.803	16.687	3.654
	61	956.000	153.798	943.548	-93.363	-153.798	-943.548

Definicion esfuerzos unitarios cable : 19

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
1	1075.937	-253.474	1045.654	-377.335	-253.474	1045.654
				23.632	41.080	-3.052
2	1064.016	-212.394	1042.603			
				-3.399	71.657	-6.305
3	1045.811	-140.737	1036.298			
				-9.964	71.117	-11.001
4	1027.657	-69.620	1025.296			
				-16.997	69.620	-15.608
5	1009.689	0.000	1009.689			
				-14.981	44.270	-13.756
6	996.916	44.270	995.933			
				-14.978	42.891	-15.457
7	984.343	87.160	980.476			
				-12.396	41.305	-17.004
8	971.999	128.466	963.473			
				-0.804	42.425	-2.175
9	976.369	170.891	961.297			
				-0.411	43.530	3.691
10	988.524	214.420	964.989			
				-52.294	-214.420	73.509
11	1038.498	0.000	1038.498			
				-2.680	0.000	3.769
12	1042.267	0.000	1042.267			
				-87.074	-70.106	16.094
13	1060.680	-70.106	1058.361			
				51.063	-58.094	9.974
14	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 20

	Acciones del cable			Esfuerzos		
Se.	Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	momento (mxt)	cortante (t)	axil (t)
14	841.472	-100.257	835.479	-335.027	-100.257	835.479
				-96.363	-125.163	6.361
15	871.498	-225.421	841.840			
				305.216	225.421	86.046
16	927.886	0.000	927.886			
				17.185	68.676	16.667
17	947.046	68.676	944.553			
				8.206	67.528	11.653
18	965.858	136.204	956.206			
				1.300	39.912	4.818
19	977.028	176.116	961.024			
				-62.458	0.454	19.973
20	996.761	176.570	980.997			
				2.339	-176.570	57.501
21	1038.498	0.000	1038.498			
				-2.680	0.000	3.769
22	1042.267	0.000	1042.267			
				-87.074	-70.106	16.094
23	1060.680	-70.106	1058.361			
				51.063	-58.094	9.974
24	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 21

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	24	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.362
	25	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	26	927.886	0.000	927.886			
---					17.185	68.676	16.667
	27	947.046	68.676	944.553			
---					8.206	67.528	11.653
	28	965.858	136.204	956.206			
---					1.300	39.912	4.818
	29	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	30	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	31	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	32	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	33	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	34	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 22

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	34	841.472	-100.257	835.479	-335.027	-100.257	835.479
---					-96.363	-125.163	6.362
	35	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	36	927.886	0.000	927.886			
---					17.185	68.676	16.667
	37	947.046	68.676	944.553			
---					8.206	67.528	11.653
	38	965.858	136.204	956.206			
---					1.300	39.912	4.818
	39	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	40	996.761	176.570	980.997			
---					2.339	-176.570	57.501
	41	1038.498	0.000	1038.498			
---					-2.680	0.000	3.769
	42	1042.267	0.000	1042.267			
---					-87.074	-70.106	16.094
	43	1060.680	-70.106	1058.361			
---					51.063	-58.094	9.974
	44	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 23

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	44	841.472	-100.257	835.478	-335.027	-100.257	835.478
---					-96.363	-125.163	6.362
	45	871.498	-225.421	841.840			
---					305.215	225.421	86.046
	46	927.886	0.000	927.886			
---					17.185	68.676	16.667
	47	947.046	68.676	944.553			
---					8.206	67.528	11.653
	48	965.858	136.204	956.206			
---					1.300	39.912	4.818
	49	977.028	176.116	961.024			
---					-62.458	0.454	19.973
	50	996.760	176.570	980.997			
---					2.339	-176.570	57.501
	51	1038.498	0.000	1038.498			
---					-3.848	0.000	5.412
	52	1043.910	0.000	1043.910			
---					49.404	-128.200	24.426
	53	1076.000	-128.200	1068.335	428.402	128.200	-1068.335

Definicion esfuerzos unitarios cable : 24

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	53	809.816	-96.486	804.048	-322.423	-96.486	804.048
---					-35.062	-34.545	4.675
	54	819.269	-131.031	808.723			
---					44.096	-102.845	1.028
	55	842.849	-233.876	809.750			
---					90.882	116.291	53.917
	56	871.635	-117.584	863.668			
---					-20.301	150.216	41.984
	57	906.240	32.632	905.652			
---					10.661	54.625	10.443
	58	920.241	87.257	916.095			
---					5.810	55.364	7.284
	59	934.329	142.621	923.380			
---					1.790	55.539	4.113
	60	948.425	198.160	927.493			
---					-15.892	23.581	2.487
	61	956.050	221.741	929.980	335.672	-221.741	-929.980

Cable Numero 1

Definicion general

Seccion inicial ..... = 13 (32.750) Activa
Seccion final ..... = 19 (54.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Replanteo del cable : 1

Se.	X	Y (s)	Y (i)	Exce.	Pend.
13	32.750	2.300	0.150	1.349	0.0000
14	35.250	2.300	0.150	1.349	0.0000
15	39.375	2.300	0.150	1.349	0.0000
16	43.500	2.300	0.150	1.349	0.0000
17	47.625	2.300	0.150	1.349	0.0000
18	51.750	2.300	0.150	1.349	0.0000
19	54.250	2.300	0.150	1.349	0.0000

Cable Numero 2

Definicion general

Seccion inicial ..... = 23 (65.750) Activa
Seccion final ..... = 29 (87.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Replanteo del cable : 2

Se.	X	Y (s)	Y (i)	Exce.	Pend.
23	65.750	2.300	0.150	1.349	0.0000
24	68.250	2.300	0.150	1.349	0.0000
25	72.375	2.300	0.150	1.349	0.0000
26	76.500	2.300	0.150	1.349	0.0000
27	80.625	2.300	0.150	1.349	0.0000
28	84.750	2.300	0.150	1.349	0.0000
29	87.250	2.300	0.150	1.349	0.0000

Cable Numero 3

Definicion general

Seccion inicial ..... = 33 (98.750) Activa
Seccion final ..... = 39 (120.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Replanteo del cable : 3

Se.	X	Y (s)	Y (i)	Exce.	Pend.
33	98.750	2.300	0.150	1.349	0.0000
34	101.250	2.300	0.150	1.349	0.0000
35	105.375	2.300	0.150	1.349	0.0000
36	109.500	2.300	0.150	1.349	0.0000
37	113.625	2.300	0.150	1.349	0.0000
38	117.750	2.300	0.150	1.349	0.0000
39	120.250	2.300	0.150	1.349	0.0000

Cable Numero 4

Definicion general

Seccion inicial ..... = 43 (131.750) Activa
Seccion final ..... = 49 (153.250) Activa

Fuerza de Pretensado ..... = 598.0000
Coef. rozamiento (mu) ..... = 0.2100
Coef. desviacion parasita (k/mu).. = 0.0060

Puntos Singulares del trazado

Pto.	X	Y	Pend
1	0.000	-2.300	0.0000
2	186.000	-2.300	0.0000

Replanteo del cable : 4

Se.	X	Y (s)	Y (i)	Exce.	Pend.
43	131.750	2.300	0.150	1.349	0.0000
44	134.250	2.300	0.150	1.349	0.0000
45	138.375	2.300	0.150	1.349	0.0000
46	142.500	2.300	0.150	1.349	0.0000
47	146.625	2.300	0.150	1.349	0.0000
48	150.750	2.300	0.150	1.349	0.0000
49	153.250	2.300	0.150	1.349	0.0000

Definicion esfuerzos unitarios cable : 1

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	13	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	14	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	15	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	16	589.955	0.000	589.955			
---					4.147	0.000	3.074
	17	593.029	0.000	593.029			
---					4.169	0.000	3.090
	18	596.119	0.000	596.119			
---					2.537	0.000	1.881
	19	598.000	0.000	598.000	-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 2

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	23	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	24	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	25	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	26	589.955	0.000	589.955			
---					4.147	0.000	3.074
	27	593.029	0.000	593.029			
---					4.169	0.000	3.090
	28	596.119	0.000	596.119			
---					2.537	0.000	1.881
	29	598.000	0.000	598.000	-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 3

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	33	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	34	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	35	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	36	589.955	0.000	589.955			
---					4.147	0.000	3.074
	37	593.029	0.000	593.029			
---					4.169	0.000	3.090
	38	596.119	0.000	596.119			
---					2.537	0.000	1.881
	39	598.000	0.000	598.000	-806.702	0.000	-598.000

Definicion esfuerzos unitarios cable : 4

	Se.	Acciones del cable Esf.un. (t)	Proy.v. (t)	Proy.h. (t)	Esfuerzos momento (mxt)	cortante (t)	axil (t)
	43	598.000	0.000	598.000	806.702	0.000	598.000
---					-2.537	0.000	-1.881
	44	596.119	0.000	596.119			
---					-4.169	0.000	-3.090
	45	593.029	0.000	593.029			
---					-4.147	0.000	-3.074
	46	589.955	0.000	589.955			
---					4.147	0.000	3.074
	47	593.029	0.000	593.029			
---					4.169	0.000	3.090
	48	596.119	0.000	596.119			
---					2.537	0.000	1.881
	49	598.000	0.000	598.000	-806.702	0.000	-598.000

Coeficientes para perdidas de pretensado

Coef. de retraccion del hormigon ..... = 0.0003
Coef. de relajacion del acero ..... = 0.0600
Coef. de fluencia del hormigon ..... = 2.5000

Coef. medio de perdidas elasticas instantaneas ..... = 0.9902 (1.0%)
Coef. medio de perdidas en estado inicial ..... = 0.9579 (4.2%)
Coef. medio de perdidas diferidas inicial ..... = 0.9486 (5.1%)
Coef. medio de perdidas diferidas ..... = 0.8597 (14.0%)
Coef. medio de perdidas totales ..... = 0.8513 (14.9%)

Coef. de ponderacion maximo del pretensado ..... = 1.1000
Coef. de ponderacion minimo del pretensado ..... = 0.9000
Coef. de ponderacion para perdidas en estado inicial . = 0.3000

Comprobacion de tensiones

Estado 1 Pretensado de 1076. tn Familia 1
Estado 2 Pretensado de 1076. tn Familia 2
Estado 3 Pretensado de 1076. tn Familia 3
Estado 4 Pretensado de 1076. tn Familia 4
Estado 5 Pretensado de 1076. tn Familia 5
Estado 6 Pretensado de 956. tn Familia 6
Estado 7 Pretensado de 1076. tn Familia 1
Estado 8 Pretensado de 1076. tn Familia 2
Estado 9 Pretensado de 1076. tn Familia 3
Estado 10 Pretensado de 1076. tn Familia 4
Estado 11 Pretensado de 1076. tn Familia 5
Estado 12 Pretensado de 956. tn Familia 6
Estado 13 Pretensado de 1076. tn Familia 1
Estado 14 Pretensado de 1076. tn Familia 2
Estado 15 Pretensado de 1076. tn Familia 3
Estado 16 Pretensado de 1076. tn Familia 4
Estado 17 Pretensado de 1076. tn Familia 5
Estado 18 Pretensado de 956. tn Familia 6
Estado 19 Pretensado de 1076. tn Familia 1
Estado 20 Pretensado de 1076. tn Familia 2
Estado 21 Pretensado de 1076. tn Familia 3
Estado 22 Pretensado de 1076. tn Familia 4
Estado 23 Pretensado de 1076. tn Familia 5
Estado 24 Pretensado de 956. tn Familia 6
Estado 1 Pretensado de 598. tn (Refuerzo)
Estado 2 Pretensado de 598. tn (Refuerzo)
Estado 3 Pretensado de 598. tn (Refuerzo)
Estado 4 Pretensado de 598. tn (Refuerzo)

Esfuerzos de pretensado (sin ponderar) en Estado Inicial

0.9486

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1469.97	517.6	-4032.1	25.12	77.87
		2	-2783.04	424.6	-4014.7	6.64	106.50
	2	2	-2783.04	424.6	-4014.7	6.64	106.50
		3	-3691.31	265.3	-3988.1	-6.31	126.14
	3	3	-3691.31	265.3	-3988.1	-6.31	126.14
		4	-4158.74	107.8	-3953.8	-13.21	136.01
	4	4	-4158.74	107.8	-3953.8	-13.21	136.01
		5	-4192.57	-46.6	-3912.1	-14.15	136.28
	5	5	-4192.57	-46.6	-3912.1	-14.15	136.28
		6	-3771.10	-218.2	-3858.8	-8.89	126.43
	6	6	-3771.10	-218.2	-3858.8	-8.89	126.43
		7	-2893.00	-384.3	-3798.9	2.67	106.47
	7	7	-2893.00	-384.3	-3798.9	2.67	106.47
		8	-1583.83	-544.4	-3733.0	20.16	76.99
	8	8	-1583.83	-544.4	-3733.0	20.16	76.99
		9	125.09	-700.3	-3677.2	43.33	38.84
	9	9	125.09	-700.3	-3677.2	43.33	38.84
		10	2228.82	-855.0	-3637.8	72.18	-7.79
	10	10	2228.82	-855.0	-3637.8	72.18	-7.79
		11	3566.04	-46.6	-3819.9	92.86	-35.09
2	11	11	3566.04	-8.6	-3819.9	92.86	-35.09
		12	2727.03	514.2	-3880.2	81.86	-15.99
	12	12	2727.03	514.2	-3880.2	81.86	-15.99
		13	1148.49	510.5	-3997.2	61.20	19.99
	13	13	383.28	510.5	-4564.4	56.95	43.20
		14	-860.85	487.0	-4615.8	40.21	71.10
	14	14	-552.89	387.0	-3780.3	35.05	54.89
		15	-2205.33	403.0	-3826.7	12.56	91.69
	15	15	-2205.33	403.0	-3826.7	12.56	91.69
		16	-3435.53	-8.6	-3972.7	-2.93	120.35
	16	16	-3435.53	-8.6	-3972.7	-2.93	120.35
		17	-2952.58	-261.3	-4036.9	4.53	110.47
	17	17	-2952.58	-261.3	-4036.9	4.53	110.47
		18	-1401.34	-509.6	-4082.7	26.65	76.93
	18	18	-1401.34	-509.6	-4082.7	26.65	76.93
		19	47.20	-656.5	-4102.2	47.05	45.35
	19	19	812.41	-656.5	-3535.0	51.29	22.14
		20	2923.99	-658.1	-3608.4	81.53	-23.39
	20	20	2923.99	-658.1	-3608.4	81.53	-23.39
		21	3851.21	-8.6	-3819.9	96.84	-41.35
3	21	21	3851.21	2.9	-3819.9	96.84	-41.35
		22	2978.92	525.8	-3880.2	85.37	-21.52
	22	22	2978.92	525.8	-3880.2	85.37	-21.52
		23	1367.10	522.1	-3997.2	64.24	15.19
	23	23	601.89	522.1	-4564.4	60.00	38.40
		24	-671.19	498.6	-4615.8	42.85	66.93
	24	24	-363.23	398.6	-3780.3	37.69	50.72
		25	-2063.42	414.6	-3826.7	14.53	88.57

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9486

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-2063.42	414.6	-3826.7	14.53	88.57
		26	-3341.38	2.9	-3972.7	-1.61	118.28
	26	26	-3341.38	2.9	-3972.7	-1.61	118.28
		27	-2906.19	-249.7	-4036.9	5.17	109.45
	27	27	-2906.19	-249.7	-4036.9	5.17	109.45
		28	-1402.69	-498.1	-4082.7	26.63	76.96
	28	28	-1402.69	-498.1	-4082.7	26.63	76.96
		29	16.90	-644.9	-4102.2	46.62	46.02
	29	29	782.11	-644.9	-3535.0	50.87	22.80
		30	2860.41	-646.5	-3608.4	80.65	-21.99
	30	30	2860.41	-646.5	-3608.4	80.65	-21.99
		31	3754.35	2.9	-3819.9	95.49	-39.22
4	31	31	3754.35	-2.2	-3819.9	95.49	-39.22
		32	2896.76	520.7	-3880.2	84.22	-19.72
	32	32	2896.76	520.7	-3880.2	84.22	-19.72
		33	1299.65	517.0	-3997.2	63.30	16.67
	33	33	534.44	517.0	-4564.4	59.06	39.88
		34	-725.85	493.5	-4615.8	42.09	68.13
	34	34	-417.90	393.4	-3780.3	36.93	51.92
		35	-2096.99	409.5	-3826.7	14.07	89.31
	35	35	-2096.99	409.5	-3826.7	14.07	89.31
		36	-3353.84	-2.2	-3972.7	-1.79	118.55
	36	36	-3353.84	-2.2	-3972.7	-1.79	118.55
		37	-2897.55	-254.8	-4036.9	5.29	109.26
	37	37	-2897.55	-254.8	-4036.9	5.29	109.26
		38	-1372.96	-503.2	-4082.7	27.05	76.31
	38	38	-1372.96	-503.2	-4082.7	27.05	76.31
		39	59.43	-650.0	-4102.2	47.22	45.08
	39	39	824.63	-650.0	-3535.0	51.46	21.87
		40	2917.64	-651.7	-3608.4	81.44	-23.25
	40	40	2917.64	-651.7	-3608.4	81.44	-23.25
		41	3826.28	-2.2	-3819.9	96.49	-40.80
5	41	41	3826.28	5.9	-3819.9	96.49	-40.80
		42	2945.61	528.7	-3880.2	84.91	-20.79
	42	42	2945.61	528.7	-3880.2	84.91	-20.79
		43	1325.41	525.0	-3997.2	63.66	16.10
	43	43	560.20	525.0	-4564.4	59.42	39.32
		44	-720.16	501.5	-4615.8	42.17	68.01
	44	44	-412.21	401.5	-3780.3	37.01	51.80
		45	-2124.42	417.5	-3826.7	13.68	89.91
	45	45	-2124.43	417.5	-3826.7	13.68	89.91
		46	-3414.40	5.9	-3972.7	-2.63	119.88
	46	46	-3414.40	5.8	-3972.7	-2.63	119.88
		47	-2991.23	-246.8	-4036.9	3.99	111.32
	47	47	-2991.23	-246.8	-4036.9	3.99	111.32
		48	-1499.77	-495.2	-4082.7	25.28	79.09
	48	48	-1499.77	-495.2	-4082.7	25.28	79.09
		49	-87.46	-642.0	-4102.2	45.17	48.31
	49	49	677.75	-642.0	-3535.0	49.41	25.10
		50	2747.67	-643.6	-3608.4	79.07	-19.52

Esfuerzos de pretensado (sin ponderar) en Estado Inicial 0.9486

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	2747.67	-643.6	-3608.4	79.07	-19.52
		51	3633.23	5.8	-3819.9	93.80	-36.57
6	51	51	3633.22	49.1	-3819.9	93.80	-36.57
		52	1877.70	613.2	-3898.7	70.24	2.87
	52	52	1877.70	613.2	-3898.7	70.24	2.87
		53	-507.45	544.8	-4050.4	38.74	56.94
	53	53	-310.80	448.5	-3276.1	32.72	43.87
		54	-1378.87	453.2	-3296.2	18.07	67.55
	54	54	-1378.87	453.2	-3296.2	18.07	67.55
		55	-2503.64	458.2	-3332.6	2.82	92.65
	55	55	-2503.64	458.2	-3332.6	2.82	92.65
		56	-3455.55	228.2	-3426.4	-9.38	114.61
	56	56	-3455.55	228.2	-3426.4	-9.38	114.61
		57	-3686.06	-23.3	-3497.9	-11.78	120.48
	57	57	-3686.06	-23.3	-3497.9	-11.78	120.48
		58	-3523.09	-144.3	-3527.5	-9.18	117.24
	58	58	-3523.09	-144.3	-3527.5	-9.18	117.24
		59	-3065.61	-267.0	-3552.0	-2.53	107.47
	59	59	-3065.61	-267.0	-3552.0	-2.53	107.47
		60	-2310.79	-390.7	-3571.3	8.20	91.12
	60	60	-2310.79	-390.7	-3571.3	8.20	91.12
		61	-1305.81	-444.0	-3584.2	22.34	69.20

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8513

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
1	1	1	-1319.26	438.2	-3618.7	22.55	69.88
		2	-2426.49	354.7	-3603.1	6.95	94.02
	2	2	-2426.49	354.7	-3603.1	6.95	94.02
		3	-3170.41	211.8	-3579.2	-3.68	110.08
	3	3	-3170.41	211.8	-3579.2	-3.68	110.08
		4	-3518.69	70.4	-3548.5	-8.88	117.38
	4	4	-3518.69	70.4	-3548.5	-8.88	117.38
		5	-3477.82	-68.2	-3511.0	-8.73	116.06
	5	5	-3477.82	-68.2	-3511.0	-8.73	116.06
		6	-3028.34	-222.2	-3463.2	-3.02	105.65
	6	6	-3028.34	-222.2	-3463.2	-3.02	105.65
		7	-2169.03	-371.3	-3409.4	8.35	86.17
	7	7	-2169.04	-371.3	-3409.4	8.35	86.17
		8	-922.86	-515.0	-3350.3	25.03	58.15
	8	8	-922.87	-515.0	-3350.3	25.03	58.15
		9	682.08	-654.9	-3300.2	46.82	22.35
	9	9	682.08	-654.9	-3300.2	46.82	22.35
		10	2641.35	-793.7	-3264.9	73.71	-21.07
	10	10	2641.35	-793.7	-3264.9	73.71	-21.07
		11	3912.70	-68.2	-3428.3	93.26	-47.13
2	11	11	3912.70	11.3	-3428.3	93.26	-47.13
		12	3105.02	480.5	-3482.4	82.63	-28.79
	12	12	3105.02	480.5	-3482.4	82.63	-28.79
		13	1633.64	477.2	-3587.4	63.32	4.70
	13	13	1003.25	477.2	-4054.7	59.83	23.83
		14	-161.06	456.1	-4101.0	44.13	49.91
	14	14	115.32	366.3	-3351.1	39.50	35.36
		15	-1446.45	380.7	-3392.9	18.22	70.12
	15	15	-1446.45	380.7	-3392.9	18.22	70.12
		16	-2629.28	11.3	-3524.2	3.23	97.58
	16	16	-2629.28	11.3	-3524.2	3.23	97.58
		17	-2274.02	-215.4	-3581.6	8.83	90.43
	17	17	-2274.02	-215.4	-3581.6	8.83	90.43
		18	-959.99	-438.4	-3622.5	27.59	62.04
	18	18	-959.99	-438.4	-3622.5	27.59	62.04
		19	292.66	-570.1	-3639.8	45.24	34.74
	19	19	923.04	-570.1	-3172.5	48.73	15.61
		20	2763.45	-571.6	-3238.5	75.11	-24.05
	20	20	2763.45	-571.6	-3238.5	75.11	-24.05
		21	3540.92	11.3	-3428.3	88.09	-38.97
3	21	21	3540.92	-3.0	-3428.3	88.09	-38.97
		22	2774.13	466.3	-3482.4	78.02	-21.52
	22	22	2774.13	466.3	-3482.4	78.02	-21.52
		23	1343.63	463.0	-3587.4	59.28	11.07
	23	23	713.25	463.0	-4054.7	55.79	30.19
		24	-415.51	441.9	-4101.0	40.59	55.50
	24	24	-139.13	352.1	-3351.1	35.96	40.95
		25	-1642.24	366.5	-3392.9	15.50	74.42

Esfuerzos de pretensado (sin ponderar) en Estado Final 0.8513

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	25	25	-1642.24	366.5	-3392.9	15.50	74.42
		26	-2766.41	-3.0	-3524.2	1.32	100.59
	26	26	-2766.41	-3.0	-3524.2	1.32	100.59
		27	-2352.49	-229.7	-3581.6	7.74	92.15
	27	27	-2352.49	-229.7	-3581.6	7.74	92.15
		28	-979.79	-452.6	-3622.5	27.32	62.47
	28	28	-979.79	-452.6	-3622.5	27.32	62.47
		29	308.42	-584.4	-3639.8	45.46	34.39
	29	29	938.80	-584.4	-3172.5	48.95	15.27
		30	2820.10	-585.9	-3238.5	75.90	-25.29
	30	30	2820.10	-585.9	-3238.5	75.90	-25.29
		31	3638.45	-3.0	-3428.3	89.44	-41.11
4	31	31	3638.45	0.6	-3428.3	89.44	-41.11
		32	2861.37	469.9	-3482.4	79.23	-23.44
	32	32	2861.37	469.9	-3482.4	79.23	-23.44
		33	1420.58	466.6	-3587.4	60.35	9.38
	33	33	790.20	466.6	-4054.7	56.86	28.50
		34	-347.51	445.5	-4101.0	41.54	54.00
	34	34	-71.12	355.7	-3351.1	36.90	39.46
		35	-1589.00	370.1	-3392.9	16.24	73.25
	35	35	-1589.00	370.1	-3392.9	16.24	73.25
		36	-2727.93	0.6	-3524.2	1.86	99.74
	36	36	-2727.93	0.6	-3524.2	1.86	99.74
		37	-2328.78	-226.1	-3581.6	8.07	91.63
	37	37	-2328.78	-226.1	-3581.6	8.07	91.63
		38	-970.85	-449.0	-3622.5	27.44	62.28
	38	38	-970.84	-449.0	-3622.5	27.44	62.28
		39	308.41	-580.8	-3639.8	45.46	34.39
	39	39	938.80	-580.8	-3172.6	48.95	15.27
		40	2809.80	-582.3	-3238.5	75.76	-25.06
	40	40	2809.80	-582.3	-3238.5	75.76	-25.06
		41	3617.87	0.6	-3428.3	89.16	-40.66
5	41	41	3617.87	0.5	-3428.3	89.16	-40.66
		42	2841.24	469.7	-3482.4	78.95	-23.00
	42	42	2841.24	469.7	-3482.4	78.95	-23.00
		43	1400.91	466.4	-3587.4	60.08	9.81
	43	43	770.53	466.4	-4054.7	56.58	28.94
		44	-366.78	445.3	-4101.0	41.27	54.43
	44	44	-90.40	355.5	-3351.1	36.64	39.88
		45	-1607.62	369.9	-3392.9	15.98	73.66
	45	45	-1607.63	369.9	-3392.9	15.98	73.66
		46	-2745.90	0.5	-3524.2	1.61	100.14
	46	46	-2745.90	0.5	-3524.2	1.61	100.14
		47	-2346.08	-226.2	-3581.6	7.83	92.01
	47	47	-2346.08	-226.2	-3581.6	7.83	92.01
		48	-987.50	-449.2	-3622.5	27.21	62.64
	48	48	-987.50	-449.2	-3622.5	27.21	62.64
		49	292.16	-580.9	-3639.8	45.23	34.75
	49	49	922.54	-580.9	-3172.6	48.73	15.62
		50	2794.01	-582.4	-3238.5	75.54	-24.72

Esfuerzos de pretensado (sin ponderar) en Estado Final

0.8513

V.	Barra	Nudo	Momento (m x t)	Cortante (t)	Axil (t)	Te.F.Sup (kg/cm2)	Te.F.Inf (kg/cm2)
	50	50	2794.01	-582.4	-3238.5	75.54	-24.72
		51	3602.53	0.5	-3428.3	88.94	-40.32
6	51	51	3602.53	56.7	-3428.3	88.94	-40.32
		52	1974.77	563.0	-3499.0	67.07	-3.79
	52	52	1974.77	563.0	-3499.0	67.07	-3.79
		53	-218.07	501.6	-3635.1	38.07	45.89
	53	53	-41.58	415.2	-2940.2	32.67	34.16
		54	-1029.82	419.4	-2958.3	19.11	56.06
	54	54	-1029.82	419.4	-2958.3	19.11	56.06
		55	-2068.95	423.9	-2990.9	5.01	79.24
	55	55	-2068.95	423.9	-2990.9	5.01	79.24
		56	-2952.93	217.5	-3075.1	-6.35	99.60
	56	56	-2952.93	217.5	-3075.1	-6.35	99.60
		57	-3189.49	-8.3	-3139.3	-8.92	105.52
	57	57	-3189.49	-8.3	-3139.3	-8.92	105.52
		58	-3072.89	-116.8	-3165.8	-7.00	103.26
	58	58	-3072.89	-116.8	-3165.8	-7.00	103.26
		59	-2691.99	-227.0	-3187.8	-1.44	95.15
	59	59	-2691.99	-227.0	-3187.8	-1.44	95.15
		60	-2044.23	-338.0	-3205.2	7.77	81.12
	60	60	-2044.23	-338.0	-3205.2	7.77	81.12
		61	-1171.93	-385.9	-3216.7	20.05	62.10

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO - I E-5

FECHA

HOJA N.º

COMPROBACION DE TENSIONES

A las tensiones obtenidas mediante el programa de viga continua se sumen las producidas por el gradiente térmico y las fuerzas longitudinales reológicas

Las tensiones pésivas se obtienen en las juntas de construcción en las fases intermedias. Para reducir las tracciones en la zona del anclaje pasivo se tesan los cables al 80% y se anclan al 75%, consiguiendo reducir las pérdidas en esta zona.

Las tracciones son inferiores a la resistencia a tracción del hormigón : $0.45 * \sqrt[3]{350^2} = 22.4 \, kg/cm^2$ en todas las secciones en estudio

A continuación se adjunta :

- Tensiones en construcción y servicio producidas por las sobrecargas + peso propio + pretensado
- Tensiones producidas por el gradiente térmico, fuerzas longitudinales reológicas y axiles producidas por el frenado.
- Tensiones totales, últimas a tracciones y armaduras resultantes con los cables tesados y anclados al 75%
- Tensiones totales, últimas a tracciones y armaduras resultantes con los cables tesados al 80%

Tensiones en Construccion (kg/cm2) Estado 1

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	5.	114.	6.	125.	9.	-14.	15.	111.
	3	-10.	137.	-11.	151.	16.	-25.	4.	126.
	4	-19.	151.	-21.	166.	20.	-32.	-1.	134.
	5	-22.	154.	-24.	169.	23.	-36.	-2.	134.
	6	-18.	146.	-20.	161.	23.	-36.	2.	125.
	7	-8.	128.	-9.	141.	20.	-32.	11.	109.
	8	8.	101.	9.	111.	16.	-25.	25.	85.
	9	31.	64.	34.	70.	9.	-15.	43.	55.
	10	59.	18.	65.	20.	1.	-1.	65.	19.
	11	79.	-8.	86.	-9.	-10.	16.	76.	8.
2	1	79.	-8.	86.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 2

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	7.	-12.	15.	111.
	3	-7.	132.	-7.	145.	13.	-20.	5.	125.
	4	-14.	142.	-15.	156.	16.	-25.	0.	132.
	5	-15.	142.	-16.	156.	16.	-26.	0.	131.
	6	-9.	132.	-10.	145.	15.	-23.	5.	122.
	7	3.	111.	3.	122.	11.	-17.	14.	105.
	8	21.	80.	23.	88.	5.	-8.	28.	80.
	9	45.	40.	50.	44.	-3.	5.	47.	49.
	10	76.	-8.	83.	-9.	-13.	21.	70.	12.
	11	97.	-37.	107.	-41.	-26.	41.	81.	0.
2	1	97.	-37.	107.	-41.	-26.	41.	81.	0.
	2	84.	-14.	92.	-15.	-11.	18.	81.	3.
	3	60.	27.	66.	29.	1.	-1.	67.	28.
	4	38.	50.	42.	55.	9.	-14.	51.	41.
	5	9.	85.	10.	93.	19.	-30.	29.	64.
	6	-10.	119.	-11.	131.	23.	-37.	13.	94.
	7	-5.	113.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	39.	58.	11.	-17.	49.	40.
	10	65.	8.	71.	9.	1.	-2.	73.	6.
	11	79.	-8.	86.	-9.	-10.	16.	76.	8.
3	1	79.	-8.	86.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 3

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	6.	112.	7.	123.	8.	-12.	15.	111.
	3	-8.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-17.	159.	17.	-26.	0.	132.
	5	-17.	145.	-18.	160.	18.	-28.	0.	131.
	6	-12.	136.	-13.	149.	17.	-27.	4.	123.
	7	0.	116.	0.	127.	14.	-21.	14.	106.
	8	18.	86.	19.	94.	8.	-13.	28.	81.
	9	41.	47.	46.	51.	0.	-1.	46.	51.
	10	71.	-1.	78.	-2.	-10.	15.	69.	14.
	11	92.	-29.	101.	-32.	-22.	34.	80.	2.
2	1	92.	-29.	101.	-32.	-22.	34.	80.	2.
	2	81.	-9.	89.	-10.	-9.	14.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	8.	-13.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	5.	98.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	31.	69.	6.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-18.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
3	1	97.	-36.	106.	-40.	-26.	40.	81.	0.
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-1.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	94.
	7	-5.	114.	-5.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	86.	-9.	-10.	16.	76.	8.
4	1	79.	-8.	86.	-9.	-10.	16.	76.	8.
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	16.	-26.	0.	132.
	5	-16.	144.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	16.	-26.	4.	122.
	7	1.	114.	1.	126.	13.	-20.	14.	105.
	8	19.	84.	21.	93.	7.	-12.	28.	81.
	9	43.	45.	47.	49.	-1.	1.	46.	50.
	10	72.	-3.	80.	-4.	-11.	17.	69.	13.
	11	94.	-31.	103.	-34.	-23.	36.	80.	2.
2	1	94.	-31.	103.	-34.	-23.	36.	80.	2.
	2	82.	-11.	90.	-12.	-10.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	89.	17.	-26.	30.	62.
	6	-5.	112.	-5.	123.	19.	-30.	14.	92.
	7	2.	102.	2.	113.	17.	-27.	19.	86.
	8	24.	68.	27.	75.	9.	-15.	36.	61.
	9	45.	36.	50.	40.	2.	-3.	52.	36.
	10	76.	-11.	84.	-12.	-8.	13.	76.	2.
	11	92.	-29.	101.	-32.	-22.	34.	80.	2.
3	1	92.	-29.	101.	-32.	-22.	34.	80.	2.
	2	80.	-9.	89.	-10.	-9.	14.	80.	4.
	3	59.	29.	65.	32.	2.	-3.	66.	29.
	4	39.	49.	43.	54.	9.	-14.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	4.	99.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	30.	70.	7.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-17.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
4	1	97.	-36.	106.	-40.	-26.	40.	81.	0.
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-2.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	94.
	7	-5.	114.	-6.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	86.	-9.	-10.	16.	76.	8.
5	1	79.	-8.	86.	-9.	-10.	16.	76.	8.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 4

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
	2	67.	13.	73.	14.	-4.	7.	69.	21.
	3	45.	51.	49.	56.	-1.	2.	48.	57.
	4AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 5

		Hipotesis 1		Hipotesis 2		Hipotesis 3		Hipotesis 4	
V.	SE	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf	F.Sup	F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	17.	-26.	0.	132.
	5	-16.	145.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	16.	-26.	4.	122.
	7	1.	115.	1.	126.	13.	-21.	14.	106.
	8	18.	85.	20.	93.	8.	-12.	28.	81.
	9	42.	45.	46.	50.	0.	0.	46.	50.
	10	72.	-3.	79.	-3.	-10.	16.	69.	13.
	11	93.	-31.	102.	-34.	-23.	36.	80.	2.
2	1	93.	-31.	102.	-34.	-23.	36.	80.	2.
	2	81.	-10.	89.	-11.	-9.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	88.	16.	-26.	30.	62.
	6	-5.	111.	-5.	122.	19.	-30.	14.	92.
	7	3.	101.	3.	111.	16.	-26.	19.	86.
	8	25.	67.	28.	74.	9.	-13.	36.	60.
	9	46.	34.	51.	38.	1.	-2.	52.	36.
	10	78.	-13.	85.	-14.	-9.	15.	76.	1.
	11	93.	-31.	103.	-34.	-23.	36.	80.	2.
3	1	93.	-31.	103.	-34.	-23.	36.	80.	2.
	2	81.	-10.	89.	-11.	-9.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	50.	42.	55.	9.	-14.	51.	41.
	5	12.	81.	13.	89.	17.	-26.	30.	63.
	6	-5.	112.	-6.	123.	19.	-31.	14.	93.
	7	2.	103.	2.	113.	17.	-27.	19.	86.
	8	24.	69.	27.	75.	9.	-15.	36.	61.
	9	45.	36.	50.	40.	2.	-3.	52.	36.
	10	76.	-11.	84.	-12.	-8.	13.	76.	2.
	11	92.	-29.	101.	-31.	-22.	34.	80.	2.
4	1	92.	-29.	101.	-31.	-22.	34.	80.	2.
	2	80.	-9.	88.	-10.	-9.	14.	80.	4.
	3	59.	29.	65.	32.	2.	-3.	66.	29.
	4	39.	49.	43.	54.	9.	-14.	51.	41.
	5	13.	79.	14.	87.	16.	-25.	30.	62.
	6	-3.	109.	-4.	120.	18.	-28.	14.	92.
	7	4.	99.	5.	108.	15.	-23.	20.	85.
	8	28.	63.	30.	70.	7.	-10.	37.	59.
	9	49.	30.	54.	33.	-1.	2.	53.	35.
	10	81.	-17.	89.	-19.	-12.	19.	77.	0.
	11	97.	-36.	106.	-40.	-26.	40.	81.	0.
5	1	97.	-36.	106.	-40.	-26.	40.	81.	0.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 5

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	83.	-13.	92.	-15.	-11.	17.	81.	3.
	3	60.	27.	66.	30.	1.	-2.	67.	29.
	4	38.	51.	42.	56.	9.	-15.	51.	41.
	5	9.	85.	10.	94.	19.	-30.	29.	64.
	6	-10.	120.	-11.	132.	24.	-37.	12.	94.
	7	-5.	114.	-6.	125.	23.	-36.	17.	89.
	8	15.	83.	17.	91.	17.	-27.	34.	64.
	9	35.	52.	38.	58.	11.	-17.	49.	41.
	10	65.	8.	71.	9.	2.	-2.	73.	6.
	11	79.	-8.	86.	-9.	-10.	16.	76.	8.
6	1	79.	-8.	86.	-9.	-10.	16.	76.	8.
	2	57.	29.	63.	32.	-3.	4.	60.	36.
	3AI	27.	81.	30.	89.	0.	0.	30.	89.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 6

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	112.	7.	123.	8.	-12.	15.	111.
	3	-7.	133.	-8.	146.	13.	-21.	5.	125.
	4	-15.	144.	-16.	158.	17.	-26.	0.	132.
	5	-16.	145.	-18.	159.	18.	-28.	0.	131.
	6	-11.	135.	-12.	148.	16.	-26.	4.	122.
	7	1.	115.	1.	126.	13.	-21.	14.	105.
	8	18.	84.	20.	93.	7.	-12.	28.	81.
	9	42.	45.	47.	50.	0.	1.	46.	50.
	10	72.	-3.	79.	-3.	-10.	16.	69.	13.
	11	93.	-31.	103.	-34.	-23.	36.	80.	2.
2	1	93.	-31.	103.	-34.	-23.	36.	80.	2.
	2	81.	-10.	90.	-11.	-9.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	49.	43.	54.	9.	-13.	51.	41.
	5	12.	80.	13.	88.	16.	-26.	30.	62.
	6	-5.	111.	-5.	122.	19.	-30.	14.	92.
	7	3.	102.	3.	112.	16.	-26.	19.	86.
	8	25.	67.	28.	74.	9.	-14.	36.	60.
	9	46.	35.	51.	38.	1.	-2.	52.	36.
	10	77.	-12.	85.	-13.	-9.	15.	76.	1.
	11	93.	-30.	102.	-33.	-22.	35.	80.	2.
3	1	93.	-30.	102.	-33.	-22.	35.	80.	2.
	2	81.	-10.	89.	-11.	-9.	15.	80.	4.
	3	59.	28.	65.	31.	1.	-2.	67.	29.
	4	39.	50.	42.	55.	9.	-14.	51.	41.
	5	12.	80.	13.	89.	17.	-26.	30.	62.
	6	-5.	111.	-5.	122.	19.	-30.	14.	92.
	7	3.	102.	3.	112.	17.	-26.	19.	86.
	8	25.	67.	28.	74.	9.	-14.	37.	60.
	9	46.	35.	51.	38.	2.	-3.	52.	36.
	10	77.	-12.	85.	-13.	-9.	14.	76.	1.
	11	93.	-30.	102.	-33.	-22.	35.	80.	2.
4	1	93.	-30.	102.	-33.	-22.	35.	80.	2.
	2	81.	-10.	89.	-11.	-9.	14.	80.	4.
	3	59.	28.	65.	31.	2.	-2.	67.	29.
	4	39.	50.	42.	55.	9.	-14.	51.	41.
	5	12.	81.	13.	89.	16.	-26.	29.	63.
	6	-5.	112.	-5.	123.	19.	-30.	13.	93.
	7	2.	102.	3.	112.	16.	-26.	19.	87.
	8	25.	68.	27.	75.	8.	-13.	36.	61.
	9	46.	35.	50.	39.	1.	-2.	51.	37.
	10	77.	-12.	85.	-13.	-10.	15.	75.	3.
	11	93.	-30.	102.	-33.	-23.	36.	79.	4.
5	1	93.	-30.	102.	-33.	-23.	36.	79.	4.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado 6

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	81.	-9.	89.	-10.	-9.	15.	79.	5.
	3	59.	29.	65.	31.	1.	-2.	66.	29.
	4	39.	50.	43.	54.	9.	-14.	51.	41.
	5	12.	80.	13.	88.	17.	-27.	30.	61.
	6	-4.	111.	-5.	122.	20.	-31.	15.	90.
	7	3.	101.	3.	111.	18.	-28.	21.	83.
	8	26.	66.	29.	73.	10.	-16.	39.	57.
	9	47.	33.	52.	37.	3.	-5.	55.	32.
	10	78.	-14.	86.	-15.	-7.	11.	79.	-4.
	11	94.	-32.	104.	-36.	-20.	32.	83.	-4.
6	1	94.	-32.	104.	-36.	-20.	32.	83.	-4.
	2	70.	8.	77.	9.	-3.	4.	74.	13.
	3	35.	57.	38.	62.	10.	-15.	48.	47.
	4	17.	74.	18.	81.	14.	-22.	32.	59.
	5	1.	100.	1.	110.	17.	-27.	18.	83.
	6	-11.	122.	-13.	134.	19.	-29.	6.	105.
	7	-14.	128.	-15.	141.	18.	-29.	3.	112.
	8	-11.	124.	-12.	136.	16.	-25.	5.	111.
	9	-3.	113.	-4.	125.	12.	-20.	9.	105.
	10	8.	96.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado ultimo

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
1	1	26.	81.	29.	89.	0.	0.	29.	89.
	2	7.	111.	8.	122.	8.	-12.	15.	110.
	3	-7.	132.	-7.	145.	13.	-21.	6.	124.
	4	-14.	142.	-15.	156.	17.	-26.	1.	130.
	5	-15.	142.	-16.	156.	18.	-28.	1.	129.
	6	-9.	132.	-10.	145.	16.	-26.	6.	119.
	7	3.	111.	3.	122.	13.	-21.	16.	102.
	8	21.	80.	23.	88.	7.	-12.	31.	77.
	9	45.	41.	50.	45.	0.	1.	49.	45.
	10	75.	-8.	83.	-9.	-10.	16.	72.	7.
	11	97.	-37.	107.	-40.	-23.	36.	84.	-5.
2	1	97.	-37.	107.	-40.	-23.	36.	84.	-5.
	2	85.	-17.	94.	-18.	-9.	15.	85.	-3.
	3	62.	33.	68.	36.	1.	-2.	69.	34.
	4	39.	66.	43.	72.	9.	-13.	52.	59.
	5	13.	96.	14.	105.	16.	-26.	31.	80.
	6	-3.	126.	-3.	138.	19.	-30.	16.	108.
	7	5.	115.	5.	127.	16.	-26.	22.	101.
	8	28.	80.	31.	88.	9.	-14.	39.	75.
	9	51.	35.	56.	39.	1.	-2.	58.	37.
	10	85.	-24.	94.	-27.	-9.	15.	84.	-12.
	11	101.	-43.	111.	-47.	-22.	35.	89.	-12.
3	1	101.	-43.	111.	-47.	-22.	35.	89.	-12.
	2	89.	-22.	98.	-25.	-9.	15.	89.	-10.
	3	65.	28.	71.	31.	1.	-2.	73.	28.
	4	42.	61.	46.	68.	9.	-14.	55.	54.
	5	15.	92.	17.	102.	17.	-26.	33.	76.
	6	-2.	123.	-2.	136.	19.	-30.	17.	106.
	7	5.	114.	6.	126.	17.	-26.	23.	100.
	8	28.	80.	31.	88.	9.	-14.	39.	74.
	9	51.	36.	56.	40.	2.	-3.	58.	37.
	10	84.	-23.	93.	-25.	-9.	14.	84.	-11.
	11	100.	-41.	110.	-45.	-22.	35.	87.	-10.
4	1	100.	-41.	110.	-45.	-22.	35.	87.	-10.
	2	88.	-21.	97.	-23.	-9.	14.	88.	-8.
	3	64.	30.	70.	32.	2.	-2.	72.	30.
	4	41.	63.	45.	69.	9.	-14.	54.	55.
	5	15.	93.	16.	103.	16.	-26.	33.	77.
	6	-2.	124.	-2.	136.	19.	-30.	17.	106.
	7	6.	114.	6.	125.	16.	-26.	22.	100.
	8	28.	80.	31.	88.	8.	-13.	39.	74.
	9	52.	35.	57.	38.	1.	-2.	58.	37.
	10	85.	-24.	94.	-27.	-10.	15.	84.	-11.
	11	101.	-43.	111.	-47.	-23.	36.	88.	-11.
5	1	101.	-43.	111.	-47.	-23.	36.	88.	-11.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Construccion (kg/cm2) Estado ultimo

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf
	2	89.	-22.	97.	-24.	-9.	15.	88.	-9.
	3	64.	29.	71.	32.	1.	-2.	72.	30.
	4	41.	63.	45.	69.	9.	-14.	54.	55.
	5	14.	94.	16.	103.	17.	-27.	33.	76.
	6	-3.	125.	-3.	138.	20.	-31.	17.	106.
	7	4.	116.	5.	128.	18.	-28.	22.	100.
	8	26.	83.	29.	91.	10.	-16.	39.	75.
	9	49.	38.	54.	42.	3.	-5.	57.	37.
	10	83.	-20.	91.	-22.	-7.	11.	84.	-11.
	11	98.	-38.	108.	-42.	-20.	32.	87.	-10.
6	1	98.	-38.	108.	-42.	-20.	32.	87.	-10.
	2	73.	3.	81.	3.	-3.	4.	78.	8.
	3	37.	53.	41.	58.	10.	-15.	51.	43.
	4	19.	71.	21.	78.	14.	-22.	35.	55.
	5	3.	97.	3.	106.	17.	-27.	20.	79.
	6	-10.	120.	-11.	132.	19.	-29.	8.	102.
	7	-12.	126.	-14.	138.	18.	-29.	5.	110.
	8	-10.	122.	-11.	135.	16.	-25.	6.	109.
	9	-3.	112.	-3.	123.	12.	-20.	10.	104.
	10	9.	95.	9.	105.	7.	-11.	16.	94.
	11	23.	72.	26.	79.	0.	0.	26.	79.

Hipotesis 1 : Pretensado con perdidas instantaneas (sin ponderar)
Hipotesis 2 : Pretensado con perdidas instantaneas (ponderado)
Hipotesis 3 : Peso propio
Hipotesis 4 : Hipotesis 2 + Hipotesis 3

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	28.	86.	28.	86.	28.	86.	28.	86.	28.	86.
	2	19.	99.	31.	80.	16.	103.	24.	91.	18.	101.
	3	12.	108.	34.	74.	7.	116.	21.	95.	10.	112.
	4	10.	112.	37.	68.	2.	124.	21.	94.	6.	117.
	5	10.	110.	41.	61.	-1.	126.	22.	90.	6.	116.
	6	14.	102.	45.	53.	1.	123.	26.	83.	8.	110.
	7	21.	89.	49.	44.	5.	113.	32.	71.	15.	98.
	8	32.	70.	54.	35.	13.	98.	40.	56.	24.	81.
	9	45.	47.	58.	27.	24.	79.	50.	39.	37.	60.
	10	62.	19.	68.	10.	37.	59.	64.	16.	52.	35.
	11	66.	19.	73.	8.	25.	83.	69.	14.	49.	44.
2	1	66.	19.	73.	8.	25.	83.	69.	14.	49.	44.
	2	73.	9.	78.	2.	51.	45.	75.	6.	64.	23.
	3	64.	36.	74.	21.	50.	59.	68.	30.	59.	45.
	4AI	55.	62.	73.	33.	42.	82.	62.	50.	49.	70.
	4AD	49.	44.	67.	15.	36.	64.	56.	32.	44.	52.
	5	36.	66.	66.	19.	24.	85.	48.	47.	31.	74.
	6	23.	92.	57.	38.	11.	110.	36.	70.	18.	99.
	7	27.	87.	58.	37.	14.	108.	40.	67.	22.	95.
	8	40.	68.	61.	35.	23.	95.	48.	55.	33.	79.
	9	54.	38.	65.	19.	34.	69.	58.	30.	46.	50.
	10	73.	0.	79.	-9.	47.	42.	76.	-4.	63.	17.
	11	70.	11.	77.	1.	25.	83.	73.	7.	52.	40.
3	1	70.	11.	77.	1.	25.	83.	73.	7.	52.	40.
	2	78.	2.	82.	-5.	51.	45.	79.	-1.	67.	19.
	3	68.	30.	78.	14.	49.	60.	72.	23.	60.	42.
	4AI	58.	57.	78.	25.	41.	83.	66.	44.	51.	67.
	4AD	52.	39.	72.	7.	36.	65.	60.	26.	45.	50.
	5	38.	62.	69.	14.	24.	85.	50.	43.	32.	72.
	6	24.	89.	59.	35.	11.	111.	38.	67.	19.	98.
	7	28.	85.	59.	36.	14.	108.	40.	66.	22.	94.
	8	40.	68.	61.	35.	23.	95.	48.	55.	33.	79.
	9	53.	38.	65.	20.	34.	69.	58.	31.	46.	50.
	10	73.	1.	78.	-8.	46.	44.	75.	-2.	62.	18.
	11	69.	14.	76.	3.	24.	85.	72.	9.	51.	42.
4	1	69.	14.	76.	3.	24.	85.	72.	9.	51.	42.
	2	76.	4.	82.	-5.	49.	46.	79.	0.	66.	21.
	3	67.	32.	78.	14.	48.	62.	72.	24.	59.	44.
	4AI	57.	58.	78.	25.	40.	85.	65.	45.	50.	69.
	4AD	51.	41.	72.	7.	34.	67.	60.	27.	44.	51.
	5	38.	63.	69.	14.	23.	86.	50.	44.	32.	73.
	6	24.	90.	58.	35.	10.	111.	38.	68.	18.	98.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	28.	86.	58.	37.	13.	109.	40.	66.	22.	95.
	8	40.	68.	60.	36.	23.	94.	48.	55.	33.	78.
	9	54.	38.	64.	21.	35.	68.	58.	31.	46.	50.
	10	73.	1.	77.	-6.	46.	43.	75.	-2.	62.	18.
	11	69.	13.	76.	2.	24.	84.	72.	9.	51.	41.
5	1	69.	13.	76.	2.	24.	84.	72.	9.	51.	41.
	2	77.	3.	83.	-6.	50.	45.	79.	0.	66.	20.
	3	67.	31.	79.	13.	48.	62.	72.	24.	59.	44.
	4AI	57.	58.	78.	25.	40.	85.	66.	45.	50.	69.
	4AD	51.	40.	73.	7.	34.	67.	60.	27.	44.	51.
	5	38.	63.	69.	14.	24.	85.	50.	43.	32.	72.
	6	24.	90.	58.	36.	12.	108.	38.	68.	19.	97.
	7	28.	86.	58.	38.	16.	104.	40.	67.	23.	93.
	8	40.	68.	58.	39.	27.	88.	47.	56.	35.	76.
	9	53.	38.	63.	23.	39.	61.	57.	32.	48.	47.
	10	73.	1.	77.	-5.	50.	37.	74.	-1.	63.	16.
	11	69.	13.	76.	2.	28.	78.	72.	9.	53.	39.
6	1	69.	13.	76.	2.	28.	78.	72.	9.	53.	39.
	2	70.	15.	77.	3.	48.	49.	73.	10.	61.	28.
	3AI	54.	44.	77.	9.	36.	73.	63.	30.	47.	56.
	3AD	48.	30.	70.	-6.	30.	58.	57.	16.	40.	41.
	4	39.	44.	67.	1.	23.	69.	50.	27.	33.	54.
	5	27.	64.	58.	16.	13.	86.	39.	45.	22.	73.
	6	16.	85.	47.	35.	5.	103.	28.	65.	11.	92.
	7	13.	92.	43.	45.	4.	106.	25.	73.	9.	97.
	8	13.	92.	39.	52.	6.	103.	23.	76.	10.	97.
	9	15.	90.	35.	59.	11.	97.	23.	78.	13.	93.
	10	19.	84.	30.	67.	17.	88.	24.	77.	18.	86.
	11	25.	76.	25.	76.	25.	76.	25.	76.	25.	76.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	25.	77.	25.	77.	25.	77.	25.	77.	25.	77.
	2	19.	86.	31.	67.	16.	90.	23.	78.	17.	88.
	3	14.	92.	36.	58.	9.	100.	23.	78.	12.	95.
	4	13.	93.	41.	49.	5.	106.	24.	76.	10.	98.
	5	14.	91.	45.	42.	3.	107.	26.	71.	10.	97.
	6	18.	83.	49.	34.	5.	104.	30.	63.	13.	91.
	7	24.	71.	53.	26.	9.	95.	36.	53.	18.	81.
	8	34.	54.	56.	20.	16.	83.	43.	40.	26.	66.
	9	45.	34.	58.	14.	24.	67.	50.	26.	37.	48.
	10	59.	12.	65.	2.	34.	51.	62.	8.	49.	27.
	11	61.	13.	68.	2.	21.	77.	64.	9.	45.	39.
2	1	61.	13.	68.	2.	21.	77.	64.	9.	45.	39.
	2	70.	2.	74.	-5.	47.	38.	71.	-1.	60.	16.
	3	62.	24.	72.	9.	48.	47.	66.	18.	57.	33.
	4AI	54.	46.	73.	17.	41.	66.	62.	34.	49.	54.
	4AD	49.	30.	68.	1.	36.	50.	56.	18.	44.	38.
	5	37.	50.	67.	3.	25.	69.	49.	31.	33.	57.
	6	25.	74.	59.	20.	13.	93.	38.	52.	20.	82.
	7	27.	72.	58.	23.	13.	94.	40.	52.	22.	81.
	8	36.	59.	57.	26.	19.	87.	44.	46.	29.	70.
	9	46.	36.	58.	17.	27.	67.	51.	29.	39.	48.
	10	61.	7.	67.	-2.	35.	49.	64.	3.	51.	24.
	11	56.	22.	63.	11.	10.	93.	59.	18.	38.	50.
3	1	56.	22.	63.	11.	10.	93.	59.	18.	38.	50.
	2	65.	10.	69.	3.	38.	52.	66.	7.	54.	27.
	3	58.	31.	69.	14.	39.	61.	62.	24.	51.	43.
	4AI	50.	52.	71.	20.	34.	78.	58.	39.	44.	63.
	4AD	45.	36.	65.	4.	29.	62.	53.	23.	39.	47.
	5	34.	55.	65.	6.	20.	78.	47.	35.	29.	64.
	6	23.	77.	57.	23.	9.	99.	36.	56.	17.	86.
	7	26.	74.	57.	25.	11.	97.	38.	54.	20.	83.
	8	36.	60.	57.	27.	19.	87.	44.	47.	29.	71.
	9	47.	36.	58.	18.	27.	66.	51.	28.	39.	48.
	10	62.	6.	68.	-3.	35.	48.	65.	2.	51.	23.
	11	57.	19.	64.	9.	12.	91.	60.	15.	39.	48.
4	1	57.	19.	64.	9.	12.	91.	60.	15.	39.	48.
	2	66.	8.	72.	-1.	39.	50.	68.	4.	55.	25.
	3	59.	29.	71.	11.	40.	60.	64.	22.	51.	41.
	4AI	51.	51.	72.	17.	34.	77.	60.	37.	45.	61.
	4AD	46.	35.	67.	1.	29.	61.	55.	21.	39.	45.
	5	35.	53.	66.	4.	21.	76.	48.	34.	29.	62.
	6	23.	76.	58.	22.	9.	98.	37.	55.	18.	85.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	26.	74.	57.	25.	12.	96.	38.	54.	20.	83.
	8	36.	60.	56.	28.	19.	86.	44.	47.	29.	70.
	9	47.	36.	57.	19.	28.	65.	51.	29.	39.	47.
	10	62.	6.	67.	-1.	35.	48.	64.	3.	51.	23.
	11	57.	20.	64.	9.	12.	91.	60.	16.	39.	49.
5	1	57.	20.	64.	9.	12.	91.	60.	16.	39.	49.
	2	66.	8.	72.	-1.	39.	50.	68.	4.	55.	25.
	3	59.	30.	71.	11.	39.	61.	64.	22.	51.	42.
	4AI	51.	51.	72.	18.	34.	78.	60.	38.	44.	62.
	4AD	46.	35.	67.	2.	29.	62.	54.	22.	39.	46.
	5	35.	54.	66.	4.	21.	75.	47.	34.	29.	62.
	6	23.	77.	57.	23.	11.	95.	37.	55.	18.	84.
	7	26.	74.	56.	27.	14.	92.	38.	55.	21.	81.
	8	36.	60.	54.	31.	23.	80.	43.	48.	30.	68.
	9	47.	36.	56.	21.	32.	59.	50.	30.	41.	45.
	10	62.	6.	66.	0.	39.	42.	64.	4.	53.	21.
	11	57.	20.	64.	9.	16.	84.	60.	16.	41.	46.
6	1	57.	20.	64.	9.	16.	84.	60.	16.	41.	46.
	2	61.	17.	68.	5.	39.	51.	64.	12.	52.	30.
	3AI	49.	40.	71.	4.	31.	68.	58.	25.	42.	51.
	3AD	43.	27.	65.	-9.	25.	55.	52.	13.	36.	38.
	4	36.	38.	64.	-5.	20.	63.	47.	21.	30.	48.
	5	26.	55.	56.	7.	12.	77.	38.	36.	20.	64.
	6	16.	73.	48.	24.	5.	91.	29.	53.	12.	80.
	7	14.	79.	44.	32.	5.	93.	26.	60.	10.	85.
	8	14.	80.	40.	39.	7.	91.	24.	64.	11.	84.
	9	15.	78.	35.	47.	11.	85.	23.	66.	13.	81.
	10	18.	74.	29.	57.	16.	78.	23.	67.	17.	75.
	11	22.	68.	22.	68.	22.	68.	22.	68.	22.	68.

Hipotesis 1 : Peso propio + Pretensado (* 1.100) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	23.	70.	23.	70.	23.	70.	23.	70.	23.	70.
	2	17.	78.	30.	58.	15.	82.	22.	70.	16.	80.
	3	14.	83.	35.	49.	8.	91.	22.	69.	12.	86.
	4	12.	85.	40.	40.	4.	97.	23.	67.	9.	89.
	5	13.	83.	44.	34.	2.	99.	25.	63.	8.	89.
	6	15.	77.	47.	28.	2.	97.	28.	57.	10.	85.
	7	21.	67.	49.	23.	5.	92.	32.	50.	14.	77.
	8	28.	54.	50.	20.	9.	83.	36.	41.	20.	66.
	9	36.	39.	49.	19.	16.	72.	42.	31.	28.	52.
	10	47.	21.	53.	11.	22.	60.	50.	17.	37.	37.
	11	47.	26.	54.	15.	6.	90.	50.	21.	31.	52.
2	1	47.	26.	54.	15.	6.	90.	50.	21.	31.	52.
	2	57.	12.	61.	5.	34.	48.	59.	9.	48.	26.
	3	53.	29.	62.	15.	38.	52.	56.	23.	47.	39.
	4AI	46.	48.	65.	19.	34.	68.	54.	36.	41.	56.
	4AD	42.	33.	60.	4.	29.	53.	49.	22.	37.	41.
	5	33.	48.	63.	1.	21.	66.	45.	29.	29.	55.
	6	23.	68.	58.	13.	11.	86.	37.	46.	18.	75.
	7	26.	65.	57.	15.	13.	86.	39.	45.	21.	73.
	8	34.	53.	56.	19.	17.	80.	43.	39.	28.	64.
	9	44.	31.	56.	13.	24.	62.	49.	24.	36.	43.
	10	57.	5.	63.	-5.	31.	46.	59.	1.	46.	21.
	11	51.	20.	58.	9.	6.	91.	54.	16.	33.	48.
3	1	51.	20.	58.	9.	6.	91.	54.	16.	33.	48.
	2	60.	6.	65.	-1.	33.	49.	62.	4.	50.	23.
	3	56.	25.	66.	8.	37.	54.	60.	18.	48.	36.
	4AI	49.	44.	69.	12.	33.	70.	57.	31.	43.	54.
	4AD	44.	29.	65.	-3.	28.	55.	53.	16.	38.	39.
	5	35.	45.	66.	-4.	21.	68.	48.	25.	29.	54.
	6	25.	65.	59.	11.	11.	87.	38.	44.	19.	74.
	7	27.	63.	58.	14.	13.	86.	39.	44.	21.	72.
	8	35.	53.	56.	19.	18.	79.	43.	39.	28.	63.
	9	44.	31.	55.	13.	24.	62.	48.	24.	36.	44.
	10	56.	6.	62.	-3.	29.	48.	59.	2.	46.	23.
	11	50.	21.	56.	11.	5.	93.	53.	17.	32.	50.
4	1	50.	21.	56.	11.	5.	93.	53.	17.	32.	50.
	2	60.	8.	65.	-1.	33.	50.	62.	4.	49.	25.
	3	55.	26.	66.	8.	35.	56.	59.	19.	47.	38.
	4AI	48.	45.	69.	12.	31.	72.	57.	31.	42.	55.
	4AD	44.	30.	65.	-3.	27.	57.	52.	17.	37.	41.
	5	35.	46.	66.	-4.	20.	68.	47.	26.	29.	55.
	6	24.	66.	59.	12.	11.	88.	38.	44.	19.	75.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado inicial

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	27.	64.	57.	15.	12.	87.	39.	44.	21.	73.
	8	34.	53.	55.	21.	18.	79.	43.	40.	28.	63.
	9	44.	31.	54.	15.	25.	61.	48.	25.	36.	43.
	10	56.	6.	61.	-1.	29.	48.	58.	3.	46.	23.
	11	50.	21.	57.	11.	5.	93.	53.	17.	32.	50.
5	1	50.	21.	57.	11.	5.	93.	53.	17.	32.	50.
	2	60.	8.	66.	-2.	33.	49.	62.	4.	49.	24.
	3	55.	26.	67.	7.	35.	57.	60.	18.	47.	38.
	4AI	49.	44.	70.	11.	31.	72.	57.	31.	42.	55.
	4AD	44.	30.	65.	-4.	27.	57.	52.	16.	37.	41.
	5	35.	45.	66.	-4.	21.	67.	47.	25.	30.	54.
	6	24.	66.	59.	12.	13.	84.	38.	44.	20.	73.
	7	27.	63.	57.	16.	15.	82.	39.	45.	22.	71.
	8	35.	52.	53.	23.	22.	72.	42.	41.	30.	60.
	9	44.	31.	53.	16.	29.	54.	48.	25.	38.	40.
	10	57.	5.	61.	-1.	34.	41.	58.	3.	48.	20.
	11	50.	21.	57.	10.	10.	85.	53.	16.	34.	46.
6	1	50.	21.	57.	10.	10.	85.	53.	16.	34.	46.
	2	56.	14.	63.	2.	34.	49.	59.	9.	47.	28.
	3AI	47.	33.	69.	-3.	29.	61.	56.	19.	39.	44.
	3AD	41.	21.	64.	-14.	23.	49.	50.	7.	34.	32.
	4	35.	31.	63.	-13.	19.	56.	46.	13.	29.	41.
	5	26.	46.	57.	-3.	13.	67.	39.	26.	21.	54.
	6	18.	62.	49.	12.	6.	80.	30.	42.	13.	69.
	7	15.	68.	45.	21.	6.	82.	27.	49.	12.	73.
	8	15.	69.	41.	28.	8.	80.	25.	53.	12.	73.
	9	16.	68.	35.	38.	11.	75.	24.	56.	14.	71.
	10	18.	66.	29.	49.	15.	69.	22.	59.	17.	67.
	11	20.	62.	20.	62.	20.	62.	20.	62.	20.	62.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
1	1	20.	63.	20.	63.	20.	63.	20.	63.	20.	63.
	2	17.	67.	30.	48.	15.	72.	22.	60.	16.	69.
	3	15.	70.	37.	36.	10.	78.	24.	56.	13.	73.
	4	15.	70.	43.	26.	7.	82.	26.	52.	12.	75.
	5	16.	67.	47.	18.	5.	84.	28.	48.	11.	74.
	6	18.	62.	49.	13.	5.	82.	31.	42.	13.	70.
	7	23.	53.	51.	9.	7.	78.	34.	36.	17.	63.
	8	29.	43.	51.	8.	11.	71.	37.	29.	21.	54.
	9	36.	30.	49.	10.	15.	63.	41.	22.	28.	43.
	10	44.	16.	51.	6.	19.	55.	47.	12.	34.	31.
	11	43.	22.	50.	11.	2.	87.	46.	18.	27.	48.
2	1	43.	22.	50.	11.	2.	87.	46.	18.	27.	48.
	2	53.	8.	57.	1.	30.	44.	55.	5.	44.	22.
	3	50.	21.	60.	6.	36.	44.	54.	15.	44.	30.
	4AI	45.	36.	64.	7.	32.	56.	53.	24.	40.	44.
	4AD	41.	23.	60.	-6.	28.	43.	49.	11.	36.	31.
	5	34.	36.	64.	-11.	22.	55.	46.	17.	29.	43.
	6	24.	55.	58.	0.	12.	73.	38.	33.	19.	62.
	7	25.	54.	57.	5.	12.	75.	38.	34.	20.	63.
	8	30.	47.	52.	13.	13.	74.	39.	34.	24.	58.
	9	37.	31.	49.	12.	17.	62.	42.	24.	29.	43.
	10	46.	12.	52.	2.	20.	53.	49.	8.	36.	28.
	11	38.	30.	45.	19.	-7.	101.	41.	25.	20.	58.
3	1	38.	30.	45.	19.	-7.	101.	41.	25.	20.	58.
	2	49.	14.	53.	7.	22.	57.	51.	11.	38.	31.
	3	47.	27.	57.	10.	28.	56.	51.	20.	39.	39.
	4AI	42.	41.	62.	9.	26.	67.	50.	28.	36.	51.
	4AD	38.	28.	58.	-4.	22.	54.	46.	15.	31.	38.
	5	31.	40.	62.	-9.	17.	63.	44.	20.	25.	49.
	6	22.	57.	57.	3.	9.	79.	36.	35.	17.	66.
	7	24.	56.	56.	6.	10.	78.	37.	36.	18.	65.
	8	30.	47.	51.	14.	13.	74.	39.	34.	23.	58.
	9	37.	31.	49.	13.	18.	61.	42.	23.	29.	43.
	10	47.	11.	53.	2.	20.	53.	49.	7.	36.	28.
	11	39.	28.	46.	17.	-6.	99.	42.	24.	21.	56.
4	1	39.	28.	46.	17.	-6.	99.	42.	24.	21.	56.
	2	50.	12.	56.	3.	23.	55.	52.	9.	39.	29.
	3	48.	25.	59.	7.	28.	56.	52.	18.	40.	38.
	4AI	43.	40.	64.	7.	26.	67.	51.	26.	36.	50.
	4AD	39.	27.	60.	-7.	22.	53.	47.	13.	32.	37.
	5	32.	39.	63.	-11.	17.	61.	44.	19.	26.	48.
	6	23.	56.	57.	2.	9.	78.	37.	35.	17.	65.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

Tensiones en Servicio (kg/cm2) Estado final

V.	SE	Hipotesis 1 F.Sup	Hipotesis 1 F.Inf	Hipotesis 2 F.Sup	Hipotesis 2 F.Inf	Hipotesis 3 F.Sup	Hipotesis 3 F.Inf	Hipotesis 4 F.Sup	Hipotesis 4 F.Inf	Hipotesis 5 F.Sup	Hipotesis 5 F.Inf
	7	25.	55.	55.	7.	10.	78.	37.	36.	19.	64.
	8	30.	47.	51.	15.	14.	73.	38.	34.	24.	58.
	9	37.	31.	48.	14.	18.	60.	41.	24.	30.	42.
	10	47.	11.	51.	4.	20.	53.	49.	8.	36.	28.
	11	39.	28.	46.	18.	-6.	100.	42.	24.	21.	57.
5	1	39.	28.	46.	18.	-6.	100.	42.	24.	21.	57.
	2	50.	13.	56.	3.	23.	54.	52.	9.	39.	29.
	3	47.	26.	59.	7.	28.	57.	52.	18.	39.	38.
	4AI	43.	40.	64.	7.	26.	67.	51.	27.	36.	51.
	4AD	39.	27.	60.	-6.	21.	54.	47.	14.	32.	38.
	5	32.	39.	63.	-10.	18.	60.	44.	19.	26.	48.
	6	23.	57.	57.	3.	11.	75.	36.	35.	18.	64.
	7	24.	55.	54.	8.	13.	74.	36.	37.	20.	63.
	8	30.	47.	49.	18.	17.	68.	38.	36.	25.	55.
	9	37.	31.	47.	16.	23.	54.	41.	25.	31.	40.
	10	47.	11.	51.	5.	24.	47.	48.	8.	38.	25.
	11	39.	28.	46.	17.	-2.	92.	42.	24.	23.	54.
6	1	39.	28.	46.	17.	-2.	92.	42.	24.	23.	54.
	2	47.	17.	55.	6.	25.	52.	50.	13.	38.	31.
	3AI	41.	30.	64.	-5.	23.	59.	50.	16.	34.	42.
	3AD	36.	20.	59.	-15.	18.	48.	45.	6.	29.	31.
	4	32.	27.	60.	-17.	16.	52.	43.	10.	26.	37.
	5	25.	39.	55.	-9.	11.	61.	37.	20.	19.	48.
	6	17.	53.	49.	4.	6.	71.	30.	33.	13.	60.
	7	15.	58.	45.	11.	6.	72.	27.	39.	12.	64.
	8	15.	59.	41.	18.	8.	70.	25.	43.	12.	63.
	9	15.	59.	35.	28.	11.	66.	23.	47.	14.	62.
	10	17.	58.	28.	41.	14.	61.	21.	51.	16.	59.
	11	18.	56.	18.	56.	18.	56.	18.	56.	18.	56.

Hipotesis 1 : Peso propio + Pretensado (* 0.900) + Cargas muertas
Hipotesis 2 : Hipotesis 1 + Envolvente sobrecargas positivas
Hipotesis 3 : Hipotesis 1 + Envolvente sobrecargas negativas
Hipotesis 4 : Hipotesis 1 + Envolvente sobrecargas positivas * 0.4
Hipotesis 5 : Hipotesis 1 + Envolvente sobrecargas negativas * 0.4

LINEA ALTA VELOCIDAD ZARAGOZA - LLEIDA
F. LONGITUD. SUBTRAMO 1 E-5
REOLOGICAS

X	NUDO	TEMPERATURA F. Sup.	TEMPERATURA F. Inf.	RETRAC (t)	RETRAC (kg/cm2)	FRENADO (t)	FRENADO (kg/cm2)
0.000	1	0	0	228	-2.5	777	-8.4
2.700	2	0.91	-1.44	225	-2.5	766	-8.3
5.400	3	1.82	-2.87	221	-2.5	754	-8.2
8.100	4	2.73	-4.31	218	-2.4	743	-8.0
10.800	5	3.65	-5.75	215	-2.4	732	-7.9
13.500	6	4.56	-7.18	211	-2.3	721	-7.8
16.200	7	5.47	-8.62	208	-2.3	709	-7.7
18.900	8	6.38	-10.06	205	-2.3	698	-7.5
21.600	9	7.29	-11.49	202	-2.2	687	-7.4
24.300	10	8.2	-12.93	198	-2.2	675	-7.3
27.000	11	9.11	-14.36	195	-2.2	664	-7.2
27.000	11	9.11	-14.36	195	-2.2	664	-7.2
29.875	12	8.91	-14.05	191	-2.1	652	-7.1
32.750	13	8.71	-13.73	188	-2.1	640	-6.9
35.250	14	8.54	-13.46	185	-2.1	630	-6.8
35.250	14	8.54	-13.46	185	-2.1	630	-6.8
39.375	15	8.25	-13.01	180	-2.0	613	-6.6
43.500	16	7.97	-12.56	175	-1.9	595	-6.4
47.625	17	7.68	-12.11	170	-1.9	578	-6.2
51.750	18	7.39	-11.65	165	-1.8	561	-6.1
54.250	19	7.22	-11.38	162	-1.8	550	-6.0
57.125	20	7.02	-11.07	158	-1.8	538	-5.8
60.000	21	6.82	-10.75	154	-1.7	526	-5.7
60.000	21	6.82	-10.75	154	-1.7	526	-5.7
62.875	22	6.89	-10.86	151	-1.7	514	-5.6
65.750	23	6.95	-10.96	147	-1.6	502	-5.4
68.250	24	7.01	-11.05	144	-1.6	492	-5.3
68.250	24	7.01	-11.05	144	-1.6	492	-5.3
72.375	25	7.11	-11.2	139	-1.5	475	-5.1
76.500	26	7.2	-11.35	134	-1.5	457	-4.9
80.625	27	7.3	-11.5	129	-1.4	440	-4.8
84.750	28	7.39	-11.66	124	-1.4	423	-4.6
87.250	29	7.45	-11.75	121	-1.3	413	-4.5
90.125	30	7.52	-11.85	118	-1.3	401	-4.3
93.000	31	7.59	-11.96	114	-1.3	389	-4.2
93.000	31	7.59	-11.96	114	-1.3	389	-4.2
95.875	32	7.52	-11.85	110	-1.2	376	-4.1
98.750	33	7.45	-11.75	107	-1.2	364	-3.9
101.250	34	7.39	-11.65	104	-1.2	354	-3.8
101.250	34	7.39	-11.65	104	-1.2	354	-3.8
105.375	35	7.3	-11.5	99	-1.1	337	-3.6
109.500	36	7.2	-11.35	94	-1.0	320	-3.5
113.625	37	7.11	-11.2	89	-1.0	302	-3.3
117.750	38	7.01	-11.05	84	-0.9	285	-3.1
120.250	39	6.95	-10.96	81	-0.9	275	-3.0
123.125	40	6.89	-10.85	77	-0.9	263	-2.8
126.000	41	6.82	-10.75	74	-0.8	251	-2.7
126.000	41	6.82	-10.75	74	-0.8	251	-2.7
128.875	42	7.02	-11.07	70	-0.8	239	-2.6
131.750	43	7.22	-11.38	67	-0.7	227	-2.5
134.250	44	7.39	-11.66	63	-0.7	216	-2.3
134.250	44	7.39	-11.66	63	-0.7	216	-2.3
138.375	45	7.68	-12.11	58	-0.6	199	-2.2
142.500	46	7.97	-12.56	53	-0.6	182	-2.0
146.625	47	8.26	-13.01	48	-0.5	164	-1.8
150.750	48	8.54	-13.47	43	-0.5	147	-1.6
153.250	49	8.72	-13.74	40	-0.4	137	-1.5
156.125	50	8.92	-14.06	37	-0.4	125	-1.3
159.000	51	9.12	-14.37	33	-0.4	113	-1.2
159.000	51	9.12	-14.37	33	-0.4	113	-1.2
163.125	52	7.72	-12.18	28	-0.3	96	-1.0
167.250	53	6.33	-9.98	23	-0.3	78	-0.8
167.250	53	6.33	-9.98	23	-0.3	78	-0.8
169.594	54	5.54	-8.73	20	-0.2	69	-0.7
171.938	55	4.75	-7.48	17	-0.2	59	-0.6
174.282	56	3.96	-6.24	14	-0.2	49	-0.5
176.626	57	3.17	-4.99	11	-0.1	39	-0.4
178.970	58	2.37	-3.74	9	-0.1	29	-0.3
181.314	59	1.58	-2.49	6	-0.1	20	-0.2
183.658	60	0.79	-1.25	3	-0.0	10	-0.1
186.000	61	0	0	0	0.0	0	0.0

LINEA ALTA VELOCIDAD ZARAGOZA-LLEIDA. SUBTRAMO 1 E-5

TESADOS AL 75.

TOTAL FRENADO: 777 Af 9 I. fr = 23.7
TOTAL RETRACCIO 228 Ar: 9.25
L. TOTAL: 166 canto 2.45

		M+ FINAL Pret*1.1 SIN TEMPERATURA		M+ FINAL Pret*1.1 CON TEMPERATUR		M- FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 CON TEMPERATUR		M- FREQ. FINAL Pret*1.1 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	25	77	25.0	77.0	25	77	25	77	25.0	77.0	25	77
2.700	2	31	67	31.9	65.6	16	91	24	79	24.9	77.6	18	88
5.400	3	36	58	37.8	55.1	9	101	23	79	24.8	76.1	12	96
8.100	4	41	50	43.7	45.7	5	106	24	76	26.7	71.7	10	99
10.800	5	45	42	48.7	36.3	3	107	26	71	29.7	65.3	10	98
13.500	6	49	34	53.6	26.8	5	104	30	64	34.6	56.8	13	92
16.200	7	53	27	58.5	18.4	9	96	36	53	41.5	44.4	18	81
18.900	8	56	20	62.4	9.9	16	83	43	41	49.4	30.9	27	66
21.600	9	58	14	65.3	2.5	25	67	51	26	58.3	14.5	37	48
24.300	10	66	2	74.2	-10.9	34	51	62	8	70.2	-4.9	49	27
27.000	11	69	2	78.1	-12.4	21	77	65	8	74.1	-6.4	46	38
27.000	11	69	2	78.1	-12.4	21	77	65	8	74.1	-6.4	46	38
29.875	12	74	-5	82.9	-19.1	47	38	72	-1	80.9	-15.1	61	16
32.750	13	72	9	80.7	-4.7	48	47	66	18	74.7	4.3	57	33
35.250	14	73	17	81.5	3.5	41	67	62	35	70.5	21.5	49	54
35.250	14	68	1	76.5	-12.5	36	50	57	19	65.5	5.5	44	38
39.375	15	67	3	75.3	-10.0	26	69	49	31	57.3	18.0	33	58
43.500	16	59	20	67.0	7.4	13	93	38	53	46.0	40.4	20	82
47.625	17	58	23	65.7	10.9	13	94	40	53	47.7	40.9	22	81
51.750	18	57	26	64.4	14.4	19	87	45	46	52.4	34.4	29	70
54.250	19	58	18	65.2	6.6	27	67	51	29	58.2	17.6	39	48
57.125	20	68	-2	75.0	-13.1	35	49	64	3	71.0	-8.1	51	24
60.000	21	63	11	69.8	0.3	11	93	59	17	65.8	6.3	38	50
60.000	21	63	11	69.8	0.3	11	93	59	17	65.8	6.3	38	50
62.875	22	69	3	75.9	-7.9	38	52	67	7	73.9	-3.9	54	27
65.750	23	69	15	76.0	4.0	39	61	62	24	69.0	13.0	51	43
68.250	24	71	20	78.0	9.0	34	78	59	40	68.0	29.0	44	63
68.250	24	66	4	73.0	-7.1	29	62	53	24	60.0	13.0	39	47
72.375	25	65	8	72.1	-5.2	20	78	47	36	54.1	24.8	29	64
76.500	26	57	23	64.2	11.7	9	99	36	56	43.2	44.7	17	86
80.625	27	57	25	64.3	13.5	11	97	38	55	45.3	43.5	20	84
84.750	28	57	27	64.4	15.3	19	87	44	47	51.4	35.3	29	71
87.250	29	58	18	65.5	6.3	27	66	51	28	58.5	16.3	39	48
90.125	30	68	-4	75.5	-15.9	36	48	65	2	72.5	-9.9	52	23
93.000	31	64	9	71.6	-3.0	12	91	60	15	67.6	3.0	40	48
93.000	31	64	9	71.6	-3.0	12	91	60	15	67.6	3.0	40	48
95.875	32	72	-1	79.5	-12.9	39	50	69	4	76.5	-7.9	55	25
98.750	33	71	11	78.5	-0.8	40	60	64	22	71.5	10.3	52	41
101.250	34	73	18	80.4	6.4	34	78	60	37	67.4	25.4	45	61
101.250	34	67	2	74.4	-9.7	29	62	55	21	62.4	9.4	40	45
105.375	35	67	4	74.3	-7.5	21	76	48	34	55.3	22.5	29	63
109.500	36	58	23	65.2	11.7	9	98	37	55	44.2	43.7	18	85
113.625	37	57	25	64.1	13.8	12	97	38	55	45.1	43.8	20	83
117.750	38	56	28	63.0	17.0	19	86	44	47	51.0	36.0	29	70
120.250	39	57	19	64.0	8.0	26	65	51	29	58.0	18.0	39	48
123.125	40	67	-1	73.9	-11.9	35	48	64	3	70.9	-7.9	52	23
126.000	41	64	9	70.8	-1.8	12	91	60	16	66.8	5.3	39	48
126.000	41	64	9	70.8	-1.8	12	91	60	16	66.8	5.3	39	48
128.875	42	72	-1	79.0	-12.1	40	50	68	4	75.0	-7.1	55	25
131.750	43	71	11	78.2	-0.4	40	61	64	22	71.2	10.6	51	42
134.250	44	72	18	79.4	6.3	34	78	60	38	67.4	26.3	44	62
134.250	44	67	2	74.4	-9.7	29	62	55	22	62.4	10.3	39	46
138.375	45	66	5	73.7	-7.1	21	75	47	34	54.7	21.9	30	63
142.500	46	57	23	65.0	10.4	11	96	37	56	45.0	43.4	18	85
146.625	47	56	27	64.3	14.0	14	93	38	55	46.3	42.0	21	82
150.750	48	54	31	62.5	17.5	23	80	43	48	51.5	34.5	31	68
153.250	49	56	21	64.7	7.3	32	59	50	30	58.7	16.3	41	45
156.125	50	66	0	74.9	-14.1	39	42	64	3	72.9	-11.1	53	20
159.000	51	64	9	73.1	-5.4	17	84	60	16	69.1	1.6	41	46
159.000	51	64	9	73.1	-5.4	17	84	60	16	69.1	1.6	41	46
163.125	52	68	5	75.7	-7.2	39	51	64	12	71.7	-0.2	52	30
167.250	53	71	4	77.3	-8.0	31	68	58	26	64.3	16.0	42	51
167.250	53	65	-8	71.3	-18.0	25	55	52	13	58.3	3.0	36	38
169.594	54	64	-5	69.5	-13.7	20	63	47	21	52.5	12.3	30	48
171.938	55	57	7	61.8	-0.5	12	77	38	36	42.8	28.5	20	64
174.282	56	48	24	52.0	17.8	5	91	29	54	33.0	47.8	12	81
176.626	57	43	32	46.2	27.0	5	94	26	61	29.2	56.0	10	85
178.970	58	40	40	42.4	36.3	7	91	24	64	26.4	60.3	11	85
181.314	59	35	46	36.6	45.5	11	86	23	66	24.6	63.5	13	81
183.656	60	29	57	29.8	55.8	16	78	23	67	23.8	65.8	17	76
186.000	61	22	69	22.0	69.0	22	69	22	69	22.0	69.0	22	69

LINEA ALTA VELOCIDAD ZARAGOZA-LLEIDA. SUBTRAMO 1 E-5

TESADOS AL 75 %

		M+ FINAL Pret*0.9 SIN TEMPERATURA		M+ FINAL Pret*0.9 CON TEMPERATUR		M- FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 CON TEMPERATUR		M- FREQ. FINAL Pret*0.9 SIN TEMPERATURA	
X	NUDO	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	20	63	20.0	63.0	20	63	20	63	20.0	63.0	20	63
2.700	2	30	48	30.9	46.6	15	72	22	60	22.9	58.6	16	69
5.400	3	37	36	38.8	33.1	10	79	24	57	25.8	54.1	13	74
8.100	4	43	26	45.7	21.7	7	83	26	53	28.7	48.7	11	75
10.800	5	47	19	50.7	13.3	5	84	28	48	31.7	42.3	11	74
13.500	6	49	13	53.6	5.8	5	83	31	43	35.6	35.6	13	70
16.200	7	51	9	56.5	0.4	7	78	34	36	39.5	27.4	17	64
18.900	8	51	8	57.4	-2.1	11	71	38	29	44.4	18.9	22	54
21.600	9	49	10	56.3	-1.5	15	63	41	22	48.3	10.5	28	43
24.300	10	51	6	59.2	-6.9	20	55	47	12	55.2	-0.9	35	31
27.000	11	50	11	59.1	-3.4	2	86	46	18	55.1	3.6	27	48
27.000	11	50	11	59.1	-3.4	2	86	46	18	55.1	3.6	27	48
29.875	12	57	1	65.9	-13.1	30	44	55	5	63.9	-9.1	44	22
32.750	13	60	6	68.7	-7.7	36	44	54	15	62.7	1.3	44	30
35.250	14	64	7	72.5	-6.5	33	57	53	25	61.5	11.5	40	44
35.250	14	60	-6	68.5	-19.5	28	43	49	12	57.5	-1.5	36	31
39.375	15	64	-11	72.3	-24.0	22	55	46	17	54.3	4.0	29	44
43.500	16	58	1	66.0	-11.6	12	74	38	33	46.0	20.4	19	62
47.625	17	57	5	64.7	-7.1	12	76	38	35	45.7	22.9	20	63
51.750	18	52	14	59.4	2.4	13	74	39	34	46.4	22.4	24	58
54.250	19	49	13	56.2	1.6	18	62	42	24	49.2	12.6	29	43
57.125	20	53	2	60.0	-9.1	20	53	49	8	56.0	-3.1	36	28
60.000	21	45	19	51.8	8.3	-7	101	41	25	47.8	14.3	20	58
60.000	21	45	19	51.8	8.3	-7	101	41	25	47.8	14.3	20	58
62.875	22	54	7	60.9	-3.9	22	57	51	11	57.9	0.1	38	31
65.750	23	57	10	64.0	-1.0	28	56	51	20	58.0	9.0	39	39
68.250	24	63	9	70.0	-2.1	26	67	50	28	57.0	17.0	36	52
68.250	24	58	-4	65.0	-15.1	22	54	46	15	53.0	3.9	32	38
72.375	25	62	-8	69.1	-19.2	17	63	44	21	51.1	9.8	25	49
76.500	26	57	3	64.2	-8.4	9	79	36	36	43.2	24.7	17	66
80.625	27	56	7	63.3	-4.5	10	79	37	36	44.3	24.5	19	65
84.750	28	51	14	58.4	2.3	13	74	39	34	46.4	22.3	23	58
87.250	29	49	13	56.5	1.3	18	61	42	23	49.5	11.3	30	43
90.125	30	53	2	60.5	-9.9	20	53	50	7	57.5	-4.9	37	28
93.000	31	46	17	53.6	5.0	-5	99	42	23	49.6	11.0	22	56
93.000	31	46	17	53.6	5.0	-5	99	42	23	49.6	11.0	22	56
95.875	32	56	3	63.5	-8.9	23	55	53	9	60.5	-2.9	40	29
98.750	33	59	7	66.5	-4.8	28	56	52	18	59.5	6.3	40	38
101.250	34	64	7	71.4	-4.7	26	67	52	27	59.4	15.4	36	51
101.250	34	60	-6	67.4	-17.7	22	54	47	14	54.4	2.4	32	38
105.375	35	63	-10	70.3	-21.5	18	62	44	19	51.3	7.5	28	48
109.500	36	57	2	64.2	-9.4	9	78	37	35	44.2	23.7	17	65
113.625	37	55	7	62.1	-4.2	10	78	37	36	44.1	24.8	19	65
117.750	38	51	15	58.0	3.9	14	73	39	35	46.0	24.0	24	58
120.250	39	48	14	55.0	3.0	19	60	42	24	49.0	13.0	30	43
123.125	40	52	4	58.9	-6.9	20	53	49	8	55.9	-2.9	36	28
126.000	41	46	17	52.8	6.3	-6	99	42	24	48.8	13.3	21	57
126.000	41	46	17	52.8	6.3	-6	99	42	24	48.8	13.3	21	57
128.875	42	56	3	63.0	-8.1	24	54	52	9	59.0	-2.1	40	29
131.750	43	59	7	66.2	-4.4	28	57	52	18	59.2	6.6	40	38
134.250	44	64	7	71.4	-4.7	26	67	51	27	58.4	15.3	36	51
134.250	44	60	-6	67.4	-17.7	22	54	47	14	54.4	2.3	32	38
138.375	45	63	-10	70.7	-22.1	18	61	44	19	51.7	6.9	28	48
142.500	46	57	3	65.0	-9.6	11	76	36	35	44.0	22.4	18	65
146.625	47	54	8	62.3	-5.0	13	74	36	37	44.3	24.0	20	63
150.750	48	49	18	57.5	4.5	17	66	38	36	46.5	22.5	25	56
153.250	49	47	16	55.7	2.3	23	54	41	25	49.7	11.3	31	40
156.125	50	51	4	59.9	-10.1	24	47	49	8	57.9	-6.1	38	25
159.000	51	46	17	55.1	2.6	-1	92	42	24	51.1	9.6	23	54
159.000	51	46	17	55.1	2.6	-1	92	42	24	51.1	9.6	23	54
163.125	52	55	6	62.7	-6.2	25	52	50	13	57.7	0.8	39	31
167.250	53	64	-5	70.3	-15.0	23	59	50	16	58.3	6.0	34	42
167.250	53	59	-15	65.3	-25.0	18	48	45	6	51.3	-4.0	29	31
169.594	54	60	-16	65.5	-24.7	16	52	43	10	48.5	1.3	26	37
171.938	55	56	-9	60.8	-16.5	11	61	37	20	41.8	12.5	19	48
174.282	56	49	4	53.0	-2.2	6	71	30	34	34.0	27.8	13	61
176.626	57	45	11	48.2	6.0	6	72	27	39	30.2	34.0	12	64
178.970	58	41	19	43.4	15.3	8	70	25	43	27.4	39.3	12	64
181.314	59	35	29	36.6	26.5	11	67	23	47	24.6	44.5	14	62
183.656	60	28	41	28.8	39.8	14	62	21	51	21.8	49.8	16	59
186.000	61	18	56	18.0	56.0	18	56	18	56	18.0	56.0	18	56

L A V ZARAGOZA-LLEIDA SUBTRAMO-1 E-5

TESADOS AL 75%

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret°1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M FINAL Pret°1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret°0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M FINAL Pret°0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.	F. Sup.	F. Inf.	Vt sup.	Vt inf.
0.000	1	22.5	74.5	0.0	0.0	22.5	74.5	0.0	0.0	17.5	80.5	0.0	0.0	17.5	80.5	0.0	0.0
2.700	2	29.4	83.1	0.0	0.0	13.5	88.5	0.0	0.0	28.4	44.1	0.0	0.0	12.5	89.5	0.0	0.0
5.400	3	35.4	92.7	0.0	0.0	6.5	98.5	0.0	0.0	36.4	30.7	0.0	0.0	7.5	76.5	0.0	0.0
8.100	4	41.3	43.3	0.0	0.0	2.6	103.6	0.0	0.0	43.3	19.3	0.0	0.0	4.6	80.6	0.0	0.0
10.800	5	46.3	33.9	0.0	0.0	0.6	104.6	0.0	0.0	48.3	10.9	0.0	0.0	2.6	81.6	0.0	0.0
13.500	6	51.2	24.5	0.0	0.0	2.7	101.7	0.0	0.0	51.2	3.5	0.0	0.0	2.7	80.7	0.0	0.0
16.200	7	56.2	16.1	0.0	0.0	6.7	93.7	0.0	0.0	54.2	1.9	0.0	-0.8	4.7	75.7	0.0	0.0
18.900	8	60.1	7.7	0.0	0.0	13.7	80.7	0.0	0.0	55.1	-4.3	0.0	-3.9	6.7	68.7	0.0	0.0
21.600	9	63.1	0.3	0.0	0.0	22.8	64.8	0.0	0.0	54.1	-3.7	0.0	-2.9	12.8	60.8	0.0	0.0
24.300	10	72.0	-13.1	0.0	-24.8	31.8	48.8	0.0	0.0	57.0	-9.1	0.0	-15.4	17.8	52.8	0.0	0.0
27.000	11	75.9	-14.3	0.0	-28.6	18.8	74.8	0.0	0.0	56.9	-5.5	0.0	-6.0	0.2	83.8	-0.0	0.0
27.000	11	75.9	-14.3	0.0	-28.6	18.8	74.8	0.0	0.0	56.9	-5.5	0.0	-6.0	0.2	83.8	-0.0	0.0
29.875	12	80.8	-21.2	0.0	-53.9	44.9	35.8	0.0	0.0	63.8	-13.2	0.0	-35.7	27.8	41.9	0.0	0.0
32.750	13	79.6	-6.8	0.0	-6.7	45.9	44.9	0.0	0.0	66.6	-9.8	0.0	-15.4	33.9	41.9	0.0	0.0
35.250	14	79.5	1.3	0.0	0.0	38.9	64.9	0.0	0.0	70.5	-8.5	0.0	-11.2	30.8	54.9	0.0	0.0
35.250	14	74.5	-14.3	0.0	-29.0	33.9	47.9	0.0	0.0	66.5	-21.5	0.0	-64.4	25.9	40.9	0.0	0.0
39.375	15	73.3	-12.0	0.0	-20.7	24.0	67.0	0.0	0.0	70.3	-26.0	0.0	-86.1	20.0	53.0	0.0	0.0
43.500	16	65.0	5.5	0.0	0.0	11.1	91.1	0.0	0.0	64.0	-13.5	0.0	-28.8	10.1	72.1	0.0	0.0
47.625	17	63.8	9.0	0.0	0.0	11.1	92.1	0.0	0.0	62.6	-9.0	0.0	-13.8	10.1	74.1	0.0	0.0
51.750	18	62.6	12.5	0.0	0.0	17.2	83.2	0.0	0.0	57.8	0.5	0.0	0.0	11.2	72.2	0.0	0.0
54.250	19	63.4	4.8	0.0	0.0	23.2	65.2	0.0	0.0	54.4	-0.2	0.0	-0.0	16.2	80.2	0.0	0.0
57.125	20	73.3	-14.8	0.0	-30.6	33.2	47.2	0.0	0.0	58.3	-10.8	0.0	-20.8	18.2	51.2	0.0	0.0
60.000	21	68.1	-1.5	0.0	-0.4	9.3	91.3	0.0	0.0	50.1	6.5	0.0	0.0	-8.7	99.3	-8.6	0.0
60.000	21	68.1	-1.5	0.0	-0.4	9.3	91.3	0.0	0.0	50.1	6.5	0.0	0.0	-8.7	99.3	-8.6	0.0
62.875	22	74.2	-9.5	0.0	-13.3	36.3	90.3	0.0	0.0	59.2	-5.5	0.0	-5.8	20.3	95.3	0.0	0.0
65.750	23	74.3	2.4	0.0	0.0	37.4	59.4	0.0	0.0	62.3	-2.6	0.0	-1.3	26.4	54.4	0.0	0.0
68.250	24	76.4	7.3	0.0	0.0	32.4	76.4	0.0	0.0	68.4	-3.7	0.0	-2.3	24.4	65.4	0.0	0.0
68.250	24	71.4	-8.7	0.0	-11.5	27.4	60.4	0.0	0.0	63.4	-16.7	0.0	-42.4	20.4	52.4	0.0	0.0
72.375	25	70.6	-6.7	0.0	-7.2	18.5	76.5	0.0	0.0	67.6	-20.7	0.0	-59.7	13.5	61.5	0.0	0.0
76.500	26	62.7	10.2	0.0	0.0	7.9	97.5	0.0	0.0	62.7	-9.8	0.0	-16.4	7.5	77.5	0.0	0.0
80.625	27	62.9	12.1	0.0	0.0	9.6	85.6	0.0	0.0	61.9	-3.9	0.0	-6.4	8.6	77.6	0.0	0.0
84.750	28	63.0	14.0	0.0	0.0	17.6	65.6	0.0	0.0	57.0	1.0	0.0	0.0	11.6	72.6	0.0	0.0
87.250	29	64.1	4.9	0.0	0.0	25.7	64.7	0.0	0.0	56.1	-0.1	0.0	-0.0	16.7	59.7	0.0	0.0
90.125	30	74.2	-17.2	0.0	-39.5	34.7	46.7	0.0	0.0	59.2	-11.2	0.0	-21.7	18.7	51.7	0.0	0.0
93.000	31	70.3	-4.2	0.0	-2.9	10.7	88.7	0.0	0.0	52.3	3.8	0.0	0.0	-5.3	97.7	-4.6	0.0
93.000	31	70.3	-4.2	0.0	-2.9	10.7	88.7	0.0	0.0	52.3	3.8	0.0	0.0	-5.3	97.7	-4.6	0.0
95.875	32	78.3	-14.1	0.0	-26.3	37.8	46.8	0.0	0.0	62.3	-10.1	0.0	-17.2	21.8	53.8	0.0	0.0
98.750	33	77.3	-1.9	0.0	-6.6	36.8	56.8	0.0	0.0	65.3	-3.9	0.0	-6.1	26.8	34.8	0.0	0.0
101.250	34	79.2	5.2	0.0	0.0	32.8	76.8	0.0	0.0	70.2	-3.8	0.0	-5.4	24.8	63.8	0.0	0.0
101.250	34	73.2	-10.8	0.0	-17.0	27.8	60.8	0.0	0.0	66.2	-16.8	0.0	-50.9	20.8	32.8	0.0	0.0
105.375	35	73.2	-8.6	0.0	-11.1	19.8	74.9	0.0	0.0	69.2	-22.6	0.0	-68.1	16.9	60.9	0.0	0.0
109.500	36	64.2	10.6	0.0	0.0	9.0	97.0	0.0	0.0	63.2	-10.4	0.0	-18.0	8.0	77.0	0.0	0.0
113.625	37	63.1	12.8	0.0	0.0	11.0	96.0	0.0	0.0	61.1	-3.2	0.0	-5.0	9.0	77.0	0.0	0.0
117.750	38	62.1	16.0	0.0	0.0	18.1	85.1	0.0	0.0	57.1	3.0	0.0	0.0	13.1	72.1	0.0	0.0
120.250	39	63.1	7.1	0.0	0.0	27.1	64.1	0.0	0.0	54.1	2.1	0.0	0.0	16.1	59.1	0.0	0.0
123.123	40	73.0	-12.7	0.0	-23.1	34.1	47.1	0.0	0.0	58.0	-7.7	0.0	-11.1	19.1	52.1	0.0	0.0
126.000	41	70.0	-2.6	0.0	-1.1	11.2	90.2	0.0	0.0	52.0	5.4	0.0	0.0	-6.8	98.2	-5.4	0.0
126.000	41	70.0	-2.6	0.0	-1.1	11.2	90.2	0.0	0.0	52.0	5.4	0.0	0.0	-6.8	98.2	-5.4	0.0
128.875	42	78.2	-12.8	0.0	-22.2	38.2	49.2	0.0	0.0	62.2	-8.8	0.0	-13.5	23.2	53.2	0.0	0.0
131.750	43	77.3	-1.1	0.0	-0.2	38.3	80.3	0.0	0.0	65.5	-3.1	0.0	-4.5	27.3	34.3	0.0	0.0
134.250	44	78.7	5.6	0.0	0.0	33.3	77.3	0.0	0.0	70.7	-3.4	0.0	-4.6	25.3	66.3	0.0	0.0
134.250	44	73.7	-10.4	0.0	-15.7	28.3	61.3	0.0	0.0	66.7	-18.4	0.0	-48.6	21.3	53.3	0.0	0.0
138.375	45	73.0	-7.8	0.0	-9.1	20.4	74.4	0.0	0.0	70.0	-22.8	0.0	-68.4	17.4	60.4	0.0	0.0
142.500	46	64.4	9.8	0.0	0.0	10.4	95.4	0.0	0.0	64.4	-10.2	0.0	-16.9	10.4	73.4	0.0	0.0
146.625	47	63.7	13.5	0.0	0.0	13.5	92.5	0.0	0.0	61.7	-3.5	0.0	-5.6	12.5	73.5	0.0	0.0
150.750	48	62.1	17.0	0.0	0.0	22.5	79.5	0.0	0.0	57.1	4.0	0.0	0.0	16.5	67.5	0.0	0.0
153.250	49	64.3	6.8	0.0	0.0	31.6	58.6	0.0	0.0	55.3	1.8	0.0	0.0	22.6	53.6	0.0	0.0
156.125	50	74.5	14.5	0.0	28.8	38.6	41.6	0.0	0.0	58.5	10.3	0.0	19.2	23.6	46.6	0.0	0.0
159.000	51	72.8	5.7	0.0	5.1	16.6	83.6	0.0	0.0	54.8	2.3	0.0	0.0	-1.4	91.6	-0.2	0.0
159.000	51	72.8	5.7	0.0	-5.1	16.6	83.6	0.0	0.0	54.8	2.3	0.0	0.0	-1.4	91.6	-0.2	0.0
163.125	52	75.4	7.5	0.0	-8.3	38.7	50.7	0.0	0.0	62.4	-6.3	0.0	-7.5	24.7	51.7	0.0	0.0
167.250	53	77.1	6.2	0.0	-5.7	30.7	67.7	0.0	0.0	70.1	-15.2	0.0	-33.3	22.7	36.7	0.0	0.0
167.250	53	71.1	18.2	0.0	45.6	24.7	34.7	0.0	0.0	65.1	-25.2	0.0	-86.4	17.7	47.7	0.0	0.0
169.594	54	69.3	-14.0	0.0	28.6	19.8	62.8	0.0	0.0	65.3	-23.0	0.0	-84.5	13.8	31.8	0.0	0.0
171.938	55	61.6	-0.7	0.0	-0.1	11.5	78.8	0.0	0.0	60.6	-16.7	0.0	-44.1	10.8	60.8	0.0	0.0
174.282	56	51.8	17.6	0.0	0.0	4.8	90.8	0.0	0.0	52.8	-2.4	0.0	-1.3	5.8	70.8	0.0	0.0
176.626	57	46.0	24.9	0.0	0.0	4.8	93.9	0.0	0.0	48.0	5.9	0.0	0.0	5.9	71.9	0.0	0.0
178.970	58	42.3	36.2	0.0	0.0	6.9	90.9	0.0	0.0	43.3	15.2	0.0	0.0	7.9	69.9	0.0	0.0
181.314	59	36.5	45.4	0.0	0.0	10.9	85.9	0.0	0.0	36.5	26.4	0.0	0.0	10.9	66.9	0.0	0.0
183.658	60	29.8	55.7	0.0	0.0	16.0	78.0	0.0	0.0	28.8	38.7	0.0	0.0	14.0	62.0	0.0	0.0
186.000	61	22.0	69.0	0.0	0.0	22.0	69.0	0.0	0.0	18.0	56.0	0.0	0.0	18.0	36.0	0.0	0.0

L. A. V ZARAGOZA - LLEIDA
SUBTRAMO-1. E-5
CABLES TESADOS AL 75%

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
0.000	1	0.0	0.0	32.8	10.65	10.65
2.700	2	0.0	0.0	32.3	10.49	10.49
5.400	3	0.0	0.0	31.8	10.34	10.34
8.100	4	0.0	0.0	31.4	10.18	10.18
10.800	5	0.0	0.0	30.9	10.03	10.03
13.500	6	0.0	0.0	30.4	9.87	9.87
16.200	7	0.0	-0.8	29.9	9.72	9.98
18.900	8	0.0	-3.9	29.5	9.56	10.82
21.600	9	0.0	-2.9	29.0	9.41	10.37
24.300	10	0.0	-24.8	28.5	9.25	17.31
27.000	11	-0.0	-28.6	28.0	9.10	18.38
27.000	11	-0.0	-28.6	28.0	9.10	18.38
29.875	12	0.0	-53.9	27.5	8.94	26.43
32.750	13	0.0	-15.4	27.0	8.77	13.79
35.250	14	0.0	-11.2	26.6	8.63	12.28
35.250	14	0.0	-64.4	26.6	8.63	29.55
39.375	15	0.0	-86.1	25.8	8.39	36.34
43.500	16	0.0	-28.8	25.1	8.16	17.51
47.625	17	0.0	-13.8	24.4	7.92	12.40
51.750	18	0.0	0.0	23.7	7.68	7.68
54.250	19	0.0	-0.0	23.2	7.54	7.54
57.125	20	0.0	-30.6	22.7	7.36	17.30
60.000	21	-8.6	-0.4	22.2	10.01	7.33
60.000	21	-8.6	-0.4	22.2	10.01	7.33
62.875	22	0.0	-13.3	21.7	7.05	11.37
65.750	23	0.0	-1.3	21.2	6.88	7.30
68.250	24	0.0	-2.3	20.8	6.74	7.48
68.250	24	0.0	-42.4	20.8	6.74	20.52
72.375	25	0.0	-59.7	20.0	6.50	25.89
76.500	26	0.0	-16.4	19.3	6.27	11.58
80.625	27	0.0	-6.4	18.6	6.03	8.10
84.750	28	0.0	0.0	17.8	5.79	5.79
87.250	29	0.0	-0.0	17.4	5.65	5.65
90.125	30	0.0	-39.5	16.9	5.49	18.30
93.000	31	-4.6	-2.9	16.4	6.82	6.28
93.000	31	-4.6	-2.9	16.4	6.82	6.28
95.875	32	0.0	-26.3	15.9	5.16	13.69
98.750	33	0.0	-6.1	15.4	4.99	6.96
101.250	34	0.0	-5.4	14.9	4.85	6.61
101.250	34	0.0	-50.9	14.9	4.85	21.39
105.375	35	0.0	-68.1	14.2	4.61	26.74
109.500	36	0.0	-18.0	13.5	4.38	10.22
113.625	37	0.0	-5.0	12.8	4.14	5.76
117.750	38	0.0	0.0	12.0	3.91	3.91
120.250	39	0.0	0.0	11.6	3.76	3.76
123.125	40	0.0	-23.1	11.1	3.60	11.09
126.000	41	-5.4	-1.1	10.6	5.19	3.80
126.000	41	-5.4	-1.1	10.6	5.19	3.80
128.875	42	0.0	-22.2	10.1	3.27	10.48
131.750	43	0.0	-4.5	9.6	3.10	4.58
134.250	44	0.0	-4.6	9.1	2.96	4.47
134.250	44	0.0	-48.6	9.1	2.96	18.74
138.375	45	0.0	-68.4	8.4	2.73	24.93
142.500	46	0.0	-16.9	7.7	2.49	7.99
146.625	47	0.0	-5.6	6.9	2.25	4.07
150.750	48	0.0	0.0	6.2	2.02	2.02
153.250	49	0.0	0.0	5.8	1.87	1.87
156.125	50	0.0	-28.8	5.3	1.71	11.07
159.000	51	-0.2	-5.1	4.8	1.63	3.21
159.000	51	-0.2	-5.1	4.8	1.63	3.21
163.125	52	0.0	-8.3	4.0	1.31	4.00
167.250	53	0.0	-33.3	3.3	1.07	11.90
167.250	53	0.0	-86.4	3.3	1.07	29.12
169.594	54	0.0	-84.5	2.9	0.94	28.38
171.938	55	0.0	-44.1	2.5	0.80	15.12
174.282	56	0.0	-1.3	2.1	0.67	1.09
176.626	57	0.0	0.0	1.7	0.54	0.54
178.970	58	0.0	0.0	1.2	0.40	0.40
181.314	59	0.0	0.0	0.8	0.27	0.27
183.658	60	0.0	0.0	0.4	0.13	0.13
186.000	61	0.0	0.0	0.0	0.00	0.00

L.A.V ZARAGOZA - LLEIDA. SUBTRAMO 1. E-5

TESADOS AL 80%

TOTAL FRENADO: 777 Al: 9 t. fr.= 23.7
TOTAL RETRACCION: 228 Ar: 9.25
L. TOTAL: 186 canto: 2.45

X	NUDO	M+ FINAL Pret*1.1 SIN TEMPERATURA		M+ FINAL Pret*1.1 CON TEMPERATURA		M- FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 SIN TEMPERATURA		M+ FREQ. FINAL Pret*1.1 CON TEMPERATURA		M- FREQ. FINAL Pret*1.1 SIN TEMPERATURA	
		F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	27	83	27.0	83.0	27	83	27	83	27.0	83.0	27	83
2.700	2	31	74	31.9	72.6	16	98	24	86	24.9	84.6	18	96
5.400	3	36	67	37.6	64.1	9	109	23	87	24.8	84.1	12	104
8.100	4	40	59	42.7	54.7	4	115	23	85	25.7	80.7	9	108
10.800	5	44	51	47.7	45.3	3	117	26	81	29.7	75.3	9	107
13.500	6	49	43	53.6	35.8	4	112	30	72	34.6	64.8	12	100
16.200	7	53	34	58.5	25.4	9	102	36	60	41.5	51.4	19	88
18.900	8	58	25	64.4	14.9	17	88	44	45	50.4	34.9	28	71
21.600	9	62	16	69.3	4.5	26	69	54	28	61.3	16.5	41	50
24.300	10	71	0	79.2	-12.9	40	49	67	6	75.2	-6.9	55	26
27.000	11	76	-1	85.1	-15.4	28	74	72	5	81.1	-9.4	53	35
27.000	11	76	-1	85.1	-15.4	28	74	72	5	81.1	-9.4	53	35
29.875	12	80	-7	88.9	-21.1	53	36	78	-3	86.9	-17.1	67	14
32.750	13	77	10	85.7	-3.7	53	48	71	19	79.7	5.3	61	34
35.250	14	76	20	84.5	6.5	45	69	65	38	73.5	24.5	53	57
35.250	14	71	3	79.5	-10.5	39	52	60	20	68.5	6.5	47	40
39.375	15	69	7	77.3	-6.0	27	73	51	36	59.3	23.0	34	62
43.500	16	59	27	67.0	14.4	13	100	39	59	47.0	46.4	20	89
47.625	17	59	29	66.7	16.9	14	100	40	59	47.7	46.9	22	87
51.750	18	59	30	66.4	18.4	21	91	47	50	54.4	38.4	31	75
54.250	19	62	20	69.2	8.8	30	69	55	31	62.2	19.6	42	50
57.125	20	73	-4	80.0	-15.1	41	47	69	2	76.0	-9.1	56	22
60.000	21	69	9	75.8	-1.8	17	91	65	15	71.8	4.3	44	48
60.000	21	69	9	75.8	-1.8	17	91	65	15	71.8	4.3	44	48
62.875	22	75	2	81.9	-8.9	43	51	72	8	78.9	-4.9	60	26
65.750	23	73	16	80.0	5.0	44	62	67	26	74.0	15.0	55	44
68.250	24	74	24	81.0	13.0	37	82	61	43	68.0	32.0	47	66
68.250	24	68	7	75.0	-4.1	31	65	56	26	63.0	15.0	41	49
72.375	25	66	11	73.1	-0.2	21	83	48	41	55.1	29.8	30	69
76.500	26	57	30	64.2	18.7	9	106	36	63	43.2	51.7	17	93
80.625	27	58	31	65.3	19.5	12	104	39	61	46.3	49.5	20	90
84.750	28	59	31	66.4	19.3	21	91	46	51	53.4	39.3	31	75
87.250	29	62	19	69.5	7.3	31	68	55	30	62.5	18.3	42	50
90.125	30	74	-5	81.5	-16.9	41	47	70	1	77.5	-10.9	57	21
93.000	31	71	7	78.6	-5.0	19	88	67	13	74.6	1.0	46	45
93.000	31	71	7	78.6	-5.0	19	88	67	13	74.6	1.0	46	45
95.875	32	78	-3	85.5	-14.9	45	49	74	3	81.5	-8.9	61	23
98.750	33	75	13	82.5	1.3	44	61	68	23	75.5	11.3	56	43
101.250	34	76	21	83.4	9.4	37	81	63	41	70.4	29.4	48	65
101.250	34	70	4	77.4	-7.7	32	64	57	24	64.4	12.4	42	48
105.375	35	68	9	75.3	-2.5	22	81	49	39	56.3	27.5	31	68
109.500	36	56	29	65.2	17.7	9	105	37	62	44.2	50.7	18	92
113.625	37	57	32	64.1	20.6	12	103	39	61	46.1	49.8	21	89
117.750	38	58	32	65.0	21.0	21	90	46	51	53.0	40.0	31	74
120.250	39	61	21	68.0	10.0	31	67	54	31	61.0	20.0	43	49
123.125	40	72	-2	78.9	-12.9	41	47	70	2	76.9	-8.9	57	22
126.000	41	70	7	76.8	-3.8	18	89	66	13	72.8	2.3	46	46
126.000	41	70	7	76.8	-3.8	18	89	66	13	72.8	2.3	46	46
128.875	42	77	-2	84.0	-13.1	45	49	74	3	81.0	-8.1	61	24
131.750	43	75	13	82.2	1.6	44	62	68	24	75.2	12.6	55	43
134.250	44	75	21	82.4	9.3	37	82	63	41	70.4	29.3	47	65
134.250	44	70	4	77.4	-7.7	32	65	57	24	64.4	12.3	42	48
138.375	45	67	10	74.7	-2.1	22	80	49	39	56.7	26.9	31	67
142.500	46	57	30	65.0	17.4	11	103	37	62	45.0	49.4	18	91
146.625	47	57	33	65.3	20.0	15	99	39	61	47.3	48.0	22	88
150.750	48	56	35	64.5	21.5	25	84	45	52	53.5	38.5	33	72
153.250	49	60	23	68.7	9.3	36	61	54	32	62.7	18.3	44	47
156.125	50	72	-2	80.9	-16.1	45	41	69	2	77.9	-12.1	59	19
159.000	51	71	6	80.1	-8.4	23	81	67	13	76.1	-1.4	48	43
159.000	51	71	6	80.1	-8.4	23	81	67	13	76.1	-1.4	48	43
163.125	52	73	5	80.7	-7.2	44	51	69	12	76.7	-0.2	57	30
167.250	53	74	8	80.3	-2.0	34	72	61	29	67.3	19.0	44	55
167.250	53	68	-6	74.3	-16.0	27	58	54	16	60.3	6.0	38	41
169.594	54	65	-1	70.5	-9.7	21	66	48	26	53.5	17.3	31	53
171.938	55	57	13	61.8	5.5	12	83	38	42	42.8	34.5	21	70
174.282	56	47	32	51.0	25.8	4	99	28	61	32.0	54.8	11	88
176.626	57	43	41	46.2	36.0	4	102	25	69	28.2	64.0	9	93
178.970	58	39	48	41.4	44.3	6	99	23	72	25.4	68.3	10	93
181.314	59	35	55	36.6	52.5	11	93	23	74	24.6	71.5	13	89
183.658	60	30	63	30.8	61.6	17	84	23	74	23.8	72.8	18	82
186.000	61	24	73	24.0	73.0	24	73	24	73	24.0	73.0	24	73

L.A.V ZARAGOZA - LLEIDA. SUBTRAMO 1. E-5

CABLES TESADOS AL 80%

X	NUDO	M+ FINAL Pret*0.9 SIN TEMPERATURA		M+ FINAL Pret*0.9 CON TEMPERATURA		M- FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 SIN TEMPERATURA		M+ FREQ. FINAL Pret*0.9 CON TEMPERATURA		M- FREQ. FINAL Pret*0.9 SIN TEMPERATURA	
		F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.	F. Sup.	F. Inf.
0.000	1	22	68	22.0	68.0	22	68	22	68	22.0	68.0	22	68
2.700	2	30	54	30.9	52.6	15	78	23	66	23.9	64.6	17	75
5.400	3	37	43	38.8	40.1	10	86	24	64	25.8	61.1	13	81
8.100	4	42	34	44.7	29.7	6	90	25	60	27.7	55.7	11	83
10.800	5	46	26	49.7	20.3	5	92	27	56	30.7	50.3	11	82
13.500	6	49	20	53.6	12.8	5	90	31	49	35.6	41.8	13	77
16.200	7	51	15	56.5	6.4	8	84	34	42	39.5	33.4	17	69
18.900	8	52	12	58.4	1.9	12	75	39	33	45.4	22.9	23	58
21.600	9	52	12	59.3	0.5	18	64	44	24	51.3	12.5	31	45
24.300	10	55	5	63.2	-7.9	24	54	52	11	60.2	-1.9	39	30
27.000	11	56	9	65.1	-5.4	8	84	52	15	61.1	0.6	33	45
27.000	11	56	9	65.1	-5.4	8	84	52	15	61.1	0.6	33	45
29.875	12	62	0	70.9	-14.1	35	42	60	3	68.9	-11.1	49	21
32.750	13	63	7	71.7	-6.7	39	45	58	16	66.7	2.3	48	31
35.250	14	67	9	75.5	-4.5	35	59	56	27	64.5	13.5	43	47
35.250	14	62	-5	70.5	-18.5	31	45	51	13	59.5	-0.5	39	33
39.375	15	65	-7	73.3	-20.0	23	58	47	21	55.3	8.0	30	47
43.500	16	58	6	66.0	-6.6	12	79	38	39	46.0	26.4	19	68
47.625	17	57	10	64.7	-2.1	12	81	38	40	45.7	27.9	20	68
51.750	18	53	17	60.4	5.4	15	78	41	37	48.4	25.4	25	61
54.250	19	52	14	59.2	2.6	20	64	45	25	52.2	13.6	32	45
57.125	20	57	1	64.0	-10.1	25	52	53	7	60.0	-4.1	40	27
60.000	21	50	17	56.8	6.3	-2	99	46	23	52.8	12.3	26	56
60.000	21	50	17	56.8	6.3	-2	99	46	23	52.8	12.3	26	56
62.875	22	58	6	64.9	-4.9	27	56	56	10	62.9	-0.9	43	30
65.750	23	61	12	68.0	1.0	31	58	54	22	61.0	11.0	43	40
68.250	24	65	12	72.0	0.9	28	70	53	31	60.0	20.0	38	55
68.250	24	60	-2	67.0	-13.1	24	58	48	17	55.0	6.0	34	41
72.375	25	63	-4	70.1	-15.2	18	67	44	25	51.1	13.8	26	53
76.500	26	57	9	64.2	-2.4	9	85	36	42	43.2	30.7	17	72
80.625	27	56	12	63.3	0.5	10	84	37	41	44.3	29.5	19	70
84.750	28	53	18	60.4	6.3	15	78	40	38	47.4	28.3	25	62
87.250	29	52	14	59.5	2.3	21	63	45	25	52.5	13.3	32	44
90.125	30	58	0	65.5	-11.9	25	52	54	6	61.5	-5.9	41	27
93.000	31	52	15	59.6	3.0	0	97	48	21	55.6	9.0	27	54
93.000	31	52	15	59.6	3.0	0	97	48	21	55.6	9.0	27	54
95.875	32	61	2	68.5	-9.9	26	54	57	6	64.5	-3.9	44	28
98.750	33	63	9	70.5	-2.6	32	57	56	19	63.5	7.3	43	39
101.250	34	67	10	74.4	-1.7	29	70	54	29	61.4	17.4	39	53
101.250	34	62	-5	69.4	-16.7	24	55	50	15	57.4	3.4	34	39
105.375	35	64	-6	71.3	-17.5	18	66	45	23	52.3	11.5	27	52
109.500	36	57	8	64.2	-3.4	9	84	37	41	44.2	29.7	17	71
113.625	37	56	12	63.1	0.8	10	84	37	41	44.1	29.8	19	70
117.750	38	52	19	59.0	8.0	15	77	40	38	47.0	27.0	25	61
120.250	39	51	16	58.0	5.0	21	62	44	26	51.0	15.0	33	44
123.125	40	56	3	62.9	-7.9	25	52	53	7	59.9	-3.9	41	27
126.000	41	51	15	57.8	4.3	-1	98	47	22	53.8	11.3	27	55
126.000	41	51	15	57.8	4.3	-1	98	47	22	53.8	11.3	27	55
128.875	42	61	2	68.0	-9.1	28	53	57	8	64.0	-3.1	44	29
131.750	43	62	9	69.2	-2.4	31	58	56	20	63.2	8.6	43	39
134.250	44	67	10	74.4	-1.7	28	70	54	30	61.4	18.3	38	54
134.250	44	62	-4	69.4	-15.7	24	56	49	16	56.4	4.3	34	40
138.375	45	64	-6	71.7	-18.1	19	65	45	23	52.7	10.9	27	52
142.500	46	57	9	65.0	-3.6	11	81	36	41	44.0	28.4	18	70
146.625	47	55	14	63.3	1.0	13	79	37	42	45.3	29.0	20	68
150.750	48	51	22	59.5	8.5	19	71	39	39	47.5	25.5	27	59
153.250	49	50	17	58.7	3.3	26	55	44	26	52.7	12.3	34	41
156.125	50	56	3	64.9	-11.1	29	46	53	7	61.9	-7.1	43	24
159.000	51	52	15	61.1	0.6	4	90	48	21	57.1	6.6	29	51
159.000	51	52	15	61.1	0.6	4	90	48	21	57.1	6.6	29	51
163.125	52	59	6	66.7	-6.2	30	52	54	13	61.7	0.8	43	31
167.250	53	66	-2	72.3	-12.0	26	62	53	20	59.3	10.0	36	45
167.250	53	61	-13	67.3	-23.0	20	51	47	8	53.3	-2.0	31	34
169.594	54	61	-13	66.5	-21.7	17	56	44	13	49.5	4.3	27	41
171.938	55	56	-4	60.8	-11.5	11	66	37	25	41.8	17.5	20	53
174.282	56	45	10	52.0	3.8	6	78	29	40	33.0	33.8	12	67
176.626	57	45	18	48.2	13.0	6	79	27	46	30.2	41.0	11	71
178.970	58	40	25	42.4	21.3	8	77	25	50	27.4	46.3	12	70
181.314	59	35	35	36.6	32.5	11	73	23	53	24.6	50.5	14	68
183.658	60	28	46	28.8	44.8	15	67	22	56	22.8	54.8	16	65
186.000	61	19	60	19.0	60.0	19	60	19	60	19.0	60.0	19	60

L.A.V ZARAGOZA-LLEIDA. SUBTRAMO 1. E-5. CABLES TESADOS AL 80 %

		FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*1.1 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M FINAL Pret*1.1 SIN TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M+ FINAL Pret*0.9 CON TEMPERATURA				FUERZAS LONGITUDINALES REOLOGICAS M FINAL Pret*0.9 SIN TEMPERATURA			
X	NUDO	F. Sup.	F. Inf.	Vt sup	Vt inf	F. Sup.	F. Inf.	Vt sup.	Vt inf	F. Sup.	F. Inf.	Vt sup.	Vt inf	F. Sup.	F. Inf.	Vt sup.	Vt inf
0.000	1	24.5	80.5	0.0	0.0	24.5	80.5	0.0	0.0	19.5	65.5	0.0	0.0	19.5	65.5	0.0	0.0
2.700	2	29.4	70.1	0.0	0.0	13.5	95.5	0.0	0.0	29.4	50.1	0.0	0.0	12.5	75.5	0.0	0.0
5.400	3	33.4	61.7	0.0	0.0	6.5	106.5	0.0	0.0	36.4	37.7	0.0	0.0	7.5	83.5	0.0	0.0
8.100	4	40.3	32.3	0.0	0.0	1.6	112.6	0.0	0.0	42.3	27.3	0.0	0.0	3.6	87.6	0.0	0.0
10.800	5	45.3	42.9	0.0	0.0	0.6	114.6	0.0	0.0	47.3	17.9	0.0	0.0	2.6	89.6	0.0	0.0
13.500	6	51.2	33.5	0.0	0.0	1.7	109.7	0.0	0.0	51.2	10.5	0.0	0.0	2.7	87.7	0.0	0.0
16.200	7	56.2	23.1	0.0	0.0	6.7	99.7	0.0	0.0	54.2	4.1	0.0	0.0	3.7	81.7	0.0	0.0
18.900	8	62.1	12.7	0.0	0.0	14.7	85.7	0.0	0.0	56.1	-0.3	0.0	-0.0	9.7	72.7	0.0	0.0
21.600	9	67.1	2.3	0.0	0.0	23.6	66.8	0.0	0.0	57.1	-1.7	0.0	-0.6	15.8	61.8	0.0	0.0
24.300	10	77.0	15.1	0.0	30.4	37.6	46.8	0.0	0.0	61.0	-10.1	0.0	-17.7	21.8	51.8	0.0	0.0
27.000	11	82.9	17.5	0.0	37.4	25.6	71.8	0.0	0.0	62.9	-7.5	0.0	-9.6	5.8	81.8	0.0	0.0
27.000	11	82.9	17.3	0.0	-37.4	25.6	71.8	0.0	0.0	62.9	-7.5	0.0	-9.6	5.8	81.8	0.0	0.0
29.875	12	86.6	-23.2	0.0	-59.8	30.9	33.8	0.0	0.0	68.6	-16.2	0.0	-37.7	32.9	39.8	0.0	0.0
32.750	13	83.6	5.8	0.0	-4.6	30.9	45.9	0.0	0.0	69.6	-6.8	0.0	-12.1	36.9	42.9	0.0	0.0
35.250	14	82.5	4.5	0.0	0.0	42.9	66.9	0.0	0.0	73.5	-6.5	0.0	-6.5	32.8	56.8	0.0	0.0
35.250	14	77.5	-12.5	0.0	21.3	36.9	49.9	0.0	0.0	68.5	-20.5	0.0	-57.9	28.9	42.8	0.0	0.0
39.375	15	75.3	6.0	0.0	-9.4	25.0	71.0	0.0	0.0	71.3	-22.0	0.0	-63.6	21.0	56.0	0.0	0.0
43.500	16	65.0	12.5	0.0	0.0	11.1	98.1	0.0	0.0	64.0	-8.5	0.0	-12.2	10.1	77.1	0.0	0.0
47.625	17	64.8	15.0	0.0	0.0	12.1	96.1	0.0	0.0	62.8	-4.0	0.0	-2.9	10.1	79.1	0.0	0.0
51.750	18	64.6	16.5	0.0	0.0	19.2	89.2	0.0	0.0	58.6	3.5	0.0	0.0	13.2	76.2	0.0	0.0
54.250	19	67.4	6.8	0.0	0.0	28.2	67.2	0.0	0.0	57.4	0.8	0.0	0.0	18.2	62.2	0.0	0.0
57.125	20	78.3	-16.8	0.0	36.5	38.2	45.2	0.0	0.0	62.3	-11.8	0.0	-23.1	23.2	50.2	0.0	0.0
60.000	21	74.1	3.5	0.0	-1.9	15.3	89.3	0.0	0.0	55.1	4.5	0.0	0.0	3.7	97.3	-1.7	0.0
60.000	21	74.1	3.5	0.0	-1.9	15.3	89.3	0.0	0.0	55.1	4.5	0.0	0.0	3.7	97.3	-1.7	0.0
62.875	22	80.2	-10.5	0.0	-15.0	41.3	68.3	0.0	0.0	63.2	-6.5	0.0	-7.5	23.3	54.3	0.0	0.0
65.750	23	78.3	3.4	0.0	0.0	42.4	80.4	0.0	0.0	66.3	-0.6	0.0	-0.1	29.4	56.4	0.0	0.0
68.250	24	79.4	11.3	0.0	0.0	35.4	80.4	0.0	0.0	70.4	-0.7	0.0	-0.1	26.4	68.4	0.0	0.0
68.250	24	73.4	-5.7	0.0	-3.0	29.4	63.4	0.0	0.0	65.4	-14.7	0.0	-32.9	22.4	54.4	0.0	0.0
72.375	25	71.6	-1.7	0.0	-0.3	19.5	81.5	0.0	0.0	68.6	-16.7	0.0	-40.3	16.5	65.5	0.0	0.0
76.500	26	62.7	17.2	0.0	0.0	7.5	104.5	0.0	0.0	62.7	-3.8	0.0	-2.7	7.5	93.5	0.0	0.0
80.625	27	63.9	18.1	0.0	0.0	10.6	102.6	0.0	0.0	61.9	-0.9	0.0	-0.2	8.6	92.6	0.0	0.0
84.750	28	63.0	18.0	0.0	0.0	19.6	88.6	0.0	0.0	58.0	3.0	0.0	0.0	13.6	78.6	0.0	0.0
87.250	29	68.1	5.9	0.0	0.0	29.7	66.7	0.0	0.0	58.1	0.9	0.0	0.0	19.7	61.7	0.0	0.0
90.125	30	80.2	-16.2	0.0	-41.0	39.7	43.7	0.0	0.0	64.2	-13.2	0.0	-27.4	23.7	50.7	0.0	0.0
93.000	31	77.3	-6.2	0.0	-5.7	17.7	86.7	0.0	0.0	58.3	1.8	0.0	0.0	-1.3	85.7	-0.2	0.0
93.000	31	77.3	-6.2	0.0	-5.7	17.7	86.7	0.0	0.0	58.3	1.8	0.0	0.0	-1.3	85.7	-0.2	0.0
95.875	32	84.3	-16.1	0.0	-31.5	43.8	47.8	0.0	0.0	67.3	-11.1	0.0	-19.2	26.8	52.8	0.0	0.0
98.750	33	81.3	0.1	0.0	0.0	42.8	38.8	0.0	0.0	69.3	-3.9	0.0	-2.6	30.8	36.8	0.0	0.0
101.250	34	82.2	8.2	0.0	0.0	35.8	79.8	0.0	0.0	73.2	-2.8	0.0	-1.3	27.8	68.8	0.0	0.0
101.250	34	76.2	-8.8	0.0	-11.2	30.8	62.8	0.0	0.0	68.2	-17.8	0.0	-45.1	22.8	53.8	0.0	0.0
105.375	35	74.2	-3.6	0.0	-2.0	20.9	78.9	0.0	0.0	70.2	-16.6	0.0	-47.7	16.9	64.9	0.0	0.0
109.500	36	64.2	16.6	0.0	0.0	8.0	104.0	0.0	0.0	63.2	-4.4	0.0	-3.5	8.0	93.0	0.0	0.0
113.625	37	63.1	19.8	0.0	0.0	11.0	102.0	0.0	0.0	62.1	-0.2	0.0	-0.0	9.0	93.0	0.0	0.0
117.750	38	64.1	20.0	0.0	0.0	20.1	88.1	0.0	0.0	58.1	7.0	0.0	0.0	14.1	78.1	0.0	0.0
120.250	39	67.1	9.1	0.0	0.0	30.1	66.1	0.0	0.0	57.1	4.1	0.0	0.0	20.1	61.1	0.0	0.0
123.125	40	78.0	-13.7	0.0	-25.1	40.1	46.1	0.0	0.0	62.0	-8.7	0.0	-13.1	24.1	31.1	0.0	0.0
126.000	41	76.0	-4.6	0.0	-3.2	17.2	88.2	0.0	0.0	57.0	3.4	0.0	0.0	-1.8	97.2	-0.4	0.0
126.000	41	76.0	-4.6	0.0	-3.2	17.2	88.2	0.0	0.0	57.0	3.4	0.0	0.0	-1.8	97.2	-0.4	0.0
128.875	42	83.2	-13.8	0.0	-24.2	44.2	48.2	0.0	0.0	67.2	-9.8	0.0	-15.4	27.2	52.2	0.0	0.0
131.750	43	81.3	0.9	0.0	0.0	43.3	61.3	0.0	0.0	68.3	-3.1	0.0	-1.7	30.3	57.3	0.0	0.0
134.250	44	81.7	6.6	0.0	0.0	36.3	61.3	0.0	0.0	73.7	-2.4	0.0	-0.9	27.3	69.3	0.0	0.0
134.250	44	76.7	-8.4	0.0	-10.1	31.3	64.3	0.0	0.0	68.7	-16.4	0.0	-38.6	23.3	55.3	0.0	0.0
138.375	45	74.0	-2.8	0.0	1.2	21.4	79.4	0.0	0.0	71.0	-18.8	0.0	-48.0	18.4	64.4	0.0	0.0
142.500	46	64.4	16.8	0.0	0.0	10.4	102.4	0.0	0.0	64.4	-4.2	0.0	-3.1	10.4	80.4	0.0	0.0
146.625	47	64.7	19.5	0.0	0.0	14.5	98.5	0.0	0.0	62.7	0.5	0.0	0.0	12.5	78.5	0.0	0.0
150.750	48	64.1	21.0	0.0	0.0	24.5	83.5	0.0	0.0	58.1	8.0	0.0	0.0	18.5	70.5	0.0	0.0
153.250	49	68.3	8.8	0.0	0.0	35.6	60.6	0.0	0.0	58.3	2.8	0.0	0.0	25.6	54.6	0.0	0.0
156.125	50	80.5	-16.5	0.0	-34.3	44.6	40.6	0.0	0.0	64.5	-11.5	0.0	-21.2	28.6	43.6	0.0	0.0
159.000	51	79.8	-8.7	0.0	-10.6	22.6	80.6	0.0	0.0	60.8	0.3	0.0	0.0	3.6	89.6	0.0	0.0
159.000	51	79.8	-8.7	0.0	-10.6	22.6	80.6	0.0	0.0	60.8	0.3	0.0	0.0	3.6	89.6	0.0	0.0
163.125	52	80.4	-7.5	0.0	-7.8	43.7	50.7	0.0	0.0	66.4	-6.5	0.0	-7.1	29.7	31.7	0.0	0.0
167.250	53	80.1	2.2	0.0	-0.7	33.7	71.7	0.0	0.0	72.1	-12.2	0.0	-21.8	25.7	61.7	0.0	0.0
167.250	53	74.1	-16.2	0.0	-35.8	24.7	57.7	0.0	0.0	67.1	-23.2	0.0	-73.2	19.7	30.7	0.0	0.0
169.594	54	70.3	-10.0	0.0	-15.1	20.8	67.8	0.0	0.0	66.3	-22.0	0.0	-66.9	16.8	55.8	0.0	0.0
171.938	55	61.6	5.3	0.0	0.0	11.8	82.8	0.0	0.0	60.6	-11.7	0.0	-23.1	10.8	65.8	0.0	0.0
174.282	56	50.8	25.6	0.0	0.0	3.8	96.8	0.0	0.0	51.8	3.6	0.0	0.0	5.8	77.8	0.0	0.0
176.626	57	46.0	35.9	0.0	0.0	3.9	101.9	0.0	0.0	46.0	12.9	0.0	0.0	5.9	78.9	0.0	0.0
178.970	58	41.3	44.2	0.0	0.0	5.9	98.9	0.0	0.0	42.3	21.2	0.0	0.0	7.9	76.9	0.0	0.0
181.314	59	36.5	52.4	0.0	0.0	10.8	92.9	0.0	0.0	36.5	32.4	0.0	0.0	10.9	72.9	0.0	0.0
183.658	60	30.8	61.7	0.0	0.0	17.0	84.0	0.0	0.0	28.8	44.7	0.0	0.0	13.0	67.0	0.0	0.0
186.000	61	24.0	73.0	0.0	0.0	24.0	73.0	0.0	0.0	19.0	60.0	0.0	0.0	19.0	60.0	0.0	0.0

L.A.V ZARAGOZA-LLEIDA SUBTRAMO 1. E-5
CABLES TESADOS AL 80 %

		VALORES MAXIMOS			ARMADURAS	
		Vt sup.	Vt inf.	frenado		
X	NUDO	max(t/m)	max(t/m)	(t/m)	As cm2	Ai cm2
0.000	1	0.0	0.0	32.8	10.65	10.65
2.700	2	0.0	0.0	32.3	10.49	10.49
5.400	3	0.0	0.0	31.8	10.34	10.34
8.100	4	0.0	0.0	31.4	10.18	10.18
10.800	5	0.0	0.0	30.9	10.03	10.03
13.500	6	0.0	0.0	30.4	9.87	9.87
16.200	7	0.0	0.0	29.9	9.72	9.72
18.900	8	0.0	-0.0	29.5	9.56	9.57
21.600	9	0.0	-0.6	29.0	9.41	9.61
24.300	10	0.0	-30.4	28.5	9.25	19.14
27.000	11	0.0	-37.4	28.0	9.10	21.26
27.000	11	0.0	-37.4	28.0	9.10	21.26
29.875	12	0.0	-59.8	27.5	8.94	28.37
32.750	13	0.0	-12.1	27.0	8.77	12.71
35.250	14	0.0	-6.5	26.6	8.63	10.74
35.250	14	0.0	-57.9	26.6	8.63	27.43
39.375	15	0.0	-63.6	25.8	8.39	29.05
43.500	16	0.0	-12.2	25.1	8.16	12.12
47.625	17	0.0	-2.9	24.4	7.92	8.87
51.750	18	0.0	0.0	23.7	7.68	7.68
54.250	19	0.0	0.0	23.2	7.54	7.54
57.125	20	0.0	-36.5	22.7	7.38	19.22
60.000	21	-1.7	-1.9	22.2	7.76	7.83
60.000	21	-1.7	-1.9	22.2	7.76	7.83
62.875	22	0.0	-15.0	21.7	7.05	11.91
65.750	23	0.0	-0.1	21.2	6.88	6.90
68.250	24	0.0	-0.1	20.8	6.74	6.76
68.250	24	0.0	-32.9	20.8	6.74	17.41
72.375	25	0.0	-40.3	20.0	6.50	19.58
76.500	26	0.0	-2.7	19.3	6.27	7.15
80.625	27	0.0	-0.2	18.6	6.03	6.09
84.750	28	0.0	0.0	17.8	5.79	5.79
87.250	29	0.0	0.0	17.4	5.65	5.65
90.125	30	0.0	-41.0	16.9	5.49	18.82
93.000	31	-0.2	-5.7	16.4	5.39	7.17
93.000	31	-0.2	-5.7	16.4	5.39	7.17
95.875	32	0.0	-31.5	15.9	5.16	15.40
98.750	33	0.0	-2.6	15.4	4.99	5.84
101.250	34	0.0	-1.3	14.9	4.85	5.26
101.250	34	0.0	-45.1	14.9	4.85	19.51
105.375	35	0.0	-47.7	14.2	4.61	20.11
109.500	36	0.0	-3.5	13.5	4.38	5.51
113.625	37	0.0	-0.0	12.8	4.14	4.14
117.750	38	0.0	0.0	12.0	3.91	3.91
120.250	39	0.0	0.0	11.6	3.76	3.76
123.125	40	0.0	-25.1	11.1	3.60	11.74
126.000	41	-0.4	-3.2	10.6	3.57	4.46
126.000	41	-0.4	-3.2	10.6	3.57	4.46
128.875	42	0.0	-24.2	10.1	3.27	11.13
131.750	43	0.0	-1.7	9.6	3.10	3.65
134.250	44	0.0	-0.9	9.1	2.96	3.25
134.250	44	0.0	-38.6	9.1	2.96	15.49
138.375	45	0.0	-48.0	8.4	2.73	18.31
142.500	46	0.0	-3.1	7.7	2.49	3.49
146.625	47	0.0	0.0	6.9	2.25	2.25
150.750	48	0.0	0.0	6.2	2.02	2.02
153.250	49	0.0	0.0	5.8	1.87	1.87
156.125	50	0.0	-34.3	5.3	1.71	12.83
159.000	51	0.0	-10.6	4.8	1.55	4.98
159.000	51	0.0	-10.6	4.8	1.55	4.98
163.125	52	0.0	-7.8	4.0	1.31	3.85
167.250	53	0.0	-21.8	3.3	1.07	8.14
167.250	53	0.0	-73.2	3.3	1.07	24.85
169.594	54	0.0	-66.9	2.9	0.94	22.66
171.938	55	0.0	-23.1	2.5	0.80	8.31
174.282	56	0.0	0.0	2.1	0.67	0.67
176.626	57	0.0	0.0	1.7	0.54	0.54
178.970	58	0.0	0.0	1.2	0.40	0.40
181.314	59	0.0	0.0	0.8	0.27	0.27
183.658	60	0.0	0.0	0.4	0.13	0.13
186.000	61	0.0	0.0	0.0	0.00	0.00

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-5
COMPROBACION A ROTURA

FECHA

HOJA N.º

COMPROBACION A ROTURA POR FLEXION

A continuación se adjuntan para cada sección los momentos mayorados producidos por las cargas exteriores, el momento hiperestático de pretensado, la suma de ambos, ponderando el pretensado por 0,9 ó 1.1 y los momentos últimos, tanto positivos como negativos

En el siguiente cuadro se resumen las secciones de centro de vano y sobre pilas.

SECCION	Md F. exteriores	Md. Exteriores + hiperestático ponderado	Mdultimo
V-1	6271	7081	9615
P-1	-9400	-7742	-9613
P-2 a P-4	-9927	-8604	-9613
V-2 a V-5	6365	8[illegible]3	11229
P-5	-9378	-7998	-9613
V-6	6269	7001	8794

El momento total es inferior al momento último en todas las secciones estudiadas => El coeficiente de seguridad a rotura es superior a 1.6.

Calculo de Comprobacion a Rotura - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
1	1	(H1)	0.00	-0.01	-0.01	5895.97	0.4	-5125.22	0.6
	1	(H2)	0.00	-0.01	-0.01	5895.97	0.4	-5125.22	0.6
	2	(H1)	2673.37	184.23	2876.03	7662.86	0.4	-3429.94	0.5
	2	(H2)	950.15	184.23	1152.81	7662.86	0.4	-3429.94	0.5
	3	(H1)	4609.60	368.47	5014.92	8903.20	0.4	-2171.42	0.4
	3	(H2)	1517.80	368.47	1923.12	8903.20	0.4	-2171.42	0.4
	4	(H1)	5808.69	552.72	6416.67	9647.56	0.4	-1521.47	0.4
	4	(H2)	1702.95	552.72	2310.93	9647.56	0.4	-1521.47	0.4
	5	(H1)	6270.63	736.96	7081.28	9895.61	0.4	-1312.62	0.4
	5	(H2)	1505.59	736.96	2316.24	9895.61	0.4	-1312.62	0.4
	6	(H1)	5995.43	921.20	7008.75	9615.20	0.4	-1519.33	0.4
	6	(H2)	925.73	921.20	1939.06	9615.20	0.4	-1519.33	0.4
	7	(H1)	4983.08	1105.45	6199.08	8773.98	0.4	-2205.57	0.4
	7	(H2)	-36.62	1105.45	958.28	8773.98	0.4	-2205.57	0.4
	8	(H1)	3233.60	1289.70	4652.27	7371.94	0.4	-3514.10	0.5
	8	(H2)	-1381.48	1289.70	-220.76	7371.94	0.4	-3514.10	0.5
	9	(H1)	746.97	1473.95	2368.31	5338.59	0.4	-5478.67	0.6
	9	(H2)	-3108.84	1473.95	-1782.29	5338.59	0.4	-5478.67	0.6
	10	(H1)	-1811.26	1658.20	-318.88	2597.49	0.3	-8133.24	0.8
	10	(H2)	-5391.51	1658.20	-3899.13	2597.49	0.3	-8133.24	0.8
	11	(H1)	-3925.02	1842.45	-2266.82	1361.86	0.3	-9612.65	0.8
	11	(H2)	-9400.39	1842.45	-7742.18	1361.86	0.3	-9612.65	0.8
2	1	(H1)	-3925.02	1842.45	-2266.82	1361.86	0.3	-9612.65	0.8
	1	(H2)	-9400.39	1842.45	-7742.18	1361.86	0.3	-9612.65	0.8
	2	(H1)	-1973.97	1810.06	-344.92	2462.30	0.3	-8422.91	0.7
	2	(H2)	-5072.29	1810.06	-3443.24	2462.30	0.3	-8422.91	0.7
	3	(H1)	470.95	1805.85	2457.38	5759.51	0.4	-6397.21	0.7
	3	(H2)	-2287.70	1805.85	-662.43	5759.51	0.4	-6397.21	0.7
	4AI	(H1)	2768.15	1805.69	4754.41	5865.81	0.4	-5165.41	0.5
	4AI	(H2)	-833.63	1805.69	791.49	5865.81	0.4	-5165.41	0.5
	4AD	(H1)	2768.15	1805.69	4754.41	7099.78	0.4	-5042.41	0.6

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	4AD	(H2)	-833.63	1805.69	791.49	7099.78	0.4	-5042.41	0.6
	5	(H1)	5426.90	1758.93	7361.72	9610.23	0.4	-2713.00	0.5
	5	(H2)	625.76	1758.93	2560.58	9610.23	0.4	-2713.00	0.5
	6	(H1)	6365.07	1712.17	8248.45	11229.09	0.4	-1264.08	0.4
	6	(H2)	1059.60	1712.17	2942.99	11229.09	0.4	-1264.08	0.4
	7	(H1)	5586.25	1665.99	7418.84	10523.40	0.4	-1774.11	0.4
	7	(H2)	429.26	1665.99	2261.85	10523.40	0.4	-1774.11	0.4
	8	(H1)	3092.14	1619.82	4873.94	8445.12	0.4	-3614.68	0.6
	8	(H2)	-1332.68	1619.82	125.16	8445.12	0.4	-3614.68	0.6
	9	(H1)	743.18	1563.66	2463.20	6425.76	0.4	-5431.59	0.7
	9	(H2)	-2858.06	1563.66	-1450.77	6425.76	0.4	-5431.59	0.7
	10	(H1)	-1755.37	1503.09	-402.58	2212.46	0.3	-8541.63	0.8
	10	(H2)	-5471.29	1503.09	-4118.51	2212.46	0.3	-8541.63	0.8
	11	(H1)	-3941.01	1470.71	-2617.37	1361.86	0.3	-9612.65	0.8
	11	(H2)	-9927.14	1470.71	-8603.50	1361.86	0.3	-9612.65	0.8
3	1	(H1)	-3941.01	1470.71	-2617.37	1361.86	0.3	-9612.65	0.8
	1	(H2)	-9927.14	1470.71	-8603.50	1361.86	0.3	-9612.65	0.8
	2	(H1)	-1923.82	1479.20	-592.54	2462.30	0.3	-8422.91	0.7
	2	(H2)	-5543.57	1479.20	-4212.29	2462.30	0.3	-8422.91	0.7
	3	(H1)	601.33	1515.88	2268.80	5759.51	0.4	-6397.21	0.7
	3	(H2)	-2758.68	1515.88	-1394.38	5759.51	0.4	-6397.21	0.7
	4AI	(H1)	2976.29	1551.28	4682.69	5865.81	0.4	-5165.41	0.5
	4AI	(H2)	-1246.35	1551.28	149.80	5865.81	0.4	-5165.41	0.5
	4AD	(H1)	2976.29	1551.28	4682.70	7099.78	0.4	-5042.41	0.6
	4AD	(H2)	-1246.35	1551.28	149.80	7099.78	0.4	-5042.41	0.6
	5	(H1)	5516.55	1563.18	7236.04	9610.23	0.4	-2713.00	0.5
	5	(H2)	312.55	1563.18	2032.04	9610.23	0.4	-2713.00	0.5
	6	(H1)	6386.06	1575.08	8118.65	11229.09	0.4	-1264.08	0.4
	6	(H2)	849.22	1575.08	2581.80	11229.09	0.4	-1264.08	0.4
	7	(H1)	5587.33	1587.56	7333.64	10523.40	0.4	-1774.11	0.4
	7	(H2)	332.64	1587.56	2078.96	10523.40	0.4	-1774.11	0.4

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
	8	(H1)	3073.55	1600.05	4833.60	8445.12	0.4	-3614.68	0.6
	8	(H2)	-1307.63	1600.05	132.42	8445.12	0.4	-3614.68	0.6
	9	(H1)	712.67	1579.44	2450.05	6425.76	0.4	-5431.59	0.7
	9	(H2)	-2828.87	1579.44	-1407.38	6425.76	0.4	-5431.59	0.7
	10	(H1)	-1777.76	1559.76	-373.98	2212.46	0.3	-8541.63	0.8
	10	(H2)	-5532.05	1559.76	-4128.27	2212.46	0.3	-8541.63	0.8
	11	(H1)	-3968.00	1568.26	-2556.56	1361.86	0.3	-9612.65	0.8
	11	(H2)	-9909.43	1568.26	-8498.00	1361.86	0.3	-9612.65	0.8
4	1	(H1)	-3968.00	1568.26	-2556.56	1361.86	0.3	-9612.65	0.8
	1	(H2)	-9909.43	1568.26	-8498.00	1361.86	0.3	-9612.65	0.8
	2	(H1)	-1778.21	1566.47	-368.39	2462.30	0.3	-8422.91	0.7
	2	(H2)	-5538.52	1566.47	-4128.70	2462.30	0.3	-8422.91	0.7
	3	(H1)	701.57	1592.85	2453.71	5759.51	0.4	-6397.21	0.7
	3	(H2)	-2829.62	1592.85	-1396.05	5759.51	0.4	-6397.21	0.7
	4AI	(H1)	3063.35	1619.30	4844.57	5865.81	0.4	-5165.41	0.5
	4AI	(H2)	-1308.75	1619.30	148.62	5865.81	0.4	-5165.41	0.5
	4AD	(H1)	3063.35	1619.30	4844.58	7099.78	0.4	-5042.41	0.6
	4AD	(H2)	-1308.75	1619.30	148.62	7099.78	0.4	-5042.41	0.6
	5	(H1)	5581.85	1616.42	7359.92	9610.23	0.4	-2713.00	0.5
	5	(H2)	327.28	1616.42	2105.35	9610.23	0.4	-2713.00	0.5
	6	(H1)	6383.50	1613.55	8158.41	11229.09	0.4	-1264.08	0.4
	6	(H2)	849.38	1613.55	2624.29	11229.09	0.4	-1264.08	0.4
	7	(H1)	5517.22	1611.27	7289.62	10523.40	0.4	-1774.11	0.4
	7	(H2)	313.22	1611.27	2085.62	10523.40	0.4	-1774.11	0.4
	8	(H1)	2981.69	1608.99	4751.58	8445.12	0.4	-3614.68	0.6
	8	(H2)	-1250.02	1608.99	198.07	8445.12	0.4	-3614.68	0.6
	9	(H1)	607.62	1579.43	2345.00	6425.76	0.4	-5431.59	0.7
	9	(H2)	-2762.72	1579.43	-1341.23	6425.76	0.4	-5431.59	0.7
	10	(H1)	-1928.19	1549.46	-533.68	2212.46	0.3	-8541.63	0.8
	10	(H2)	-5541.73	1549.46	-4147.22	2212.46	0.3	-8541.63	0.8
	11	(H1)	-3945.83	1547.67	-2552.93	1361.86	0.3	-9612.65	0.8
	11	(H2)	-9924.95	1547.67	-8532.05	1361.86	0.3	-9612.65	0.8

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V.	Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
5	1	(H1)	-3945.83	1547.67	-2552.93	1361.86	0.3	-9612.65	0.8
	1	(H2)	-9924.95	1547.67	-8532.05	1361.86	0.3	-9612.65	0.8
	2	(H1)	-1757.77	1546.32	-366.08	2462.30	0.3	-8422.91	0.7
	2	(H2)	-5473.66	1546.32	-4081.97	2462.30	0.3	-8422.91	0.7
	3	(H1)	732.95	1573.16	2463.43	5759.51	0.4	-6397.21	0.7
	3	(H2)	-2857.93	1573.16	-1442.09	5759.51	0.4	-6397.21	0.7
	4AI	(H1)	3085.28	1600.00	4845.29	5865.81	0.4	-5165.41	0.5
	4AI	(H2)	-1330.45	1600.00	109.55	5865.81	0.4	-5165.41	0.5
	4AD	(H1)	3085.28	1600.01	4845.29	7099.78	0.4	-5042.41	0.6
	4AD	(H2)	-1330.45	1600.01	109.55	7099.78	0.4	-5042.41	0.6
	5	(H1)	5588.04	1597.78	7345.60	9610.23	0.4	-2713.00	0.5
	5	(H2)	431.32	1597.78	2188.88	9610.23	0.4	-2713.00	0.5
	6	(H1)	6373.97	1595.57	8129.10	11229.09	0.4	-1264.08	0.4
	6	(H2)	1068.68	1595.57	2823.81	11229.09	0.4	-1264.08	0.4
	7	(H1)	5439.34	1593.94	7192.67	10523.40	0.4	-1774.11	0.4
	7	(H2)	638.29	1593.94	2391.63	10523.40	0.4	-1774.11	0.4
	8	(H1)	2784.13	1592.31	4535.68	8445.12	0.4	-3614.68	0.6
	8	(H2)	-817.63	1592.31	615.46	8445.12	0.4	-3614.68	0.6
	9	(H1)	489.07	1563.15	2208.53	6425.76	0.4	-5431.59	0.7
	9	(H2)	-2269.59	1563.15	-862.76	6425.76	0.4	-5431.59	0.7
	10	(H1)	-1953.46	1533.63	-573.20	2212.46	0.3	-8541.63	0.8
	10	(H2)	-5051.77	1533.63	-3671.50	2212.46	0.3	-8541.63	0.8
	11	(H1)	-3902.11	1532.29	-2523.05	1361.86	0.3	-9612.65	0.8
	11	(H2)	-9377.45	1532.29	-7998.38	1361.86	0.3	-9612.65	0.8
6	1	(H1)	-3902.11	1532.29	-2523.05	1361.86	0.3	-9612.65	0.8
	1	(H2)	-9377.45	1532.29	-7998.38	1361.86	0.3	-9612.65	0.8
	2	(H1)	-660.33	1298.19	508.04	3363.04	0.3	-7555.89	0.7
	2	(H2)	-4037.95	1298.19	-2869.58	3363.04	0.3	-7555.89	0.7
	3AI	(H1)	3366.09	1064.08	4536.58	5865.81	0.4	-5165.41	0.5
	3AI	(H2)	-1280.70	1064.08	-323.02	5865.81	0.4	-5165.41	0.5

Calculo de Comprobacion a Rotura

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 0.90/1.10*Hip. Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 0.90/1.10*Hip. Pt

V. Sec		Momento F.exte. (m x t)	Momento Hipere. (m x t)	Momento Total (m x t)	Momento Rotura+ (m x t)	Xr +	Momento Rotura- (m x t)	Xr -
3AD	(H1)	3366.09	1064.08	4536.58	5279.56	0.3	-4744.00	0.5
3AD	(H2)	-1280.70	1064.08	-323.02	5279.56	0.3	-4744.00	0.5
4	(H1)	4889.55	931.05	5913.71	6499.85	0.3	-3557.03	0.4
4	(H2)	-111.72	931.05	726.23	6499.85	0.3	-3557.03	0.4
5	(H1)	5857.44	798.02	6735.26	7836.02	0.4	-2255.17	0.4
5	(H2)	768.98	798.02	1646.81	7836.02	0.4	-2255.17	0.4
6	(H1)	6269.76	665.00	7001.25	8793.76	0.4	-1367.56	0.4
6	(H2)	1361.39	665.00	2092.88	8793.76	0.4	-1367.56	0.4
7	(H1)	6126.50	531.97	6711.67	8838.73	0.4	-1336.15	0.4
7	(H2)	1665.51	531.97	2250.68	8838.73	0.4	-1336.15	0.4
8	(H1)	5427.67	398.95	5866.51	8468.70	0.4	-1649.98	0.4
8	(H2)	1681.35	398.95	2120.19	8468.70	0.4	-1649.98	0.4
9	(H1)	4173.26	265.92	4465.78	7764.77	0.4	-2310.40	0.4
9	(H2)	1408.90	265.92	1701.42	7764.77	0.4	-2310.40	0.4
10	(H1)	2363.29	132.90	2509.49	6726.85	0.4	-3394.01	0.5
10	(H2)	848.17	132.90	994.36	6726.85	0.4	-3394.01	0.5
11	(H1)	0.00	0.00	-0.01	5348.16	0.3	-4728.08	0.5
11	(H2)	0.00	0.00	-0.01	5348.16	0.3	-4728.08	0.5

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 E-5
COMPROBACION A CORTANTE
FECHA
HOJA N.°

COMPROBACION A CORTANTE

Para el cálculo a cortante se ha tomado un ancho bruto de 1,08 m y un ancho neto de 0.86 m en riostras y pilas → sección maciza

Se ha dividido el tablero en dos zonas y armado:

- Zona de armadura mínima → 2c Ø16/0.20

- Tablero en zonas próximas a riostras y pilas

Arm: $120 - \frac{120-56.4}{2.875} \times 1 = 98 \text{ cm}^2/\text{m} \rightarrow 2c\ \Phi 20/0.125$

A continuación se adjunta un listado con la armadura necesaria en cada sección de cálculo.

Calculo de Comprobacion a Cortante - Datos generales

Limite elastico del acero pasivo	=	5100.00	kg/cm2
Coeficiente del acero pasivo	=	1.15	
Limite elastico de acero activo	=	170.00	kg/cm2
Coeficiente del acero activo	=	1.10	
Resistencia caracteristica del hormigon	=	350.00	kg/cm2
Coeficiente del hormigon	=	1.50	
Coef. mayoracion Cargas muertas y Peso propio	=	1.60	
Coef. mayoracion Sobrecargas	=	1.60	

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
1	1	(H1)	0.00	-422.7	0.0	-1319.26	438.2	-3618.7
	1	(H2)	0.00	-1126.6	0.0	-1319.26	438.2	-3618.7
	2	(H1)	950.15	-281.1	0.0	-2426.49	354.7	-3603.1
	2	(H2)	2673.37	-853.6	0.0	-2426.49	354.7	-3603.1
	3	(H1)	1517.80	-139.4	0.0	-3170.41	211.8	-3579.2
	3	(H2)	4609.60	-580.6	0.0	-3170.41	211.8	-3579.2
	4	(H1)	1702.95	2.3	0.0	-3518.69	70.4	-3548.5
	4	(H2)	5808.69	-307.6	0.0	-3518.69	70.4	-3548.5
	5	(H1)	1505.59	143.9	0.0	-3477.82	-68.2	-3511.0
	5	(H2)	5331.23	-77.0	0.0	-3477.82	-68.2	-3511.0
	6	(H1)	4514.09	348.2	0.0	-3028.34	-222.2	-3463.2
	6	(H2)	2818.76	145.4	0.0	-3028.34	-222.2	-3463.2
	7	(H1)	3205.48	621.2	0.0	-2169.04	-371.3	-3409.4
	7	(H2)	2235.00	287.0	0.0	-2169.04	-371.3	-3409.4
	8	(H1)	1159.73	894.2	0.0	-922.86	-515.0	-3350.3
	8	(H2)	1268.75	428.7	0.0	-922.86	-515.0	-3350.3
	9	(H1)	-1623.17	1167.2	0.0	682.08	-654.9	-3300.2
	9	(H2)	-80.01	570.4	0.0	682.08	-654.9	-3300.2
	10	(H1)	-5143.20	1440.2	0.0	2641.35	-793.7	-3264.9
	10	(H2)	-1811.26	712.0	0.0	2641.35	-793.7	-3264.9
	11	(H1)	-9400.39	1713.2	0.0	3912.70	-68.2	-3428.3
	11	(H2)	-3925.02	853.7	0.0	3912.70	-68.2	-3428.3
2	1	(H1)	-3925.02	-754.1	0.0	3912.70	11.3	-3428.3
	1	(H2)	-9370.56	-1736.5	0.0	3912.70	11.3	-3428.3
	2	(H1)	-1973.97	-603.2	0.0	3105.02	480.5	-3482.4
	2	(H2)	-4832.59	-1450.2	0.0	3105.02	480.5	-3482.4
	3	(H1)	-456.61	-452.4	0.0	1318.44	477.2	-3821.0
	3	(H2)	-1078.72	-1160.5	0.0	1318.44	477.2	-3821.0
	4AI	(H1)	510.30	-321.2	0.0	-161.06	456.1	-4101.0
	4AI	(H2)	1506.48	-907.7	0.0	-161.06	456.1	-4101.0
	4AD	(H1)	510.30	-321.2	0.0	115.32	366.3	-3351.1

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
4AD	(H2)	1506.48	-907.7	0.0	115.32	366.3	-3351.1
5	(H1)	1388.76	-104.7	0.0	-1446.45	380.7	-3392.9
5	(H2)	4390.40	-490.6	0.0	-1446.45	380.7	-3392.9
6	(H1)	1374.42	111.7	0.0	-2629.28	11.3	-3524.2
6	(H2)	4964.95	-101.9	0.0	-2629.28	11.3	-3524.2
7	(H1)	4086.04	509.0	0.0	-2274.02	-215.4	-3581.6
7	(H2)	1534.75	133.3	0.0	-2274.02	-215.4	-3581.6
8	(H1)	1126.02	926.1	0.0	-959.99	-438.4	-3622.5
8	(H2)	538.60	349.7	0.0	-959.99	-438.4	-3622.5
9	(H1)	-1505.32	1178.9	0.0	607.85	-570.1	-3406.2
9	(H2)	-499.63	480.9	0.0	607.85	-570.1	-3406.2
10	(H1)	-5312.87	1468.7	0.0	2763.45	-571.6	-3238.5
10	(H2)	-2099.02	631.7	0.0	2763.45	-571.6	-3238.5
11	(H1)	-9802.29	1751.1	0.0	3540.92	11.3	-3428.3
11	(H2)	-4132.09	782.6	0.0	3540.92	11.3	-3428.3
3 1	(H1)	-3941.01	-755.7	0.0	3540.92	-3.0	-3428.3
1	(H2)	-9805.86	-1753.3	0.0	3540.92	-3.0	-3428.3
2	(H1)	-1985.19	-604.9	0.0	2774.13	466.3	-3482.4
2	(H2)	-5177.42	-1465.1	0.0	2774.13	466.3	-3482.4
3	(H1)	-463.06	-454.0	0.0	1028.44	463.0	-3821.0
3	(H2)	-1380.57	-1175.4	0.0	1028.44	463.0	-3821.0
4AI	(H1)	507.99	-322.8	0.0	-415.51	441.9	-4101.0
4AI	(H2)	1242.00	-922.6	0.0	-415.51	441.9	-4101.0
4AD	(H1)	507.99	-322.8	0.0	-139.13	352.1	-3351.1
4AD	(H2)	1242.00	-922.6	0.0	-139.13	352.1	-3351.1
5	(H1)	1393.29	-106.4	0.0	-1642.24	366.5	-3392.9
5	(H2)	3463.96	-505.6	0.0	-1642.24	366.5	-3392.9
6	(H1)	4706.49	116.7	0.0	-2766.41	-3.0	-3524.2
6	(H2)	4756.58	-121.2	0.0	-2766.41	-3.0	-3524.2
7	(H1)	4119.88	510.3	0.0	-2352.49	-229.7	-3581.6
7	(H2)	1410.42	110.0	0.0	-2352.49	-229.7	-3581.6

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
8	(H1)	1154.42	927.5	0.0	-979.79	-452.6	-3622.5
8	(H2)	510.41	326.4	0.0	-979.79	-452.6	-3622.5
9	(H1)	-1480.21	1180.2	0.0	623.61	-584.4	-3406.2
9	(H2)	-469.57	457.6	0.0	623.61	-584.4	-3406.2
10	(H1)	-5291.55	1470.0	0.0	2820.10	-585.9	-3238.5
10	(H2)	-2001.95	608.4	0.0	2820.10	-585.9	-3238.5
11	(H1)	-9817.98	1753.7	0.0	3638.46	-3.0	-3428.3
11	(H2)	-3968.03	759.3	0.0	3638.46	-3.0	-3428.3
4 1	(H1)	-3968.00	-759.1	0.0	3638.46	0.6	-3428.3
1	(H2)	-9817.98	-1753.5	0.0	3638.46	0.6	-3428.3
2	(H1)	-2002.35	-608.3	0.0	2861.37	469.9	-3482.4
2	(H2)	-5291.73	-1469.8	0.0	2861.37	469.9	-3482.4
3	(H1)	-470.40	-457.4	0.0	1105.39	466.6	-3821.0
3	(H2)	-1481.39	-1180.1	0.0	1105.39	466.6	-3821.0
4AI	(H1)	509.21	-326.3	0.0	-347.51	445.5	-4101.0
4AI	(H2)	1152.91	-927.3	0.0	-347.51	445.5	-4101.0
4AD	(H1)	509.21	-326.3	0.0	-71.12	355.7	-3351.1
4AD	(H2)	1152.91	-927.3	0.0	-71.12	355.7	-3351.1
5	(H1)	1408.60	-109.8	0.0	-1589.00	370.1	-3392.9
5	(H2)	4117.84	-510.2	0.0	-1589.00	370.1	-3392.9
6	(H1)	4756.74	121.1	0.0	-2727.93	0.6	-3524.2
6	(H2)	4701.61	-116.8	0.0	-2727.93	0.6	-3524.2
7	(H1)	4184.83	505.7	0.0	-2328.78	-226.1	-3581.6
7	(H2)	1390.32	106.5	0.0	-2328.78	-226.1	-3581.6
8	(H1)	1238.72	922.8	0.0	-970.84	-449.0	-3622.5
8	(H2)	504.40	323.0	0.0	-970.84	-449.0	-3622.5
9	(H1)	-1384.18	1175.6	0.0	623.60	-580.8	-3406.2
9	(H2)	-467.02	454.2	0.0	623.60	-580.8	-3406.2
10	(H1)	-5182.03	1465.3	0.0	2809.80	-582.3	-3238.5
10	(H2)	-1989.58	605.0	0.0	2809.80	-582.3	-3238.5
11	(H1)	-9810.65	1753.4	0.0	3617.87	0.6	-3428.3
11	(H2)	-3945.83	755.9	0.0	3617.87	0.6	-3428.3

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
5	1	(H1)	-4136.88	-783.4	0.0	3617.87	0.5	-3428.3
	1	(H2)	-9807.07	-1752.0	0.0	3617.87	0.5	-3428.3
	2	(H1)	-2101.39	-632.6	0.0	2841.24	469.7	-3482.4
	2	(H2)	-5315.01	-1469.5	0.0	2841.24	469.7	-3482.4
	3	(H1)	-499.59	-481.7	0.0	1085.72	466.4	-3821.0
	3	(H2)	-1505.63	-1179.8	0.0	1085.72	466.4	-3821.0
	4AI	(H1)	540.75	-350.5	0.0	-366.78	445.3	-4101.0
	4AI	(H2)	1127.85	-927.0	0.0	-366.78	445.3	-4101.0
	4AD	(H1)	540.75	-350.6	0.0	-90.40	355.5	-3351.1
	4AD	(H2)	1127.85	-927.0	0.0	-90.40	355.5	-3351.1
	5	(H1)	1540.36	-134.1	0.0	-1607.62	369.9	-3392.9
	5	(H2)	4091.41	-509.9	0.0	-1607.62	369.9	-3392.9
	6	(H1)	4974.03	101.0	0.0	-2745.90	0.5	-3524.2
	6	(H2)	1383.53	-112.5	0.0	-2745.90	0.5	-3524.2
	7	(H1)	4403.17	489.7	0.0	-2346.08	-226.2	-3581.6
	7	(H2)	1401.33	103.9	0.0	-2346.08	-226.2	-3581.6
	8	(H1)	1522.80	906.8	0.0	-987.50	-449.2	-3622.5
	8	(H2)	526.32	320.3	0.0	-987.50	-449.2	-3622.5
	9	(H1)	-1060.26	1159.6	0.0	607.35	-580.9	-3406.2
	9	(H2)	-438.51	451.5	0.0	607.35	-580.9	-3406.2
	10	(H1)	-4812.31	1449.3	0.0	2794.00	-582.4	-3238.5
	10	(H2)	-1953.46	602.4	0.0	2794.00	-582.4	-3238.5
	11	(H1)	-9347.62	1735.6	0.0	3602.53	0.5	-3428.3
	11	(H2)	-3902.11	753.2	0.0	3602.53	0.5	-3428.3
6	1	(H1)	-3902.11	-852.9	0.0	3602.53	56.7	-3428.3
	1	(H2)	-9377.45	-1712.4	0.0	3602.53	56.7	-3428.3
	2	(H1)	-830.45	-636.4	0.0	1974.77	563.0	-3499.0
	2	(H2)	-3174.10	-1295.3	0.0	1974.77	563.0	-3499.0
	3AI	(H1)	1348.40	-420.0	0.0	-218.07	501.6	-3635.1
	3AI	(H2)	1308.68	-878.2	0.0	-218.07	501.6	-3635.1

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Esfuerzos de C. Exteriores Momento (m x t)	Cortante (t)	Axil (t)	Esfuerzos de Pretensado Momento (m x t)	Cortante (t)	Axil (t)
	3AD	(H1)	1348.40	-420.0	0.0	-41.58	415.2	-2940.2
	3AD	(H2)	1308.68	-878.2	0.0	-41.58	415.2	-2940.2
	4	(H1)	2188.71	-297.0	0.0	-1029.82	419.4	-2958.3
	4	(H2)	3089.35	-641.2	0.0	-1029.82	419.4	-2958.3
	5	(H1)	2740.73	-174.0	0.0	-2068.95	423.9	-2990.9
	5	(H2)	4314.44	-404.1	0.0	-2068.95	423.9	-2990.9
	6	(H1)	3004.47	-51.0	0.0	-2952.93	217.5	-3075.1
	6	(H2)	1361.39	-191.2	0.0	-2952.93	217.5	-3075.1
	7	(H1)	6126.50	179.6	0.0	-3189.49	-8.3	-3139.3
	7	(H2)	1665.51	-68.3	0.0	-3189.49	-8.3	-3139.3
	8	(H1)	5427.67	416.6	0.0	-3072.90	-116.8	-3165.8
	8	(H2)	1681.35	54.7	0.0	-3072.90	-116.8	-3165.8
	9	(H1)	4173.26	653.7	0.0	-2692.00	-227.0	-3187.8
	9	(H2)	1408.90	177.7	0.0	-2692.00	-227.0	-3187.8
	10	(H1)	2363.29	890.7	0.0	-2044.23	-338.0	-3205.2
	10	(H2)	848.17	300.7	0.0	-2044.23	-338.0	-3205.2
	11	(H1)	0.00	1127.5	0.0	-1171.93	-385.9	-3216.7
	11	(H2)	0.00	423.6	0.0	-1171.93	-385.9	-3216.7

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
1	1	(H1)	AB	1.6826	15.4	1269.1	0.01	157.64	--	12.00
	1	(H2)	AB	1.6826	-688.5	1269.1	0.54	157.64	34.78	12.00
	2	(H1)	AB	1.6802	73.6	1269.9	0.06	157.64	--	12.00
	2	(H2)	AB	1.6802	-498.9	1269.9	0.39	157.64	22.39	12.00
	3	(H1)	AB	1.6766	72.3	1271.2	0.06	157.64	--	12.00
	3	(H2)	AB	1.6766	-368.9	1271.2	0.29	157.64	13.89	12.00
	4	(H1)	AB	1.6720	72.6	1272.9	0.06	157.64	--	12.00
	4	(H2)	AB	1.6720	-237.2	1272.9	0.19	157.64	5.25	12.00
	5	(H1)	AB	1.6663	75.7	1275.0	0.06	157.64	--	12.00
	5	(H2)	AB	1.6663	-145.3	1275.0	0.11	157.64	--	12.00
	6	(H1)	AB	1.6590	126.0	1277.6	0.10	157.64	--	12.00
	6	(H2)	AB	1.6590	-76.8	1277.6	0.06	157.64	--	12.00
	7	(H1)	AB	1.6508	249.9	1280.5	0.20	157.64	6.16	12.00
	7	(H2)	AB	1.6508	-84.3	1280.5	0.07	157.64	--	12.00
	8	(H1)	AB	1.6417	379.2	1283.8	0.30	157.64	14.88	12.00
	8	(H2)	AB	1.6417	-86.2	1283.8	0.07	157.64	--	12.00
	9	(H1)	AB	1.6340	512.3	1286.6	0.40	157.64	23.92	12.00
	9	(H2)	AB	1.6340	-84.5	1286.6	0.07	157.64	--	12.00
	10	(H1)	AB	1.6285	646.5	1288.5	0.50	157.64	33.09	12.00
	10	(H2)	AB	1.6285	-81.6	1288.5	0.06	157.64	--	12.00
	11	(H1)	C	1.6537	1645.0	1785.3	0.92	0.00	109.65	13.33
	11	(H2)	AB	1.6537	785.5	1785.3	0.44	219.96	37.69	13.33
2	1	(H1)	AB	1.6537	-742.8	1785.3	0.42	219.96	34.85	13.33
	1	(H2)	C	1.6537	-1725.2	1785.3	0.97	0.00	115.00	13.33
	2	(H1)	AB	1.6619	-122.7	1276.5	0.10	157.64	--	12.00
	2	(H2)	AB	1.6619	-969.7	1276.5	0.76	157.64	53.86	12.00
	3	(H1)	AB	1.7127	24.9	1258.2	0.02	157.64	--	12.00
	3	(H2)	AB	1.7127	-683.3	1258.2	0.54	157.64	33.83	12.00
	4AI	(H1)	AB	1.7536	134.9	1243.5	0.11	157.64	--	12.00
	4AI	(H2)	AB	1.7536	-451.6	1243.5	0.36	157.64	18.48	12.00
	4AD	(H1)	AB	1.6418	45.1	1283.7	0.04	157.64	--	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec		Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
	4AD	(H2)	AB	1.6418	-541.4	1283.7	0.42	157.64	25.76	12.00
	5	(H1)	AB	1.6483	276.0	1281.4	0.22	157.64	7.91	12.00
	5	(H2)	C	1.6483	-109.8	1281.4	0.09	157.64	--	12.00
	6	(H1)	AB	1.6683	123.0	1274.2	0.10	157.64	--	12.00
	6	(H2)	AB	1.6683	-90.6	1274.2	0.07	157.64	--	12.00
	7	(H1)	AB	1.6770	293.6	1271.1	0.23	157.64	8.94	12.00
	7	(H2)	AB	1.6770	-82.2	1271.1	0.06	157.64	--	12.00
	8	(H1)	AB	1.6831	487.8	1268.9	0.38	157.64	21.62	12.00
	8	(H2)	AB	1.6831	-88.7	1268.9	0.07	157.64	--	12.00
	9	(H1)	AB	1.6503	608.8	1280.7	0.48	157.64	30.13	12.00
	9	(H2)	AB	1.6503	-89.2	1280.7	0.07	157.64	--	12.00
	10	(H1)	AB	1.6244	897.0	1290.0	0.70	157.64	50.17	12.00
	10	(H2)	AB	1.6244	60.1	1290.0	0.05	157.64	--	12.00
	11	(H1)	C	1.6537	1762.4	1785.3	0.99	0.00	117.47	13.33
	11	(H2)	AB	1.6537	793.8	1785.3	0.44	219.96	38.25	13.33
3	1	(H1)	AB	1.6537	-758.7	1785.3	0.42	219.96	35.91	13.33
	1	(H2)	C	1.6537	-1756.2	1785.3	0.98	0.00	117.06	13.33
	2	(H1)	AB	1.6619	-138.6	1276.5	0.11	157.64	--	12.00
	2	(H2)	AB	1.6619	-998.8	1276.5	0.78	157.64	55.79	12.00
	3	(H1)	AB	1.7127	9.0	1258.2	0.01	157.64	--	12.00
	3	(H2)	AB	1.7127	-712.4	1258.2	0.57	157.64	35.71	12.00
	4AI	(H1)	AB	1.7536	119.1	1243.5	0.10	157.64	--	12.00
	4AI	(H2)	AB	1.7536	-480.7	1243.5	0.39	157.64	20.31	12.00
	4AD	(H1)	AB	1.6418	29.3	1283.7	0.02	157.64	--	12.00
	4AD	(H2)	AB	1.6418	-570.5	1283.7	0.44	157.64	27.72	12.00
	5	(H1)	AB	1.6483	260.1	1281.4	0.20	157.64	6.85	12.00
	5	(H2)	AB	1.6483	-139.0	1281.4	0.11	157.64	--	12.00
	6	(H1)	AB	1.6683	113.7	1274.2	0.09	157.64	--	12.00
	6	(H2)	AB	1.6683	-124.1	1274.2	0.10	157.64	--	12.00
	7	(H1)	AB	1.6770	280.7	1271.1	0.22	157.64	8.09	12.00
	7	(H2)	AB	1.6770	-119.7	1271.1	0.09	157.64	--	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
8		(H1) AB	1.6831	474.9	1268.9	0.37	157.64	20.77	12.00
8		(H2) AB	1.6831	-126.2	1268.9	0.10	157.64	--	12.00
9		(H1) AB	1.6503	595.9	1280.7	0.47	157.64	29.27	12.00
9		(H2) AB	1.6503	-126.8	1280.7	0.10	157.64	--	12.00
10		(H1) AB	1.6244	884.1	1290.0	0.69	157.64	49.30	12.00
10		(H2) AB	1.6244	22.6	1290.0	0.02	157.64	--	12.00
11		(H1) C	1.6537	1750.7	1785.3	0.98	0.00	116.70	13.33
11		(H2) AB	1.6537	756.3	1785.3	0.42	219.96	35.75	13.33
4	1	(H1) AB	1.6537	-758.5	1785.3	0.42	219.96	35.90	13.33
	1	(H2) C	1.6537	-1752.9	1785.3	0.98	0.00	116.84	13.33
	2	(H1) AB	1.6619	-138.4	1276.5	0.11	157.64	--	12.00
	2	(H2) AB	1.6619	-1000.0	1276.5	0.78	157.64	55.87	12.00
	3	(H1) AB	1.7127	9.1	1258.2	0.01	157.64	--	12.00
	3	(H2) AB	1.7127	-713.6	1258.2	0.57	157.64	35.78	12.00
	4AI	(H1) AB	1.7536	119.2	1243.5	0.10	157.64	--	12.00
	4AI	(H2) AB	1.7536	-481.9	1243.5	0.39	157.64	20.38	12.00
	4AD	(H1) AB	1.6418	29.4	1283.7	0.02	157.64	--	12.00
	4AD	(H2) AB	1.6418	-571.6	1283.7	0.45	157.64	27.80	12.00
	5	(H1) AB	1.6483	260.3	1281.4	0.20	157.64	6.86	12.00
	5	(H2) AB	1.6483	-140.1	1281.4	0.11	157.64	--	12.00
	6	(H1) AB	1.6683	121.7	1274.2	0.10	157.64	--	12.00
	6	(H2) AB	1.6683	-116.1	1274.2	0.09	157.64	--	12.00
	7	(H1) AB	1.6770	279.6	1271.1	0.22	157.64	8.01	12.00
	7	(H2) AB	1.6770	-119.5	1271.1	0.09	157.64	--	12.00
	8	(H1) AB	1.6831	473.7	1268.9	0.37	157.64	20.70	12.00
	8	(H2) AB	1.6831	-126.0	1268.9	0.10	157.64	--	12.00
	9	(H1) AB	1.6503	594.8	1280.7	0.46	157.64	29.20	12.00
	9	(H2) AB	1.6503	-126.6	1280.7	0.10	157.64	--	12.00
	10	(H1) AB	1.6244	883.0	1290.0	0.68	157.64	49.22	12.00
	10	(H2) AB	1.6244	22.7	1290.0	0.02	157.64	--	12.00
	11	(H1) C	1.6537	1754.0	1785.3	0.98	0.00	116.92	13.33
	11	(H2) AB	1.6537	756.5	1785.3	0.42	219.96	35.76	13.33

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V.	Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
5	1	(H1) AB	1.6537	-783.0	1785.3	0.44	219.96	37.53	13.33
	1	(H2) C	1.6537	-1751.5	1785.3	0.98	0.00	116.75	13.33
	2	(H1) AB	1.6619	-162.8	1276.5	0.13	157.64	0.35	12.00
	2	(H2) AB	1.6619	-999.8	1276.5	0.78	157.64	55.86	12.00
	3	(H1) AB	1.7127	-15.3	1258.2	0.01	157.64	--	12.00
	3	(H2) AB	1.7127	-713.4	1258.2	0.57	157.64	35.77	12.00
	4AI	(H1) AB	1.7536	94.8	1243.5	0.08	157.64	--	12.00
	4AI	(H2) AB	1.7536	-481.7	1243.5	0.39	157.64	20.37	12.00
	4AD	(H1) AB	1.6418	5.0	1283.7	0.00	157.64	--	12.00
	4AD	(H2) AB	1.6418	-571.5	1283.7	0.45	157.64	27.78	12.00
	5	(H1) AB	1.6483	235.8	1281.4	0.18	157.64	5.23	12.00
	5	(H2) AB	1.6483	-140.0	1281.4	0.11	157.64	--	12.00
	6	(H1) AB	1.6683	101.5	1274.2	0.08	157.64	--	12.00
	6	(H2) AB	1.6683	-112.1	1274.2	0.09	157.64	--	12.00
	7	(H1) AB	1.6770	263.5	1271.1	0.21	157.64	6.96	12.00
	7	(H2) AB	1.6770	-122.3	1271.1	0.10	157.64	--	12.00
	8	(H1) AB	1.6831	457.7	1268.9	0.36	157.64	19.65	12.00
	8	(H2) AB	1.6831	-128.8	1268.9	0.10	157.64	--	12.00
	9	(H1) AB	1.6503	578.7	1280.7	0.45	157.64	28.12	12.00
	9	(H2) AB	1.6503	-129.4	1280.7	0.10	157.64	--	12.00
	10	(H1) AB	1.6244	866.9	1290.0	0.67	157.64	48.13	12.00
	10	(H2) AB	1.6244	19.9	1290.0	0.02	157.64	--	12.00
	11	(H1) C	1.6537	1736.1	1785.3	0.97	0.00	115.72	13.33
	11	(H2) AB	1.6537	753.7	1785.3	0.42	219.96	35.58	13.33
6	1	(H1) AB	1.6537	-796.1	1785.3	0.45	219.96	38.40	13.33
	1	(H2) C	1.6537	-1655.6	1785.3	0.93	0.00	110.36	13.33
	2	(H1) AB	1.6645	-73.5	1275.6	0.06	157.64	--	12.00
	2	(H2) AB	1.6645	-732.3	1275.6	0.57	157.64	38.06	12.00
	3AI	(H1) AB	1.6850	81.6	1268.2	0.06	157.64	--	12.00
	3AI	(H2) AB	1.6850	-376.6	1268.2	0.30	157.64	14.32	12.00

Calculo de Comprobacion a Cortante

H1 : [1.60*Cm + 1.60*Pp + 1.60*S(+)]+ 1.00*Pt
H2 : [1.60*Cm + 1.60*Pp + 1.60*S(-)]+ 1.00*Pt

V. Sec	Zona	Cotg b	Vrd (t)	Vul (t)	Vrd/Vul	Vcu (t)	Ar cm2/m	Ar.min cm2/m
3AD (H1)	AB	1.5773	-4.8	1306.8	0.00	157.64	--	12.00
3AD (H2)	AB	1.5773	-463.0	1306.8	0.35	157.64	21.34	12.00
4 (H1)	AB	1.5801	122.4	1305.7	0.09	157.64	--	12.00
4 (H2)	AB	1.5801	-221.8	1305.7	0.17	157.64	4.47	12.00
5 (H1)	AB	1.5854	249.9	1303.9	0.19	157.64	6.41	12.00
5 (H2)	AB	1.5854	19.7	1303.9	0.02	157.64	--	12.00
6 (H1)	AB	1.5987	166.4	1299.1	0.13	157.64	0.61	12.00
6 (H2)	AB	1.5987	26.2	1299.1	0.02	157.64	--	12.00
7 (H1)	C	1.6089	171.4	1295.5	0.13	157.64	0.94	12.00
7 (H2)	AB	1.6089	-76.5	1295.5	0.06	157.64	--	12.00
8 (H1)	AB	1.6130	299.8	1294.1	0.23	157.64	9.72	12.00
8 (H2)	AB	1.6130	-62.1	1294.1	0.05	157.64	--	12.00
9 (H1)	AB	1.6165	426.7	1292.8	0.33	157.64	18.35	12.00
9 (H2)	AB	1.6165	-49.2	1292.8	0.04	157.64	--	12.00
10 (H1)	AB	1.6192	552.7	1291.9	0.43	157.64	26.90	12.00
10 (H2)	AB	1.6192	-37.2	1291.9	0.03	157.64	--	12.00
11 (H1)	AB	1.6210	741.6	1291.2	0.57	157.64	39.71	12.00
11 (H2)	AB	1.6210	37.7	1291.2	0.03	157.64	--	12.00

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 - E-5
FECHA
HOJA N.º

ARMADURAS ANCLAJES PRETENSADO

Cables principales

Horizontal: $538 \times 1.6 \times 0.3 \times \left(\frac{0.746 - 0.43}{0.746}\right) \times \frac{1.15}{5.1} = 25\ cm^2$/anclaje → 5×2c ϕ12/anclaje

Avertical: $4 \times 538 \times 1.6 \times 0.3 \times \left(\frac{2.62 - 2.15}{2.62}\right) \times \frac{1.15}{5.1} = 42\ cm^2$

$\left(\frac{2.74 - 2.01}{2.74}\right) \times \frac{1.15}{5.1} = 62.1\ cm^2$ → 5×2c ϕ20

Cables de cosido al estribo

Fmax = 5131434 - 6112
Fmax = 4788

Para el anclaje 0.43 × 0.43

Aver: $1.6 \times (538) \times 0.3 \times \frac{1.15}{5.1} \times \left(\frac{2.00 - 0.45}{2.00}\right) = 45\ cm^2$

Vert.

Horiz. $\left(\frac{2.60 - 0.45}{2.60}\right) = 48\ cm^2$

Para el anclaje 0.50 × 0.50

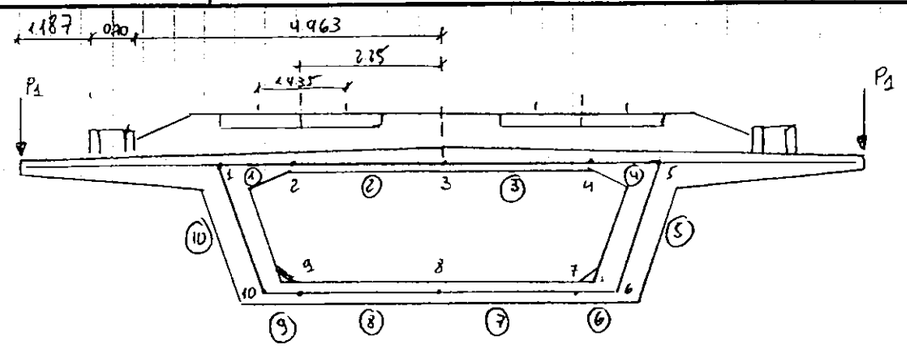
$1.6 \times \left(538 + \frac{1004}{2}\right) \times 0.3 \times \frac{1.15}{5.1} \left(\frac{2.00 - 0.75}{2.00}\right) = 71\ cm^2$

$\left(\frac{2.60 - 0.75}{2.60}\right) = 80\ cm^2$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO-1. PUENTES CAJON
CALCULO TRANSVERSAL

FECHA

HOJA N.° 1



Coordenadas de los nudos

NUDO	X	Y
1	-3.687	2.10
2	-2.50	2.10
3	0.00	2.10
4	2.50	2.10
5	3.687	2.10
6	3.015	0.00
7	2.50	0.00
8	0.00	0.00
9	-2.50	0.00
10	-3.015	0.00

Características de las barras

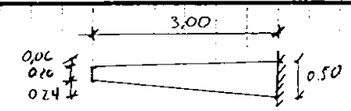
BARRAS	Area (m^2)	Inercia (m^4)	E (t/m^2)
2 y 3	0325	0,002861	3500000
1 y 4	0.466	0,008433	=
5 y 10	0.54	0,013122	=
6 y 9	0.40	0,005333	=
7 y 8	0,30	0,002250	3.500.000

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1 PUENTES CAJON
CALCULO TRANSVERSAL

FECHA

HOJA N.° 2

HIPOTESIS DE CARGAS:



- Cargas en extremo de voladizo:

Imposta: $(0.70 \times 0.30 + 0.08 \times 0.25) \times 2.5 = 0.58\ t/m$

Baranda: $0.1\ t/m$

TOTAL: $0.68\ t/m$

- Arqueta longitudinal.

$(2 \times 0.40 - 0.15 + 0.40 \times 0.05) \times 2.5 = 0.35\ t/m$

- Balasto + traviesas + vía. $4.74\ t/m$ por vía $= \frac{4.74}{4.96} = 0.96\ t/m^2$

Cargas en extremo de voladizo:

$V = 0.20 \times 3.00 \times 2.5 + \frac{1}{2} \cdot 0.30 \cdot 3.00 \times 2.50 + 0.68 + 0.35 + 0.96 \times 1.13 = 4.72\ t$

$M = 0.2 \times 2.5 \times \frac{3^2}{2} + \frac{1}{2} 0.3 \times 3 \times 2.5 \times \frac{1}{3} \times 3.00 + 0.68 \times 3 + 0.35 = 1.463 + 0.91 \cdot \frac{1.13^2}{2} = 6.52\ mt$

HIPOTESIS 1: PESO PROPIO + CARGA PERMANENTE

Nudo 1 P = -4,72 M = 6.52
5 P = -4.72 M = -6.52

Barra		P
	1	2.13 t/m
	2	1.773
	3	1.773
	4	2.13
	5	1.35
	6	1.00
	7	0.75
	8	0.75
	9	1.00
	10	1.35

$\alpha = 270°$

COEFICIENTE IMPACTO:

$$C = \frac{144\sqrt{7.37}}{3.10 - 1.76\sqrt{7.37} + 7.37} = 69 \quad \text{IMPACTO } 1.69$$

Por carril, carga por metro lineal. $p = \frac{15}{1.50} \times 1.69 = 16.9\ t/m$

HIPOTESIS 2: DOS TRENES SIN RIPAR

Barra 1	P = 16.9	a = 0.7195	$\alpha = 270°$
2		0.9675	
3		1.5325	
4		0.4675	

HIPOTESIS 3: DOS TRENES RIPADOS 0,30 m

Barra 1	P = 16.9	a = 0.4195	$\alpha = 270°$
2		0,6675	
3		1.2325	
4		0.1675	

HIPOTESIS 4: PEATONES VOLADIZOS

Nudo 1: $p = 0.4 \times 1.887 = 0.75\ t$ $\quad M = 0.75 \times 2.06 = +1.55\ m\,t$
Nudo 5: $p = 0.75\ t$ $\quad M = -1.55\ m\,t$

Flexión en el voladizo:

Las hipótesis de descarrilamiento son determinantes para el voladizo, no para el forjado intermedio entre almas.

CASO A a) $M = 1.5 \times (2.25 + 2.8 - 3.85) = 1.80\ m\,t/m$

A 6) $M = \frac{10}{t} = 3,2\ m\,t/m$

B a) $M = 5 \times 1.20 = 6,0\ m\,t/m$

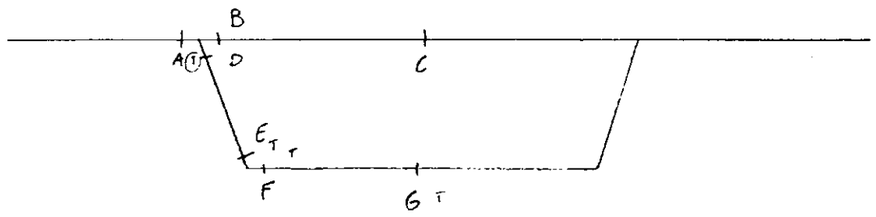
B 6) $M = \frac{22}{t} = 7,0\ m\,t/m$

$M_d = 1.6 \times (6,5 + 1.55) = 12,9\ m\,t/m$

$8,05 + 7,0 = 15,1\ m\,t/m \rightarrow 6.5$

$U_c = \frac{3500}{11} \times 1.0 \times 0.45 = 1432 \quad A = 7,8\ cm^2/m$

Dimensionamiento por flexión transversal



Sección	Md (m t/m)	d (m)	A_{req} (cm^2/m)	A_{min} (cm^2/m)
A	−15.1	0.45	7.8	10,8
B	−78.5	0.55	33,9	13,3
C	+19.7	0.30	15,5	7,2
D	−67.8	0.50	32,3	12,0
E	+7.9	0.50	3,6	12,0
F	−7,8	0.50	3.5	12,0
G	±1,5	0.75	—	6,0

```
L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.
CONTROL
10 10 9 4
:
NUDOS
1 -3.687 2.10
2 -2.50 2.10
3 0 2.10
4 2.50 2.10
5 3.687 2.10
6 3.015 0.0
7 2.50 0
8 0 0
9 -2.50 0
10 -3.015 0.0
:
BARRAS TIPO
5
.325 .002861 3500000
.466 .008433 3500000
.54 .013122 3500000
.40 .005333 3500000
.30 .002250 3500000
:
BARRAS
1 1 2 2
2 2 3 1
3 3 4 1
4 4 5 2
5 5 6 3
6 6 7 4
7 7 8 5
8 8 9 5
9 9 10 4
10 1 10 3
:
APOYOS
2
6 1 1 0
10 0 1 0
:
CARGAS
H-1 PESO PROPIO+CARGA PERMANENTE
2
1 0 -4.72 6.52
5 0 -4.72 -6.52
10
1  2 2.13 270
2  2 1.78 270
3  2 1.78 270
4  2 2.13 270
5  2 1.35 270
6  2 1.00 270
7  2 0.75 270
8  2 0.75 270
9  2 1.00 270
10 2 1.35 270
H-2.DOS TRENES SIN RIPAR
0
```



```
4
1 1 16.9 0.7195 270
2 1 16.9 0.9675 270
3 1 16.9 1.5325 270
4 1 16.9 0.4675 270
H-3 DOS TRENES RIPADOS 30 CM.
0
4
1 1 16.9 0.4195  270
2 1 16.9 0.6675  270
3 1 16.9 1.2325  270
4 1 16.9 0.1675  270
H-4.PEATONES VOLADIZOS
2
1 0 -.75 1.55
5 0 -.75 -1.55
0
:
```

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 1 H-1 PESO PROPIO+CARGA PERMANENTE

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000019	-0.000025
2	0.000001	-0.000214	-0.000258
3	0.000005	-0.000826	-0.000000
4	0.000008	-0.000214	0.000258
5	0.000009	-0.000019	0.000025
6	0.000000	-0.000000	0.000006
7	0.000001	-0.000018	0.000058
8	0.000005	-0.000245	-0.000000
9	0.000008	-0.000018	-0.000058
10	0.000009	-0.000000	-0.000006

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	17.06	-0.00
10	0.00	17.06	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	1.64	-9.46	-6.98
	2	1.64	-2.67	-4.45
2	2	1.64	-2.67	-4.45
	3	1.64	2.89	0.00
3	3	1.64	2.89	-0.00
	4	1.64	-2.67	4.45
4	4	1.64	-2.67	4.45
	5	1.64	-9.46	6.98
5	5	-11.64	-2.94	-2.00
	6	-14.48	2.48	-2.91
6	6	-1.64	2.48	2.39
	7	-1.64	1.38	1.87
7	7	-1.64	1.38	1.87
	8	-1.64	-0.96	-0.00
8	8	-1.64	-0.96	-0.00
	9	-1.64	1.38	-1.88
9	9	-1.64	1.38	-1.88
	10	-1.64	2.48	-2.39
10	1	-11.64	2.94	2.00
	10	-14.48	-2.48	2.91

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. n° 2 H-2.DOS TRENES SIN RIPAR

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	0.000001	-0.000021	-0.000642
2	-0.000005	-0.001416	-0.001485
3	-0.000023	-0.004005	-0.000000
4	-0.000041	-0.001416	0.001485
5	-0.000047	-0.000021	0.000642
6	0.000000	-0.000000	-0.000285
7	-0.000003	0.000141	-0.000262
8	-0.000023	0.000469	0.000000
9	-0.000043	0.000141	0.000262
10	-0.000046	-0.000000	0.000285

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	33.80	0.00
10	-0.00	33.80	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.37	-39.46	-33.80
	2	-8.37	-7.24	-16.90
2	2	-8.37	-7.24	-16.90
	3	-8.37	9.11	-0.00
3	3	-8.37	9.11	0.00
	4	-8.37	-7.24	16.90
4	4	-8.37	-7.24	16.90
	5	-8.37	-39.46	33.80
5	5	-29.64	-39.46	-18.27
	6	-29.64	0.83	-18.27
6	6	8.37	0.83	-0.00
	7	8.37	0.83	-0.00
7	7	8.37	0.83	0.00
	8	8.37	0.83	0.00
8	8	8.37	0.83	0.00
	9	8.37	0.83	0.00
9	9	8.37	0.83	-0.00
	10	8.37	0.83	-0.00
10	1	-29.64	39.46	18.27
	10	-29.64	-0.83	18.27

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 3 H-3 DOS TRENES RIPADOS 30 CM.

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000368	-0.000143	-0.000452
2	-0.000374	-0.001318	-0.001333
3	-0.000392	-0.004033	-0.000235
4	-0.000410	-0.001509	0.001651
5	-0.000416	0.000100	0.000821
6	0.000000	-0.000000	-0.000130
7	-0.000003	0.000072	-0.000147
8	-0.000023	0.000465	-0.000097
9	-0.000042	0.000208	0.000373
10	-0.000045	-0.000000	0.000436

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	30.44	-0.00
10	-0.00	37.16	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-8.21	-39.43	-36.63
	2	-8.21	-8.92	-19.73
2	2	-8.21	-8.92	-19.73
	3	-8.21	9.44	-2.83
3	3	-8.21	9.44	-2.83
	4	-8.21	-4.89	14.07
4	4	-8.21	-4.89	14.07
	5	-8.21	-38.82	30.97
5	5	-26.99	-38.82	-17.25
	6	-26.99	-0.78	-17.25
6	6	8.21	-0.78	-0.53
	7	8.21	-0.51	-0.53
7	7	8.21	-0.51	-0.53
	8	8.21	0.82	-0.53
8	8	8.21	0.82	-0.53
	9	8.21	2.14	-0.53
9	9	8.21	2.14	-0.53
	10	8.21	2.42	-0.53
10	1	-32.39	39.43	18.98
	10	-32.39	-2.42	18.98

L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-3/4/5. TRANSVERSAL.

Hip. nº 4 H-4.PEATONES VOLADIZOS

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	-0.000003	0.000026
2	0.000001	0.000026	0.000022
3	0.000003	0.000054	0.000000
4	0.000005	0.000026	-0.000022
5	0.000005	-0.000003	-0.000026
6	0.000000	-0.000000	0.000009
7	0.000000	-0.000004	0.000008
8	0.000003	-0.000014	-0.000000
9	0.000005	-0.000004	-0.000008
10	0.000005	-0.000000	-0.000009

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
6	-0.00	0.75	0.00
10	0.00	0.75	0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	0.95	-0.09	-0.00
	2	0.95	-0.09	-0.00
2	2	0.95	-0.09	-0.00
	3	0.95	-0.09	-0.00
3	3	0.95	-0.09	0.00
	4	0.95	-0.09	0.00
4	4	0.95	-0.09	0.00
	5	0.95	-0.09	0.00
5	5	-1.00	1.46	0.67
	6	-1.00	-0.02	0.67
6	6	-0.95	-0.02	-0.00
	7	-0.95	-0.02	-0.00
7	7	-0.95	-0.02	-0.00
	8	-0.95	-0.02	-0.00
8	8	-0.95	-0.02	-0.00
	9	-0.95	-0.02	-0.00
9	9	-0.95	-0.02	-0.00
	10	-0.95	-0.02	-0.00
10	1	-1.00	-1.46	-0.67
	10	-1.00	0.02	-0.67

ARMADURA DE RASANTE

Momentos estáticos:

Sección A:

$$M_E = 0{,}20 \cdot 3{,}0 \cdot \left(0{,}95 - 0{,}237\right) + \frac{1}{2}\,0{,}06 \cdot 3 \cdot \left(0{,}95 - 0{,}137 + \frac{0{,}06}{3}\right) + \frac{1}{2}\,0{,}24 \cdot 3 \cdot \left(0{,}95 - 0{,}137 - \frac{0{,}24}{3}\right)$$

$$= \underline{0{,}7667\ m^3}$$

Sección B:

$$M_E = 3{,}249 \cdot 0{,}285 \cdot \left(0{,}95 - 0{,}065 - \frac{0{,}285}{2}\right) + \frac{1}{2}\,3{,}249 \cdot 0{,}065 \left(0{,}95 - \frac{0{,}065 \cdot 2}{3}\right) + \frac{1}{2}\,0{,}749 \cdot 0{,}332 \cdot \left(0{,}95 - 0{,}35 - \frac{0{,}332}{3}\right)$$

$$= 0{,}6875 + 0{,}0957 + 0{,}06084 = \underline{0{,}8441\ m^3}$$

Sección F:

$$M_E = 2{,}843 \cdot 0{,}30 \cdot \left(1{,}5 - 0{,}15\right) + \frac{1}{2}\,0{,}343 \cdot 0{,}20 \cdot \left(1{,}5 - 0{,}30 - \frac{1}{3}\,0{,}20\right) =$$

$$1{,}1514 + 0{,}0389 = \underline{1{,}1903\ m^3}$$

Armadura: $A_{nec} = \dfrac{V_{rd\,um} \cdot M_E}{I} \cdot \dfrac{1}{4{,}2}\ cm^2/m$

SECCION A ⇒ 0,02674 Vrd cm^2/m

B ⇒ 0,02944 Vrd cm^2/m

F ⇒ 0,04151 Vrd cm^2/m

Tomando un valor medio por tramos:

	Vrd	(A)	(B)	(F)
Estribos	528/583	15.6 cm^2/m	17.2 cm^2/m	24.2 cm^2/m
2L/10 Estribo	303/363	9.7	10.7	15,1
2L/10 V. lateral	444/341	11.9	13,1	18.4
P. Lateral	1203/1157	32.2	35.4	49,9
2L/10 V intermedios	641	17.1	18.9	26.6
Pilas intermedias	1234	33.0	36.3	51.2

TORSION

Hipótesis de carga a tener en cuenta:

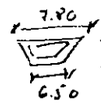
- Dos vías cargadas ripadas 30cm
- Una vía cargada ripada 30cm
- Viento → $0.2 \times (2.45 \times (0.95 - 1.225) + 0.70 \times (0.95+0.33) + 3.50 \times (0.95+1.75)$
  $= 1.94$ mt/m
- S. aceras → $0.75 \times 5.90 = 4.43$ mt/m

· Respecto a las almas hay que comparar para ver el estado mas desfavorable las acciones debidas a cortante y las debidas a torsión. Suponiendo una carga p t/m y por vía:

a) 2 vías cargadas: Fuerza por alma: $P \times \frac{33}{2} = 16.5\,P$

b) 1 vía cargada: Cortante 8,25 P fuerza por alma por cortante

Torsión $2.25\,P \times \frac{33}{2} = 37.125$ mt

Area resistente a torsión 

$A_e = 14,6\ m^2$

Flujo de fuerza por metro: $f = \frac{37.125}{14.6}\,P = 2.54\,P$

Longitud alma: 2.20 => fuerza por alma (por torsión) = $5,6\,P$ t

Total b) => $5,6 + 8.25 = 13,85\,P$

Para las almas es más desfavorable cargar las dos vías y para las cabezas superior e inferior cargar una sola vía.

SECCION DE APOYO

Maximas acciones en almas:

$$T_d = 1.6 \cdot \left[1.24 \times 24 \times 30 \times \frac{18}{33} \times 0.30 + 1.24 \times \frac{1.5}{33} \times 20 \times 3 \times 0.30 + \right.$$
$$\left. + 1.35 \times \frac{33}{2} + 4.43 \cdot \frac{33}{2} \right] = 1.6 \left[146,1 + 1,0 + 22.3 + 73 \right] = 388 \text{ mt}$$
$$242,5$$

A transversal: $\frac{388}{2 \times 14.6 \times 42} = 3.2\ cm^2/m$ $A_{long} = 3,0\ cm^2/m$

$T_{u1} = 0.36 \cdot \frac{3500}{1.5} \times 14.6 \times 0.54 = 6622$ mt $\quad \frac{T_d}{T_{u1}} = 0,06$

$\frac{V_{rd}}{V_{u1}} + \frac{T_d}{T_{u1}} < 1$ En el final de la rodilla $0.99 - \frac{0.99 - 0.6}{2.775} \times 1 = 0.86 = 0.14$

Máximas acciones en losas superior e inferior:

$$T_d = 1.6 \cdot \left[1.24 \times 12 \times 30 \times \frac{18}{33} \times 2.35 + 1.24 \times 10 \times 3 \times \frac{1.5}{33} \times 2.55 + (1.35 + 4.43) \cdot \frac{33}{2} \right] =$$
$$= 1.6 \cdot \left[621 + 4.3 + 22.3 + 73 \right] = 1153 \text{ mt}$$
$$720,5$$

$A_t = \frac{1153}{2 \times 14.6 \times 4.2} = 9.4\ cm^2/m$ $\quad A_l = 8.9\ cm^2/m$

$T_{u1} = 0.36 \cdot \frac{3500}{1.5} \times 14.6 \times 0.30 = 3679$ $\quad \frac{T_d}{T_{u1}} = 0.31$

SECCION A CUARTOS DE LUZ

Losa superior e inferior $T_d = 1.6 \cdot \left[1.24 \times 12 \times 21.25 \times 2.55 \times \frac{12.375}{33} + (1.35 + 4.43) \cdot \frac{12.37}{33} \right.$
$24.75 = 650$ mt $\quad A_t = 5.3\ cm^2/m$ $\quad A_l = 5.0\ cm^2/m$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 PUENTES CA-301
COSTILLA SOBRE PILAS

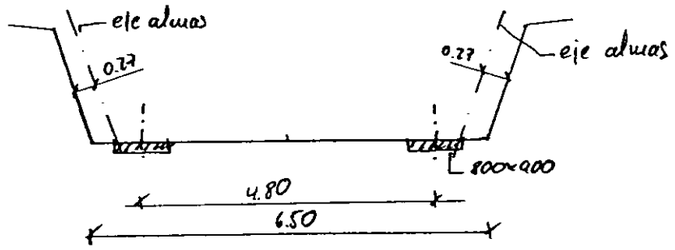
FECHA

HOJA N.° 15

COSTILLA SOBRE PILAS

Reacción en apoyos :

$$R_{max} = \frac{1}{2}\left(793.2 + 352.5 + 6.6 + 843.5 + 9.3\right) + \frac{485}{4.80} = 1104\,t$$



Tracción: $F = 1.6 \times 1104 \times 0.58 \times \frac{1}{2.30} = 445\,t \rightarrow 100\,cm^2$

PROYECTO L.A.V ZARAGOZA-LLEIDA
SUBTRAMO 1 PUENTES CA-301
COSTILLA SOBRE E. MOVIL

FECHA

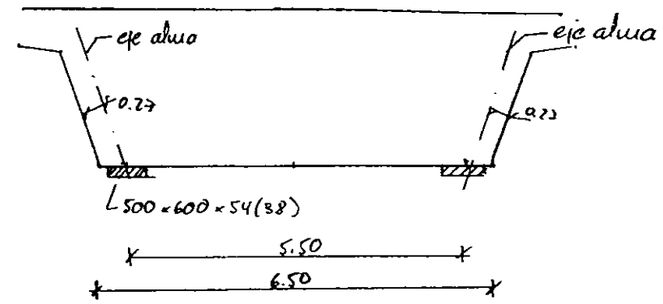
HOJA N.° 16

COSTILLA EN ESTRIBO MOVIL

Reacciones en estribo

$$R_{max} = \frac{1}{2}\left(284 + 108 + 25 + 298 + 67\right) + \frac{M_E}{5.50} = 427\,t$$

$$M_E = 1.24 \times 24 \times \frac{27}{2} \times 0.30 + \left(1.35 + 4.43\right) \times \frac{27}{2} = 199$$



Tracción en parte superior $F = 1.6 \cdot 427 \cdot \frac{1}{2.30} \cdot 0.23 = 68.3\,t \Rightarrow 16\,cm^2$

PROYECTO L.A.V ZARAGOZA - LLEIDA
SUBTRAMO 1. PUENTES CASAO E-5
COSTILLA APOYO EN ESTRIBO FIJO

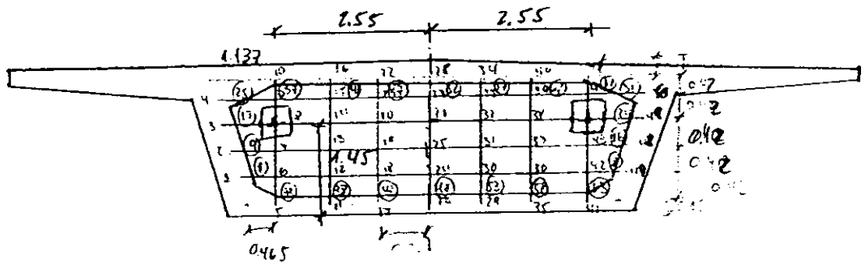
FECHA

HOJA N.º 17

COSTILLA APOYO EN ESTRIBO FIJO.

El tiro debido al frenado + deformaciones diferidas es de:

776.4 + 227,1 = 1004 t repartido en 2 puntos de cosido al estribo situados :



Para distribuir la armadura se usa malla electrosoldada

		x	y
Nudo	1	-3.5526	0.42
	2	-3.4182	0.84
	3	-3.2838	1.26
	4	-3.149	1.68

Barras horizontales → $I = \frac{1}{12} 0.42 \cdot 2^3 \rightarrow 0.280\ m^4$ $\quad I = 2I$

vertical: $I = \frac{1}{12} 0.85 \cdot 2^3 \rightarrow 0.567\ m^4$

Barras vertical (M | MT)$_{max}$ = 151 mt/m · 1.6 $\quad A_{nec} = 29\ cm^2/m$

horizontales $\quad 115$ mt/m · 1.6 $\quad A_{nec} = 22\ cm^2/m$

Cortante $\quad 240 \cdot 1.6 = 384$ t/m $\quad 103\ cm^2/m$

$V_{cu} = 310$ t/m

$A_{min} = 12.7\ cm^2/m$

COSTIE5 pag. 1

```
COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-5.
CONTROL
  50    67     6     1
:
NUDOS
    1       -3.1490       0.420
    2       -3.2838       0.840
    3       -3.4182       1.260
    4       -3.5526       1.680
    5       -2.550        0.000
    6       -2.550        0.420
    7       -2.550        0.840
    8       -2.550        1.260
    9       -2.550        1.680
   10       -2.550        2.100
   11       -1.700        0.000
   12       -1.700        0.420
   13       -1.700        0.840
   14       -1.700        1.260
   15       -1.700        1.680
   16       -1.700        2.100
   17       -0.850        0.000
   18       -0.850        0.420
   19       -0.850        0.840
   20       -0.850        1.260
   21       -0.850        1.680
   22       -0.850        2.100
   23        0.000        0.000
   24        0.000        0.420
   25        0.000        0.840
   26        0.000        1.260
   27        0.000        1.680
   28        0.000        2.100
   29        0.850        0.000
   30        0.850        0.420
   31        0.850        0.840
   32        0.850        1.260
   33        0.850        1.680
   34        0.850        2.100
   35        1.700        0.000
   36        1.700        0.420
   37        1.700        0.840
   38        1.700        1.260
   39        1.700        1.680
   40        1.700        2.100
   41        2.550        0.000
   42        2.550        0.420
   43        2.550        0.840
   44        2.550        1.260
   45        2.550        1.680
   46        2.550        2.100
   47        3.149        0.420
   48        3.2838       0.840
   49        3.4182       1.260
   50        3.5526       1.680
:
SECCIONES
2
  0.280000    0.560000     3500000     1500000
```

```
  0.567000   1.134000     3500000     1500000
:
BARRAS
   1    1    6    1
   2    6   12    1
   3   12   18    1
   4   18   24    1
   5   24   30    1
   6   30   36    1
   7   36   42    1
   8   42   47    1
   9    2    7    1
  10    7   13    1
  11   13   19    1
  12   19   25    1
  13   25   31    1
  14   31   37    1
  15   37   43    1
  16   43   48    1
  17    3    8    1
  18    8   14    1
  19   14   20    1
  20   20   26    1
  21   26   32    1
  22   32   38    1
  23   38   44    1
  24   44   49    1
  25    4    9    1
  26    9   15    1
  27   15   21    1
  28   21   27    1
  29   27   33    1
  30   33   39    1
  31   39   45    1
  32   45   50    1
  33    5    6    2
  34    6    7    2
  35    7    8    2
  36    8    9    2
  37    9   10    2
  38   11   12    2
  39   12   13    2
  40   13   14    2
  41   14   15    2
  42   15   16    2
  43   17   18    2
  44   18   19    2
  45   19   20    2
  46   20   21    2
  47   21   22    2
  48   23   24    2
  49   24   25    2
  50   25   26    2
  51   26   27    2
  52   27   28    2
  53   29   30    2
  54   30   31    2
  55   31   32    2
  56   32   33    2
```



```
  57   33   34    2
  58   35   36    2
  59   36   37    2
  60   37   38    2
  61   38   39    2
  62   39   40    2
  63   41   42    2
  64   42   43    2
  65   43   44    2
  66   44   45    2
  67   45   46    2
:
APOYOS
22
   1          0          0          1
   2          0          0          1
   3          0          0          1
   4          0          0          1
   5          0          0          1
  10          0          0          1
  11          0          0          1
  16          0          0          1
  17          0          0          1
  22          0          0          1
  23          0          0          1
  28          0          0          1
  29          0          0          1
  34          0          0          1
  35          0          0          1
  40          0          0          1
  41          0          0          1
  46          0          0          1
  47          0          0          1
  48          0          0          1
  49          0          0          1
  50          0          0          1
:
HIPOTESIS DE CARGA
H-1.TIRON DE 2X502.0 T. ARTICULADO
2
8  0 0 502
44 0 0 502
0
:
```

COSTILLA DE ESTRIBO L.A.V. ZARAGOZA-LLEIDA. SUBTRAMO-1. E-5.

Hip. n° 1 H-1.TIRON DE 2X502.0 T. ARTICULADO

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000017	0.000015	0.000000
2	-0.000012	0.000025	0.000000
3	0.000004	0.000026	0.000000
4	0.000021	0.000014	0.000000
5	-0.000018	0.000007	0.000000
6	-0.000017	0.000007	0.000007
7	-0.000012	0.000007	0.000014
8	0.000004	0.000005	0.000016
9	0.000021	0.000004	0.000011
10	0.000027	0.000004	0.000000
11	-0.000016	-0.000007	0.000000
12	-0.000013	-0.000007	0.000006
13	-0.000006	-0.000009	0.000011
14	0.000004	-0.000010	0.000011
15	0.000014	-0.000008	0.000007
16	0.000018	-0.000008	0.000000
17	-0.000005	-0.000004	0.000000
18	-0.000005	-0.000004	0.000002
19	-0.000002	-0.000005	0.000004
20	0.000002	-0.000005	0.000004
21	0.000005	-0.000004	0.000002
22	0.000005	-0.000004	0.000000
23	-0.000001	-0.000000	-0.000000
24	-0.000002	-0.000000	0.000001
25	-0.000001	-0.000000	0.000001
26	0.000001	-0.000000	0.000001
27	0.000002	-0.000000	0.000001
28	0.000001	-0.000000	-0.000000
29	-0.000005	0.000004	0.000000
30	-0.000005	0.000004	0.000002
31	-0.000002	0.000005	0.000004
32	0.000002	0.000005	0.000004
33	0.000005	0.000004	0.000002
34	0.000005	0.000004	0.000000
35	-0.000016	0.000007	0.000000
36	-0.000013	0.000007	0.000006
37	-0.000006	0.000009	0.000011
38	0.000004	0.000010	0.000011
39	0.000014	0.000008	0.000007
40	0.000018	0.000008	0.000000
41	-0.000018	-0.000007	0.000000
42	-0.000017	-0.000007	0.000007
43	-0.000012	-0.000007	0.000014
44	0.000004	-0.000005	0.000016
45	0.000021	-0.000004	0.000011
46	0.000027	-0.000004	0.000000
47	-0.000017	-0.000015	0.000000
48	-0.000012	-0.000025	0.000000
49	0.000004	-0.000026	0.000000
50	0.000021	-0.000014	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	0.00	-0.00	43.79
2	0.00	-0.00	64.94
3	0.00	-0.00	52.95
4	0.00	0.00	20.28
5	0.00	0.00	19.48
10	-0.00	0.00	124.68
11	0.00	0.00	72.10
16	-0.00	0.00	86.07
17	-0.00	0.00	12.70
22	0.00	0.00	10.63
23	-0.00	0.00	-5.45
28	0.00	-0.00	-5.82
29	0.00	0.00	12.70
34	0.00	0.00	10.63
35	0.00	0.00	72.10
40	-0.00	0.00	86.07
41	0.00	0.00	19.48
46	0.00	0.00	124.68
47	-0.00	0.00	43.79
48	-0.00	-0.00	64.94
49	0.00	-0.00	52.95
50	0.00	-0.00	20.28

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	1	0.00	-0.00	43.79
	6	0.00	26.23	43.79
2	6	3.98	26.29	-24.76
	12	3.98	5.25	-24.76
3	12	8.36	-4.62	4.19
	18	8.36	-1.06	4.19
4	18	3.00	-6.58	4.44
	24	3.00	-2.81	4.44
5	24	-3.00	-2.81	-4.44
	30	-3.00	-6.58	-4.44
6	30	-8.36	-1.06	-4.19
	36	-8.36	-4.62	-4.19
7	36	-3.98	5.25	24.76
	42	-3.98	26.29	24.76
8	42	-0.00	26.23	-43.79
	47	-0.00	-0.00	-43.79
9	2	0.00	-0.00	64.94
	7	0.00	47.66	64.94
10	7	6.55	40.10	-50.59
	13	6.55	-2.91	-50.59
11	13	3.83	2.84	-16.28
	19	3.83	-11.00	-16.28
12	19	1.14	-5.50	-1.81
	25	1.14	-7.04	-1.81
13	25	-1.14	-7.04	1.81
	31	-1.14	-5.50	1.81
14	31	-3.83	-11.00	16.28
	37	-3.83	2.84	16.28
15	37	-6.55	-2.91	50.59
	43	-6.55	40.10	50.59
16	43	-0.00	47.66	-64.94

	48	-0.00	0.00	-64.94
17	3	0.00	-0.00	52.95
	8	0.00	45.97	52.95
18	8	0.54	46.40	-67.69
	14	0.54	-11.13	-67.69
19	14	-2.54	0.64	-13.85
	20	-2.54	-11.13	-13.85
20	20	-1.13	-5.56	-1.68
	26	-1.13	-6.99	-1.68
21	26	1.13	-6.99	1.68
	32	1.13	-5.56	1.68
22	32	2.54	-11.13	13.85
	38	2.54	0.64	13.85
23	38	-0.54	-11.13	67.69
	44	-0.54	46.40	67.69
24	44	0.00	45.97	-52.95
	49	0.00	0.00	-52.95
25	4	0.00	0.00	20.28
	9	0.00	20.34	20.28
26	9	-7.45	27.40	-32.82
	15	-7.45	-0.50	-32.82
27	15	-8.96	-8.15	8.24
	21	-8.96	-1.14	8.24
28	21	-3.02	-6.69	4.68
	27	-3.02	-2.71	4.68
29	27	3.02	-2.71	-4.68
	33	3.02	-6.69	-4.68
30	33	8.96	-1.14	-8.24
	39	8.96	-8.15	-8.24
31	39	7.45	-0.50	32.83
	45	7.45	27.40	32.83
32	45	0.00	20.34	-20.28
	50	0.00	0.00	-20.28
33	5	0.00	-0.00	19.48
	6	0.00	8.18	19.48
34	6	0.06	4.20	88.04
	7	0.06	41.18	88.04
35	7	-7.50	34.62	203.57
	8	-7.50	120.13	203.57
36	8	-7.06	119.59	-177.79
	9	-7.06	44.92	-177.79
37	9	0.00	52.37	-124.68
	10	0.00	-0.00	-124.68
38	11	0.00	-0.00	72.10
	12	0.00	30.28	72.10
39	12	-9.87	25.91	43.15
	13	-9.87	44.03	43.15
40	13	-4.12	46.76	8.84
	14	-4.12	50.47	8.84
41	14	7.65	53.54	-45.00
	15	7.65	34.64	-45.00
42	15	0.00	36.15	-86.07
	16	0.00	-0.00	-86.07
43	17	0.00	0.00	12.70
	18	0.00	5.34	12.70
44	18	-5.52	10.70	12.45
	19	-5.52	15.93	12.45
45	19	-0.03	18.62	-2.02
	20	-0.03	17.77	-2.02

46	20	5.54	16.36	-14.19
	21	5.54	10.40	-14.19
47	21	0.00	4.46	-10.63
	22	0.00	0.00	-10.63
48	23	0.00	0.00	-5.45
	24	0.00	-2.29	-5.45
49	24	-0.00	3.70	3.43
	25	-0.00	5.14	3.43
50	25	-0.00	7.41	-0.18
	26	-0.00	7.34	-0.18
51	26	0.00	5.08	-3.54
	27	0.00	3.59	-3.54
52	27	-0.00	-2.44	5.82
	28	-0.00	0.00	5.82
53	29	0.00	-0.00	12.70
	30	0.00	5.34	12.70
54	30	5.52	10.70	12.45
	31	5.52	15.93	12.45
55	31	0.03	18.62	-2.02
	32	0.03	17.77	-2.02
56	32	-5.54	16.36	-14.19
	33	-5.54	10.40	-14.19
57	33	0.00	4.46	-10.63
	34	0.00	0.00	-10.63
58	35	0.00	-0.00	72.10
	36	0.00	30.28	72.10
59	36	9.87	25.91	43.15
	37	9.87	44.03	43.15
60	37	4.12	46.76	8.84
	38	4.12	50.47	8.84
61	38	-7.65	53.54	-45.00
	39	-7.65	34.64	-45.00
62	39	0.00	36.15	-86.07
	40	0.00	-0.00	-86.07
63	41	0.00	0.00	19.48
	42	0.00	8.18	19.48
64	42	-0.06	4.20	88.04
	43	-0.06	41.18	88.04
65	43	7.50	34.63	203.57
	44	7.50	120.13	203.57
66	44	7.06	119.59	-177.79
	45	7.06	44.92	-177.79
67	45	0.00	52.37	-124.68
	46	0.00	0.00	-124.68

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 1. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	-----Y----	----P----
1	-0.8500	2.1120	-0.24937
2	1.1500	1.6132	-0.24937
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	32.0000	2.2100	-0.32700
7	33.2500	2.1400	-0.12000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	-----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	2.112	0.000	-0.2494	0.0000
2	0.000	1.900	0.000	-0.2494	0.0000
3	1.000	1.651	0.000	-0.2494	0.0000
4	2.000	1.411	0.000	-0.2274	0.0000
5	3.000	1.196	0.000	-0.2016	0.0000
6	4.000	1.007	0.000	-0.1757	0.0000
7	5.000	0.845	0.000	-0.1499	0.0000
8	6.000	0.708	0.000	-0.1240	0.0000
9	7.000	0.597	0.000	-0.0982	0.0000
10	8.000	0.511	0.000	-0.0724	0.0000
11	9.000	0.452	0.000	-0.0465	0.0000
12	10.000	0.418	0.000	-0.0207	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.262	0.000	0.0916	0.0000
31	29.000	2.367	0.000	0.1046	0.0000
32	30.000	2.445	0.000	0.0392	0.0000
33	31.000	2.419	0.000	-0.1046	0.0000
34	32.000	2.210	0.000	-0.3270	0.0000
35	33.000	2.153	0.000	-0.0006	0.0000
36	34.000	2.050	0.000	-0.1200	0.0000
37	35.000	1.930	0.000	-0.1200	0.0000
38	35.250	1.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	556.94	138.89
2	0.000	0.0000	0.0000	0.0000	573.38	556.34	138.76
3	1.000	0.0000	0.0000	0.0000	572.66	555.64	138.57
4	2.000	0.0208	0.0000	0.0208	569.45	555.28	126.27
5	3.000	0.0455	0.0000	0.0455	565.79	554.64	111.79
6	4.000	0.0704	0.0000	0.0704	562.13	553.64	97.29
7	5.000	0.0956	0.0000	0.0956	558.46	552.29	82.78
8	6.000	0.1210	0.0000	0.1210	554.79	550.57	68.29
9	7.000	0.1465	0.0000	0.1465	551.13	548.49	53.86
10	8.000	0.1722	0.0000	0.1722	547.48	546.05	39.51
11	9.000	0.1979	0.0000	0.1979	543.84	543.25	25.27
12	10.000	0.2237	0.0000	0.2237	540.22	540.11	11.17
13	11.000	0.2477	0.0000	0.2477	536.83	536.83	-1.77
14	12.000	0.2641	0.0000	0.2641	534.31	534.20	-10.55
15	13.000	0.2806	0.0000	0.2806	531.79	531.45	-19.25
16	14.000	0.2970	0.0000	0.2970	529.29	528.56	-27.84
17	15.000	0.3134	0.0000	0.3134	526.81	525.56	-36.34
18	16.000	0.3298	0.0000	0.3298	524.34	522.43	-44.72
19	17.000	0.3461	0.0000	0.3461	521.89	519.19	-52.99
20	18.000	0.3624	0.0000	0.3624	519.46	515.85	-61.14
21	19.000	0.3786	0.0000	0.3786	517.04	512.39	-69.16
22	20.000	0.3947	0.0000	0.3947	514.64	508.84	-77.06
23	21.000	0.4107	0.0000	0.4107	512.27	505.19	-84.82
24	22.000	0.4267	0.0000	0.4267	509.91	501.46	-92.45
25	23.000	0.4426	0.0000	0.4426	507.57	497.64	-99.94
26	24.000	0.4583	0.0000	0.4583	505.26	493.74	-107.28
27	25.000	0.5186	0.0000	0.5186	498.28	491.66	-80.93
28	26.000	0.5948	0.0000	0.5948	500.73	499.05	-41.07
29	27.000	0.5127	0.0000	0.5127	510.09	510.09	-0.00
30	28.000	0.6040	0.0000	0.6040	501.03	498.94	-45.68
31	29.000	0.6169	0.0000	0.6169	500.30	497.58	-52.07
32	30.000	0.5519	0.0000	0.5519	507.82	507.43	-19.91
33	31.000	0.4084	0.0000	0.4084	524.01	521.17	54.53
34	32.000	0.1966	0.0000	0.1966	548.53	521.37	170.49
35	33.000	0.1188	0.0000	0.1188	558.27	558.27	0.33
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 258.9 mm. Retesado = 9.6 mm.
larg. tesado ext. final = 239.7 mm. Retesado = 28.8 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----p----
1	-0.8500	1.5410	-0.16569
2	1.1500	1.2090	-0.16569
3	10.8000	0.4100	0.00000
4	24.3000	1.9100	0.22222
5	27.0000	2.2100	0.00000
6	33.2500	1.7400	-0.17000
7	35.2500	1.4000	-0.17000
8	35.2500	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----p----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.541	0.000	-0.1657	0.0000
2	0.000	1.400	0.000	-0.1661	0.0000
3	1.000	1.234	0.000	-0.1658	0.0000
4	2.000	1.074	0.000	-0.1511	0.0000
5	3.000	0.932	0.000	-0.1339	0.0000
6	4.000	0.807	0.000	-0.1167	0.0000
7	5.000	0.699	0.000	-0.0995	0.0000
8	6.000	0.608	0.000	-0.0823	0.0000
9	7.000	0.534	0.000	-0.0652	0.0000
10	8.000	0.477	0.000	-0.0480	0.0000
11	9.000	0.438	0.000	-0.0309	0.0000
12	10.000	0.415	0.000	-0.0137	0.0000
13	11.000	0.410	0.000	0.0033	0.0000
14	12.000	0.422	0.000	0.0198	0.0000
15	13.000	0.450	0.000	0.0362	0.0000
16	14.000	0.494	0.000	0.0527	0.0000
17	15.000	0.555	0.000	0.0691	0.0000
18	16.000	0.633	0.000	0.0856	0.0000
19	17.000	0.726	0.000	0.1021	0.0000
20	18.000	0.837	0.000	0.1185	0.0000
21	19.000	0.963	0.000	0.1350	0.0000
22	20.000	1.107	0.000	0.1514	0.0000
23	21.000	1.266	0.000	0.1679	0.0000
24	22.000	1.442	0.000	0.1844	0.0000
25	23.000	1.635	0.000	0.2008	0.0000
26	24.000	1.844	0.000	0.2173	0.0000
27	25.000	2.045	0.000	0.1646	0.0000
28	26.000	2.169	0.000	0.0823	0.0000
29	27.000	2.210	0.000	0.0000	0.0000
30	28.000	2.201	0.000	-0.0193	0.0000
31	29.000	2.170	0.000	-0.0416	0.0000
32	30.000	2.116	0.000	-0.0669	0.0000
33	31.000	2.036	0.000	-0.0953	0.0000
34	32.000	1.925	0.000	-0.1266	0.0000
35	33.000	1.781	0.000	-0.1609	0.0000
36	34.000	1.613	0.000	-0.1700	0.0000
37	35.000	1.442	0.000	-0.1700	0.0000
38	35.250	1.400	0.000	-0.1700	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	566.28	93.83
2	0.000	0.0004	0.0000	0.0004	573.33	565.58	93.97
3	1.000	0.0001	0.0000	0.0001	572.65	564.93	93.68
4	2.000	0.0143	0.0000	0.0143	570.23	563.83	85.18
5	3.000	0.0311	0.0000	0.0311	567.50	562.48	75.31
6	4.000	0.0480	0.0000	0.0480	564.78	560.97	65.46
7	5.000	0.0650	0.0000	0.0650	562.06	559.30	55.66
8	6.000	0.0820	0.0000	0.0820	559.35	557.46	45.90
9	7.000	0.0991	0.0000	0.0991	556.64	555.46	36.20
10	8.000	0.1162	0.0000	0.1162	553.95	553.31	26.57
11	9.000	0.1333	0.0000	0.1333	551.27	551.00	17.01
12	10.000	0.1505	0.0000	0.1505	548.59	548.54	7.52
13	11.000	0.1675	0.0000	0.1675	545.95	545.95	-1.80
14	12.000	0.1839	0.0000	0.1839	543.38	543.27	-10.73
15	13.000	0.2004	0.0000	0.2004	540.82	540.47	-19.57
16	14.000	0.2168	0.0000	0.2168	538.28	537.54	-28.32
17	15.000	0.2332	0.0000	0.2332	535.76	534.48	-36.95
18	16.000	0.2496	0.0000	0.2496	533.25	531.30	-45.48
19	17.000	0.2659	0.0000	0.2659	530.75	528.01	-53.89
20	18.000	0.2822	0.0000	0.2822	528.28	524.61	-62.18
21	19.000	0.2984	0.0000	0.2984	525.82	521.10	-70.34
22	20.000	0.3145	0.0000	0.3145	523.38	517.48	-78.37
23	21.000	0.3305	0.0000	0.3305	520.97	513.77	-86.26
24	22.000	0.3465	0.0000	0.3465	518.57	509.97	-94.02
25	23.000	0.3624	0.0000	0.3624	516.19	506.09	-101.63
26	24.000	0.4407	0.0000	0.4407	515.89	504.13	-109.54
27	25.000	0.3805	0.0000	0.3805	523.12	516.17	-84.97
28	26.000	0.2995	0.0000	0.2995	532.77	530.97	-43.70
29	27.000	0.2174	0.0000	0.2174	542.72	542.72	-0.00
30	28.000	0.1981	0.0000	0.1981	545.61	545.51	10.53
31	29.000	0.1758	0.0000	0.1758	548.86	548.39	22.82
32	30.000	0.1505	0.0000	0.1505	552.47	551.24	36.89
33	31.000	0.1224	0.0000	0.1224	556.45	553.94	52.76
34	32.000	0.0914	0.0000	0.0914	560.78	556.34	70.43
35	33.000	0.0578	0.0000	0.0578	565.47	558.29	89.85
36	34.000	0.0490	0.0000	0.0490	567.23	559.21	95.07
37	35.000	0.0490	0.0000	0.0490	567.95	559.92	95.19
38	35.250	0.0490	0.0000	0.0490	568.13	560.09	95.22

Alarg. tesado ext. inicial = 264.2 mm. Retesado = 10.4 mm.
Larg. tesado ext. final = 254.6 mm. Retesado = 20.0 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	1.0010	-0.11883
2	1.1500	0.7630	-0.11883
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.9500	1.5110	-0.18190
7	33.2500	1.1400	-0.12000
8	35.2500	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	1.001	0.000	-0.1188	0.0000
2	0.000	0.900	0.000	-0.1191	0.0000
3	1.000	0.781	0.000	-0.1189	0.0000
4	2.000	0.666	0.000	-0.1083	0.0000
5	3.000	0.564	0.000	-0.0960	0.0000
6	4.000	0.474	0.000	-0.0837	0.0000
7	5.000	0.397	0.000	-0.0714	0.0000
8	6.000	0.332	0.000	-0.0591	0.0000
9	7.000	0.279	0.000	-0.0467	0.0000
10	8.000	0.238	0.000	-0.0344	0.0000
11	9.000	0.210	0.000	-0.0221	0.0000
12	10.000	0.194	0.000	-0.0098	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.948	0.000	-0.0804	0.0000
31	29.000	1.837	0.000	-0.1376	0.0000
32	30.000	1.680	0.000	-0.1714	0.0000
33	31.000	1.502	0.000	-0.1819	0.0000
34	32.000	1.324	0.000	-0.1691	0.0000
35	33.000	1.172	0.000	-0.1327	0.0000
36	34.000	1.050	0.000	-0.1200	0.0000
37	35.000	0.930	0.000	-0.1200	0.0000
38	35.250	0.900	0.000	-0.1200	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	569.99	67.73
2	0.000	0.0002	0.0000	0.0002	573.36	569.33	67.80
3	1.000	0.0000	0.0000	0.0000	572.66	568.65	67.61
4	2.000	0.0104	0.0000	0.0104	570.70	567.38	61.47
5	3.000	0.0226	0.0000	0.0226	568.52	565.92	54.34
6	4.000	0.0348	0.0000	0.0348	566.35	564.38	47.23
7	5.000	0.0470	0.0000	0.0470	564.19	562.75	40.16
8	6.000	0.0593	0.0000	0.0593	562.03	561.05	33.13
9	7.000	0.0716	0.0000	0.0716	559.87	559.26	26.14
10	8.000	0.0839	0.0000	0.0839	557.73	557.40	19.19
11	9.000	0.0961	0.0000	0.0961	555.59	555.45	12.29
12	10.000	0.1084	0.0000	0.1084	553.46	553.43	5.44
13	11.000	0.1216	0.0000	0.1216	551.24	551.24	-1.81
14	12.000	0.1380	0.0000	0.1380	548.65	548.54	-10.84
15	13.000	0.1545	0.0000	0.1545	546.07	545.71	-19.76
16	14.000	0.1709	0.0000	0.1709	543.50	542.75	-28.59
17	15.000	0.1873	0.0000	0.1873	540.95	539.66	-37.31
18	16.000	0.2037	0.0000	0.2037	538.41	536.45	-45.92
19	17.000	0.2200	0.0000	0.2200	535.90	533.13	-54.41
20	18.000	0.2362	0.0000	0.2362	533.40	529.69	-62.78
21	19.000	0.2524	0.0000	0.2524	530.92	526.15	-71.02
22	20.000	0.2686	0.0000	0.2686	528.46	522.50	-79.13
23	21.000	0.2846	0.0000	0.2846	526.01	518.75	-87.10
24	22.000	0.3006	0.0000	0.3006	523.59	514.92	-94.93
25	23.000	0.3165	0.0000	0.3165	521.19	510.99	-102.62
26	24.000	0.3322	0.0000	0.3322	518.82	506.99	-110.16
27	25.000	0.4036	0.0000	0.4036	520.59	513.68	-84.56
28	26.000	0.3226	0.0000	0.3226	530.19	528.40	-43.49
29	27.000	0.2404	0.0000	0.2404	540.09	540.09	-0.00
30	28.000	0.1602	0.0000	0.1602	549.97	548.20	44.10
31	29.000	0.1037	0.0000	0.1037	557.23	552.03	75.94
32	30.000	0.0707	0.0000	0.0707	561.81	553.74	94.90
33	31.000	0.0605	0.0000	0.0605	563.73	554.63	100.87
34	32.000	0.0480	0.0000	0.0480	565.92	558.00	94.33
35	33.000	0.0125	0.0000	0.0125	570.87	565.90	75.12
36	34.000	0.0000	0.0000	0.0000	573.10	569.01	68.28
37	35.000	0.0000	0.0000	0.0000	573.82	569.73	68.37
38	35.250	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alarg. tesado ext. inicial = 265.4 mm. Retesado = 11.1 mm.
Larg. tesado ext. final = 254.8 mm. Retesado = 21.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE 1.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	-0.8500	0.4299	-0.03515
2	1.1500	0.3596	-0.03515
3	10.8000	0.1900	0.00000
4	24.3000	1.6900	0.22222
5	27.0000	1.9900	0.00000
6	30.3500	1.2590	-0.32700
7	33.2500	0.5500	-0.08000
8	35.2500	0.3900	-0.08000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	-0.8500	0.0000	0.00000
2	35.2500	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	0

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	-0.850	0.430	0.000	-0.0352	0.0000
2	0.000	0.400	0.000	-0.0352	0.0000
3	1.000	0.365	0.000	-0.0352	0.0000
4	2.000	0.331	0.000	-0.0321	0.0000
5	3.000	0.301	0.000	-0.0284	0.0000
6	4.000	0.274	0.000	-0.0248	0.0000
7	5.000	0.251	0.000	-0.0211	0.0000
8	6.000	0.232	0.000	-0.0175	0.0000
9	7.000	0.216	0.000	-0.0138	0.0000
10	8.000	0.204	0.000	-0.0102	0.0000
11	9.000	0.196	0.000	-0.0066	0.0000
12	10.000	0.191	0.000	-0.0029	0.0000
13	11.000	0.190	0.000	0.0033	0.0000
14	12.000	0.202	0.000	0.0198	0.0000
15	13.000	0.230	0.000	0.0362	0.0000
16	14.000	0.274	0.000	0.0527	0.0000
17	15.000	0.335	0.000	0.0691	0.0000
18	16.000	0.413	0.000	0.0856	0.0000
19	17.000	0.506	0.000	0.1021	0.0000
20	18.000	0.617	0.000	0.1185	0.0000
21	19.000	0.743	0.000	0.1350	0.0000
22	20.000	0.887	0.000	0.1514	0.0000
23	21.000	1.046	0.000	0.1679	0.0000
24	22.000	1.222	0.000	0.1844	0.0000
25	23.000	1.415	0.000	0.2008	0.0000
26	24.000	1.624	0.000	0.2173	0.0000
27	25.000	1.825	0.000	0.1646	0.0000
28	26.000	1.949	0.000	0.0823	0.0000
29	27.000	1.990	0.000	0.0000	0.0000
30	28.000	1.902	0.000	-0.1663	0.0000
31	29.000	1.677	0.000	-0.2742	0.0000
32	30.000	1.373	0.000	-0.3235	0.0000
33	31.000	1.049	0.000	-0.3144	0.0000
34	32.000	0.764	0.000	-0.2468	0.0000
35	33.000	0.575	0.000	-0.1207	0.0000
36	34.000	0.490	0.000	-0.0800	0.0000
37	35.000	0.410	0.000	-0.0800	0.0000
38	35.250	0.390	0.000	-0.0800	0.0000

Cables tesados desde ambos extremos.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	-0.850	0.0000	0.0000	0.0000	574.00	573.65	20.16
2	0.000	0.0000	0.0000	0.0000	573.39	573.03	20.14
3	1.000	0.0000	0.0000	0.0000	572.66	572.31	20.12
4	2.000	0.0031	0.0000	0.0031	571.57	571.28	18.31
5	3.000	0.0067	0.0000	0.0067	570.42	570.19	16.20
6	4.000	0.0104	0.0000	0.0104	569.26	569.09	14.10
7	5.000	0.0140	0.0000	0.0140	568.11	567.98	12.00
8	6.000	0.0177	0.0000	0.0177	566.96	566.87	9.91
9	7.000	0.0213	0.0000	0.0213	565.81	565.76	7.83
10	8.000	0.0249	0.0000	0.0249	564.67	564.64	5.76
11	9.000	0.0286	0.0000	0.0286	563.53	563.52	3.69
12	10.000	0.0322	0.0000	0.0322	562.39	562.39	1.64
13	11.000	0.0384	0.0000	0.0384	560.95	560.95	-1.85
14	12.000	0.0549	0.0000	0.0549	558.31	558.20	-11.03
15	13.000	0.0713	0.0000	0.0713	555.68	555.32	-20.11
16	14.000	0.0878	0.0000	0.0878	553.07	552.31	-29.09
17	15.000	0.1042	0.0000	0.1042	550.48	549.17	-37.97
18	16.000	0.1205	0.0000	0.1205	547.90	545.90	-46.73
19	17.000	0.1368	0.0000	0.1368	545.34	542.52	-55.37
20	18.000	0.1531	0.0000	0.1531	542.79	539.02	-63.88
21	19.000	0.1693	0.0000	0.1693	540.27	535.41	-72.27
22	20.000	0.1854	0.0000	0.1854	537.76	531.70	-80.52
23	21.000	0.2015	0.0000	0.2015	535.28	527.89	-88.63
24	22.000	0.2174	0.0000	0.2174	532.81	523.98	-96.60
25	23.000	0.2333	0.0000	0.2333	530.37	519.99	-104.43
26	24.000	0.2491	0.0000	0.2491	527.95	515.92	-112.10
27	25.000	0.3093	0.0000	0.3093	520.66	513.75	-84.57
28	26.000	0.3903	0.0000	0.3903	511.23	509.51	-41.94
29	27.000	0.5522	0.0000	0.5522	505.86	505.86	-0.00
30	28.000	0.3874	0.0000	0.3874	524.34	517.23	86.04
31	29.000	0.2846	0.0000	0.2846	536.45	517.36	141.86
32	30.000	0.2393	0.0000	0.2393	542.26	515.93	166.93
33	31.000	0.2248	0.0000	0.2248	544.61	519.54	163.34
34	32.000	0.1621	0.0000	0.1621	552.52	536.43	132.37
35	33.000	0.0403	0.0000	0.0403	567.56	563.47	67.99
36	34.000	0.0000	0.0000	0.0000	573.10	571.27	45.70
37	35.000	0.0000	0.0000	0.0000	573.82	571.99	45.76
38	35.250	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alarg. tesado ext. inicial = 267.0 mm. Retesado = 9.8 mm.
Alarg. tesado ext. final = 241.8 mm. Retesado = 35.0 mm.

N° de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.7000	1.0570	-0.27428
4	8.2500	0.4100	0.00000
5	21.4500	1.9100	0.22222
6	24.7500	2.2100	0.00000
7	29.7500	2.2100	-0.32700
8	31.0000	2.1400	-0.12000
9	33.0000	1.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.490	0.000	-0.2138	0.0000
5	4.000	1.247	0.000	-0.2645	0.0000
6	5.000	0.975	0.000	-0.2720	0.0000
7	6.000	0.717	0.000	-0.2367	0.0000
8	7.000	0.516	0.000	-0.1583	0.0000
9	8.000	0.415	0.000	-0.0370	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
20	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.214	0.000	0.0302	0.0000
27	26.000	2.287	0.000	0.1022	0.0000
28	27.000	2.392	0.000	0.0956	0.0000
29	28.000	2.452	0.000	0.0106	0.0000
30	29.000	2.387	0.000	-0.1529	0.0000
31	30.000	2.155	0.000	-0.1248	0.0000
32	31.000	2.140	0.000	-0.1200	0.0000
33	32.000	2.020	0.000	-0.1200	0.0000
34	33.000	1.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	1.3659	0.0000	1.3659	413.31	410.37	49.24
2	1.000	1.3659	0.0000	1.3659	413.83	410.88	49.31
3	2.000	1.3659	0.0000	1.3659	414.35	411.40	49.37
4	3.000	1.2748	0.0000	1.2748	422.90	413.55	88.41
5	4.000	1.2268	0.0000	1.2268	427.71	413.50	109.35
6	5.000	1.2156	0.0000	1.2156	429.26	414.21	112.68
7	6.000	1.1824	0.0000	1.1824	432.82	421.18	99.68
8	7.000	1.1070	0.0000	1.1070	440.27	434.86	68.85
9	8.000	0.9870	0.0000	0.9870	452.08	451.77	16.73
10	9.000	0.9365	0.0000	0.9365	457.47	457.43	-6.15
11	10.000	0.9188	0.0000	0.9188	459.76	459.54	-14.34
12	11.000	0.9012	0.0000	0.9012	462.04	461.49	-22.52
13	12.000	0.8839	0.0000	0.8839	464.31	463.30	-30.68
14	13.000	0.8667	0.0000	0.8667	466.57	464.96	-38.80
15	14.000	0.8498	0.0000	0.8498	468.83	466.48	-46.89
16	15.000	0.8331	0.0000	0.8331	471.07	467.85	-54.94
17	16.000	0.8166	0.0000	0.8166	473.29	469.09	-62.93
18	17.000	0.8004	0.0000	0.8004	475.51	470.20	-70.86
19	18.000	0.7844	0.0000	0.7844	477.71	471.18	-78.72
20	19.000	0.7687	0.0000	0.7687	479.89	472.03	-86.51
21	20.000	0.7533	0.0000	0.7533	482.06	472.76	-94.22
22	21.000	0.7381	0.0000	0.7381	484.21	473.38	-101.84
23	22.000	0.6794	0.0000	0.6794	490.83	484.01	-81.48
24	23.000	0.6001	0.0000	0.6001	499.70	497.79	-43.63
25	24.000	0.5419	0.0000	0.5419	506.49	506.27	-14.79
26	25.000	0.5429	0.0000	0.5429	507.02	506.78	-15.33
27	26.000	0.6145	0.0000	0.6145	500.08	497.49	-50.84
28	27.000	0.6080	0.0000	0.6080	501.39	499.11	-47.74
29	28.000	0.5233	0.0000	0.5233	511.04	511.01	-5.43
30	29.000	0.3610	0.0000	0.3610	529.42	523.34	80.00
31	30.000	0.0047	0.0000	0.0047	571.27	566.87	70.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 220.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE 2.

N° de puntos singulares en alzado = 7

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	8.2500	0.4100	0.00000
4	21.4500	1.9100	0.22222
5	24.7500	2.2100	0.00000
6	31.0000	1.7400	-0.17000
7	33.0000	1.4000	-0.17000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.895	0.000	-0.1581	0.0000
5	4.000	0.746	0.000	-0.1404	0.0000
6	5.000	0.617	0.000	-0.1169	0.0000
7	6.000	0.514	0.000	-0.0875	0.0000
8	7.000	0.444	0.000	-0.0522	0.0000
9	8.000	0.411	0.000	-0.0112	0.0000
10	9.000	0.415	0.000	0.0134	0.0000
11	10.000	0.437	0.000	0.0312	0.0000
12	11.000	0.477	0.000	0.0488	0.0000
13	12.000	0.535	0.000	0.0662	0.0000
14	13.000	0.610	0.000	0.0835	0.0000
15	14.000	0.702	0.000	0.1005	0.0000
16	15.000	0.811	0.000	0.1174	0.0000
17	16.000	0.937	0.000	0.1341	0.0000
18	17.000	1.079	0.000	0.1507	0.0000
19	18.000	1.238	0.000	0.1671	0.0000
20	19.000	1.413	0.000	0.1833	0.0000
21	20.000	1.604	0.000	0.1993	0.0000
22	21.000	1.812	0.000	0.2151	0.0000
23	22.000	2.017	0.000	0.1683	0.0000
24	23.000	2.143	0.000	0.0877	0.0000
25	24.000	2.200	0.000	0.0292	0.0000
26	25.000	2.209	0.000	-0.0045	0.0000
27	26.000	2.195	0.000	-0.0246	0.0000
28	27.000	2.159	0.000	-0.0477	0.0000
29	28.000	2.099	0.000	-0.0737	0.0000
30	29.000	2.011	0.000	-0.1028	0.0000
31	30.000	1.892	0.000	-0.1349	0.0000
32	31.000	1.740	0.000	-0.1700	0.0000
33	32.000	1.570	0.000	-0.1700	0.0000
34	33.000	1.400	0.000	-0.1700	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.7741	0.0000	0.7741	468.01	461.39	78.44
2	1.000	0.7741	0.0000	0.7741	468.60	461.97	78.53
3	2.000	0.7741	0.0000	0.7741	469.19	462.55	78.63
4	3.000	0.7625	0.0000	0.7625	470.92	465.14	73.55
5	4.000	0.7452	0.0000	0.7452	473.24	468.64	65.80
6	5.000	0.7221	0.0000	0.7221	476.14	472.93	55.26
7	6.000	0.6930	0.0000	0.6930	479.66	477.84	41.79
8	7.000	0.6579	0.0000	0.6579	483.82	483.16	25.24
9	8.000	0.6169	0.0000	0.6169	488.62	488.59	5.46
10	9.000	0.5923	0.0000	0.5923	491.77	491.72	-6.61
11	10.000	0.5745	0.0000	0.5745	494.23	493.99	-15.41
12	11.000	0.5570	0.0000	0.5570	496.68	496.09	-24.21
13	12.000	0.5396	0.0000	0.5396	499.12	498.03	-32.98
14	13.000	0.5225	0.0000	0.5225	501.55	499.82	-41.71
15	14.000	0.5055	0.0000	0.5055	503.98	501.45	-50.41
16	15.000	0.4888	0.0000	0.4888	506.38	502.93	-59.06
17	16.000	0.4724	0.0000	0.4724	508.78	504.26	-67.64
18	17.000	0.4562	0.0000	0.4562	511.16	505.45	-76.17
19	18.000	0.4402	0.0000	0.4402	513.52	506.50	-84.62
20	19.000	0.4245	0.0000	0.4245	515.87	507.42	-92.99
21	20.000	0.4090	0.0000	0.4090	518.20	508.20	-101.28
22	21.000	0.3938	0.0000	0.3938	520.51	508.87	-109.48
23	22.000	0.3352	0.0000	0.3352	527.62	520.30	-87.59
24	23.000	0.2558	0.0000	0.2558	537.17	535.11	-46.90
25	24.000	0.1976	0.0000	0.1976	544.46	544.23	-15.90
26	25.000	0.1638	0.0000	0.1638	549.02	549.02	2.49
27	26.000	0.1438	0.0000	0.1438	552.03	551.87	13.57
28	27.000	0.1208	0.0000	0.1208	555.41	554.78	26.44
29	28.000	0.0948	0.0000	0.0948	559.15	557.64	41.11
30	29.000	0.0659	0.0000	0.0659	563.26	560.31	57.60
31	30.000	0.0343	0.0000	0.0343	567.73	562.63	75.90
32	31.000	0.0000	0.0000	0.0000	572.56	564.46	95.96
33	32.000	0.0000	0.0000	0.0000	573.28	565.17	96.08
34	33.000	0.0000	0.0000	0.0000	574.00	565.88	96.20

Alargamiento = 236.9 mm.

N° de puntos singulares en alzado = 8

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	8.2500	0.1900	0.00000
4	21.4500	1.6900	0.22222
5	24.7500	1.9900	0.00000
6	28.7000	1.5110	-0.18190
7	31.0000	1.1400	-0.12000
8	33.0000	0.9000	-0.12000

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 574.000 t.
Area del cable = 3780 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.543	0.000	-0.1131	0.0000
5	4.000	0.435	0.000	-0.1014	0.0000
6	5.000	0.342	0.000	-0.0852	0.0000
7	6.000	0.267	0.000	-0.0642	0.0000
8	7.000	0.215	0.000	-0.0386	0.0000
9	8.000	0.191	0.000	-0.0083	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.987	0.000	-0.0223	0.0000
27	26.000	1.926	0.000	-0.0969	0.0000
28	27.000	1.801	0.000	-0.1482	0.0000
29	28.000	1.637	0.000	-0.1762	0.0000
30	29.000	1.457	0.000	-0.1809	0.0000
31	30.000	1.283	0.000	-0.1622	0.0000
32	31.000	1.140	0.000	-0.1200	0.0000
33	32.000	1.020	0.000	-0.1200	0.0000
34	33.000	0.900	0.000	-0.1200	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.7972	0.0000	0.7972	465.74	462.43	55.49
2	1.000	0.7972	0.0000	0.7972	466.33	463.01	55.56
3	2.000	0.7972	0.0000	0.7972	466.92	463.59	55.63
4	3.000	0.7903	0.0000	0.7903	468.18	465.22	52.60
5	4.000	0.7789	0.0000	0.7789	469.90	467.50	47.43
6	5.000	0.7627	0.0000	0.7627	472.09	470.39	40.06
7	6.000	0.7419	0.0000	0.7419	474.76	473.79	30.42
8	7.000	0.7163	0.0000	0.7163	477.92	477.56	18.43
9	8.000	0.6861	0.0000	0.6861	481.57	481.55	4.00
10	9.000	0.6643	0.0000	0.6643	484.38	484.34	-6.51
11	10.000	0.6466	0.0000	0.6466	486.81	486.57	-15.18
12	11.000	0.6290	0.0000	0.6290	489.22	488.64	-23.84
13	12.000	0.6117	0.0000	0.6117	491.63	490.55	-32.48
14	13.000	0.5945	0.0000	0.5945	494.02	492.31	-41.09
15	14.000	0.5776	0.0000	0.5776	496.41	493.92	-49.65
16	15.000	0.5609	0.0000	0.5609	498.78	495.38	-58.17
17	16.000	0.5444	0.0000	0.5444	501.14	496.69	-66.63
18	17.000	0.5282	0.0000	0.5282	503.48	497.86	-75.02
19	18.000	0.5122	0.0000	0.5122	505.81	498.90	-83.35
20	19.000	0.4965	0.0000	0.4965	508.12	499.80	-91.60
21	20.000	0.4811	0.0000	0.4811	510.42	500.57	-99.76
22	21.000	0.4659	0.0000	0.4659	512.69	501.23	-107.84
23	22.000	0.4072	0.0000	0.4072	519.70	512.49	-86.28
24	23.000	0.3279	0.0000	0.3279	529.10	527.08	-46.20
25	24.000	0.2696	0.0000	0.2696	536.28	536.06	-15.66
26	25.000	0.2181	0.0000	0.2181	542.80	542.66	12.10
27	26.000	0.1438	0.0000	0.1438	552.03	549.46	53.25
28	27.000	0.0933	0.0000	0.0933	558.62	552.59	81.90
29	28.000	0.0660	0.0000	0.0660	562.54	554.01	97.61
30	29.000	0.0595	0.0000	0.0595	564.02	555.02	100.39
31	30.000	0.0414	0.0000	0.0414	566.89	559.58	90.75
32	31.000	0.0000	0.0000	0.0000	572.56	568.48	68.22
33	32.000	0.0000	0.0000	0.0000	573.28	569.19	68.30
34	33.000	0.0000	0.0000	0.0000	574.00	569.91	68.39

Alargamiento = 234.7 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE 2.

Nº de puntos singulares en alzado = 9

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	3.2500	0.1900	0.00000
4	8.2500	0.1900	0.00000
5	21.4500	1.6900	0.22222
6	24.7500	1.9900	0.00000
7	28.1000	1.2590	-0.32700
8	31.0000	0.5500	-0.08000
9	33.0000	0.3900	-0.08000

Nº de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	33.0000	0.0000	0.00000

Coef. rozam. curva	=	0.210
Coef. rozam. parasito	=	0.006
Fuerza de tesado	=	574.000 t.
Area del cable	=	3780 mm2.
Mod. de elasticidad	=	19000000 t/m2.
Codigo de tesado	=	2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.191	0.000	-0.0083	0.0000
5	4.000	0.190	0.000	0.0000	0.0000
6	5.000	0.190	0.000	0.0000	0.0000
7	6.000	0.190	0.000	0.0000	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0000	0.0000
10	9.000	0.195	0.000	0.0134	0.0000
11	10.000	0.217	0.000	0.0312	0.0000
12	11.000	0.257	0.000	0.0488	0.0000
13	12.000	0.315	0.000	0.0662	0.0000
14	13.000	0.390	0.000	0.0835	0.0000
15	14.000	0.482	0.000	0.1005	0.0000
16	15.000	0.591	0.000	0.1174	0.0000
17	16.000	0.717	0.000	0.1341	0.0000
18	17.000	0.859	0.000	0.1507	0.0000
19	18.000	1.018	0.000	0.1671	0.0000
20	19.000	1.193	0.000	0.1833	0.0000
21	20.000	1.384	0.000	0.1993	0.0000
22	21.000	1.592	0.000	0.2151	0.0000
23	22.000	1.797	0.000	0.1683	0.0000
24	23.000	1.923	0.000	0.0877	0.0000
25	24.000	1.980	0.000	0.0292	0.0000
26	25.000	1.984	0.000	-0.0471	0.0000
27	26.000	1.856	0.000	-0.1988	0.0000
28	27.000	1.606	0.000	-0.2920	0.0000
29	28.000	1.292	0.000	-0.3267	0.0000
30	29.000	0.972	0.000	-0.3030	0.0000
31	30.000	0.705	0.000	-0.2207	0.0000
32	31.000	0.550	0.000	-0.0800	0.0000
33	32.000	0.470	0.000	-0.0800	0.0000
34	33.000	0.390	0.000	-0.0800	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	1.0694	0.0000	1.0694	439.87	438.47	35.08
2	1.000	1.0694	0.0000	1.0694	440.42	439.02	35.12
3	2.000	1.0694	0.0000	1.0694	440.98	439.57	35.17
4	3.000	0.9979	0.0000	0.9979	448.21	448.20	3.73
5	4.000	0.9896	0.0000	0.9896	449.56	449.56	-0.00
6	5.000	0.9896	0.0000	0.9896	450.13	450.13	-0.00
7	6.000	0.9896	0.0000	0.9896	450.70	450.70	-0.00
8	7.000	0.9896	0.0000	0.9896	451.27	451.27	-0.00
9	8.000	0.9896	0.0000	0.9896	451.83	451.83	-0.00
10	9.000	0.9761	0.0000	0.9761	453.68	453.64	-6.10
11	10.000	0.9584	0.0000	0.9584	455.95	455.73	-14.22
12	11.000	0.9408	0.0000	0.9408	458.21	457.67	-22.33
13	12.000	0.9235	0.0000	0.9235	460.47	459.46	-30.42
14	13.000	0.9063	0.0000	0.9063	462.71	461.11	-38.48
15	14.000	0.8894	0.0000	0.8894	464.94	462.61	-46.51
16	15.000	0.8727	0.0000	0.8727	467.17	463.98	-54.48
17	16.000	0.8562	0.0000	0.8562	469.37	465.21	-62.41
18	17.000	0.8400	0.0000	0.8400	471.57	466.30	-70.27
19	18.000	0.8240	0.0000	0.8240	473.75	467.27	-78.07
20	19.000	0.8083	0.0000	0.8083	475.92	468.12	-85.79
21	20.000	0.7929	0.0000	0.7929	478.07	468.85	-93.44
22	21.000	0.7777	0.0000	0.7777	480.20	469.46	-101.00
23	22.000	0.7190	0.0000	0.7190	486.76	480.01	-80.81
24	23.000	0.6397	0.0000	0.6397	495.56	493.67	-43.27
25	24.000	0.5815	0.0000	0.5815	502.29	502.08	-14.67
26	25.000	0.5052	0.0000	0.5052	511.04	510.48	24.03
27	26.000	0.3560	0.0000	0.3560	527.97	517.84	102.94
28	27.000	0.2681	0.0000	0.2681	538.49	516.90	150.94
29	28.000	0.2364	0.0000	0.2364	542.77	515.92	168.58
30	29.000	0.2144	0.0000	0.2144	545.98	522.52	158.31
31	30.000	0.1374	0.0000	0.1374	555.57	542.51	119.75
32	31.000	0.0000	0.0000	0.0000	572.56	570.73	45.66
33	32.000	0.0000	0.0000	0.0000	573.28	571.45	45.72
34	33.000	0.0000	0.0000	0.0000	574.00	572.17	45.77

Alargamiento = 223.0 mm.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	1.9000	-0.12000
2	2.0000	1.6600	-0.12000
3	4.6000	1.0540	-0.28911
4	7.9500	0.4100	0.00000
5	17.4000	1.5689	0.24527
6	19.4000	2.0594	0.24527

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
Area del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.900	0.000	-0.1200	0.0000
2	1.000	1.780	0.000	-0.1200	0.0000
3	2.000	1.660	0.000	-0.1200	0.0000
4	3.000	1.483	0.000	-0.2255	0.0000
5	4.000	1.226	0.000	-0.2805	0.0000
6	5.000	0.939	0.000	-0.2847	0.0000
7	6.000	0.673	0.000	-0.2379	0.0000
8	7.000	0.480	0.000	-0.1401	0.0000
9	8.000	0.410	0.000	0.0013	0.0000
10	9.000	0.424	0.000	0.0273	0.0000
11	10.000	0.465	0.000	0.0532	0.0000
12	11.000	0.531	0.000	0.0792	0.0000
13	12.000	0.623	0.000	0.1051	0.0000
14	13.000	0.741	0.000	0.1311	0.0000
15	14.000	0.885	0.000	0.1570	0.0000
16	15.000	1.055	0.000	0.1830	0.0000
17	16.000	1.251	0.000	0.2089	0.0000
18	17.000	1.473	0.000	0.2349	0.0000
19	18.000	1.716	0.000	0.2452	0.0000
20	19.000	1.961	0.000	0.2453	0.0000
21	19.400	2.059	0.000	0.2453	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.6840	0.0000	0.6840	431.10	428.03	51.36
2	1.000	0.6840	0.0000	0.6840	431.64	428.57	51.43
3	2.000	0.6840	0.0000	0.6840	432.19	429.11	51.49
4	3.000	0.5816	0.0000	0.5816	442.14	431.30	97.28
5	4.000	0.5300	0.0000	0.5300	447.52	430.89	120.85
6	5.000	0.5179	0.0000	0.5179	449.22	432.06	122.99
7	6.000	0.4741	0.0000	0.4741	453.94	441.62	105.06
8	7.000	0.3797	0.0000	0.3797	463.61	459.13	64.33
9	8.000	0.2392	0.0000	0.2392	478.10	478.09	-0.62
10	9.000	0.2133	0.0000	0.2133	481.31	481.13	-13.11
11	10.000	0.1874	0.0000	0.1874	484.55	483.87	-25.74
12	11.000	0.1615	0.0000	0.1615	487.80	486.28	-38.49
13	12.000	0.1358	0.0000	0.1358	491.06	488.37	-51.34
14	13.000	0.1102	0.0000	0.1102	494.33	490.14	-64.24
15	14.000	0.0848	0.0000	0.0848	497.60	491.58	-77.19
16	15.000	0.0595	0.0000	0.0595	500.88	492.70	-90.15
17	16.000	0.0346	0.0000	0.0346	504.15	493.49	-103.11
18	17.000	0.0098	0.0000	0.0098	507.41	493.97	-116.03
19	18.000	0.0000	0.0000	0.0000	509.10	494.45	-121.26
20	19.000	0.0000	0.0000	0.0000	509.74	495.07	-121.42
21	19.400	0.0000	0.0000	0.0000	510.00	495.32	-121.49

Alargamiento = 144.6 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 2. FASE ULTIMA.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	1.4000	-0.17000
2	2.0000	1.0600	-0.17000
3	7.9500	0.4100	0.00000
4	17.4000	1.1800	0.16296
5	19.4000	1.5060	0.16296

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
rea del cable = 3360 mm2.
od. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	1.400	0.000	-0.1700	0.0000
2	1.000	1.230	0.000	-0.1700	0.0000
3	2.000	1.060	0.000	-0.1700	0.0000
4	3.000	0.893	0.000	-0.1618	0.0000
5	4.000	0.739	0.000	-0.1453	0.0000
6	5.000	0.606	0.000	-0.1206	0.0000
7	6.000	0.501	0.000	-0.0878	0.0000
8	7.000	0.433	0.000	-0.0467	0.0000
9	8.000	0.410	0.000	0.0009	0.0000
10	9.000	0.420	0.000	0.0181	0.0000
11	10.000	0.446	0.000	0.0354	0.0000
12	11.000	0.490	0.000	0.0526	0.0000
13	12.000	0.551	0.000	0.0698	0.0000
14	13.000	0.630	0.000	0.0871	0.0000
15	14.000	0.726	0.000	0.1043	0.0000
16	15.000	0.839	0.000	0.1216	0.0000
17	16.000	0.969	0.000	0.1388	0.0000
18	17.000	1.116	0.000	0.1561	0.0000
19	18.000	1.278	0.000	0.1630	0.0000
20	19.000	1.441	0.000	0.1630	0.0000
21	19.400	1.506	0.000	0.1630	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3299	0.0000	0.3299	464.37	457.80	77.83
2	1.000	0.3299	0.0000	0.3299	464.96	458.38	77.92
3	2.000	0.3299	0.0000	0.3299	465.54	458.96	78.02
4	3.000	0.3219	0.0000	0.3219	466.91	460.92	74.56
5	4.000	0.3058	0.0000	0.3058	469.08	464.21	67.46
6	5.000	0.2816	0.0000	0.2816	472.07	468.67	56.54
7	6.000	0.2491	0.0000	0.2491	475.91	474.08	41.61
8	7.000	0.2082	0.0000	0.2082	480.62	480.10	22.40
9	8.000	0.1607	0.0000	0.1607	486.05	486.05	-0.42
10	9.000	0.1434	0.0000	0.1434	488.42	488.34	-8.84
11	10.000	0.1262	0.0000	0.1262	490.81	490.51	-17.34
12	11.000	0.1090	0.0000	0.1090	493.21	492.53	-25.91
13	12.000	0.0918	0.0000	0.0918	495.62	494.41	-34.53
14	13.000	0.0747	0.0000	0.0747	498.03	496.15	-43.21
15	14.000	0.0576	0.0000	0.0576	500.45	497.75	-51.93
16	15.000	0.0406	0.0000	0.0406	502.88	499.20	-60.69
17	16.000	0.0236	0.0000	0.0236	505.31	500.51	-69.48
18	17.000	0.0067	0.0000	0.0067	507.74	501.67	-78.29
19	18.000	0.0000	0.0000	0.0000	509.10	502.46	-81.91
20	19.000	0.0000	0.0000	0.0000	509.74	503.10	-82.00
21	19.400	0.0000	0.0000	0.0000	510.00	503.36	-82.03

Alargamiento = 148.2 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 3. FASE ULTIMA.

N° de puntos singulares en alzado = 5

PTO	----X----	----Y----	----P----
1	0.0000	0.9000	-0.12000
2	2.0000	0.6600	-0.12000
3	7.9500	0.1900	0.00000
4	17.4000	0.7420	0.11687
5	19.4000	0.9760	0.11687

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----P----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 510.000 t.
rea del cable = 3360 mm2.
od. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.900	0.000	-0.1200	0.0000
2	1.000	0.780	0.000	-0.1200	0.0000
3	2.000	0.660	0.000	-0.1200	0.0000
4	3.000	0.542	0.000	-0.1158	0.0000
5	4.000	0.431	0.000	-0.1051	0.0000
6	5.000	0.334	0.000	-0.0880	0.0000
7	6.000	0.257	0.000	-0.0644	0.0000
8	7.000	0.207	0.000	-0.0344	0.0000
9	8.000	0.190	0.000	0.0006	0.0000
10	9.000	0.197	0.000	0.0130	0.0000
11	10.000	0.216	0.000	0.0253	0.0000
12	11.000	0.247	0.000	0.0377	0.0000
13	12.000	0.291	0.000	0.0501	0.0000
14	13.000	0.348	0.000	0.0624	0.0000
15	14.000	0.416	0.000	0.0748	0.0000
16	15.000	0.497	0.000	0.0872	0.0000
17	16.000	0.591	0.000	0.0995	0.0000
18	17.000	0.696	0.000	0.1119	0.0000
19	18.000	0.812	0.000	0.1170	0.0000
20	19.000	0.929	0.000	0.1170	0.0000
21	19.400	0.976	0.000	0.1169	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.2358	0.0000	0.2358	473.64	470.27	56.43
2	1.000	0.2358	0.0000	0.2358	474.24	470.86	56.50
3	2.000	0.2358	0.0000	0.2358	474.84	471.46	56.57
4	3.000	0.2316	0.0000	0.2316	475.85	472.70	54.72
5	4.000	0.2210	0.0000	0.2210	477.51	474.90	49.91
6	5.000	0.2041	0.0000	0.2041	479.82	477.97	42.05
7	6.000	0.1807	0.0000	0.1807	482.79	481.79	31.04
8	7.000	0.1508	0.0000	0.1508	486.44	486.16	16.75
9	8.000	0.1157	0.0000	0.1157	490.66	490.66	-0.30
10	9.000	0.1034	0.0000	0.1034	492.55	492.51	-6.39
11	10.000	0.0910	0.0000	0.0910	494.45	494.29	-12.52
12	11.000	0.0787	0.0000	0.0787	496.36	496.01	-18.69
13	12.000	0.0663	0.0000	0.0663	498.28	497.65	-24.91
14	13.000	0.0540	0.0000	0.0540	500.20	499.23	-31.16
15	14.000	0.0417	0.0000	0.0417	502.13	500.73	-37.45
16	15.000	0.0294	0.0000	0.0294	504.06	502.15	-43.77
17	16.000	0.0171	0.0000	0.0171	506.00	503.51	-50.12
18	17.000	0.0049	0.0000	0.0049	507.94	504.79	-56.49
19	18.000	0.0002	0.0000	0.0002	509.08	505.63	-59.18
20	19.000	0.0001	0.0000	0.0001	509.73	506.28	-59.23
21	19.400	0.0000	0.0000	0.0000	510.00	506.55	-59.20

Alargamiento = 149.6 mm.

LINEA ALTA VELOCIDA ZARAGOZA-LLEIDA. E-3/4/5. CABLE 4. FASE ULTIMA.

de puntos singulares en alzado = 6

PTO	----X----	----Y----	----P----
1	0.0000	0.3900	-0.08000
2	2.0000	0.2300	-0.08000
3	6.7000	0.1900	0.00000
4	7.9500	0.1900	0.00000
5	17.4000	0.3530	0.03457
6	19.4000	0.4225	0.03457

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----p----
1	0.0000	0.0000	0.00000
2	19.4000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
ıerza de tesado = 510.000 t.
..rea del cable = 3360 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.390	0.000	-0.0800	0.0000
2	1.000	0.310	0.000	-0.0800	0.0000
3	2.000	0.230	0.000	-0.0800	0.0000
4	3.000	0.176	0.000	-0.0313	0.0000
5	4.000	0.162	0.000	0.0002	0.0000
6	5.000	0.171	0.000	0.0147	0.0000
7	6.000	0.185	0.000	0.0120	0.0000
8	7.000	0.190	0.000	0.0000	0.0000
9	8.000	0.190	0.000	0.0002	0.0000
10	9.000	0.192	0.000	0.0038	0.0000
11	10.000	0.198	0.000	0.0075	0.0000
12	11.000	0.207	0.000	0.0111	0.0000
13	12.000	0.220	0.000	0.0148	0.0000
14	13.000	0.236	0.000	0.0184	0.0000
15	14.000	0.257	0.000	0.0221	0.0000
16	15.000	0.281	0.000	0.0257	0.0000
17	16.000	0.308	0.000	0.0294	0.0000
18	17.000	0.339	0.000	0.0331	0.0000
19	18.000	0.374	0.000	0.0348	0.0000
20	19.000	0.409	0.000	0.0347	0.0000
21	19.400	0.422	0.000	0.0346	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.1144	0.0000	0.1144	485.87	484.32	38.75
2	1.000	0.1144	0.0000	0.1144	486.48	484.94	38.79
3	2.000	0.1144	0.0000	0.1144	487.10	485.55	38.84
4	3.000	0.0659	0.0000	0.0659	492.71	492.46	15.43
5	4.000	0.0348	0.0000	0.0348	496.56	496.56	-0.11
6	5.000	0.0492	0.0000	0.0492	495.68	495.62	-7.28
7	6.000	0.0466	0.0000	0.0466	496.58	496.54	-5.98
8	7.000	0.0346	0.0000	0.0346	498.46	498.46	-0.00
9	8.000	0.0344	0.0000	0.0344	499.11	499.11	-0.09
10	9.000	0.0307	0.0000	0.0307	500.12	500.12	-1.91
11	10.000	0.0271	0.0000	0.0271	501.14	501.12	-3.74
12	11.000	0.0234	0.0000	0.0234	502.15	502.12	-5.58
13	12.000	0.0198	0.0000	0.0198	503.17	503.12	-7.43
14	13.000	0.0161	0.0000	0.0161	504.19	504.11	-9.29
15	14.000	0.0125	0.0000	0.0125	505.22	505.09	-11.15
16	15.000	0.0088	0.0000	0.0088	506.24	506.07	-13.03
17	16.000	0.0051	0.0000	0.0051	507.27	507.05	-14.92
18	17.000	0.0015	0.0000	0.0015	508.30	508.02	-16.81
19	18.000	0.0002	0.0000	0.0002	509.08	508.77	-17.70
20	19.000	0.0002	0.0000	0.0002	509.72	509.42	-17.70
21	19.400	0.0000	0.0000	0.0000	510.00	509.70	-17.62

Alargamiento = 152.0 mm.

N° de puntos singulares en alzado = 6

PTO	----X----	----Y----	----p----
1	0.0000	0.5000	-0.17500
2	1.5000	0.2375	-0.17500
3	2.5000	0.1500	0.00000
4	19.0000	0.1500	0.00000
5	20.0000	0.2375	0.17500
6	21.5000	0.5000	0.17500

N° de puntos singulares en planta = 2

PTO	----X----	----Z----	----p----
1	0.0000	0.0000	0.00000
2	21.5000	0.0000	0.00000

Coef. rozam. curva = 0.210
Coef. rozam. parasito = 0.006
Fuerza de tesado = 299.000 t.
Area del cable = 2100 mm2.
Mod. de elasticidad = 19000000 t/m2.
Codigo de tesado = 2

Puntos de cálculo:

PTO	---X---	---Y---	---Z---	--P V--	--P H--
1	0.000	0.500	0.000	-0.1750	0.0000
2	1.000	0.325	0.000	-0.1750	0.0000
3	2.000	0.172	0.000	-0.0875	0.0000
4	3.000	0.150	0.000	0.0000	0.0000
5	4.000	0.150	0.000	0.0000	0.0000
6	5.000	0.150	0.000	0.0000	0.0000
7	6.000	0.150	0.000	0.0000	0.0000
8	7.000	0.150	0.000	0.0000	0.0000
9	8.000	0.150	0.000	0.0000	0.0000
10	9.000	0.150	0.000	0.0000	0.0000
11	10.000	0.150	0.000	0.0000	0.0000
12	11.000	0.150	0.000	0.0000	0.0000
13	12.000	0.150	0.000	0.0000	0.0000
14	13.000	0.150	0.000	0.0000	0.0000
15	14.000	0.150	0.000	0.0000	0.0000
16	15.000	0.150	0.000	0.0000	0.0000
17	16.000	0.150	0.000	0.0000	0.0000
18	17.000	0.150	0.000	0.0000	0.0000
19	18.000	0.150	0.000	0.0000	0.0000
20	19.000	0.150	0.000	0.0000	0.0000
21	20.000	0.237	0.000	0.1750	0.0000
22	21.000	0.412	0.000	0.1750	0.0000
23	21.500	0.500	0.000	0.1750	0.0000

Cables tesados desde el extremo final.

PTO	---X---	-Ang V-	-Ang H-	-Ang T-	----F---	----H---	----V---
1	0.000	0.3465	0.0000	0.3465	270.59	266.54	46.64
2	1.000	0.3465	0.0000	0.3465	270.93	266.87	46.70
3	2.000	0.2605	0.0000	0.2605	276.21	275.16	24.08
4	3.000	0.1732	0.0000	0.1732	281.67	281.67	-0.00
5	4.000	0.1732	0.0000	0.1732	282.03	282.03	-0.00
6	5.000	0.1732	0.0000	0.1732	282.39	282.39	-0.00
7	6.000	0.1732	0.0000	0.1732	282.74	282.74	-0.00
8	7.000	0.1732	0.0000	0.1732	283.10	283.10	-0.00
9	8.000	0.1732	0.0000	0.1732	283.45	283.45	-0.00
10	9.000	0.1732	0.0000	0.1732	283.81	283.81	-0.00
11	10.000	0.1732	0.0000	0.1732	284.17	284.17	-0.00
12	11.000	0.1732	0.0000	0.1732	284.53	284.53	-0.00
13	12.000	0.1732	0.0000	0.1732	284.89	284.89	-0.00
14	13.000	0.1732	0.0000	0.1732	285.25	285.25	-0.00
15	14.000	0.1732	0.0000	0.1732	285.61	285.61	-0.00
16	15.000	0.1732	0.0000	0.1732	285.97	285.97	-0.00
17	16.000	0.1732	0.0000	0.1732	286.33	286.33	-0.00
18	17.000	0.1732	0.0000	0.1732	286.69	286.69	-0.00
19	18.000	0.1732	0.0000	0.1732	287.05	287.05	-0.00
20	19.000	0.1732	0.0000	0.1732	287.41	287.41	-0.00
21	20.000	0.0000	0.0000	0.0000	298.44	293.97	-51.44
22	21.000	0.0000	0.0000	0.0000	298.81	294.34	-51.51
23	21.500	0.0000	0.0000	0.0000	299.00	294.52	-51.54

Alargamiento = 153.3 mm.

2.- CALCULO REACCIONES Y APOYOS

Reacciones y giros acumulados por peso propio

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (rd)
1	237.54	-.000442
11	724.79	0.000137
21	728.82	0.000261
31	730.04	0.000265
41	727.54	0.000271
51	737.01	0.000250
61	711.73	0.000327
71	244.06	0.000481

ΔR por uniformes

Apoyo 1: $[19.54 \cdot 1.0 + (19.54 - 8.84) \cdot 1.0] \cdot 2.5 = 75.6\ t$

Apoyos intermedios: $[(19.54 - 8.84) \cdot 2.0 - 1.4 \cdot 1.8 \cdot 2] \cdot 2.5 = 41\ t$

Apoyo 71: $[19.54 \cdot 0.8 + [19.54 - 8.84] \cdot 0.5] \cdot 2.5 = 52.5\ t$

Reacciones y giros acumulados por peso propio

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (rd)
1	225.11	-.000380
11	736.76	0.000013
21	729.31	0.000021
31	729.62	0.000022
41	729.42	0.000022
51	729.98	0.000021
61	735.69	0.000025
71	225.64	0.000383

Reacciones y giros debidos a cargas muertas

Apoyo	Reaccion (t)	Giro (rd)
1	108.27	-.000181
11	356.64	0.000001
21	352.55	0.000000
31	352.66	0.000000
41	352.66	0.000000
51	352.55	0.000000
61	356.64	-.000001
71	108.27	0.000181

Reacciones y giros debidos a temperatura

Apoyo	Reaccion (t)	Giro (rd)
1	22.64	0.000160
11	-27.19	-.000047
21	5.69	0.000013
31	-1.14	-.000004
41	-1.14	0.000004
51	5.70	-.000013
61	-27.21	0.000047
71	22.65	-.000160

Reacciones y giros por ferrocarril (RENFE)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(rd) maximo	Giro(rd) minimo
1	299.059	-55.829	0.0002795	-0.0006686
11	808.287	-71.643	0.0005086	-0.0005590
21	844.602	-71.256	0.0006319	-0.0006001
31	845.095	-70.259	0.0006341	-0.0006260
41	845.159	-70.257	0.0006273	-0.0006328
51	844.668	-71.253	0.0006014	-0.0006306
61	808.287	-71.641	0.0005589	-0.0005086
71	299.060	-55.826	0.0006686	-0.0002795

Reacciones y giros por ferrocarril (UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(rd) maximo	Giro(rd) minimo
1	229.822	-44.678	0.0002237	-0.0005458
11	636.131	-57.383	0.0003707	-0.0004473
21	656.399	-57.259	0.0004569	-0.0004595
31	657.171	-57.122	0.0004601	-0.0004603
41	657.171	-57.122	0.0004603	-0.0004601
51	656.398	-57.259	0.0004595	-0.0004569
61	636.131	-57.383	0.0004473	-0.0003707
71	229.822	-44.678	0.0005458	-0.0002237

Reacciones y giros por ferrocarril (RENFE/UIC)

Apoyo	Reaccion (t) maxima	Reaccion (t) minima	Giro(rd) maximo	Giro(rd) minimo
1	299.059	-55.829	0.0002795	-0.0006686
11	808.287	-71.643	0.0005086	-0.0005590
21	844.602	-71.256	0.0006319	-0.0006001
31	845.095	-70.259	0.0006341	-0.0006260
41	845.159	-70.257	0.0006273	-0.0006328
51	844.668	-71.253	0.0006014	-0.0006306
61	808.287	-71.641	0.0005589	-0.0005086
71	299.060	-55.826	0.0006686	-0.0002795

Reacciones y giros por pretensado (sin ponderar)

0.9485

Estructura completa estado inicial

Apoyo	Reaccion (t)	Giro (rd)
1	46.67	0.001673
11	-38.17	-.000536
21	-10.92	-.000303
31	2.67	-.000275
41	1.09	-.000289
51	-6.96	-.000267
61	-43.56	-.000342
71	49.18	-.001318

Reacciones y giros por pretensado (sin ponderar)

0.8511

Estructura completa estado final

Apoyo	Reaccion (t)	Giro (rd)
1	68.22	0.001369
11	-79.50	-.000217
21	14.30	-.000046
31	-3.87	-.000085
41	1.25	-.000075
51	-1.14	-.000076
61	-55.92	-.000084
71	56.66	-.001119

PROYECTO L.A.V. ZARAGOZA - LÉRIDA
SUBTRAMO I E-5

FECHA 5-97

HOJA N.º 1

REACCIONES VERTICALES A TODO LO ANCHO

	PPI	PPF	C.M.	TEMP.	RENFE		PRET. I.	PRET. F
E-2 (FIJO)	313.1	300.7	1083	22.6	299.1	-55.8	46.7	68.2
P-5	765.8	777.8	3566	-27.2	808.3	-71.6	-37.3	-79.5
P-4	769.8	770.3	352.6	5.7	844.6	-713	-10.9	14.3
P-3	771.0	770.6	352.7	-1.1	845.1	-70.3	2.7	-3.9
P-2	768.5	770.4	3527	-1.1	845.2	-70.3	1.1	1.3
P-1	778.0	771.0	3526	5.7	844.7	-713	-7.0	-11
P-0	752.7	776.7	3566	-27.2	808.3	-71.6	-43.6	-55.9
E-1	296.6	278.1	1023	22.6	299.1	-55.2	49.2	56.7
Σ	5215.5	5215.5	2340.4	0	-	-	0	0

APARATOS DE APOYO.

Reacciones máximas por apoyo:

	E-2	P-5	P-4	P-3	P-2	P-1	P-0	E-1
R_{max} (t)	422	1003	1047	1039	1038	1043	1000	408
σ_{max} (kg/cm²)	140,6	139.2	145.4	144.3	144,1	144,8	138,8	136.0

APOYOS DISPUESTOS:

E-2: 2 × 500 × 600 × 54 (38)
P-5: 2 × 800 × 900 × 79 (59)
P-4: 2 × 800 × 900 × 107 (77)
P-3: 2 × 800 × 900 × 171 (123)
P-2: 2 × 800 × 900 × 194 (140)
P-1: 2 × 800 × 900 × 217 (167)
P-0: 2 × 800 × 900 × 79 (57) + 4 (10)
E-1: 2 × 500 × 600 × 54 (32) + 5 (3.0)

PROYECTO

E-5

FECHA X-97

HOJA N.º 2

REACCIONES HORIZONTALES LONGITUDINALES

- FRENADO : RENFE: $F_H = \frac{1}{8}(30 \times 12.00 + 191 \times 10.00) 1.5 = 539$

U.I.C: $F_H = \frac{1}{4}(100 + 215 \times 8.00) \times 2 = 910$ t

Esta carga se la lleva íntegra el estribo 2 (fijo)

- DEFORMACIONES DIFERIDAS:

- RETRACCIÓN = $\varepsilon = -25 \times 10^{-5}$

- TEMPERATURA = $\varepsilon = \pm 20 \times 10^{-5}$

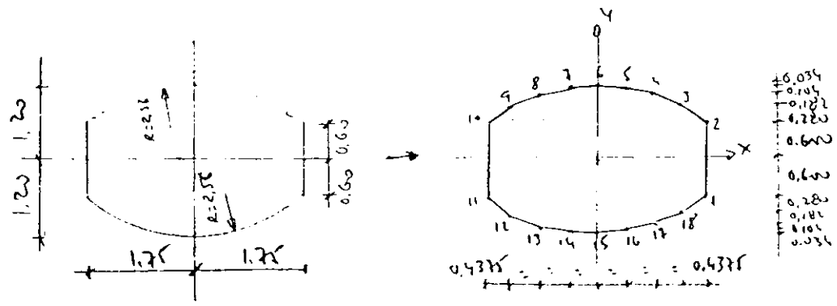
- FLUENCIA: $\sigma_{media} = \frac{3600}{8,79} = 410\ t/m^2 = 41\ kg/cm^2$

$$\varepsilon = -\frac{41}{3,5 \times 10^5} \times 3,5 = -41 \times 10^{-5}$$

$\varepsilon_{total} = -86 \times 10^{-5}$.

Cada pila se llevará la correspondiente a su rigidez y desplazamiento.

Sección de pila:



SECCION: ZARAGOZA-LERIDA.T-1.E-5.SECCION PILA

NUM. CONTORNOS	NUM. CIRCULOS
1	0

CONTORNO 1 PUNTOS 18

	COORD. X	Y
1	1.750	-0.600
2	1.750	0.600
3	1.313	0.880
4	0.875	1.062
5	0.438	1.166
6	0.000	1.200
7	-0.438	1.166
8	-0.875	1.062
9	-1.313	0.880
10	-1.750	0.600
11	-1.750	-0.600
12	-1.313	-0.880
13	-0.875	-1.062
14	-0.438	-1.166
15	0.000	-1.200
16	0.438	-1.166
17	0.875	-1.062
18	1.313	-0.880

FIBRA INFERIOR X	Y	FIBRA SUPERIOR X	Y
0.000	-1.200	0.000	1.200

RESULTADOS

AREA = 7.01400 m2

CENTRO DE GRAVEDAD Xg= 0.00000 Yg= -0.00000

```
****************** EJES ORIGINALES **************************
MOMENTOS ESTATICOS        INERCIAS              EJES PRINCIPALES

Mx =  -0.0000000      Ixx =   2.5577340      ANG. FI =   0.0000
My =   0.0000000      Iyy =   6.0299668
                      Ixy =   0.0000000

****************** EJES PARALELOS POR G **********************
MOMENTOS ESTATICOS        INERCIAS              EJES PRINCIPALES

Mx =  -0.0000000      Ixx =   2.5577340      ANG. FI =   0.0000
My =   0.0000000      Iyy =   6.0299668
                      Ixy =   0.0000000

****************** EJES PRINCIPALES **************************
MOMENTOS ESTATICOS        INERCIAS              EJES PRINCIPALES

Mx =  -0.0000000      Ixx =   2.5577340      ANG. FI =   0.0000
My =   0.0000000      Iyy =   6.0299668
                      Ixy =   0.0000000

CARACTERISTICAS MECANICAS PARA EJES PARALELOS POR G
==================================================

Di =   1.20000          Ds =   1.20000
Wi =   2.13145          Ws =   2.13145
Radio Giro X-X =  0.60387     Radio Giro Y-Y=   0.92720
```


PROYECTO E-5

FECHA X-97

HOJA N.° 5

Flexibilidad: $\frac{L^3}{3EI} + \frac{ne}{GA} = \frac{L^3}{3 \times \frac{3,0 \times 10^6}{2,5} \times 2,5577} + \frac{ne}{2 \times 1W \times 0,72} =$

$= \frac{L^3}{9.207 \times 10^6} + \frac{ne}{144}$

$F_{HL} = \frac{\delta}{\text{Flexibilidad}}$ P-O => TEFLON

Elemento	L	δ	F_{HL}	Rigidez (t/m)
E-2	-	0	-189,0	∞
P-5	22,20	0,0232	14,5	625.
P-4	32,40	0,0516	12.2	237
P-3	32,10	0,0800	17,8	222
P-2	31,80	0,1084	23,9	221
P-1	27,60	0,1367	39,7	290
E-1	-	0,1600	24 2	-

($F_{HL\ P-O} = 0.05 (776,7 + 356,6)$ 56,7t

($F_{HL\ E-1} = 0.05 \cdot 299 + 108.3 + 72 (+ 56.7) = 24.2t$)

SISMO LONGITUDINAL

El pretil en viga de arriostramiento longitudinal, por estar anclado en el estribo 2.

Por Fuente S: 0,08 (grado VII).

Fuerza sobre estribo 2:

$F_{HL} = 0.08 (5216 + 2340 - 0.6 \times 3640) = 779,2$ t

PROYECTO E-5 | FECHA X-97 | HOJA N.º 6

FUERZAS HORIZONTALES TRANSVERSALES.

- VIENTO

Tablero $q = 0,2\,(2.45 + 0,70 + 3,50) = 1,33$ t/m. (Viaducto 2.96 m)

pila : $q = 0,2 \times 2,40 = 0,48$ t/m

Rigidez transversal de pilas y apoyos.

$$F = \frac{L^3}{3 \times 3 \times 10^6 \times 6.030} + \frac{ne}{144}$$

Elemento	L	ne	Rigidez.
E-2	—	—	∞
P-5	22.20	0.059	1636
P-4	32.40	0,077	861
P-3	32,10	0,131	658
P-2	31.80	0.149	615
P-1	27.60	0,167	646
P-0	15.65	0,059 (-)	2082 (1415)
E-1	—	0.038 (-)	3780 (FIJO)

Barra (tablero) { A : 8,79 m²; I 100,0 m⁴


```
ESVIENTO                                                    pag.   1

ZARAGOZA-LERIDA. SUBTRAMO 1. E-5 VIENTO.
CONTROL
8 7 1 1
:
NUDOS
1         0         0
2         27        0
3         60        0
4         93        0
5         126       0
6         159       0
7         192       0
8         219       0
:
SECCIONES
1
8.79 100.0 4.0E6
:.
BARRAS
1 1 2 1
2 2 3 1
3 3 4 1
4 4 5 1
5 5 6 1
6 6 7 1
7 7 8 1
:
APOYOS
8
1 1       1    0
2 1  1636      0
3 1  861       0
4 1  658       0
5 1  615       0
6 1  646       0
7 1  2082    0
8 1  3780 0
:
HIPOTESIS DE CARGA
H-1 FUERZA DE VIENTO 1.33 T/M
0
7
1 2 1.33 90
2 2 1.33 90
3 2 1.33 90
4 2 1.33 90
5 2 1.33 90
6 2 1.33 90
7 2 1.33 90
:
```

ZARAGOZA-LERIDA. SUBTRAMO 1. E-5 VIENTO.

Hip. nº 1 H-1 FUERZA DE VIENTO 1.33 T/M

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.000000	0.000596
2	-0.000000	0.015632	0.000548
3	-0.000000	0.031355	0.000390
4	-0.000000	0.040680	0.000168
5	-0.000000	0.042229	-0.000073
6	-0.000000	0.036172	-0.000285
7	-0.000000	0.024317	-0.000415
8	-0.000000	0.012546	-0.000448

Reacciones en apoyos

Nudo	Fza. x	Fza. y		Mto. z
1	0.00	-64.54	E-2	0.00
2	0.00	-25.57	P-5	-0.00
3	0.00	-27.00	P-4	0.00
4	0.00	-26.77	P-3	0.00
5	0.00	-25.97	P-2	0.00
6	0.00	-23.37	P-1	-0.00
7	0.00	-50.63	P-0	0.01
8	0.00	-47.43	E-1	-0.01

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	-0.00	64.54
	2	0.00	-1257.79	28.63
2	2	-0.00	-1257.79	54.20
	3	0.00	-2322.36	10.31
3	3	-0.00	-2322.36	37.31
	4	0.00	-2829.45	-6.58
4	4	-0.00	-2829.45	20.19
	5	0.00	-2771.50	-23.70
5	5	-0.00	-2771.50	2.27
	6	0.00	-2122.23	-41.62
6	6	-0.00	-2122.23	-18.25
	7	0.00	-795.69	-62.14
7	7	-0.00	-795.70	-11.52
	8	0.00	-0.01	-47.43

PROYECTO E-5 FECHA X·97 HOJA N.º 9

SISMO TRANSVERSAL.

Aplicamos la fórmula de Lord Rayleigh para calcular el período.

Carga debida al pp + cp + 0.6 × sobrecarga:

$P = 2.5 \times 8.79 + 9.60 + 0.6 \times 2 \times 10.00 = 43.6$ t/m

Por tanto, los desplazamientos de los nudos son los que dé el cálculo de viento multiplicados por $\frac{43.6}{1.33}$.

$$T = 2\pi \sqrt{\frac{\Sigma m \cdot u^2}{g \Sigma m \cdot u}}$$

Las masas son las que actúan horizontalmente en cada pila, que valen $m = g \cdot 33 \times 43.6$, y en el estribo 1 $m = g \times 105 \times 43.6$

PILA	u	u^2	
P-5	0,51176	0,26190	
P-4	1,02671	1,05311	
P-3	1,33078	1,77098	T = 2,12 segundos
P-2	1,38035	1,90537	
P-1	1,18081	1,39430	$\Sigma m u^2$ = 10165 g
P-0	0,79178	0,62692	$\Sigma m u$ = 9138 g
E-1	0,40640	0,1651 6	

$$S = \alpha \cdot \eta \times \beta \cdot \delta$$

$\alpha = C R \frac{0.08}{1-2,12} \times 1 = 0,019$ (grado VII)

	PROYECTO	FECHA V-97
	E-5	HOJA N.º 10

$$\eta = u \times \frac{\Sigma \cdot \Phi \cdot u}{\Sigma Q \cdot u^2} = u \times \frac{\Sigma u}{\Sigma u^2} = u \times 1.112$$

$\beta = 1$

$\delta = 0,7$ (pilotes resistentes por el fuste)

PILA	η	S	F_T pila
P-5	0,57	0,008	11,5
P-4	1.14	0,015	21,6
P-3	1.48	0,020	28.8
P-2	1,54	0,020	28.8
P-1	1.31	0,017	24.5
P-0	0,88	0,012	17.3
E-1	0.45	0.006	8,6

F_T fuste = $5 \times 33 \times 436 = 1438.8.5$

$F_{T\ E-2} = 0.08\ (313,1 + 108.3 + 24,2 + 68.2 + 0.6 \times 299,01 = 55,5\ t$

	PROYECTO TAV ZARAGOZA-LERIDA TRAMO I ESTRUCTURA E-5	FECHA X-97 HOJA N.º 1

PILAS

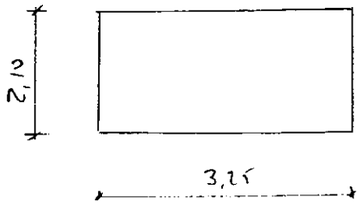
Sección de pila

Área = 7.014 m²

$I_{xx} = I_L = 2.5577\ m^4$

$I_{yy} = I_T = 6.0304\ m^4$

Sección rectangular equivalente:



Área = 6.821 m² → 97.3%

$I_{xx} = 2.5082\ m^4$ → 98.1%

$I_{yy} = 6.0074\ m^4$ → 99.6%

Combinaciones de cargas:

H-1: 1.6 × (P propio + C permanente + def. diferidas + sobrecarga + + frenada + f centrífuga + Lazo)

H-2: 1.44 × (P propio + C permanente + def. diferidas + sobrecarga + + frenada + f centrífuga + Lazo + viento)

H-3: 1.28 × (P propio + C permanente + def. diferidas + sobrecarga + + 0.75 × viento) + sismo transversal

PILA	F(1.44 × viento)	F(0.25 × 1.28 × viento + sismo transv.)
0	72.9	33.5
1	33.7	31.9
2	37.4	37.1
3	38.5	37.3
4	38.9	30.2
5	36.8	19.7

	PROYECTO E-5	FECHA X-97 HOJA N.º 2

FUERZAS MAYORADAS EN CABEZA DE PILAS:

PILA	H	F_{xd}	F_{yd}	F_{zd}	M_{xd}	M_{yd}
0	15.65	90.7 81.6 72.6	8.0 80.1 33.8	3037 2733 2429	—	388.0 567.8 376.3
1	27.60 (29.80)	63.5 57.2 50.8	8.0 40.9 31.9	3168 2851 2534	—	405.5 463.8 370.9
2	31.80 (30.91)	38.2 34.4 30.6	8.0 44.6 37.1	3151 2836 2621	—	405.7 475.2 377.8
3	32.10 (31.21)	28.5 25.6 22.8	8.0 45.7 37.3	3154 2839 2524	—	405.6 478.5 378.5
4	32.10 (31.20)	19.5 17.6 15.6	8.0 46.1 30.2	3120 2262 2544	—	405.4 479.2 371.4
5	27.20 (26.31)	23.2 20.9 18.6	8.0 44.0 19.7	3047 2742 2432	—	388.0 457.7 346.0

M_y Viento: $F_{xv} \times 2.95$

M_y Sismo: $F_{xs} \times 2.0$

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 0.(58 ∅ 25-58 ∅ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 15.65

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	78	78	78	78	78	78	78	78	78	78	78
"Aey:"	206	206	206	206	206	206	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS EN LA CABEZA (t)			MOMENTOS (mt)		FUSTE (t/m) SEC.BASE		SEC.CABEZA		COEF. GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	90.70	8.00	3037.00	000.00	388.00	0	0	0	0	1.60
2	81.60	80.10	2733.00	000.00	567.80	0	0.69	0	0.69	1.44
3	72.60	33.80	2429.00	000.00	376.30	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 0.(58 ∅ 25-58 ∅ 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	130.30	1980.24	3464.18	0.225	6.649
1	0.001	0.000	117.68	1835.48	3421.46	0.190	5.835
2	0.003	0.000	104.91	1685.91	3378.75	0.158	5.088
3	0.007	0.000	92.01	1532.24	3336.03	0.129	4.418
4	0.011	0.000	79.01	1375.14	3293.31	0.104	3.825
5	0.017	0.001	65.94	1215.17	3250.59	0.080	3.307
6	0.023	0.001	52.80	1052.82	3207.87	0.062	2.848
7	0.030	0.001	39.63	888.51	3165.15	0.047	2.395
8	0.038	0.001	26.43	722.66	3122.44	0.031	1.941
9	0.046	0.001	13.21	555.67	3079.72	0.015	1.488
10	0.054	0.002	-0.00	387.90	3037.00	0.015	1.036

Exc. totales result. cabeza 0.12773 -0.00000
Exc. reales 1er ord. cabeza 0.12776 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 0.(58 0 25-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1395.13	2038.49	3117.47	2.917	8.590
1	0.001	0.000	1252.61	1907.52	3079.02	2.429	7.457
2	0.004	0.001	1109.98	1771.01	3040.57	1.988	6.408
3	0.008	0.003	967.60	1629.86	3002.13	1.596	5.461
4	0.014	0.005	825.80	1484.90	2963.68	1.252	4.628
5	0.021	0.007	684.86	1336.82	2925.23	0.954	3.907
6	0.029	0.009	545.01	1186.23	2886.79	0.700	3.294
7	0.038	0.012	406.45	1033.63	2848.34	0.487	2.773
8	0.047	0.014	269.34	879.44	2809.89	0.311	2.325
9	0.057	0.017	133.81	724.02	2771.45	0.154	1.908
10	0.067	0.020	-0.03	567.70	2733.00	0.154	1.492

Exc. totales result. cabeza 0.20772 -0.00001
Exc. reales 1er ord. cabeza 0.20776 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 0.(58 0 25-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	736.52	1627.09	2770.75	1.252	5.538
1	0.001	0.000	647.84	1511.61	2736.57	1.032	4.844
2	0.003	0.001	562.19	1392.92	2702.40	0.837	4.213
3	0.005	0.001	479.73	1271.52	2668.22	0.666	3.651
4	0.009	0.002	400.58	1147.85	2634.05	0.519	3.156
5	0.014	0.003	324.85	1022.28	2599.87	0.394	2.724
6	0.019	0.004	252.63	895.15	2565.70	0.291	2.343
7	0.025	0.005	183.97	766.74	2531.52	0.209	1.996
8	0.031	0.006	118.95	637.29	2497.35	0.135	1.655
9	0.038	0.007	57.61	507.06	2463.17	0.065	1.314
10	0.045	0.008	-0.01	376.27	2429.00	0.065	0.973

Exc. totales result. cabeza 0.15491 -0.00000
Exc. reales 1er ord. cabeza 0.15492 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 1.(100 ϕ 32-66 ϕ 32-58 ϕ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 29.80

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	192	192	128	128	128	128	128	78	78	78	78
"Aey:"	600	600	400	400	400	400	400	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	63.500	8.00	3168.00	000.00	405.50	0	0	0	0	1.60
2	57.20	40.90	2851.00	000.00	463.80	0	0.69	0	0.69	1.44
3	50.80	31.90	2534.00	000.00	370.90	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 1.(100 0 32-66 0 32-58 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	296.10	3709.68	3981.42	0.539	11.795
1	0.005	0.000	271.31	3499.76	3900.08	0.476	10.807
2	0.020	0.001	244.92	3253.22	3818.74	0.521	12.382
3	0.046	0.002	216.83	2966.35	3737.39	0.426	10.554
4	0.081	0.004	187.43	2646.95	3656.05	0.335	8.676
5	0.124	0.005	157.08	2302.55	3574.71	0.252	6.869
6	0.173	0.007	126.09	1940.09	3493.37	0.178	5.249
7	0.227	0.010	94.71	1565.54	3412.03	0.134	4.536
8	0.284	0.012	63.11	1181.77	3330.68	0.076	3.223
9	0.345	0.014	31.48	793.29	3249.34	0.037	2.147
10	0.407	0.017	-0.06	403.63	3168.00	0.037	1.085

Exc. totales result. cabeza 0.12741 -0.00002
Exc. reales 1er ord. cabeza 0.12800 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 1.(100 0 32-66 0 32-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1833.00	3364.43	3583.08	3.329	11.057
1	0.005	0.001	1647.65	3176.51	3509.87	2.881	10.099
2	0.019	0.006	1459.66	2957.81	3436.66	3.093	11.629
3	0.043	0.012	1268.75	2705.01	3363.45	2.489	9.921
4	0.076	0.021	1077.11	2424.67	3290.25	1.931	8.188
5	0.116	0.032	886.67	2123.09	3217.04	1.433	6.517
6	0.162	0.044	699.11	1806.07	3143.83	1.003	5.008
7	0.213	0.057	515.78	1478.60	3070.62	0.745	4.372
8	0.267	0.070	337.51	1143.05	2997.42	0.414	3.098
9	0.324	0.084	165.28	803.35	2924.21	0.192	2.136
10	0.384	0.098	-0.30	462.37	2851.00	0.192	1.222

Exc. totales result. cabeza 0.16218 -0.00011
Exc. reales 1er ord. cabeza 0.16268 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 1.(100 0 32-66 0 32-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	1854.67	2626.13	3184.74	3.020	8.012
1	0.004	0.001	1627.14	2463.50	3119.66	2.543	7.223
2	0.014	0.005	1406.22	2281.29	3054.59	2.548	7.935
3	0.031	0.011	1192.20	2078.44	2989.52	2.007	6.730
4	0.054	0.018	986.78	1859.02	2924.44	1.526	5.560
5	0.081	0.027	791.45	1626.82	2859.37	1.112	4.476
6	0.113	0.037	607.40	1385.21	2794.29	0.768	3.524
7	0.148	0.048	435.62	1137.03	2729.22	0.553	3.111
8	0.186	0.059	276.71	883.69	2664.15	0.319	2.322
9	0.226	0.071	131.28	627.38	2599.07	0.149	1.638
10	0.267	0.082	-0.24	369.95	2534.00	0.149	0.962

Exc. totales result. cabeza 0.14599 -0.00010
Exc. reales 1er ord. cabeza 0.14637 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 2.(132 ϕ 32-58 ϕ 32-58 ϕ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 30.81

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	256	256	128	128	128	128	78	78	78	78	78
"Aey:"	800	800	336	336	336	336	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)		COEF.		
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	38.20	8.00	3151.00	000.00	405.70	0	0	0	0	1.60
2	34.40	44.60	2836.00	000.00	475.20	0	0.69	0	0.69	1.44
3	30.60	37.10	2521.00	000.00	377.80	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 2.(132 ϕ 32-58 ϕ 32-58 ϕ 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	287.88	2323.35	3991.99	0.331	4.949
1	0.002	0.000	262.61	2196.36	3907.89	0.295	4.610
2	0.009	0.001	236.27	2052.65	3823.79	0.349	5.888
3	0.021	0.001	208.72	1888.36	3739.69	0.292	5.215
4	0.039	0.002	180.20	1706.81	3655.59	0.236	4.538
5	0.060	0.004	150.97	1511.15	3571.49	0.185	3.891
6	0.085	0.005	121.22	1304.27	3487.40	0.151	3.605
7	0.114	0.007	91.10	1087.72	3403.30	0.109	2.976
8	0.146	0.008	60.76	864.09	3319.20	0.072	2.348
9	0.179	0.010	30.35	635.81	3235.10	0.036	1.718
10	0.215	0.012	-0.03	405.17	3151.00	0.036	1.088

Exc. totales result. cabeza 0.12858 -0.00001
Exc. reales 1er ord. cabeza 0.12875 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 2.(132 0 32-58 0 32-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1967.99	2264.48	3592.89	2.451	5.385
1	0.003	0.001	1764.21	2149.38	3517.20	2.137	4.978
2	0.010	0.004	1560.00	2018.03	3441.51	2.573	6.688
3	0.023	0.010	1354.28	1865.62	3365.82	2.092	5.819
4	0.043	0.018	1148.92	1695.86	3290.13	1.649	4.963
5	0.066	0.027	945.60	1512.23	3214.44	1.253	4.157
6	0.094	0.037	745.75	1317.88	3138.76	1.003	3.803
7	0.126	0.049	550.28	1114.44	3063.07	0.677	3.050
8	0.160	0.060	360.27	904.62	2987.38	0.420	2.416
9	0.197	0.073	176.55	690.64	2911.69	0.205	1.834
10	0.235	0.085	-0.25	474.44	2836.00	0.205	1.253

Exc. totales result. cabeza 0.16729 -0.00009
Exc. reales 1er ord. cabeza 0.16756 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 2.(132 0 32-58 0 32-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	2086.35	1815.57	3193.79	2.497	4.288
1	0.002	0.001	1831.22	1714.83	3126.51	2.119	3.913
2	0.008	0.004	1584.37	1602.74	3059.23	2.383	5.044
3	0.018	0.010	1345.32	1476.55	2991.95	1.893	4.357
4	0.033	0.017	1115.76	1338.83	2924.67	1.464	3.710
5	0.051	0.026	897.09	1191.92	2857.40	1.097	3.121
6	0.072	0.035	690.49	1037.87	2790.12	0.857	2.851
7	0.096	0.046	496.73	877.79	2722.84	0.580	2.327
8	0.122	0.057	316.63	713.38	2655.56	0.362	1.869
9	0.150	0.068	150.80	546.07	2588.28	0.172	1.425
10	0.179	0.080	-0.24	377.19	2521.00	0.172	0.980

Exc. totales result. cabeza 0.14962 -0.00010
Exc. reales 1er ord. cabeza 0.14986 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 3.(132 ⌀ 32-66 ⌀ 32-58 ⌀ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 31.01

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	256	256	128	128	128	128	78	78	78	78	78
"Aey:"	800	800	400	400	400	400	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	28.50	8.00	3154.00	000.00	405.60	0	0	0	0	1.60
2	25.60	45.70	2839.00	000.00	478.50	0	0.69	0	0.69	1.44
3	22.80	37.30	2524.00	000.00	378.50	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 3.(132 ∅ 32-66 ∅ 32-58 ∅ 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	284.48	1861.22	4000.45	0.292	3.769
1	0.002	0.000	259.12	1765.66	3915.81	0.261	3.551
2	0.007	0.001	232.79	1657.02	3831.16	0.286	4.184
3	0.016	0.001	205.46	1533.59	3746.52	0.243	3.818
4	0.029	0.002	177.31	1397.34	3661.87	0.202	3.441
5	0.045	0.003	148.54	1250.20	3577.23	0.166	3.058
6	0.065	0.004	119.30	1094.05	3492.58	0.143	3.009
7	0.087	0.006	89.68	929.54	3407.94	0.107	2.540
8	0.111	0.007	59.84	758.67	3323.29	0.071	2.061
9	0.138	0.009	29.90	583.38	3238.65	0.035	1.576
10	0.166	0.010	-0.01	405.48	3154.00	0.035	1.090

Exc. totales result. cabeza 0.12856 -0.00000
Exc. reales 1er ord. cabeza 0.12860 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 3.(132 0 32-66 0 32-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1991.32	1831.99	3600.80	2.285	4.161
1	0.002	0.001	1782.64	1745.45	3524.62	1.992	3.865
2	0.008	0.004	1574.01	1646.10	3448.44	2.190	4.731
3	0.018	0.009	1365.06	1531.68	3372.26	1.807	4.207
4	0.032	0.016	1157.34	1404.56	3296.08	1.452	3.688
5	0.050	0.024	952.23	1266.96	3219.90	1.133	3.194
6	0.071	0.034	750.92	1120.96	3143.72	0.939	3.120
7	0.095	0.044	554.15	967.24	3067.54	0.659	2.611
8	0.121	0.055	362.88	807.74	2991.36	0.423	2.155
9	0.150	0.066	177.87	644.13	2915.18	0.206	1.710
10	0.180	0.078	-0.21	477.97	2839.00	0.206	1.263

Exc. totales result. cabeza 0.16836 -0.00007
Exc. reales 1er ord. cabeza 0.16855 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 3.(132 0 32-66 0 32-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	2093.53	1473.44	3201.16	2.350	3.358
1	0.002	0.001	1835.42	1397.60	3133.44	1.994	3.077
2	0.006	0.004	1586.06	1312.71	3065.73	2.087	3.676
3	0.014	0.009	1345.44	1217.41	2998.01	1.680	3.238
4	0.026	0.016	1114.99	1113.43	2930.29	1.323	2.826
5	0.039	0.024	895.92	1002.34	2862.58	1.014	2.447
6	0.056	0.033	689.25	885.54	2794.86	0.818	2.379
7	0.074	0.042	495.63	763.53	2727.15	0.570	2.011
8	0.095	0.053	315.81	637.57	2659.43	0.361	1.670
9	0.117	0.063	150.38	508.78	2591.72	0.171	1.327
10	0.140	0.074	-0.13	378.23	2524.00	0.171	0.983

Exc. totales result. cabeza 0.14985 -0.00005
Exc. reales 1er ord. cabeza 0.14996 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 4.(132 ⌀ 32-58 ⌀ 32-58 ⌀ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 31.90

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	256	256	128	128	128	128	78	78	78	78	78
"Aey:"	800	800	336	336	336	336	206	206	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5

ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	19.50	8.00	3180.00	000.00	405.40	0	0	0	0	1.60
2	17.60	46.10	2862.00	000.00	479.30	0	0.69	0	0.69	1.44
3	15.60	30.20	2544.00	000.00	371.40	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 4.(132 ⌀ 32-58 ⌀ 32-58 ⌀ 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	294.38	1561.44	4050.74	0.287	3.135
1	0.002	0.000	268.27	1492.83	3963.67	0.261	2.986
2	0.006	0.001	241.14	1412.44	3876.59	0.282	3.647
3	0.015	0.001	212.94	1318.23	3789.52	0.245	3.380
4	0.026	0.002	183.87	1211.86	3702.45	0.210	3.090
5	0.041	0.003	154.11	1095.01	3615.37	0.175	2.777
6	0.059	0.005	123.80	969.37	3528.30	0.149	2.668
7	0.080	0.006	93.09	835.81	3441.22	0.111	2.287
8	0.102	0.008	62.12	696.12	3354.15	0.074	1.894
9	0.127	0.009	31.04	552.05	3267.07	0.037	1.493
10	0.153	0.011	-0.01	405.24	3180.00	-0.037	1.090

Exc. totales result. cabeza 0.12743 -0.00000
Exc. reales 1er ord. cabeza 0.12748 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 4.(132 0 32-58 0 32-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	2085.28	1567.66	3645.67	2.294	3.493
1	0.002	0.001	1867.30	1505.09	3567.30	2.006	3.271
2	0.007	0.004	1649.23	1430.91	3488.93	2.226	4.179
3	0.016	0.010	1430.61	1342.46	3410.57	1.846	3.752
4	0.029	0.017	1213.12	1241.87	3332.20	1.495	3.328
5	0.046	0.026	998.21	1131.17	3253.83	1.176	2.923
6	0.066	0.036	787.17	1012.20	3175.47	0.960	2.786
7	0.088	0.047	580.88	885.88	3097.10	0.685	2.386
8	0.113	0.059	380.35	753.89	3018.73	0.444	2.014
9	0.140	0.071	186.41	617.73	2940.37	0.216	1.642
10	0.168	0.084	-0.18	478.84	2862.00	0.216	1.267

Exc. totales result. cabeza 0.16731 -0.00006
Exc. reales 1er ord. cabeza 0.16747 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5.PILA 4.(132 0 32-58 0 32-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	1926.75	1211.22	3240.59	2.026	2.625
1	0.001	0.001	1680.16	1157.16	3170.93	1.719	2.432
2	0.005	0.004	1443.62	1095.44	3101.28	1.788	2.995
3	0.012	0.008	1217.17	1024.63	3031.62	1.447	2.689
4	0.022	0.014	1002.09	946.10	2961.96	1.148	2.400
5	0.034	0.022	799.48	861.09	2892.30	0.889	2.131
6	0.048	0.030	610.26	770.73	2822.64	0.708	2.045
7	0.064	0.039	435.06	675.55	2752.98	0.500	1.779
8	0.082	0.048	274.57	576.59	2683.32	0.314	1.512
9	0.102	0.058	129.36	474.82	2613.66	0.147	1.240
10	0.123	0.068	-0.10	371.16	2544.00	0.147	0.966

Exc. totales result. cabeza 0.14590 -0.00004
Exc. reales 1er ord. cabeza 0.14599 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 5.(58 ∅ 32-58 ∅ 25)

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 22.05

DIMENSIONES DE LAS SECCIONES DE HORMIGON:

SECCION:	BASE		CABEZA	
DIRECCION R/EJE PUENTE:	LONG.(x)	TRAN.(y)	LONG.(x)	TRAN.(y)
"DIMENSION EXTERIOR (cm):"	210	325	210	325
"ESPESOR DE LA PARED(cm):"	104	160	104	160

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aex:"	128	128	128	128	128	128	128	128	78	78	78
"Aey:"	336	336	336	336	336	336	336	336	206	206	206

"ARMADURA INTERIOR: Recubrimiento r (cm):" 5
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sección:	0	1	2	3	4	5	6	7	8	9	10
"Aix:"	1	1	1	1	1	1	1	1	1	1	1
"Aiy:"	1	1	1	1	1	1	1	1	1	1	1

"NUM. DE HIPOTESIS DE CARGA:" 3

ACCIONES MAYORADAS EN LAS DISTINTAS HIPOTESIS:

	FUERZAS Y MOMENTOS EN LA CABEZA					FUERZAS EN EL FUSTE (t/m)				COEF.
	FUERZAS (t)			MOMENTOS (mt)		SEC.BASE		SEC.CABEZA		GAMMA
HIP.	Fx	Fy	Fz	Mx	My	fx0	fy0	fx1	fy1	PP
1	23.20	8.00	3047.00	000.00	388.20	0	0	0	0	1.60
2	20.90	44.00	2742.00	000.00	457.70	0	0.69	0	0.69	1.44
3	18.60	19.70	2438.00	000.00	346.00	0	1.52	0	1.52	1.28

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 5.(58 0 32-58 0 25)

HIPOTESIS NUM. 1

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	187.82	1074.33	3648.88	0.214	2.729
1	0.001	0.000	169.99	1020.77	3588.69	0.193	2.584
2	0.003	0.000	151.83	962.78	3528.50	0.171	2.429
3	0.006	0.000	133.39	900.78	3468.31	0.150	2.265
4	0.010	0.001	114.71	835.17	3408.13	0.129	2.093
5	0.015	0.001	95.84	766.38	3347.94	0.107	1.914
6	0.021	0.002	76.82	694.82	3287.75	0.085	1.730
7	0.028	0.002	57.69	620.89	3227.56	0.064	1.541
8	0.036	0.002	38.49	544.98	3167.38	0.045	1.466
9	0.044	0.003	19.25	467.30	3107.19	0.023	1.253
10	0.054	0.003	0.00	388.26	3047.00	0.023	1.037

Exc. totales result. cabeza 0.12742 0.00000
Exc. reales 1er ord. cabeza 0.12740 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 5.(58 0 32-58 0 25)

HIPOTESIS NUM. 2

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1202.14	1080.28	3283.69	1.426	2.827
1	0.001	0.000	1072.12	1031.95	3229.52	1.247	2.652
2	0.003	0.001	943.53	979.52	3175.35	1.077	2.478
3	0.006	0.003	816.69	923.41	3121.18	0.917	2.306
4	0.010	0.005	691.91	864.00	3067.01	0.766	2.137
5	0.015	0.007	569.46	801.67	3012.84	0.626	1.972
6	0.022	0.010	449.58	736.76	2958.68	0.492	1.806
7	0.029	0.012	332.50	669.63	2904.51	0.363	1.637
8	0.037	0.015	218.41	600.59	2850.34	0.252	1.589
9	0.046	0.019	107.50	529.80	2796.17	0.124	1.397
10	0.055	0.022	-0.05	457.61	2742.00	0.124	1.203

Exc. totales result. cabeza 0.16689 -0.00002
Exc. reales 1er ord. cabeza 0.16692 0.00000

Convergencia del equilibrio sin agotamiento

ZARAGOZA-LERIDA.TRAMO 1.VIADUCTO 5. PILA 5.(58 0 32-58 0 25)

HIPOTESIS NUM. 3

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y

0	0.000	0.000	839.18	866.34	2919.50	0.936	2.151
1	0.001	0.000	724.88	823.82	2871.35	0.799	2.025
2	0.002	0.001	616.87	778.51	2823.20	0.673	1.900
3	0.004	0.002	515.36	730.70	2775.05	0.559	1.776
4	0.008	0.003	420.55	680.62	2726.90	0.455	1.650
5	0.012	0.004	332.58	628.53	2678.75	0.359	1.520
6	0.017	0.006	251.61	574.68	2630.60	0.271	1.386
7	0.022	0.008	177.76	519.30	2582.45	0.191	1.250
8	0.028	0.010	111.16	462.64	2534.30	0.126	1.203
9	0.035	0.012	51.87	404.80	2486.15	0.059	1.050
10	0.042	0.013	0.00	346.02	2438.00	0.059	0.895

Exc. totales result. cabeza 0.14193 0.00000
Exc. reales 1er ord. cabeza 0.14192 0.00000

Convergencia del equilibrio sin agotamiento

3.2.- CALCULO CIMENTACION

PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA

HOJA N.º 1

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{1{,}80(6{,}5N+3{,}5N)}{2} \times 3.00 + 7.014(14.8 - 3.00)\right] = 274{,}4$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-0 (h = 11,4)	PESO PROPIO	1	388,4	—	—	—	—
		2	388,4	—	—	—	—
	CARGA PERMANENTE	1	178,3	—	—	—	—
		2	178,3	—	—	—	—
	SOBRECARGA MAXIMA	1	454,7	—	—	—	—
		2	353,6	—	—	—	—
	SOBRECARGA MINIMA	1	-40,3	—	—	—	—
		2	-31,3	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-13,6	28,4	—	420,	—
		2	-13,6	28,41	—	420	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-21,8	—	—	—	—
		2	-21,8	—	—	—	—
	PRETENSADO FINAL	1	-28,0	—	—	—	—
		2	-28,0	—	—	—	—
	VIENTO	1	31,6	—	25,3	—	413
		2	-31,6	—	25,3	—	413
	SISMO	1	7,7	—	19,6	—	225
		2	-7,2	—	19,6	—	225

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PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA V-97

HOJA N.º 2

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{1{,}80(6{,}5N+3{,}5N)}{2} \times 3.00 + 7.014(22.8 - 3.00)\right] = 498{,}9$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-1 (h = 27,6 m)	PESO PROPIO	1	396.0	—	—	—	—
		2	396.0	—	—	—	—
	CARGA PERMANENTE	1	178.3	—	—	—	—
		2	178.3	—	—	—	—
	SOBRECARGA MAXIMA	1	454.9	—	—	—	—
		2	353,8	—	—	—	—
	SOBRECARGA MINIMA	1	-40,3	—	—	—	—
		2	-31,3	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-14,6	33,0	—	910,8	—
		2	-14,6	33,0	—	910,8	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-22.0	—	—	—	—
		2	-22.0	—	—	—	—
	PRETENSADO FINAL	1	-36,3	—	—	—	—
		2	-36,3	—	—	—	—
	VIENTO	1	6.3	—	11,1	—	214.4
		2	-6.3	—	11,1	—	214.4
	SISMO	1	4,5	—	25,9	—	447.9
		2	-4,5	—	25,9	—	447.9

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PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA

HOJA N.° 3

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso pila: $N = 2{,}5\left[\frac{\frac{11{,}80(6{,}15+3{,}15)}{2}\times 3{,}00 + 7{,}014(31{,}8-3{,}00)}{}\right] = 577{,}5\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-2 (h = 31,20 m)	PESO PROPIO	1	396.6	—	—	—	—
		2	396.6	—	—	—	—
	CARGA PERMANENTE	1	176.3	—	—	—	—
		2	176.3	—	—	—	—
	SOBRECARGA MAXIMA	1	474,5	—	—	—	—
		2	369,0	—	—	—	—
	SOBRECARGA MINIMA	1	-39.6	—	—	—	—
		2	-30.8	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	3.3	72,3	—	709.2	—
		2	3,3	22,3	—	709.2	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-1.7	—	—	—	—
		2	-1.7	—	—	—	—
	PRETENSADO FINAL	1	4.7	—	—	—	—
		2	4.7	—	—	—	—
	VIENTO	1	11.4	—	15.6	—	376.1
		2	-11.4	—	15.6	—	376.1
	SISMO	1	8,5	—	34,7	—	747,4
		2	-8.5	—	34,7	—	747.4

PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA

HOJA N.° 4

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso pila: $N = 2{,}5\left[\frac{\frac{11{,}80(6{,}15+3{,}15)}{2}\times 3{,}00 + 7{,}014(32{,}1-3{,}00)}{}\right] = 577{,}7\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-1 (h = 32,10 m)	PESO PROPIO	1	397.9	—	—	—	—
		2	397,5	—	—	—	—
	CARGA PERMANENTE	1	176.4	—	—	—	—
		2	176.4	—	—	—	—
	SOBRECARGA MAXIMA	1	473,6	—	—	—	—
		2	368,3	—	—	—	—
	SOBRECARGA MINIMA	1	-38,3	—	—	—	—
		2	-29.8	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-1.7	17,1	—	548,9	—
		2	-1,7	17.1	—	548,9	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	0.4	—	—	—	—
		2	2.4	—	—	—	—
	PRETENSADO FINAL	1	-2.8	—	—	—	—
		2	-2.8	—	—	—	—
	VIENTO	1	14.1	—	17.7	—	442.7
		2	-14.1	—	17,7	—	442,7
	SISMO	1	9.8	—	36,8	—	820.4
		2	-9.8	—	36,8	—	820.4

PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA

HOJA N.º 5

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{1{,}80\,(6{,}5+3{,}5)}{2}\times 1{,}3.00 + 7.014(32{,}4 - 3.00)\right] = 583{,}0$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-4 (h = 32,4 m)	PESO PROPIO	1	392,9	—	—	—	—
		2	392,9	—	—	—	—
	CARGA PERMANENTE	1	176,3	—	—	—	—
		2	176,3	—	—	—	—
	SOBRECARGA MAXIMA	1	474,5	—	—	—	—
		2	317,0	—	—	—	—
	SOBRECARGA MINIMA	1	-39,6	—	—	—	—
		2	-30,8	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	3.3	12,9	—	418,0	—
		2	3,3	12,9	—	418,0	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	0.4	—	—	—	—
		2	0.4	—	—	—	—
	PRETENSADO FINAL	1	7,0	—	—	—	—
		2	7,0	—	—	—	—
	VIENTO	1	15.6	—	18.8	—	481.6
		2	-15,6	—	18,8	—	481.6
	SISMO	1	8,3	—	34,8	—	758.6
		2	-8,3	—	34,8	—	758,6

PROYECTO TN. ZARAGOZA – LERIDA
TRAMO I
E-5

FECHA

HOJA N.º 6

CIMENTACION DE PILAS.

ACCIONES EN CARA SUPERIOR DE ZAPATA O ENCEPADO

Peso PILA: $N = 2{,}5\left[\frac{1{,}80\,(6{,}5+3{,}5)}{2}\times 1{,}3.00 + 7.014(27{,}2 - 3.00)\right] = 404{,}2\,t$

PILA	ACCIONES	APOYO	N	F_L	F_T	M_L	M_T
P-1 (h = 27,2 m)	PESO PROPIO	1	378,5	—	—	—	—
		2	378,5	—	—	—	—
	CARGA PERMANENTE	1	178.3	—	—	—	—
		2	178,3	—	—	—	—
	SOBRECARGA MAXIMA	1	454,7	—	—	—	—
		2	353,8	—	—	—	—
	SOBRECARGA MINIMA	1	-40.3	—	—	—	—
		2	-31.3	—	—	—	—
	DEFORMACIONES DIFERIDAS	1	-14,6	13,1	—	290,8	—
		2	-14,6	13.1	—	290,8	—
	FRENADO	1	—	—	—	—	—
		2	—	—	—	—	—
	PRETENSADO INICIAL	1	-25,0	—	—	—	—
		2	-25,0	—	—	—	—
	PRETENSADO FINAL	1	-40.3	—	—	—	—
		2	-40,3	—	—	—	—
	VIENTO	1	15,4	—	16,2	—	300,1
		2	-15,4	—	16,2	—	300,1
	SISMO	1	4.4	—	21.7	—	312.7
		2	-4,4	—	21.9	—	312.7

PROYECTO ..... FECHA .....

HOJA N.º 7

HIPOTESIS COMBINADAS

H.1.- P. PROPIO + C. PERMANENTE + SOBRECARGA MÁXIMA + DEFORMACIONES DIFERIDAS + FRENADO + PRETENSADO

H.2 Como H-1 con sobrecarga mínima

H.3 Como H-1 con viento

H.4 Como H-2 con viento

H.5.- Como H-1 con 1/4 viento + sismo

H.6 Como H-2 con 1/4 viento + sismo

PROYECTO TAV ZARAGOZA-LERIDA TRAMO I E-5 FECHA .....

HOJA N.º 8

Esfuerzo sin mayorar en cara superior de zapata o encepad

PILA	HIP	N	F_{Ld}	F_{Td}	M_{Ld}	M_{Td}
P-1	H-1	2412,2	66.0	0	1821.6	2426
	H-2	1531,8	66.0	0	"	21.6
	H-3	2412,2	66.0	22,2	"	701,7
	H-4	1531.8	66.0	22,2	"	480,7
	H-5	2412.5	66.0	57,4	"	1274,8
	H-6	1531.8	66.0	57,4	1821.6	1053.8
P-2	H-1	2577.8	44.6	0	1418,4	253,2
	H-2	1664.0	"	0	"	21,1
	H-3	2577.8	"	31.2	"	1060,1
	H-4	1664.0	"	31.2	"	828,0
	H-5	2577.8	"	77.2	"	1990,5
	H-6	1664.0	44.6	77,2	1418,4	1758,4
P-3	H-1	2559.0	34,2	0	10978	257,7
	H-2	1645,6	"	0	"	20.4
	H-3	2559.0	"	35.4	"	1205,8
	H-4	1645.6	"	35.4	"	973,5
	H-5	2559.0	"	82,5	"	2178,8
	H-6	1645,6	34,2	82,5	1097,8	1946,5

	PROYECTO TAV ZARAGOZA-LERIDA TRAMO I E-5	FECHA HOJA N.º 9

Esfuerzo más mayorado en cara superior de zapata o encep.

PILA	HIP	N	F_L	F_T	M_L	M_T
P-4	H-1	2585,5	25,8	0	836,0	253,2
	H-2	1651,8	"	0	"	21,1
	H-3	2585,5	"	37,6	"	1291,3
	H-4	1651,8	"	37,6	"	1059,2
	H-5	2585,5	"	79,0	"	2069,8
	H-6	1651,8	25,8	79,0	836,0	1837,7
P-5	H-1	2312,5	26,2	0	581,6	747,6
	H-2	1372,4	"	0	"	21,6
	H-3	2312,5	"	32,4	"	916,7
	H-4	1372,4	"	32,4	"	695,7
	H-5	2312,5	"	51,9	"	1057,7
	H-6	1372,4	26,2	51,9	581,6	836,7
P-0	H-1	2145	56,8	0	840,6	316,6
	H-2	1253	56,8	0	=	21,6
	H-3	2145	56,8	58,6	=	1173
	H-4	1253	56,8	58,6	=	972,6
	H-5	2145	56,8	539	=	10101
	H-6	1253	56,8	539	840,6	715,1

TAV ZARAGOZA-LERIDA.TRAMO 1.E-5.ENCEPADO P-0

Dimensiones encepado
- Canto = 2.70
- Ancho L = 8.30
- Ancho T = 8.30

Reacc. pilote máx= 664.39 Pilote: 1 Hipót.: 1
Reacc. pilote mín= 229.04 Pilote: 4 Hipót.: 2

Dimensiones pila
- Ancho L = 2.10
- Ancho T = 3.25

Datos pilotes
- Número = 5
- Diámetro= 1.50
- Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.650	2.650
2	2.650	-2.650
3	-2.650	2.650
4	-2.650	-2.650
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2145.0	56.8	0.0	840.6	316.6
H- 2	1253.0	56.8	0.0	840.6	21.6

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2610.0	56.8	0.0	994.0	316.6
H- 2	1718.0	56.8	0.0	994.0	21.6

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	664.4	604.7	439.3	379.6	522.0
H- 2	458.2	454.1	233.1	229.0	343.6

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	1063.03	607.37	18.18	63.62	0.502	0.287	0.020
H- 2	733.06	366.46	18.18	63.62	0.346	0.173	0.020

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = | min
A necesaria =

DIMENSIONAMIENTO ARMADURAS ENCEPADO.

Fck=	2500	1.50	Vcu long=	4178.95	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	4178.95	
Acciones		1.60	Vcu esqu=	1169.77	
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld=	2035.70	Ail en banda=	182.21 cm2
Mtd=	1607.83	Ait en banda=	142.93 cm2
		Ail entre bandas=	15.18 cm2/m
		Ait entre bandas=	11.91 cm2/m
		A min mecánica=	39.08 cm2/m
		A min geométrica=	19.54 cm2/m

Cortante:

Vld=	3016.46	Astl=	0.00	cm2/m
Vtd=	3754.53	Astt=	0.00	cm2/m

Resistencia local:
Vesqd= 1063.03 comprobación válida.

Armadura de suspensión= 125.55 cm2

LAV ZARAGOZA-LERIDA.TRAMO 1.E-5.ENCEPADO P-0

Dimensiones encepado
Canto = 2.70
Ancho L = 8.30
Ancho T = 8.30

Reacc. pilote máx= 789.84 Pilote: 1 Hipót.: 1
Reacc. pilote mín= 103.63 Pilote: 4 Hipót.: 2

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.650	2.650
2	2.650	-2.650
3	-2.650	2.650
4	-2.650	-2.650
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2145.0	56.8	58.6	840.6	1283.0
H- 2	1253.0	56.8	58.6	840.6	987.6

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2610.0	56.8	58.6	994.0	1441.2
H- 2	1718.0	56.8	58.6	994.0	1145.8

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	789.8	479.2	564.8	254.2	522.0
H- 2	583.6	328.7	358.5	103.6	343.6

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.44

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	1137.37	366.00	23.50	82.26	0.537	0.173	0.026
H- 2	840.34	149.23	23.50	82.26	0.396	0.070	0.026

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = |min
A necesaria =

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	4178.95	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	4178.95	
Acciones		1.44	Vcu esqu=	1169.77	
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld= 2178.06 Ail en banda= 195.41 cm2
Mtd= 1720.27 Ait en banda= 153.20 cm2

Ail entre bandas= 16.28 cm2/m
Ait entre bandas= 12.77 cm2/m

A min mecánica= 39.08 cm2/m
A min geométrica= 19.54 cm2/m

Cortante:

Vld= 3227.40 Astl= 0.00 cm2/m
Vtd= 4017.09 Astt= 0.00 cm2/m

Resistencia local:
Vesqd= 1137.37 comprobación válida.

Armadura de suspensión= 113.00 cm2

Dimensiones encepado
Canto = 2.70
Ancho L = 8.30
Ancho T = 8.30

Reacc. pilote máx= 761.34 Pilote: 1 Hipót.: 1
Reacc. pilote mín= 132.09 Pilote: 4 Hipót.: 2

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 5
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	2.650	2.650
2	2.650	-2.650
3	-2.650	2.650
4	-2.650	-2.650
5	0.000	0.000

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2145.0	56.8	53.9	840.6	1010.1
H- 2	1253.0	56.8	53.9	840.6	715.1

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	2610.0	56.8	53.9	994.0	1155.6
H- 2	1718.0	56.8	53.9	994.0	860.6

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5
H- 1	761.3	507.7	536.3	282.7	522.0
H- 2	555.1	357.1	330.1	132.1	343.6

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.28		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	974.52	361.80	20.05	70.16	0.460	0.171	0.022
H- 2	710.55	169.07	20.05	70.16	0.335	0.080	0.022

Amin flexión = 70.65
Amin cortante = 8.57

W máxima = | win
A necesaria =

DIMENSIONAMIENTO ARMADURAS ENCEPADO.

Fck=	2500	1.50	Vcu long=	4178.95	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	4178.95	
Acciones		1.28	Vcu esqu=	1169.77	
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld=	1866.21	Ail en banda=	166.58 cm2
Mtd=	1473.96	Ait en banda=	130.75 cm2
		Ail entre bandas=	13.88 cm2/m
		Ait entre bandas=	10.90 cm2/m
		A min mecánica=	39.08 cm2/m
		A min geométrica=	19.54 cm2/m

Cortante:

Vld=	2765.31	Astl=	0.00 cm2/m
Vtd=	3441.93	Astt=	0.00 cm2/m

Resistencia local:
Vesqd= 974.52 comprobación válida.

Armadura de suspensión= 100.44 cm2

Dimensiones encepado
- Canto = 2.70
- Ancho L = %12.00
- Ancho T = %12.00

Reacc. pilote máx= 737.25 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 256.36 Pilote: 6 Hipót.: 6

Dimensiones pila
- Ancho L = 2.10
- Ancho T = 3.25

Datos pilotes
- Número = 6
- Diámetro= 1.50
- Long emp= 7.00

Pilote	X-Long	Y-Trans
1	4.500	4.500
2	4.500	0.000
3	4.500	-4.500
4	-4.500	4.500
5	-4.500	0.000
6	-4.500	-4.500

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2412.2	66.0	0.0	1821.6	242.6
H- 2	1531.8	66.0	0.0	1821.6	21.6
H- 3	2412.2	66.0	22.2	1821.6	701.7
H- 4	1531.8	66.0	22.2	1821.6	480.7
H- 5	2412.2	66.0	57.4	1821.6	1274.8
H- 6	1531.8	66.0	57.4	1821.6	1053.8

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	3384.2	66.0	0.0	1999.8	242.6
H- 2	2503.8	66.0	0.0	1999.8	21.6
H- 3	3384.2	66.0	22.2	1999.8	761.6
H- 4	2503.8	66.0	22.2	1999.8	540.6
H- 5	3384.2	66.0	57.4	1999.8	1429.8
H- 6	2503.8	66.0	57.4	1999.8	1208.8

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6
H- 1	660.1	646.7	633.2	494.9	481.4	467.9
H- 2	501.1	499.9	498.7	335.9	334.7	333.5
H- 3	693.3	646.7	600.0	528.0	481.4	434.8
H- 4	534.3	499.9	465.6	369.0	334.7	300.3
H- 5	737.2	646.7	556.1	572.0	481.4	390.8
H- 6	578.2	499.9	421.6	413.0	334.7	256.4

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	1056.21	748.69	17.60	61.60	0.498	0.353	0.019	0.00
H- 2	801.80	533.56	17.60	61.60	0.378	0.252	0.019	0.00
H- 3	1109.26	695.65	18.57	64.99	0.523	0.328	0.020	0.00
H- 4	854.84	480.52	18.57	64.99	0.403	0.227	0.020	0.00
H- 5	943.68	500.25	18.66	65.31	0.446	0.236	0.021	0.00
H- 6	740.15	328.15	18.66	65.31	0.350	0.155	0.021	0.00

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.00
A necesaria = 0.00 cm2
Ast = 0.00 cm2/m

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	6041.85	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	6041.85	
Acciones		1.60	Vcu esqu=	1169.77	
Acciones con sismo		1.28			
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld= 4176.36 Ail en banda= 389.75 cm2
Mtd= 3729.88 Ait en banda= 345.08 cm2

Ail entre bandas= 34.54 cm2/m
Ait entre bandas= 30.58 cm2/m

A min mecánica= 39.08 cm2/m
A min geométrica= 19.54 cm2/m

Cortante:

Vld= 7259.07 Astl= 123.85 cm2/m
Vtd= 6023.48 Astt= 0.00 cm2/m

Resistencia local:
Vesqd= 1109.26 Comprobación válida

Armadura de suspensión= 135.66 cm2

TAV ZARAGOZA-LERIDA.TRAMO 1.E-5.ENCEPADO P-2

Dimensiones encepado
Canto = 2.70
Ancho L = %12.00
Ancho T = %12.00

Reacc. pilote máx= 791.58 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 252.28 Pilote: 6 Hipót.: 6

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 6
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	4.500	4.500
2	4.500	0.000
3	4.500	-4.500
4	-4.500	4.500
5	-4.500	0.000
6	-4.500	-4.500

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2577.8	44.6	0.0	1418.4	253.2
H- 2	1664.0	44.6	0.0	1418.4	21.1
H- 3	2577.8	44.6	31.2	1418.4	1060.1
H- 4	1664.0	44.6	31.2	1418.4	828.0
H- 5	2577.8	44.6	77.2	1418.4	1990.5
H- 6	1664.0	44.6	77.2	1418.4	1758.4

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	3549.8	44.6	0.0	1538.8	253.2
H- 2	2636.0	44.6	0.0	1538.8	21.1
H- 3	3549.8	44.6	31.2	1538.8	1144.3
H- 4	2636.0	44.6	31.2	1538.8	912.2
H- 5	3549.8	44.6	77.2	1538.8	2198.9
H- 6	2636.0	44.6	77.2	1538.8	1966.8

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6
H- 1	668.5	654.4	640.3	542.9	528.9	514.8
H- 2	503.3	502.1	500.9	377.7	376.6	375.4
H- 3	724.0	654.4	584.8	598.5	528.9	459.2
H- 4	558.9	502.1	445.4	433.3	376.6	319.8
H- 5	791.6	654.4	517.2	666.0	528.9	391.7
H- 6	626.4	502.1	377.8	500.8	376.6	252.3

DIMENSIONAMIENTO ARMADURAS PILOTES.

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU
H- 1	1069.56	823.67	11.89	41.63	0.505	0.389	0.013
H- 2	805.25	600.62	11.89	41.63	0.380	0.283	0.013
H- 3	1158.48	734.75	14.51	50.80	0.547	0.347	0.016
H- 4	894.17	511.70	14.51	50.80	0.422	0.241	0.016
H- 5	1013.22	501.35	19.02	66.57	0.478	0.237	0.021
H- 6	801.78	322.92	19.02	66.57	0.378	0.152	0.021

DIMENSIONAMIENTO ARMADURAS ENCEPADO.

Fck=	2500	1.50	Vcu long=	6041.85	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	6041.85	
Acciones		1.60	Vcu esqu=	1169.77	
Acciones con sismo		1.28			
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld=	4361.68	Ail en banda=	409.55 cm2
Mtd=	3895.39	Ait en banda=	362.32 cm2
		Ail entre bandas=	37.31 cm2/m
		Ait entre bandas=	33.01 cm2/m
		A min mecánica=	39.08 cm2/m
		A min geométrica=	19.54 cm2/m

Cortante:

Vld=	7794.04	Astl=	178.29 cm2/m
Vtd=	6467.40	Astt=	43.30 cm2/m

Resistencia local:
Vesqd= 1158.48 Comprobación válida

Armadura de suspensión= 142.30 cm2

Amin flexión	=	70.65 cm2
Amin cortante	=	8.57 cm2/m
W máxima	=	0.00
A necesaria	=	0.00 cm2
Ast	=	0.00 cm2/m

TAV ZARAGOZA-LERIDA.TRAMO 1.E-5.ENCEPADO P-3

Dimensiones encepado
Canto = 2.70
Ancho L = %12.00
Ancho T = %12.00

Reacc. pilote máx= 786.47 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 251.20 Pilote: 6 Hipót.: 6

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 6
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	4.500	4.500
2	4.500	0.000
3	4.500	-4.500
4	-4.500	4.500
5	-4.500	0.000
6	-4.500	-4.500

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2559.0	34.2	0.0	1097.8	252.7
H- 2	1645.6	34.2	0.0	1097.8	20.4
H- 3	2559.0	34.2	35.4	1097.8	1205.8
H- 4	1645.6	34.2	35.4	1097.8	973.5
H- 5	2559.0	34.2	82.5	1097.8	2178.8
H- 6	1645.6	34.2	82.5	1097.8	1946.5

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	3531.0	34.2	0.0	1190.1	252.7
H- 2	2617.6	34.2	0.0	1190.1	20.4
H- 3	3531.0	34.2	35.4	1190.1	1301.4
H- 4	2617.6	34.2	35.4	1190.1	1069.1
H- 5	3531.0	34.2	82.5	1190.1	2401.6
H- 6	2617.6	34.2	82.5	1190.1	2169.3

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6
H- 1	651.1	637.0	623.0	554.0	540.0	525.9
H- 2	485.9	484.8	483.6	388.9	387.8	386.6
H- 3	716.2	637.0	557.8	619.2	540.0	460.8
H- 4	551.1	484.8	418.5	454.0	387.8	321.5
H- 5	786.5	637.0	487.6	689.4	540.0	390.5
H- 6	621.3	484.8	348.2	524.3	387.8	251.2

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck= 2000 1.50 Vcu= 84.27
Fyk= 51000 1.15
Acciones 1.60

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	1041.68	841.52	9.12	31.92	0.491	0.397	0.010	0.00
H- 2	777.46	618.59	9.12	31.92	0.367	0.292	0.010	0.00
H- 3	1145.91	737.29	13.13	45.94	0.541	0.348	0.014	0.00
H- 4	881.69	514.36	13.13	45.94	0.416	0.243	0.014	0.00
H- 5	1006.64	499.87	19.06	66.68	0.475	0.236	0.021	0.00
H- 6	795.31	321.54	19.06	66.68	0.375	0.152	0.021	0.00

Amin flexión = 70.65 cm2
Amin cortante = 8.57 cm2/m

W máxima = 0.00
A necesaria = 0.00 cm2
Ast = 0.00 cm2/m

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	6041.85	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	6041.85	
Acciones		1.60	Vcu esqu=	1169.77	
Acciones con sismo		1.28			
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld= 4314.35 Ail en banda= 404.87 cm2
Mtd= 3853.12 Ait en banda= 358.20 cm2

Ail entre bandas= 37.05 cm2/m
Ait entre bandas= 32.78 cm2/m

A min mecánica= 39.08 cm2/m
A min geométrica= 19.54 cm2/m

Cortante:

Vld= 7743.74 Astl= 173.17 cm2/m
Vtd= 6425.66 Astt= 39.05 cm2/m

Resistencia local:
Vesqd= 1145.91 Comprobación válida

Armadura de suspensión= 141.55 cm2

TAV ZARAGOZA-LERIDA.TRAMO 1.E-5.ENCEPADO P-4

Dimensiones encepado
Canto = 2.70
Ancho L = %12.00
Ancho T = %12.00

Reacc. pilote máx= 772.00 Pilote: 1 Hipót.: 5
Reacc. pilote mín= 271.11 Pilote: 6 Hipót.: 6

Dimensiones pila
Ancho L = 2.10
Ancho T = 3.25

Datos pilotes
Número = 6
Diámetro= 1.50
Long emp= 7.00

Pilote	X-Long	Y-Trans
1	4.500	4.500
2	4.500	0.000
3	4.500	-4.500
4	-4.500	4.500
5	-4.500	0.000
6	-4.500	-4.500

Esfuerzos en arranque de fuste:

	N	Fl	Ft	Ml	Mt
H- 1	2585.5	25.8	0.0	836.0	253.2
H- 2	1651.8	25.8	0.0	836.0	21.1
H- 3	2585.5	25.8	37.6	836.0	1291.3
H- 4	1651.8	25.8	37.6	836.0	1059.2
H- 5	2585.5	25.8	79.0	836.0	2069.8
H- 6	1651.8	25.8	79.0	836.0	1837.7

Esfuerzos en cara inferior de encepado:

	N	Fl	Ft	Ml	Mt
H- 1	3557.5	25.8	0.0	905.7	253.2
H- 2	2623.8	25.8	0.0	905.7	21.1
H- 3	3557.5	25.8	37.6	905.7	1392.8
H- 4	2623.8	25.8	37.6	905.7	1160.7
H- 5	3557.5	25.8	79.0	905.7	2283.1
H- 6	2623.8	25.8	79.0	905.7	2051.0

Axiles en pilotes:

HIPOT.	P-1	P-2	P-3	P-4	P-5	P-6
H- 1	643.9	629.8	615.7	570.1	556.0	542.0
H- 2	475.4	474.2	473.0	401.6	400.4	399.2
H- 3	714.5	629.8	545.1	640.7	556.0	471.3
H- 4	546.0	474.2	402.4	472.2	400.4	328.6
H- 5	772.0	629.8	487.6	698.2	556.0	413.8
H- 6	603.5	474.2	344.9	529.7	400.4	271.1

DIMENSIONAMIENTO ARMADURAS PILOTES.
****

Fck=	2000	1.50	Vcu=	84.27
Fyk=	51000	1.15		
Acciones		1.60		

Esfuerzos mayorados en pilotes

	Nd max	Nd min	Vd	Md	NU1	NU2	MU	W
H- 1	1030.19	867.14	6.88	24.08	0.486	0.409	0.008	0.00
H- 2	760.58	638.78	6.88	24.08	0.359	0.301	0.008	0.00
H- 3	1143.19	754.14	12.16	42.56	0.539	0.356	0.013	0.00
H- 4	873.57	525.79	12.16	42.56	0.412	0.248	0.013	0.00
H- 5	988.17	529.70	17.73	62.06	0.466	0.250	0.019	0.00
H- 6	772.47	347.02	17.73	62.06	0.365	0.164	0.019	0.00

DIMENSIONAMIENTO ARMADURAS ENCEPADO.
****

Fck=	2500	1.50	Vcu long=	6041.85	Uc banda= 13000.00
Fyk=	51000	1.15	Vcu tran=	6041.85	
Acciones		1.60	Vcu esqu=	1169.77	
Acciones con sismo		1.28			
Recubri=	0.10				
Banda=	3.00				

Flexión:

Mld=	4304.10	Ail en banda=	403.25 cm2
Mtd=	3843.96	Ait en banda=	356.85 cm2
		Ail entre bandas=	36.31 cm2/m
		Ait entre bandas=	32.13 cm2/m
		A min mecánica=	39.08 cm2/m
		A min geométrica=	19.54 cm2/m

Cortante:

Vld=	7601.27	Astl=	158.67	cm2/m
Vtd=	6307.44	Astt=	27.02	cm2/m

Resistencia local:
Vesqd= 1143.19 Comprobación válida

Armadura de suspensión= 142.61 cm2

Amin flexión =	70.65 cm2
Amin cortante =	8.57 cm2/m
W máxima =	0.00
A necesaria =	0.00 cm2
Ast =	0.00 cm2/m

ZARAGOZA-LERIDA.TRAMO 1.E-5.ZAPATA PILA 5

Zapata:
H = 2.500 m
BL = 7.500 m
BT = 9.000 m

Fuste:
AL = 2.100 m
AT = 3.250 m

Materiales:
Hormigón.: Fck = 2500 T/m2 gc = 1.500
Acero....: Fyk = 51000 T/m2 gs = 1.150 r = 0.100 m

Esfuerzos en arranque de fuste: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2312.50	26.20	0.00	581.60	242.60
2	1372.40	26.20	0.00	581.60	21.60
3	2312.50	26.20	32.40	581.60	916.70
4	1372.40	26.20	32.40	581.60	695.70
5	2312.50	26.20	51.90	581.60	1057.70
6	1372.40	26.20	51.90	581.60	836.70

Esfuerzos en cara inferior de zapata: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2312.50	26.20	0.00	647.10	242.60
2	1372.40	26.20	0.00	647.10	21.60
3	2312.50	26.20	32.40	647.10	997.70
4	1372.40	26.20	32.40	647.10	776.70
5	2312.50	26.20	51.90	647.10	1187.45
6	1372.40	26.20	51.90	647.10	966.45

Esfuerzos en hipótesis combinadas: (T - mT)

--H--	---N---	---FL--	---FT--	---ML--	---MT--
1	2734.38	26.20	0.00	647.10	242.60
2	1794.28	26.20	0.00	647.10	21.60
3	2734.38	26.20	32.40	647.10	997.70
4	1794.28	26.20	32.40	647.10	776.70
5	2734.38	26.20	51.90	647.10	1187.45
6	1794.28	26.20	51.90	647.10	966.45

Tensiones: (T/m2)

--H--	---T1--	---T2--	---T3--	---T4--	---TC--
1	30.44	35.24	45.78	50.57	44.11
2	18.70	19.13	34.04	34.46	29.49
3	22.99	42.69	38.32	58.03	47.05
4	11.24	26.58	26.58	41.92	32.54
5	21.11	44.57	36.45	59.91	47.86
6	9.37	28.46	24.71	43.80	33.41

Tmáx = 59.91 Tmín = 9.37 TCmáx = 47.86

Armaduras:
---:

Longitudinal:

Uc = 4000.00 T/m Vcu = 194.51 T/m
Md = 325.46 mT/m Hip = 3 gf = 1.44
Vd = 108.54 T/m Hip = 3 gf = 1.44
As = 31.62 cm2/m
0.04*Uc = 36.08 cm2/m 0.0015*Ac = 37.50 cm2/m

Transversal:

Uc = 4000.00 T/m Vcu = 185.90 T/m
Md = 401.56 mT/m Hip = 3 gf = 1.44
Vd = 120.48 T/m Hip = 3 gf = 1.44
As = 39.31 cm2/m
0.04*Uc = 36.08 cm2/m 0.0015*Ac = 37.50 cm2/m

PROYECTO E-5

FECHA V-97

HOJA N.º 34

CONCEPTO DE PILOTES

De acuerdo con el informe geotécnico se calculan las longitudes de pilote en cada pila.

Parte estratigráficas según sondeos:

	P-2	P-3	P-4	Rozamiento (t/m²)
LIMOS ARCILLOSOS	0 - 11.50	0 - 11,20	0 - 7.50	4
(con gravas)	11.50 - 12.50	11,20 - 17.40	7.50 - 9.00	8
GRAVAS SILICEAS	12.50 - 15.80	17.40 - 20.40	9.00 - 11.00	10
YESO ALTERADO	15.80 - 19.20	20.40 - 30.40	11.00 - 13.00	10
YESO MASIVO SANO	19.20 →	30.40 →	13.00 →	32

Rozamiento negativo (limos colapsable) : 23,30 × 1.50 = 35 t

Pila 2. $\frac{1}{3}(11.50\times4 + 1.00\times8 + 6.70\times10)\times\pi\times1.50 + \frac{1}{2.5}\times\pi\times1.50\times32\times L - 35 = 724,0$

L = 9.43 ≃ 10m en yeso sano. L pilote = 19.20 + 10 ≃ 29m

Pila 3. $\frac{1}{3}(11.20\times4 + 6.20\times8 + 13.00\times10)\times\pi\times1.50 + \frac{1}{2.5}\times\pi\times1.50\times32\times L - 35 = 716,2$

L = 6.61m en yeso sano. L pilote = 30.40 + 6.6m ≃ 37m

Pila 4. $\frac{1}{3}(7.50\times4 + 1.00\times8 + 4.00\times10)\times\pi\times1.50 + \frac{1}{2.5}\times\pi\times1.50\times32\times L - 35 = 714,5$

L = 10,30 ≃ 11m en yeso sano. L pilote = 13.00 + 11.00 ≃ 24m

Pila 1: N min = 693.3m

(Suponemos el mismo rozamiento que en la P-2)

L = 8,72 ≃ 9.00m en yeso sano: L pilote = 19,20 + 9.00 ≃ 28m

P-2 → Nmax 790 t → $\frac{1}{2.5}\cdot\pi\cdot1.50\cdot32\cdot L - 35 = 790$

$\frac{1}{3}(4.00\times4 + 6\times? + ?\times10)\cdot\pi\cdot1.50 + \frac{1}{2.5}\pi\cdot1.5\cdot32\cdot L = 790 + 35$ → 13,0 → 380

$\frac{1}{3}\cdot?\cdot\pi\cdot1.50$

4.- CALCULO ESTRIBOS

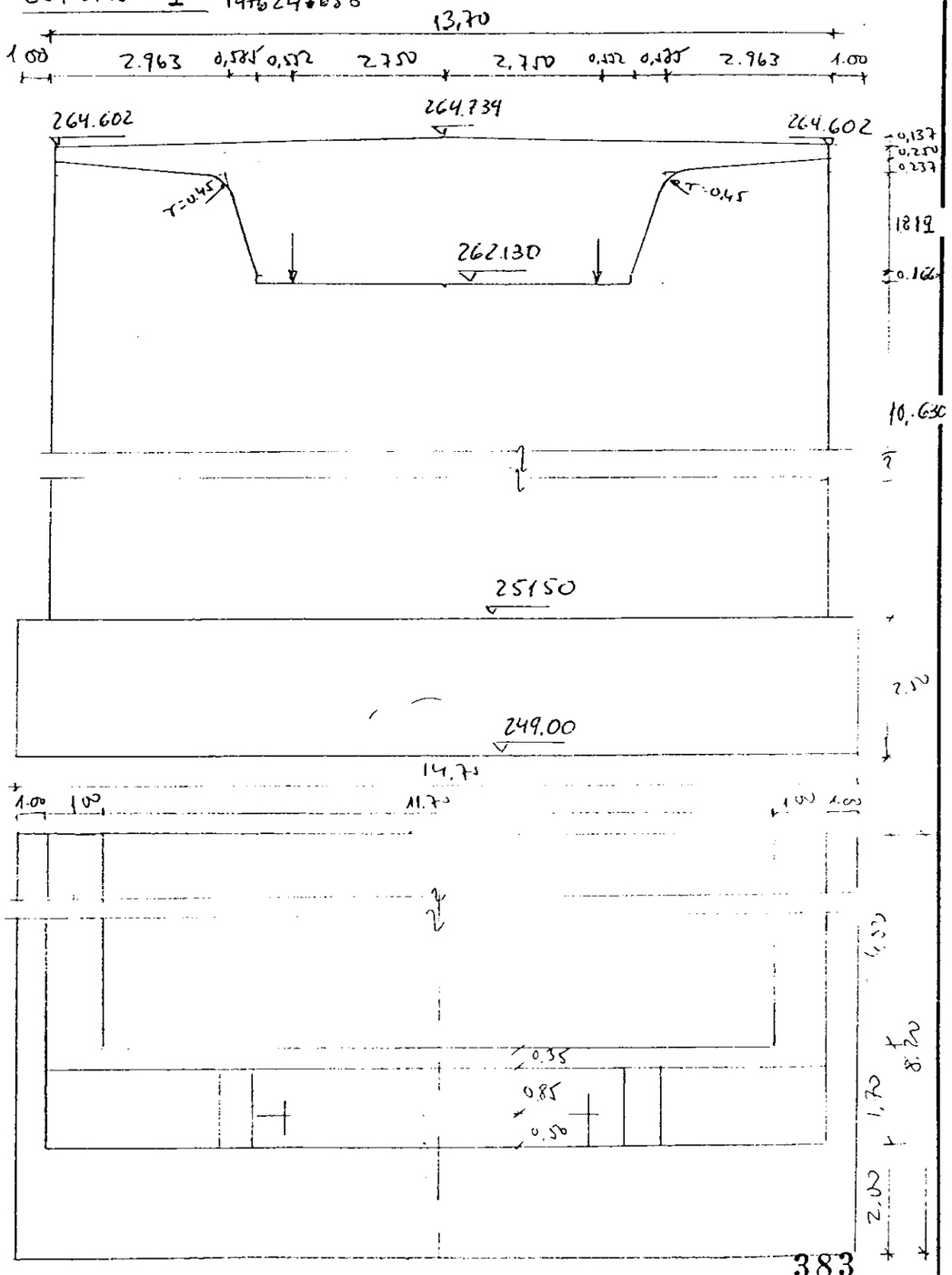
4.1.- ESTRIBO 1 (Móvil)

PROYECTO TAV ZARAGOZA - LERIDA
SUBTRAMO 1
E-5

FECHA XI-97

HOJA N.º 1

ESTRIBO 1 14+624.658



PROYECTO TAV ZARAGOZA - LERIDA
SUBTRAMO 1
E-5

FECHA

HOJA N.º 2

Reacción de PP+C.P $N = 278.1 + 108.3 + 22.6 + 56.7 = 466\ t$

Reacción de sobrecarga $N = 299.1\ t$

M sobrecarga: $M_r = 299.1 \cdot 0.3 = 90\ m\,t$

F_{HL} frenado
F_{HL} diferidas
$\Big\}$ $F_{HL} = 24{,}2\ t$

F_{HT} viento: 65.11 t (rígido)

F_{HT} sismo: $0{,}08 \cdot (278.1 + 108.3 + 22.6 + 56.7 + 0.6 \times 299) = 51.6\ t$ (rígido)

```
ZARAGOZA-LERIDA. SUBTRAMO 1. E-5 VIENTO.  E-1 RIGIDO
CONTROL
8 7 1 1
:
NUDOS
1        0        0
2        27       0
3        60       0
4        93       0
5        126      0
6        159      0
7        192      0
8        219      0
:
SECCIONES
1
8.79 100.0 4.0E6
:
BARRAS
1 1 2 1
2 2 3 1
3 3 4 1
4 4 5 1
5 5 6 1
6 6 7 1
7 7 8 1
:
APOYOS
8
1 1      1    0
2 1  1636     0
3 1  861      0
4 1  658      0
5 1  615      0
6 1  646      0
7 1  2082     0
8 1  1        0
:
HIPOTESIS DE CARGA
H-1 FUERZA DE VIENTO 1.33 T/M
0
7
1 2 1.33 90
2 2 1.33 90
3 2 1.33 90
4 2 1.33 90
5 2 1.33 90
6 2 1.33 90
7 2 1.33 90
:
```


ZARAGOZA-LERIDA. SUBTRAMO 1. E-5 VIENTO E-1 RIGIDO.

Hip. n° 1 H-1 FUERZA DE VIENTO 1.33 T/M

Desplazamientos de nudos

Nudo	Dpl. x	Dpl. y	Giro z
1	-0.000000	0.000000	0.000603
2	-0.000000	0.015799	0.000552
3	-0.000000	0.031489	0.000383
4	-0.000000	0.040226	0.000138
5	-0.000000	0.040314	-0.000134
6	-0.000000	0.031636	-0.000384
7	-0.000000	0.015832	-0.000555
8	-0.000000	0.000000	-0.000603

Reacciones en apoyos

Nudo	Fza. x	Fza. y	Mto. z
1	0.00	-67.78	0.00
2	0.00	-25.85	-0.00
3	0.00	-27.11	0.00
4	0.00	-26.47	-0.00
5	0.00	-24.79	-0.00
6	0.00	-20.44	-0.01
7	0.00	-33.72	0.00
8	0.00	-65.11	-0.00

Esfuerzos en extremos de barras

Barra	Ext.	Axil	Flector	Cortante
1	1	-0.00	-0.00	67.78
	2	0.00	-1345.16	31.87
2	2	-0.00	-1345.16	57.71
	3	0.00	-2525.51	13.82
3	3	-0.00	-2525.52	40.94
	4	0.00	-3152.19	-2.95
4	4	-0.00	-3152.19	23.52
	5	0.00	-3204.01	-20.37
5	5	-0.00	-3204.01	4.42
	6	0.00	-2625.61	-39.47
6	6	-0.00	-2625.61	-19.04
	7	0.00	-1273.26	-62.93
7	7	-0.00	-1273.26	-29.20
	8	0.00	-0.00	-65.11

ESTRUCTURA E-5 ESTRIBO 1

CARACTERISTICAS DEL RELLENO

PESO ESPECIFICO (TN/M3)		= 2.00
ANGULO DE ROZAMIENTO FI		= 35.00
ANGULO ROZAMIENTO TERRENO-MURO		= .00
SOBRECARGA (TN/M2)		= 3.00
COEFICIENTE SISMICO BASICO	C	= .080
COEFICIENTE SISMICO	S	= .080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		= .293
COEFICIENTE DE EMPUJE ACTIVO		= .271

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250. KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.050 M

CARGAS SOBRE EL ESTRIBO

CARGA VERTICAL DE TABLERO PESO PROPIO Y CARGA PERMANENTE	466.0 TN
CARGA VERTICAL DE SOBRECARGAS	299.1 TN
FUERZA LONGITUDINAL DE FRENADO RETRACCION Y TEMPERATURA	24.2 TN
FUERZA TRANSVERSAL DE VIENTO	65.1 TN
MOMENTO TRANSVERSAL DE SOBRECARGAS	90.0 MT
FUERZA LONGITUDINAL DE SISMO	.0 TN
FUERZA TRANSVERSAL DE SISMO	51.6 TN

GEOMETRIA DEL ESTRIBO

ANCHURA DEL ESTRIBO	B	= 13.70
ESVIAJE (GRADOS SEXAGESIMALES)	BETA	= .00

ALZADO DEL ESTRIBO

ESPESOR DEL FALDON	A3	= .35
ALTURA DEL FALDON	A6	= 2.60
DISTANCIA DE APOYO A BORDE ESTRIBO	A5	= .50
ESPESOR DEL ESTRIBO	A2	= 1.70
ESPESOR DE LAS ALETAS	A7	= 1.00
ALTURA TOTAL DEL ESTRIBO	H + C	= 15.80
ALTURA DE TIERRAS	H	= 13.30

ZAPATA

VUELO DELANTERO	A1	= 2.00
VUELO TRASERO	A4	= 4.50
LONGITUD TOTAL	L	= 8.20
CANTO	C	= 2.50
RESGUARDO SOBRE ZAPATA		= 0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		= 60.00 TN/M2

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 61.0 CM2/M	(FI 25 A .075 M)
		AH.= 15.3 CM2/M	(FI 20 A .200 M)
	7.9 M. SUPERIORES	AV.= 30.5 CM2/M	(FI 25 A .150 M)
		AH.= 13.7 CM2/M	(FI 20 A .225 M)
INTRADOS		AV.= 5.5 CM2/M	(FI 12 A .200 M)
		AH.= 12.1 CM2/M	(FI 20 A .250 M)
FALDON	TRASDOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 4.1 CM2/M	(FI 12 A .250 M)
	INTRADOS	AV.= 5.1 CM2/M	(FI 12 A .200 M)
		AH.= 1.9 CM2/M	(FI 8 A .200 M)
ALETAS	TRASDOS	AV.= 15.5 CM2/M	(FI 20 A .200 M)
		AH.= 18.3 CM2/M	(FI 20 A .150 M)
	INTRADOS	AV.= 7.8 CM2/M	(FI 16 A .250 M)
		AH.= 9.1 CM2/M	(FI 16 A .200 M)

ARMADURA DE ZAPATA

CARA INFERIOR.	A. PRINCIPAL = 36.8 CM2/M	(FI 25 A .125 M)
	A. DE REPARTO = 11.0 CM2/M	(FI 16 A .175 M)
CARA SUPERIOR.	A. PRINCIPAL = 36.8 CM2/M	(FI 25 A .125 M)
	A. DE REPARTO = 11.0 CM2/M	(FI 16 A .175 M)

ESTRIBO CON RELLENO DE TIERRAS Y SIN TABLERO
==========

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 41.9

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S1 = 52.4 SA = 40.6 SB = 30.7 S2 = 4.3

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.67

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.49

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 40.2

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S11 = 60.4 SA1 = 44.7 SB1 = 31.4 S21 = -3.7

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.37

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.08

ESTRIBO CON PUENTE EN SERVICIO
==========

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 58.3

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS1 = 69.2 SSA = 52.6 SSB = 38.5 SS2 = 1.0

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 72.9 SMIN = -2.7

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 2.02

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.66

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 49.9

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS11= 71.5 SSA1= 52.4 SSB1= 36.3 SS21= -6.5

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 74.8 SMIN = -9.9

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.54

COEFICIENTE DE SEGURIDAD AL VUELCO = 2.15

MEDICION DEL ESTRIBO
==========

HORMIGON

ZAPATA		280.85
ALZADO		249.20
FALDON TRASERO		12.47
ALETAS		119.70
TOTAL M3	=	662.22

ARMADURAS

	DIAMETRO	NUMERO	LONGITUD	PESO	PESO TOTAL
FALDON					
	12.	69	7.35	.89	450.59
	12.	10	14.10	.89	125.28
	8.	13	14.10	.39	72.38
ZAPATA					
	25.	109	12.90	3.86	5422.27
	25.	109	12.90	3.86	5422.27
	16.	47	18.40	1.58	1365.97
	16.	47	18.40	1.58	1365.97
ALZADO					
	25.	182	14.90	3.86	10457.38
	12.	69	13.20	.89	809.23
	20.	63	16.80	2.47	2612.13
	20.	43	16.80	2.47	1782.88
	20.	32	16.80	2.47	1326.80
A DEDUCIR					
	25.	91	7.00	3.86	-2456.43
	20.	36	16.80	2.47	-1492.65
ALETAS					
	20.	46	16.50	2.47	1873.21
	20.	178	6.50	2.47	2855.48
	16.	36	16.50	1.58	938.23
	16.	134	6.50	1.58	1375.76
TOTAL KG	=				34306.76

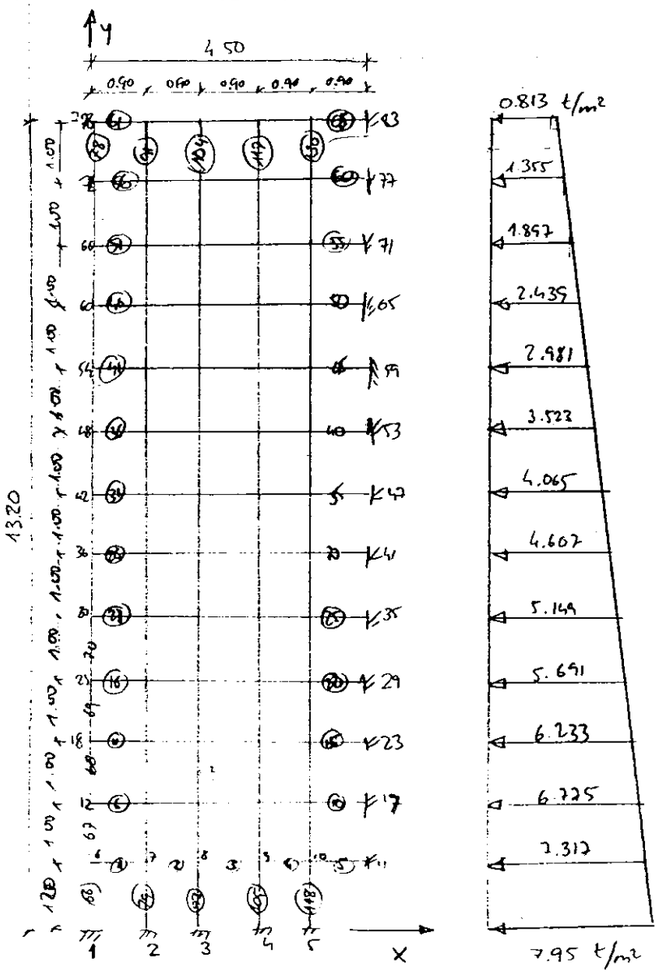
PARADA DE PROGRAMA

PROYECTO TAV. ZARAGOZA - LÉRIDA
SUBTRAMO 1
E-5

FECHA

HOJA N.º 17

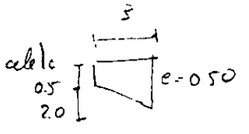
EMPARRILLADO MURO EN VUELTA



Espesor = 1m

BARRAS	I	J
61-65	0.041667	0.08333
6-60	0.08333	0.16667
1-5	0.090417	0.18083
66-78, 118-130	0.03750	0.07500
79-117	0.07500	0.15000

Se le aúde una cable



```
TAV ZARAGOZA-LLEIDA.      MUROS ESTR.1
**control**
83 130 6 1
:
 *nudos**
  1   0     0
  2   0.9   0
  3   1.8   0
  4   2.7   0
  5   3.6   0
  6   0     1.17
  7   0.9   1.17
  8   1.8   1.17
  9   2.7   1.17
  10  3.6   1.17
  11  4.5   1.17
  12  0     2.17
  13  0.9   2.17
  14  1.8   2.17
  15  2.7   2.17
  16  3.6   2.17
  17  4.5   2.17
  18  0     3.17
  19  0.9   3.17
  20  1.8   3.17
  21  2.7   3.17
  22  3.6   3.17
  23  4.5   3.17
  24  0     4.17
  25  0.9   4.17
  26  1.8   4.17
  27  2.7   4.17
  28  3.6   4.17
  29  4.5   4.17
  30  0     5.17
  31  0.9   5.17
  32  1.8   5.17
  33  2.7   5.17
  34  3.6   5.17
  35  4.5   5.17
  36  0     6.17
  37  0.9   6.17
  38  1.8   6.17
  39  2.7   6.17
  40  3.6   6.17
  41  4.5   6.17
  42  0     7.17
  43  0.9   7.17
  44  1.8   7.17
  45  2.7   7.17
  46  3.6   7.17
  47  4.5   7.17
  48  0     8.17
  49  0.9   8.17
  50  1.8   8.17
  51  2.7   8.17
  52  3.6   8.17
  53  4.5   8.17
  54  0     9.17
  55  0.9   9.17
  56  1.8   9.17
  57  2.7   9.17
  58  3.6   9.17
  59  4.5   9.17
  60  0     10.17
  61  0.9   10.17
  62  1.8   10.17
  63  2.7   10.17
  64  3.6   10.17
  65  4.5   10.17
  66  0     11.17
  67  0.9   11.17
  68  1.8   11.17
  69  2.7   11.17
  70  3.6   11.17
  71  4.5   11.17
  72  0     12.17
  73  0.9   12.17
  74  1.8   12.17
  75  2.7   12.17
  76  3.6   12.17
  77  4.5   12.17
  78  0     13.17
  79  0.9   13.17
  80  1.8   13.17
  81  2.7   13.17
  82  3.6   13.17
  83  4.5   13.17
:
**barras tipo**
5
 .04167      0.08333      3500000   1500000
 .08333      0.16667      3500000   1500000
 0.09042     0.18083      3500000   1500000
 0.03750     0.07500      3500000   1500000
 0.07500     0.15000      3500000   1500000
:
**barras**
  1    6    7    3
  2    7    8    3
  3    8    9    3
  4    9    10   3
  5    10   11   3
  6    12   13   2
  7    13   14   2
  8    14   15   2
  9    15   16   2
  10   16   17   2
  11   18   19   2
  12   19   20   2
  13   20   21   2
  14   21   22   2
  15   22   23   2
  16   24   25   2
  17   25   26   2
  18   26   27   2
  19   27   28   2
  20   28   29   2
  21   30   31   2
  22   31   32   2
  23   32   33   2
  24   33   34   2
  25   34   35   2
  26   36   37   2
  27   37   38   2
  28   38   39   2
  29   39   40   2
  30   40   41   2
  31   42   43   2
  32   43   44   2
  33   44   45   2
  34   45   46   2
  35   46   47   2
  36   48   49   2
  37   49   50   2
  38   50   51   2
```

39	51	52	2
40	52	53	2
41	54	55	2
42	55	56	2
43	56	57	2
44	57	58	2
45	58	59	2
46	60	61	2
47	61	62	2
48	62	63	2
49	63	64	2
50	64	65	2
51	66	67	2
52	67	68	2
53	68	69	2
54	69	70	2
55	70	71	2
56	72	73	2
57	73	74	2
58	74	75	2
59	75	76	2
60	76	77	2
61	78	79	1
62	79	80	1
63	80	81	1
64	81	82	1
65	82	83	1
66	1	6	4
67	6	12	4
68	12	18	4
69	18	24	4
70	24	30	4
71	30	36	4
72	36	42	4
73	42	48	4
74	48	54	4
75	54	60	4
76	60	66	4
77	66	72	4
78	72	78	4
79	2	7	5
80	7	13	5
81	13	19	5
82	19	25	5
83	25	31	5
84	31	37	5
85	37	43	5
86	43	49	5
87	49	55	5
88	55	61	5
89	61	67	5
90	67	73	5
91	73	79	5
92	3	8	5
93	8	14	5
94	14	20	5
95	20	26	5
96	26	32	5
97	32	38	5
98	38	44	5
99	44	50	5
100	50	56	5
101	56	62	5
102	62	68	5
103	68	74	5
104	74	80	5
105	4	9	5
106	9	15	5

107	15	21	5
108	21	27	5
109	27	33	5
110	33	39	5
111	39	45	5
112	45	51	5
113	51	57	5
114	57	63	5
115	63	69	5
116	69	75	5
117	75	81	5
118	5	10	4
119	10	16	4
120	16	22	4
121	22	28	4
122	28	34	4
123	34	40	4
124	40	46	4
125	46	52	4
126	52	58	4
127	58	64	4
128	64	70	4
129	70	76	4
130	76	82	4

apoyos

18

1	1	1	1
2	1	1	1
3	1	1	1
4	1	1	1
5	1	1	1
11	1	1	1
17	1	1	1
23	1	1	1
29	1	1	1
35	1	1	1
41	1	1	1
47	1	1	1
53	1	1	1
59	1	1	1
65	1	1	1
71	1	1	1
77	1	1	1
83	1	1	1

cargas

EMPUJE DE TIERRAS

0

65

1	3	7.317	7.317
2	3	7.317	7.317
3	3	7.317	7.317
4	3	7.317	7.317
5	3	7.317	7.317
6	3	6.775	6.775
7	3	6.775	6.775
8	3	6.775	6.775
9	3	6.775	6.775
10	3	6.775	6.775
11	3	6.233	6.233
12	3	6.233	6.233
13	3	6.233	6.233
14	3	6.233	6.233
15	3	6.233	6.233
16	3	5.691	5.691
17	3	5.691	5.691
18	3	5.691	5.691

19	3	5.691	5.691
20	3	5.691	5.691
21	3	5.149	5.149
22	3	5.149	5.149
23	3	5.149	5.149
24	3	5.149	5.149
25	3	5.149	5.149
26	3	4.607	4.607
27	3	4.607	4.607
28	3	4.607	4.607
29	3	4.607	4.607
30	3	4.607	4.607
31	3	4.065	4.065
32	3	4.065	4.065
33	3	4.065	4.065
34	3	4.065	4.065
35	3	4.065	4.065
36	3	3.523	3.523
37	3	3.523	3.523
38	3	3.523	3.523
39	3	3.523	3.523
40	3	3.523	3.523
41	3	2.981	2.981
42	3	2.981	2.981
43	3	2.981	2.981
44	3	2.981	2.981
45	3	2.981	2.981
46	3	2.439	2.439
47	3	2.439	2.439
48	3	2.439	2.439
49	3	2.439	2.439
50	3	2.439	2.439
51	3	1.897	1.897
52	3	1.897	1.897
53	3	1.897	1.897
54	3	1.897	1.897
55	3	1.897	1.897
56	3	1.355	1.355
57	3	1.355	1.355
58	3	1.355	1.355
59	3	1.355	1.355
60	3	1.355	1.355
61	3	0.813	0.813
62	3	0.813	0.813
63	3	0.813	0.813
64	3	0.813	0.813
65	3	0.813	0.813

Hip. nº 1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	-0.000000	0.000000
2	-0.000000	-0.000000	0.000000
3	-0.000000	-0.000000	0.000000
4	-0.000000	-0.000000	0.000000
5	-0.000000	-0.000000	-0.000000
6	-0.000102	-0.000021	0.000077
7	-0.000082	-0.000021	0.000058
8	-0.000057	-0.000021	0.000040
9	-0.000033	-0.000020	0.000022
10	-0.000012	-0.000014	0.000007
11	-0.000000	-0.000000	0.000000
12	-0.000116	-0.000049	0.000194
13	-0.000093	-0.000051	0.000149
14	-0.000065	-0.000051	0.000103
15	-0.000036	-0.000049	0.000058
16	-0.000013	-0.000036	0.000018
17	-0.000000	-0.000000	0.000000
18	-0.000101	-0.000078	0.000308
19	-0.000080	-0.000080	0.000237
20	-0.000054	-0.000082	0.000163
21	-0.000029	-0.000077	0.000090
22	-0.000010	-0.000056	0.000028
23	-0.000000	-0.000000	0.000000
24	-0.000074	-0.000103	0.000400
25	-0.000057	-0.000106	0.000306
26	-0.000038	-0.000108	0.000209
27	-0.000019	-0.000100	0.000114
28	-0.000006	-0.000070	0.000035
29	-0.000000	-0.000000	0.000000
30	-0.000046	-0.000122	0.000462
31	-0.000034	-0.000124	0.000351
32	-0.000021	-0.000125	0.000238
33	-0.000010	-0.000114	0.000128
34	-0.000003	-0.000078	0.000039
35	-0.000000	-0.000000	0.000000
36	-0.000021	-0.000134	0.000497
37	-0.000014	-0.000136	0.000375
38	-0.000008	-0.000136	0.000252
39	-0.000003	-0.000122	0.000134
40	-0.000001	-0.000081	0.000040
41	-0.000000	-0.000000	0.000000
42	-0.000002	-0.000141	0.000509
43	0.000001	-0.000142	0.000382
44	0.000003	-0.000140	0.000254
45	0.000003	-0.000123	0.000134
46	0.000001	-0.000081	0.000040
47	0.000000	-0.000000	0.000000
48	0.000011	-0.000143	0.000504
49	0.000011	-0.000143	0.000376
50	0.000009	-0.000139	0.000248
51	0.000006	-0.000120	0.000129
52	0.000002	-0.000078	0.000038
53	0.000000	-0.000000	0.000000
54	0.000019	-0.000141	0.000489
55	0.000016	-0.000141	0.000361
56	0.000013	-0.000135	0.000236
57	0.000008	-0.000115	0.000122
58	0.000003	-0.000073	0.000036
59	0.000000	-0.000000	0.000000
60	0.000022	-0.000138	0.000468
61	0.000018	-0.000137	0.000344

62	0.000014	-0.000130	0.000223
63	0.000008	-0.000109	0.000114
64	0.000003	-0.000068	0.000033
65	0.000000	-0.000000	0.000000
66	0.000021	-0.000134	0.000446
67	0.000018	-0.000132	0.000325
68	0.000013	-0.000124	0.000209
69	0.000008	-0.000103	0.000106
70	0.000003	-0.000063	0.000030
71	0.000000	-0.000000	0.000000
72	0.000018	-0.000131	0.000426
73	0.000015	-0.000128	0.000309
74	0.000012	-0.000119	0.000197
75	0.000007	-0.000097	0.000099
76	0.000003	-0.000058	0.000028
77	0.000000	-0.000000	0.000000
78	0.000016	-0.000128	0.000409
79	0.000014	-0.000126	0.000294
80	0.000011	-0.000115	0.000186
81	0.000007	-0.000092	0.000092
82	0.000003	-0.000054	0.000025
83	0.000000	-0.000000	0.000000

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	21.21	2.04	16.64
2	29.86	4.08	19.60
3	20.18	3.95	12.57
4	11.08	3.76	6.44
5	1.38	1.36	-0.01
11	3.71	7.42	7.67
17	3.59	17.08	14.29
23	2.82	25.56	18.65
29	1.80	31.18	20.64
35	0.87	34.03	20.82
41	0.14	34.69	19.81
47	-0.37	33.81	18.12
53	-0.68	31.94	16.08
59	-0.83	29.55	13.94
65	-0.86	27.01	11.86
71	-0.81	24.56	9.93
77	-0.76	22.23	8.01
83	-0.38	9.83	2.74

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	6	6.11	-1.11	4.67
	7	6.11	0.13	-1.92
2	7	7.48	-2.38	6.96
	8	7.48	0.92	0.37
3	8	7.42	-2.07	6.03
	9	7.42	0.39	-0.56
4	9	6.11	-2.41	3.29
	10	6.11	-2.41	-3.30
5	10	3.71	-3.48	-1.09
	11	3.71	-7.42	-7.67
6	12	6.48	-0.08	3.20
	13	6.48	0.06	-2.90
7	13	7.90	-0.04	2.72
	14	7.90	-0.33	-3.38
8	14	7.93	-0.36	0.90
	15	7.93	-2.29	-5.19
9	15	6.44	-2.20	-2.46
	16	6.44	-7.15	-8.55
10	16	3.59	-6.96	-8.19
	17	3.59	-17.08	-14.29

11	18	5.96	0.43	2.68
	19	5.96	0.32	-2.93
12	19	7.07	1.31	0.43
	20	7.07	-0.82	-5.18
13	20	6.88	0.44	-2.67
	21	6.88	-4.49	-8.28
14	21	5.32	-3.06	-7.04
	22	5.32	-11.92	-12.65
15	22	2.82	-11.30	-13.04
	23	2.82	-25.56	-18.65
16	24	4.76	0.67	2.28
	25	4.76	0.42	-2.84
17	25	5.44	1.88	-0.97
	26	5.44	-1.29	-6.09
18	26	5.01	0.41	-4.90
	27	5.01	-6.30	-10.02
19	27	3.62	-4.53	-9.73
	28	3.62	-15.59	-14.85
20	28	1.80	-14.91	-15.52
	29	1.80	-31.18	-20.64
21	30	3.33	0.73	1.87
	31	3.33	0.32	-2.77
22	31	3.60	1.86	-1.83
	32	3.60	-1.87	-6.46
23	32	3.05	-0.19	-6.05
	33	3.05	-7.72	-10.68
24	33	1.96	-6.09	-10.87
	34	1.96	-17.96	-15.51
25	34	0.87	-17.38	-16.19
	35	0.87	-34.03	-20.82
26	36	1.94	0.66	1.44
	37	1.94	0.09	-2.71
27	37	1.91	1.46	-2.31
	38	1.91	-2.48	-6.46
28	38	1.35	-1.06	-6.45
	39	1.35	-8.73	-10.59
29	39	0.60	-7.43	-10.96
	40	0.60	-19.16	-15.10
30	40	0.14	-18.73	-15.67
	41	0.14	-34.69	-19.81
31	42	0.77	0.53	1.02
	43	0.77	-0.19	-2.64
32	43	0.54	0.88	-2.54
	44	0.54	-3.05	-6.20
33	44	0.04	-1.99	-6.36
	45	0.04	-9.36	-10.02
34	45	-0.38	-8.44	-10.39
	46	-0.38	-19.43	-14.05
35	46	-0.37	-19.15	-14.46
	47	-0.37	-33.81	-18.12
36	48	-0.10	0.37	0.63
	49	-0.10	-0.48	-2.54
37	49	-0.44	0.26	-2.61
	50	-0.44	-3.52	-5.78
38	50	-0.85	-2.83	-6.01
	51	-0.85	-9.66	-9.18
39	51	-1.02	-9.10	-9.48
	52	-1.02	-19.05	-12.65
40	52	-0.68	-18.89	-12.91
	53	-0.68	-31.94	-16.08
41	54	-0.65	0.21	0.27
	55	-0.65	-0.75	-2.41
42	55	-1.03	-0.34	-2.60
	56	-1.03	-3.90	-5.29
43	56	-1.36	-3.54	-5.53
	57	-1.36	-9.73	-8.21
44	57	-1.35	-9.47	-8.44
	58	-1.35	-18.27	-11.13

45	58	-0.83	-18.21	-11.26
	59	-0.83	-29.55	-13.94
46	60	-0.90	0.07	-0.07
	61	-0.90	-0.98	-2.26
47	61	-1.28	-0.87	-2.58
	62	-1.28	-4.19	-4.78
48	62	-1.54	-4.12	-5.05
	63	-1.54	-9.66	-7.25
49	63	-1.44	-9.64	-7.43
	64	-1.44	-17.31	-9.63
50	64	-0.86	-17.32	-9.67
	65	-0.86	-27.01	-11.86
51	66	-0.89	-0.05	-0.41
	67	-0.89	-1.19	-2.12
52	67	-1.23	-1.30	-2.64
	68	-1.23	-4.45	-4.35
53	68	-1.46	-4.58	-4.68
	69	-1.46	-9.56	-6.39
54	69	-1.36	-9.70	-6.53
	70	-1.36	-16.35	-8.24
55	70	-0.81	-16.39	-8.22
	71	-0.81	-24.56	-9.93
56	72	-0.70	-0.12	-0.82
	73	-0.70	-1.41	-2.04
57	73	-1.02	-1.66	-2.79
	74	-1.02	-4.72	-4.01
58	74	-1.24	-4.98	-4.45
	75	-1.24	-9.53	-5.67
59	75	-1.21	-9.81	-5.72
	76	-1.21	-15.51	-6.94
60	76	-0.76	-15.57	-6.79
	77	-0.76	-22.23	-8.01
61	78	-0.28	-0.26	-0.13
	79	-0.28	-0.71	-0.86
62	79	-0.45	-1.36	-0.54
	80	-0.45	-2.18	-1.28
63	80	-0.56	-3.07	-1.09
	81	-0.56	-4.38	-1.82
64	81	-0.57	-5.39	-1.66
	82	-0.57	-7.22	-2.40
65	82	-0.38	-7.70	-2.00
	83	-0.38	-9.83	-2.74
66	1	-2.04	-21.21	16.64
	6	-2.04	-1.74	16.64
67	6	-3.15	-7.85	11.98
	12	-3.15	4.13	11.98
68	12	-3.23	-2.36	8.78
	18	-3.23	6.42	8.78
69	18	-2.80	0.46	6.09
	24	-2.80	6.56	6.09
70	24	-2.13	1.79	3.81
	30	-2.13	5.60	3.81
71	30	-1.41	2.27	1.94
	36	-1.41	4.21	1.94
72	36	-0.74	2.27	0.50
	42	-0.74	2.77	0.50
73	42	-0.21	2.01	-0.52
	48	-0.21	1.48	-0.52
74	48	0.16	1.59	-1.15
	54	0.16	0.43	-1.15
75	54	0.37	1.08	-1.42
	60	0.37	-0.34	-1.42
76	60	0.44	0.56	-1.36
	66	0.44	-0.80	-1.36
77	66	0.39	0.09	-0.95
	72	0.39	-0.86	-0.95
78	72	0.26	-0.16	-0.13
	78	0.26	-0.28	-0.13

79	2	-4.08	-29.86	19.60
	7	-4.08	-6.93	19.60
80	7	-6.60	-8.29	10.73
	13	-6.60	2.44	10.73
81	13	-6.69	1.01	5.11
	19	-6.69	6.12	5.11
82	19	-5.69	5.01	1.75
	25	-5.69	6.76	1.75
83	25	-4.23	6.09	-0.12
	31	-4.23	5.97	-0.12
84	31	-2.69	5.70	-1.06
	37	-2.69	4.64	-1.06
85	37	-1.32	4.67	-1.45
	43	-1.32	3.22	-1.45
86	43	-0.24	3.44	-1.55
	49	-0.24	1.90	-1.55
87	49	0.50	2.23	-1.47
	55	0.50	0.76	-1.47
88	55	0.91	1.15	-1.28
	61	0.91	-0.13	-1.28
89	61	1.02	0.25	-0.96
	67	1.02	-0.71	-0.96
90	67	0.90	-0.37	-0.43
	73	0.90	-0.80	-0.43
91	73	0.66	-0.48	0.31
	79	0.66	-0.16	0.31
92	3	-3.95	-20.18	12.57
	8	-3.95	-5.48	12.57
93	8	-6.94	-5.42	6.91
	14	-6.94	1.49	6.91
94	14	-6.97	1.46	2.63
	20	-6.97	4.10	2.63
95	20	-5.70	4.28	0.13
	26	-5.70	4.41	0.13
96	26	-3.99	4.83	-1.07
	32	-3.99	3.76	-1.07
97	32	-2.31	4.31	-1.48
	38	-2.31	2.83	-1.48
98	38	-0.90	3.39	-1.49
	44	-0.90	1.90	-1.49
99	44	0.17	2.40	-1.33
	50	0.17	1.08	-1.33
100	50	0.86	1.49	-1.10
	56	0.86	0.38	-1.10
101	56	1.21	0.71	-0.86
	62	1.21	-0.15	-0.86
102	62	1.28	0.10	-0.59
	68	1.28	-0.49	-0.59
103	68	1.15	-0.26	-0.26
	74	1.15	-0.52	-0.26
104	74	0.89	-0.30	0.18
	80	0.89	-0.11	0.18
105	4	-3.76	-11.08	6.44
	9	-3.76	-3.54	6.44
106	9	-6.56	-2.23	2.60
	15	-6.56	0.37	2.60
107	15	-6.46	1.86	-0.14
	21	-6.46	1.72	-0.14
108	21	-5.04	3.27	-1.38
	27	-5.04	1.89	-1.38
109	27	-3.26	3.28	-1.67
	33	-3.26	1.61	-1.67
110	33	-1.63	2.71	-1.48
	39	-1.63	1.23	-1.48
111	39	-0.33	1.97	-1.12
	45	-0.33	0.85	-1.12
112	45	0.59	1.28	-0.76
	51	0.59	0.52	-0.76

113	51	1.16	0.69	-0.46
	57	1.16	0.23	-0.46
114	57	1.42	0.22	-0.23
	63	1.42	-0.00	-0.23
115	63	1.44	-0.10	-0.04
	69	1.44	-0.14	-0.04
116	69	1.30	-0.24	0.10
	75	1.30	-0.13	0.10
117	75	1.01	-0.17	0.16
	81	1.01	-0.01	0.16
118	5	-1.36	-1.38	-0.01
	10	-1.36	-1.38	-0.01
119	10	-2.43	1.02	-2.22
	16	-2.43	-1.19	-2.22
120	16	-2.24	1.65	-2.58
	22	-2.24	-0.92	-2.58
121	22	-1.62	1.58	-2.19
	28	-1.62	-0.61	-2.19
122	28	-0.94	1.20	-1.52
	34	-0.94	-0.32	-1.52
123	34	-0.36	0.77	-0.85
	40	-0.36	-0.08	-0.85
124	40	0.07	0.38	-0.28
	46	0.07	0.10	-0.28
125	46	0.36	0.08	0.13
	52	0.36	0.21	0.13
126	52	0.52	-0.12	0.39
	58	0.52	0.27	0.39
127	58	0.58	-0.25	0.52
	64	0.58	0.27	0.52
128	64	0.57	-0.30	0.56
	70	0.57	0.26	0.56
129	70	0.53	-0.29	0.54
	76	0.53	0.25	0.54
130	76	0.48	-0.20	0.39
	82	0.48	0.19	0.39

PROYECTO TAV ZARAGOZA - LÉRIDA
SUBTRAMO 1
E-1

FECHA .....

HOJA N.º 24

ARMADURA EN MUROS EN VUELTA:

Armadura vertical:

NUDO 1:

$M_d = \frac{1'6 \times 21'21}{0.45} = 75'4133$ mt/m

$U_c = \frac{2500}{1.5} \times 0'95 = 1583'33$ t/m.

$A_s = \frac{1'15}{5'1} \times 1583'33 \left(1 - \sqrt{1 - \frac{2 \times 75'4133}{1583'33 \times 0}}\right)$

$= 16'37$ cm²/m.

⇒ Ø20 / c'15. (cI)

NUDO 24.

$M_d = 1'6 \times \left[6'56 + 4'76\right] = 11'32 \cdot 1'6 = 18'112$ mt.

$A_s = \frac{1'15}{5'1} \times 1583'33 \left(1 - \sqrt{1 - \frac{2 \times 18'112}{1583'33 \times 0'45 \cdot 0'45}}\right) = 9'68$ cm²/m.

⇒ Ø20 / c'30 (cI)

NUDO 3: $M_d = \frac{1'6 \times 29'86}{0.90} = 53'08$ mt/m ⟶ 12'83 cm²/m ⟶ Ø20/a20 (cI)

Armadura horizontal:

NUDO 41:

$M_d = 1'6 \times 34'69 = 55'50$ mt

$U_c = \frac{2500}{1.5} \cdot 0'95 = 1583.33$

$A_s = 12'20$ cm²/m

⇒ Ø16/0.15 ó Ø20/0.25 (cI)

Nd: ⇒ $1355 \times \frac{3}{2}^2 + 1355 \times 7.5 = 16,7$ mt en nudo 77 →

$M_d = 1.6 \cdot (27,3 + 16.3) = 61.8 \rightarrow A = 15.9 \rightarrow$ Ø20/0.10 en zona superior

4.2.- ESTRIBO 2 (Fijo)

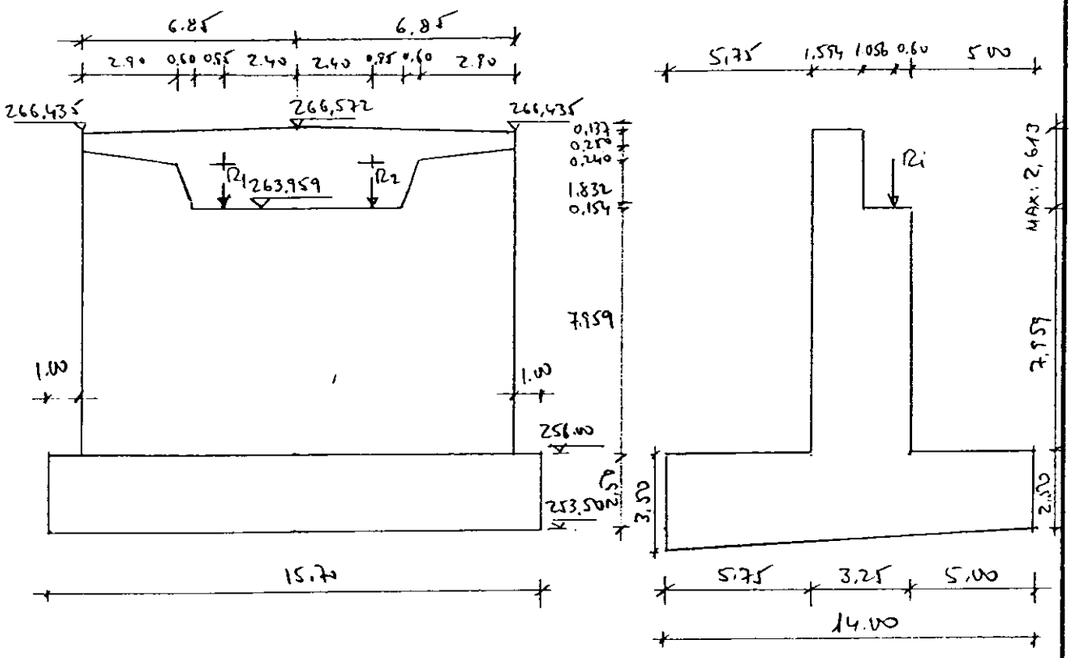
PROYECTO ZARAGOZA - LERIDA
SUB-TRAMO 1
E-5

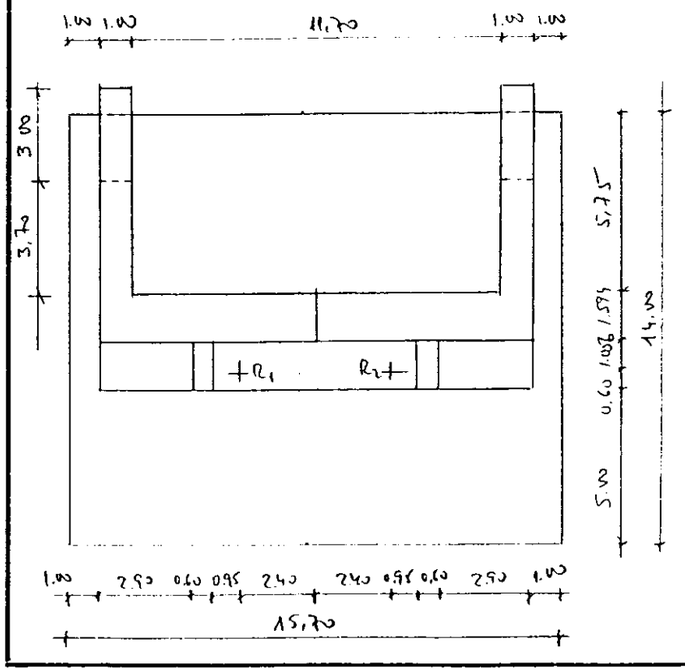
FECHA XI-97

HOJA N.º 1

ESTRIBO FIJO (E-2) (P.k 14+843,658)

Sobre: -8kg/cm² = = -80 t/m²





PROYECTO
E-5

FECHA XI-97

HOJA N.º 2

- $R_1 + R_2$

ppr cp: 313.1 + 108.3 + 24.6 + 68.2 = 514.2 t

sobrec: 299.0 t M: 299.0 × 0.30 = 89.7 mt

F_{H_L} frente: 910.0 t

F_{H_L} del 2º1: 189.0 t

F_{H_L} tierra: 779.2 t + 107.4 = 886.6 t

F_{H_T} muro: 67.8 t

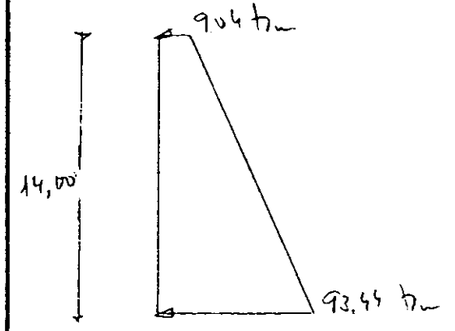
F_{H_T} tierra: 55.5 t + 107.4 = 162.9 t.

- Empuje de tierra

$\varphi = 40°$ $k_A = 0,22$. $q = 3$ t/m²

$e = 0,22\,(3.0 + 2.0 \times h)$

$E = e \times 13,7$



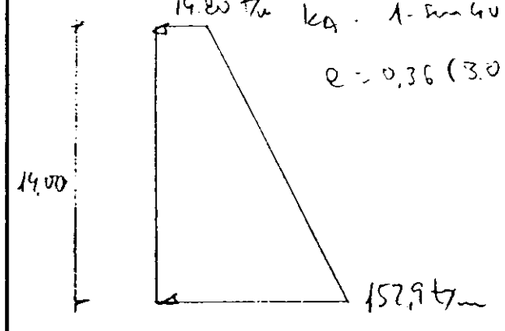
$F_{H_L} = \frac{9.04 + 93.44}{2} \times 14.00 = 717,4$ t

$M_L = 717,4 \left(\frac{18.08 + 93.44}{9.04 + 93.44} \times \frac{14.00}{3} \right) = 3643,0$ mt

- Empuje de tierra + agua

14.80 t/m $k_A = 1 - \sin 40° = 0,36$

$e = 0,36\,(3.0 + 2,0\,h)$ $E = e \times 13,7$



$F_{H_L} = \frac{14.8 + 152.9}{2} \times 14.00 = 1173,9$ t

$M_L = 1173,9 \left(\frac{29.6 + 152.9}{14.8 + 152.9} \times \frac{14.00}{3} \right) = 5961,8$ mt

- Incremento de empuje de tierras por sismo.

$C = 0.08$

$k_a = 0,22$.

$$k_{AH} = \left[\frac{\sec\alpha \cos(\psi-\alpha)}{\sqrt{\cos(\alpha+\delta)} + \sqrt{\frac{\sin(\psi+\delta)\sin(\psi-\beta)}{\cos(\beta-\alpha)}}}\right]^2 = 0,254$$

$\alpha = \psi$; $\psi = 4°$; $\beta = \psi$; $\delta = 0$; $\psi = \arctg(0.08) = 4.57°$

$$k_{AD} = \frac{k_{AH}}{\cos\psi} = \frac{0,254}{0.997} = 0,26$$

$\Delta F_{HL} = \frac{1}{2}(0.26-0.22)\cdot 2.0 \times 14.00^2 \times 13.70 = 107,4$ t

$\Delta M_L = 107.4 \times \frac{14.00}{2} = 751.9$ mt

DECENAS REFERIDAS AL CENTRO DE LA ZAPATA (C. INFERIOR)

	N	F_{HL}	F_{HT}	M_L	M_T
ZAPATA : 14,00×15,7×2,20×2,5	1373.8	–	–	–	–
½ 14,00×1,57×1,00×2,5	274.7	–	–	−641.1	–
MURO FR. : 13,7×7,96×3,25×2,5	886,1	–	–	332,3	–
MURETE : 13,7×2,53×1,60×2,5	138.6	–	–	−63,2	–
TAPES : 2×3,20×2,37×1,65×2,5	61,2	–	–	71.7	–
MUROS LAT: 2×3,70×10,50×1,00×2,5	194,3	–	–	−602,3	–
PESO TIERRAS: 11,70×5,75×10,50×2,0	1412,8	–	–	−5827,8	–
ALETAS : 2×3,00×1,50×10,0×2,5	225	–	–	−137,6	–
C.P. TAB. = 354,2+108,3+24,5+70,3	514,2	–	–	719,9	–
SOB. TAB. MAX :	299,0	–	–	418.6	89.5
SOB. TAB. MIN :	−55,0	–	–	−77,0	–
EMPUJE TIERRAS :	–	317.4	–	3643,0	–
EMP. TIERRAS REPOSO :	–	1173.9	–	5961.8	–
INCR. EMP. T. SISMO :	–	107,4	–	751.9	–
FRENADO :	–	±910.0	–	±9133.9	–
DIF-DIF :	–	189.0	–	2355.	–
VIENTO :	–	–	67.8	–	903.9
SISMO LONG :	–	±779,2	–	±9298	–
SISMO TRANS :	–	–	162,9	–	1613.0

H-1 P. propio + c perm. + sobrec. uso + dif. dif + Frenado + Emp. tierras + viento

$N = 5177,2$ t.

$F_{HL} = 1816.4$ t

$F_{HT} = 67,8$

$M_L = 11608$ mt $\quad e_L = 2.24$ m

$M_T = 9925$ mt. $\quad e_T = 0,192$ m

$$\sigma_{cab} = \frac{-5177,2}{4(7,00-2.24)(7,85-0.192)} = -35,5 \text{ t/m}^2$$

$$\sigma_{uña} = -\frac{5177,2}{219.8} \pm \frac{1160,8\times 7.00}{3590,1} \pm \frac{9925\times 7,85}{4515} = \begin{cases} -47,9 \text{ t/m}^2 \\ +0.8 \text{ t/m}^2 \end{cases}$$

$$\gamma_{vuelco} = \frac{5177,2\times 6.50}{11608} = 2,90 > 1,35$$

$$\gamma_{desliz} = \frac{5177,2\times(0.40+0.071)}{\sqrt{1816.4^2+67,8^2}} = \frac{2438.5}{1817} = 1,35$$

H-2 P. propio + c perm. + sobrec uso + def diferid. − Frenado + + empuje tierras al reposo + viento

$N = 4823,2$ t

$F_{HL} = 452,9$ t

$F_{HT} = 67.8$ t

$M_L = -9247$ mt $\quad e_L = -1,92$ m

$M_T = 903$ mt $\quad e_T = 0,19$ m

$\sigma_{cab} = -31,0$ t/m² $\quad \sigma_{uña} = \begin{cases} -41,5 \text{ t/m}^2 \\ +2,3 \text{ t/m}^2 \end{cases}$

$\gamma_{vuelco} = 3,39 > 1,35$ $\quad \gamma_{desliz.} = 4,51 > 1,35$

PROYECTO E-5 | FECHA XI-97 | HOJA N.° 5

H-3 Como H-1, sin frenado.

$N = 5177{,}2\,t$

F_{H_L} 906,4 t

$F_{H_T} = 67{,}8\,t$

$M_L = 269$ mt → $e_L = 0{,}052$ m.

$M_T = 992{,}5$ mt → $e_T = 0{,}192$ m

$\sigma_{cab} = -24{,}3$ t/m²

γ_{vuelco} — $\gamma_{desliz} = 2{,}37 > 1.50$

H-4 P. propio + c. perm. + sobrec. uso + def. dif. + emp. trans. + sism. long. + 0,6 × frenado

$N = 4823{,}2\,t$

$F_{H_L} = 2339\,t$

$F_{H_T} = 0$

$M_L = 16626{,}0$ mt → $e_L = 3{,}447$ m

$M_T = 0$ mt → $e_T = 0$ m

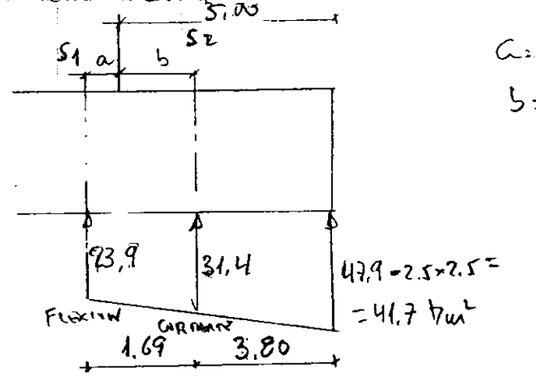
$\sigma_{cab} = -43{,}2$ t/m² $\quad \sigma_{suelo} < \begin{cases} -54{,}4\ t/m^2 \\ +10{,}5\ t/m^2 \end{cases}$

$\gamma_{vuelco} = 1{,}88 > 1$ $\quad \gamma_{desliz} = 1.00$

PROYECTO E-5 | FECHA XI-97 | HOJA N.° 6

ARMADO DE ZAPATA

- Zonas delantera:



$c = 0{,}15 \times 3{,}25 = 0{,}49$ m

$b = 1/2 \times 2{,}40 = 1{,}20$ m

$M_d = 1{,}6 \left[23{,}9 \times \frac{5{,}49^2}{2} + 17{,}8 \times \frac{5{,}49^2}{3} \right] =$

$= 862{,}1$ mt/m

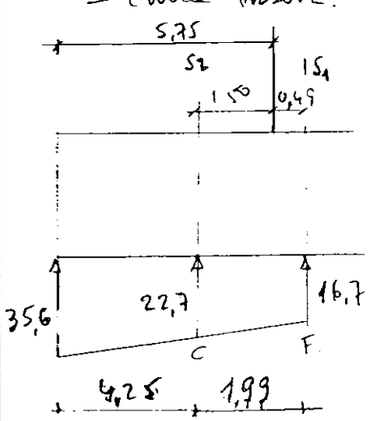
Ley de $1.00 \times 2{,}89$

$V_c = \frac{2{,}50}{1.5} \times 1.00 \times 2{,}79 = 4650$ t/m $\quad A = 70{,}6\ cm^2/m \rightarrow 2\phi 25/0.15$ con vuelco = 0.9

$V_d = 1.6 \times 36{,}7 \times 3{,}80 = 222{,}0$ t/m Ley de $1.00 \times 2{,}77$

$V_{cu} = 2 \times 5 \sqrt{\frac{2{,}50}{1.5}} \times 1.00 \times 2{,}67 = 344{,}7$ t/m > V_d

- Zonas traseras:



$M_d = 1{,}6 \left[16{,}7 \times \frac{6{,}24^2}{2} + 18{,}9 \times \frac{6{,}24^2}{3} \right] =$

$= 912{,}7$ mt/m

Ley de 1.00×3.05

$V_c = \frac{2{,}50}{1.5} \times 1.00 \times 2{,}95 = 4917$ t ; $A = 72{,}1\ cm^2/m$ ($3\phi 25/0{,}20$)

$V_d = 1.6 \times 29{,}2 \times 4{,}25 = 198{,}6\,t < V_{cu}$

$A_{min} = \frac{1}{2} 0{,}0018 \times \frac{41}{51} \times 100 \times 300 = 21{,}7\ cm^2/m \rightarrow \phi 25/0{,}20$

- Armadura superior: $M_d = 1.6\,(10{,}50 \times 2.0 + 3.0) \times \frac{5{,}80^2}{2} = 646{,}1$ mt

Ley de $1.00 \times 3.05 \rightarrow A_{sup} = 49{,}8\ cm^2/m$ ($\phi 25/0{,}10$)

PROYECTO E-5 | FECHA XI-97 | HOJA N.° 7

ARMADURA DEL CUERPO DEL ESTRIBO.

Armadura trasera.

$$M_d = \frac{1}{13,7} \times 1,6 \times \left[9,04 \times \frac{10,5^2}{2} + 63,3 \times \frac{10,5^2}{6} + 1099,0 \times 9,5 \right] = 1413 mt/m$$

CANTO 3,25 104 cm²/m ×0.9 (Fracción indicada).

Mínima 49 cm²/m

$$V_d = \frac{1}{13,7} \times 1,6 \times \left[9,04 \times 10,5 + 63,3 \times \frac{10,5}{2} + 1099 \right] = 178 t/m$$

$$V_{u2} = 0,50 \times 64,55 \times 3,20 \times 1 \left[1 + 50 \times 0,00274 \right] = 117,4 t$$

Vale con la armadura mínima de cortante 7,5 cm²/m/m

1 rama ϕ16/0,50/0.50

Armadura delantera.

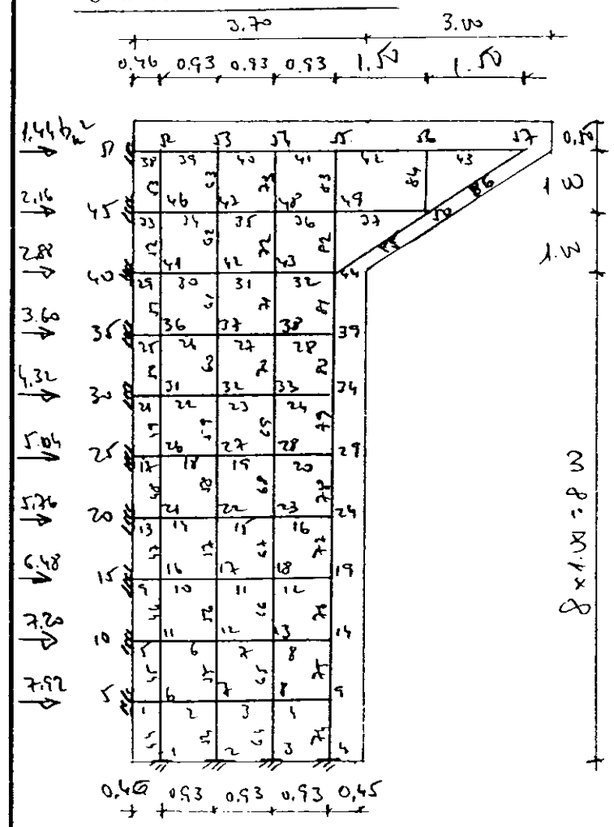
$$M_d = \frac{1}{13,7} \times 1,6 \times \left[63,3 \times \frac{10,5^2}{6} - 828 \times 9,5 \right] = -783 mt/m$$

56,7 cm²/m

PROYECTO E-5 | FECHA XI 97 | HOJA N.° 8

HOJAS ESTRIBO 2.

e = 1.00 m



e = 0,36 (3.0 + 2×2.0)

Cargas en barras

Barra	γ (h_m)
1 a 4	7.92
5 a 8	7.20
9 a 12	6.48
13 a 16	5.76
17 a 20	5.04
21 a 24	4.32
25 a 28	3.60
29 a 32	2.88
33 a 37	2.16
38 a 43	1.44
44,57,64,74	4.23

Características de barra

$I = \frac{a \times 1.00^3}{12}$ J = 27

Barra	a	I	J	Tipo
1 a 43	1.00	0.0833	0.1666	1
44 a 81	0.93	0.0735	0.1330	2
82, 83	1.215	0.1012	0.2024	3
84	1.50	0.1250	0.2500	4
85, 86	0.85	0.0708	0.1406	5

Nudo	Fz
9	3.37
14	3.24
19	2.72
24	2.59
29	2,27
34	1.95
39	1.62

TAV. ZARAGOZA-LERIDA. E-5. ALETAS ESTRIBO 2
CONTROL
57 86 7 1
:
NUDOS

1	0.460	0.000
2	1.390	0.000
3	2.320	0.000
4	3.250	0.000
5	0.000	1.000
6	0.460	1.000
7	1.390	1.000
8	2.320	1.000
9	3.250	1.000
10	0.000	2.000
11	0.460	2.000
12	1.390	2.000
13	2.320	2.000
14	3.250	2.000
15	0.000	3.000
16	0.460	3.000
17	1.390	3.000
18	2.320	3.000
19	3.250	3.000
20	0.000	4.000
21	0.460	4.000
22	1.390	4.000
23	2.320	4.000
24	3.250	4.000
25	0.000	5.000
26	0.460	5.000
27	1.390	5.000
28	2.320	5.000
29	3.250	5.000
30	0.000	6.000
31	0.460	6.000
32	1.390	6.000
33	2.320	6.000
34	3.250	6.000
35	0.000	7.000
36	0.460	7.000
37	1.390	7.000
38	2.320	7.000
39	3.250	7.000
40	0.000	8.000
41	0.460	8.000
42	1.390	8.000
43	2.320	8.000
44	3.250	8.000
45	0.000	9.000
46	0.460	9.000
47	1.390	9.000
48	2.320	9.000
49	3.250	9.000
50	4.750	9.000
51	0.000	10.000
52	0.460	10.000
53	1.390	10.000
54	2.320	10.000

55	3.250	10.000
56	4.750	10.000
57	6.250	10.000

:
SECCIONES
5

0.083300	0.166600	3000000	1300000
0.077500	0.155000	3000000	1300000
0.101200	0.202400	3000000	1300000
0.125000	0.250000	3000000	1300000
0.070800	0.140600	3000000	1300000

:
BARRAS

1	5	6	1
2	6	7	1
3	7	8	1
4	8	9	1
5	10	11	1
6	11	12	1
7	12	13	1
8	13	14	1
9	15	16	1
10	16	17	1
11	17	18	1
12	18	19	1
13	20	21	1
14	21	22	1
15	22	23	1
16	23	24	1
17	25	26	1
18	26	27	1
19	27	28	1
20	28	29	1
21	30	31	1
22	31	32	1
23	32	33	1
24	33	34	1
25	35	36	1
26	36	37	1
27	37	38	1
28	38	39	1
29	40	41	1
30	41	42	1
31	42	43	1
32	43	44	1
33	45	46	1
34	46	47	1
35	47	48	1
36	48	49	1
37	49	50	1
38	51	52	1
39	52	53	1
40	53	54	1
41	54	55	1
42	55	56	1
43	56	57	1
44	1	6	2
45	6	11	2
46	11	16	2

```
 47   16   21    2
 48   21   26    2
 49   26   31    2
 50   31   36    2
 51   36   41    2
 52   41   46    2
 53   46   52    2
 54    2    7    2
 55    7   12    2
 56   12   17    2
 57   17   22    2
 58   22   27    2
 59   27   32    2
 60   32   37    2
 61   37   42    2
 62   42   47    2
 63   47   53    2
 64    3    8    2
 65    8   13    2
 66   13   18    2
 67   18   23    2
 68   23   28    2
 69   28   33    2
 70   33   38    2
 71   38   43    2
 72   43   48    2
 73   48   54    2
 74    4    9    2
 75    9   14    2
 76   14   19    2
 77   19   24    2
 78   24   29    2
 79   29   34    2
 80   34   39    2
 81   39   44    2
 82   44   49    3
 83   49   55    3
 84   50   56    4
 85   44   50    5
 86   50   57    5
:
APOYOS
   14
  1      1.000      1.000      1.000
  2      1.000      1.000      1.000
  3      1.000      1.000      1.000
  4      1.000      1.000      1.000
  5      1.000      1.000      1.000
 10      1.000      1.000      1.000
 15      1.000      1.000      1.000
 20      1.000      1.000      1.000
 25      1.000      1.000      1.000
 30      1.000      1.000      1.000
 35      1.000      1.000      1.000
 40      1.000      1.000      1.000
 45      1.000      1.000      1.000
 51      1.000      1.000      1.000
:
CARGAS
```



```
H-1 EMPUJE DE TIERRAS
7
 9  0   0       3.57
14  0   0       3.24
19  0   0       2.92
24  0   0       2.59
29  0   0       2.27
34  0   0       1.95
39  0   0       1.62
47
 1  3   7.92    7.92
 2  3   7.92    7.92
 3  3   7.92    7.92
 4  3   7.92    7.92
 5  3   7.20    7.20
 6  3   7.20    7.20
 7  3   7.20    7.20
 8  3   7.20    7.20
 9  3   6.48    6.48
10  3   6.48    6.48
11  3   6.48    6.48
12  3   6.48    6.48
13  3   5.76    5.76
14  3   5.76    5.76
15  3   5.76    5.76
16  3   5.76    5.76
17  3   5.04    5.04
18  3   5.04    5.04
19  3   5.04    5.04
20  3   5.04    5.04
21  3   4.32    4.32
22  3   4.32    4.32
23  3   4.32    4.32
24  3   4.32    4.32
25  3   3.60    3.60
26  3   3.60    3.60
27  3   3.60    3.60
28  3   3.60    3.60
29  3   2.88    2.88
30  3   2.88    2.88
31  3   2.88    2.88
32  3   2.88    2.88
33  3   2.16    2.16
34  3   2.16    2.16
35  3   2.16    2.16
36  3   2.16    2.16
37  3   2.16    2.16
38  3   1.44    1.44
39  3   1.44    1.44
40  3   1.44    1.44
41  3   1.44    1.44
42  3   1.44    1.44
43  3   1.44    1.44
44  3   4.23    4.23
54  3   4.23    4.23
64  3   4.23    4.23
74  3   4.23    4.23
:
```

13

TAV. ZARAGOZA-LERIDA. E-5. ALETAS ESTRIBO 2

Hip. nº 1 H-1 EMPUJE DE TIERRAS

Desplazamientos de nudos

Nudo	Giro x	Giro y	Dpl. z
1	-0.000000	0.000000	0.000000
2	-0.000000	0.000000	0.000000
3	-0.000000	0.000000	0.000000
4	-0.000000	0.000000	0.000000
5	-0.000000	0.000000	0.000000
6	-0.000004	0.000009	0.000002
7	-0.000022	0.000015	0.000014
8	-0.000045	0.000017	0.000028
9	-0.000067	0.000017	0.000043
10	-0.000000	0.000000	0.000000
11	-0.000004	0.000021	0.000005
12	-0.000023	0.000041	0.000036
13	-0.000049	0.000045	0.000077
14	-0.000073	0.000043	0.000118
15	-0.000000	0.000000	0.000000
16	-0.000003	0.000032	0.000008
17	-0.000016	0.000064	0.000056
18	-0.000037	0.000071	0.000120
19	-0.000058	0.000070	0.000187
20	-0.000000	0.000000	0.000000
21	-0.000001	0.000038	0.000009
22	-0.000009	0.000080	0.000068
23	-0.000023	0.000092	0.000150
24	-0.000038	0.000091	0.000236
25	-0.000000	0.000000	0.000000
26	-0.000000	0.000041	0.000010
27	-0.000004	0.000089	0.000074
28	-0.000011	0.000105	0.000167
29	-0.000021	0.000106	0.000266
30	0.000000	0.000000	0.000000
31	0.000000	0.000042	0.000010
32	-0.000000	0.000093	0.000076
33	-0.000004	0.000113	0.000174
34	-0.000010	0.000116	0.000281
35	0.000000	0.000000	0.000000
36	0.000000	0.000041	0.000010
37	0.000001	0.000094	0.000075
38	-0.000000	0.000117	0.000175
39	-0.000005	0.000124	0.000288
40	0.000000	0.000000	0.000000
41	0.000000	0.000040	0.000009
42	0.000001	0.000093	0.000074
43	0.000000	0.000120	0.000175
44	-0.000004	0.000133	0.000293
45	0.000000	0.000000	0.000000
46	0.000000	0.000038	0.000009
47	0.000001	0.000093	0.000072
48	-0.000000	0.000123	0.000175
49	-0.000003	0.000138	0.000297
50	-0.000008	0.000147	0.000512
51	0.000000	0.000000	0.000000
52	0.000000	0.000038	0.000009

14

53	0.000000	0.000093	0.000072
54	-0.000001	0.000125	0.000175
55	-0.000003	0.000141	0.000300
56	-0.000008	0.000149	0.000520
57	-0.000009	0.000150	0.000745

Reacciones en apoyos

Nudo	Mto. x	Mto. y	Fza. z
1	1.53	-1.77	2.58
2	9.19	-3.11	9.50
3	18.35	-3.33	17.03
4	28.90	-3.43	27.87
5	1.92	-6.21	7.53
10	1.85	-14.70	14.37
15	1.29	-21.28	18.07
20	0.69	-25.04	18.95
25	0.23	-26.44	18.02
30	-0.05	-26.27	16.15
35	-0.18	-25.28	13.93
40	-0.18	-24.08	11.81
45	-0.12	-23.10	10.08
51	-0.05	-22.51	8.85

Esfuerzos en extremos de barras

Barra	Ext.	Torsor	Flector	Cortante
1	5	-1.92	-6.21	7.53
	6	-1.92	-3.59	3.89
2	6	-4.20	-2.80	4.60
	7	-4.20	-1.94	-2.76
3	7	-5.41	0.11	1.58
	8	-5.41	-1.84	-5.78
4	8	-5.14	0.50	1.10
	9	-5.14	-1.90	-6.27
5	10	-1.85	-14.70	14.37
	11	-1.85	-8.86	11.05
6	11	-4.37	-9.30	10.88
	12	-4.37	-2.29	4.19
7	12	-6.02	-2.80	6.18
	13	-6.02	-0.17	-0.52
8	13	-5.77	-0.45	3.90
	14	-5.77	0.06	-2.80
9	15	-1.29	-21.28	18.07
	16	-1.29	-13.65	15.09
10	16	-3.20	-14.46	14.48
	17	-3.20	-3.80	8.45
11	17	-4.75	-5.23	9.04
	18	-4.75	0.37	3.01
12	18	-4.84	-0.93	5.11
	19	-4.84	1.01	-0.92
13	20	-0.69	-25.04	18.95
	21	-0.69	-16.93	16.30
14	21	-1.86	-17.65	15.63
	22	-1.86	-5.61	10.27
15	22	-3.11	-7.01	10.16
	23	-3.11	-0.06	4.80
16	23	-3.47	-1.47	5.57
	24	-3.47	1.22	0.22

17	25	-0.23	-26.44	18.02
	26	-0.23	-18.68	15.70
18	26	-0.81	-19.18	15.19
	27	-0.81	-7.24	10.50
19	27	-1.73	-8.28	10.19
	28	-1.73	-0.98	5.50
20	28	-2.23	-2.09	5.65
	29	-2.23	0.98	0.96
21	30	0.05	-26.27	16.15
	31	0.05	-19.30	14.16
22	31	-0.13	-19.58	13.86
	32	-0.13	-8.55	9.85
23	32	-0.80	-9.17	9.60
	33	-0.80	-2.12	5.58
24	33	-1.40	-2.78	5.52
	34	-1.40	0.49	1.50
25	35	0.18	-25.28	13.93
	36	0.18	-19.25	12.28
26	36	0.20	-19.34	12.15
	37	0.20	-9.59	8.81
27	37	-0.33	-9.84	8.62
	38	-0.33	-3.38	5.27
28	38	-1.07	-3.68	5.37
	39	-1.07	-0.24	2.02
29	40	0.18	-24.08	11.81
	41	0.18	-18.96	10.48
30	41	0.23	-18.91	10.49
	42	0.23	-10.40	7.81
31	42	-0.26	-10.37	7.53
	43	-0.26	-4.62	4.85
32	43	-1.08	-4.66	3.88
	44	-1.08	-2.30	1.20
33	45	0.12	-23.10	10.08
	46	0.12	-18.69	9.09
34	46	0.12	-18.59	9.10
	47	0.12	-11.06	7.09
35	47	-0.25	-10.98	6.81
	48	-0.25	-5.58	4.81
36	48	-0.70	-5.74	4.55
	49	-0.70	-2.44	2.54
37	49	-0.68	-2.99	3.00
	50	-0.68	-0.92	-0.24
38	51	0.05	-22.51	8.85
	52	0.05	-18.59	8.19
39	52	0.02	-18.47	8.19
	53	0.02	-11.47	6.85
40	53	-0.24	-11.49	6.62
	54	-0.24	-5.96	5.28
41	54	-0.52	-6.36	4.96
	55	-0.52	-2.37	3.62
42	55	-0.65	-3.22	3.18
	56	-0.65	-0.07	1.02
43	56	-0.21	-0.77	1.51
	57	-0.21	-0.12	-0.65
44	1	1.77	-1.53	2.58
	6	1.77	-1.07	-1.65
45	6	2.56	1.22	-2.37
	11	2.56	-1.15	-2.37
46	11	2.11	1.38	-2.20

	16	2.11	-0.82	-2.20
47	16	1.31	1.09	-1.59
	21	1.31	-0.50	-1.59
48	21	0.59	0.68	-0.92
	26	0.59	-0.23	-0.92
49	26	0.09	0.34	-0.41
	31	0.09	-0.06	-0.41
50	31	-0.19	0.12	-0.11
	36	-0.19	0.01	-0.11
51	36	-0.27	-0.01	0.02
	41	-0.27	0.01	0.02
52	41	-0.23	-0.04	0.01
	46	-0.23	-0.02	0.01
53	46	-0.12	-0.03	0.00
	52	-0.12	-0.03	0.00
54	2	3.11	-9.19	9.50
	7	3.11	-1.80	5.27
55	7	5.17	-0.60	0.93
	12	5.17	0.33	0.93
56	12	4.65	1.98	-1.07
	17	4.65	0.91	-1.07
57	17	3.22	2.46	-1.66
	22	3.22	0.80	-1.66
58	22	1.81	2.05	-1.54
	27	1.81	0.51	-1.54
59	27	0.77	1.43	-1.23
	32	0.77	0.20	-1.23
60	32	0.15	0.88	-0.98
	37	0.15	-0.10	-0.98
61	37	-0.09	0.43	-0.79
	42	-0.09	-0.36	-0.79
62	42	-0.06	0.12	-0.51
	47	-0.06	-0.39	-0.51
63	47	0.02	-0.02	-0.23
	53	0.02	-0.25	-0.23
64	3	3.33	-18.35	17.03
	8	3.33	-3.44	12.80
65	8	5.67	-3.71	5.92
	13	5.67	2.21	5.92
66	13	5.40	1.96	1.51
	18	5.40	3.47	1.51
67	18	4.09	3.56	-0.58
	23	4.09	2.98	-0.58
68	23	2.67	3.34	-1.35
	28	2.67	1.98	-1.35
69	28	1.57	2.49	-1.50
	33	1.57	0.99	-1.50
70	33	0.91	1.58	-1.44
	38	0.91	0.14	-1.44
71	38	0.61	0.88	-1.54
	43	0.61	-0.66	-1.54
72	43	0.57	0.16	-0.57
	48	0.57	-0.41	-0.57
73	48	0.40	0.04	-0.32
	54	0.40	-0.28	-0.32
74	4	3.43	-28.90	27.87
	9	3.43	-3.14	23.64
75	9	5.33	-8.28	13.80
	14	5.33	5.52	13.80

76	14	5.27	-0.24	7.76
	19	5.27	7.52	7.76
77	19	4.25	2.68	3.92
	24	4.25	6.60	3.92
78	24	3.03	3.13	1.55
	29	3.03	4.68	1.55
79	29	2.05	2.45	0.24
	34	2.05	2.69	0.24
80	34	1.56	1.29	-0.21
	39	1.56	1.08	-0.21
81	39	1.80	0.00	0.20
	44	1.80	0.20	0.20
82	44	1.39	0.31	0.02
	49	1.39	0.33	0.02
83	49	0.84	0.31	-0.44
	55	0.84	-0.13	-0.44
84	50	0.70	-0.05	0.49
	56	0.70	0.44	0.49
85	44	0.51	-2.91	1.38
	50	0.51	-0.43	1.38
86	50	0.10	-0.96	0.65
	57	0.10	0.21	0.65

PASO SUPERIOR 6+641

Los cálculos relativos a esta estructura "Paso Superior P.K. 6+641" y que se recogen a continuación, son copia de los que figuran en el anejo correspondiente del Proyecto primitivo.

Madrid, Abril de 1.998

EL INGENIERO AUTOR DE LA MODIFICACIÓN Nº 1

Fdo. : Angel A. López López

PASO SUPERIOR P.K. 6+641

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- TABLERO
    1. Generalidades
    2. Secciones tipo
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    4. Cálculo del tablero
- APARATOS DE APOYO
- ESTRIBOS
- PROYECTO DE PRUEBA DE CARGA

TABLERO

1. GENERALIDADES

1.1. Objeto de este Anejo de Cálculo.

El objeto de este Anejo de Cálculo es la justificación técnica del tablero.

Esta justificación técnica se efectúa mediante la realización y exposición de los cálculos correspondientes.

1.2. Descripción general.

El tablero tiene una anchura de 11.70 m dividida en una calzada de 7.00 m y aceras laterales de 2.35 m.

La solución adoptada para el tablero consiste en diez vigas prefabricadas de hormigón pretensado de 1.50 m de canto y 36.00 m de longitud de sección en doble T separadas 1.20 m entre ejes y unidas en su parte superior por una losa de compresión de 0.20 m de espesor mínimo de hormigón armado. El canto total del tablero es pues de 1.70 m.

1.3. Instrucciones y Normas aplicadas.

Las Normas aplicadas son las vigentes en la fecha de redacción de este Anejo de Cálculo.

- Acciones: "Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Carreteras" de 28 de Febrero de 1972 (B.O.E. 18-Abril-72).

- Hormigón armado: EH-91 "Instrucción para el proyecto y la ejecución de obras de hormigón en masa o armado" de 28 de Junio de 1991 (B.O.E.).

- Hormigón pretensado: EP-80 "Instrucción para el proyecto y la ejecución de obras de hormigón pretensado" de 14 de Abril de 1980.

- Acciones sísmicas: "Norma Sismorresistente P.D.S.-1-1974" (B.O.E. 21-Noviembre-1974).

1.4. Niveles de control de calidad adoptados.

El control de calidad se atendrá a lo especificado en las Instrucciones EH-88 y EP-80 con los siguientes niveles de control:

- Materiales:

Acero de armar:	Intenso - Coef. minoración	=	1,10
Acero de pretensar:	Intenso - Coef. minoración	=	1,10
Hormigón en viga:	Intenso - Coef. minoración	=	1,40
Hormigón en losa:	Normal - Coef. minoración	=	1,50

- Ejecución

Tipo de control: Intenso - Coef.mayoración = 1,50

1.5. Características de los materiales.

- Hormigón pretensado vigas	: H-450	fck =	450	kg/cm²
- Hormigón armado en losa	: H-250	fck =	250	kg/cm²
- Acero de pretensar	: Tipo 190	fpk =	19.000	kg/cm²
- Acero de armar en viga	: AEH-500	fyk =	5.100	kg/cm²
- Acero de armar en losa	: AEH-500	fyk =	5.100	kg/cm²

1.6. Acciones sísmicas.

- Según la norma P.D.S.-1-1974, el puente se encuentra situado en una zona sísmica con grado sísmico igual o inferior a VII.

La Norma en el apartado 2.2. define la construcción que nos afecta como del tipo C., además los términos de cantidad para cuantificar los daños los define así:

- Algunos 5%
- Muchos 50%
- La mayoría 75%

En el mismo apartado, la clasificación de daños en las construcciones se hace de 1 a 5, y para clase 1 define:

- Clase 1: Daños ligeros. - fisuras en los revestimientos, caída de pequeños trozos de revestimiento.

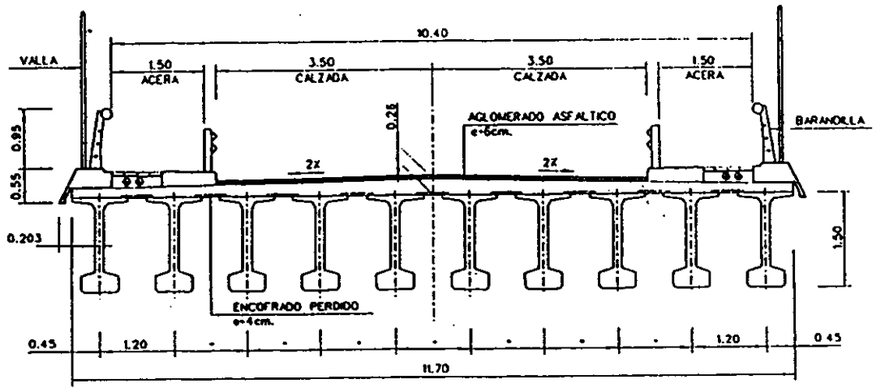
Por otra parte el apartado 2.3. define los grados de intensidad MSK y para grado VII dice textualmente:

- "Algunas construcciones del tipo C experimentan daños ligeros (Clase 1)".

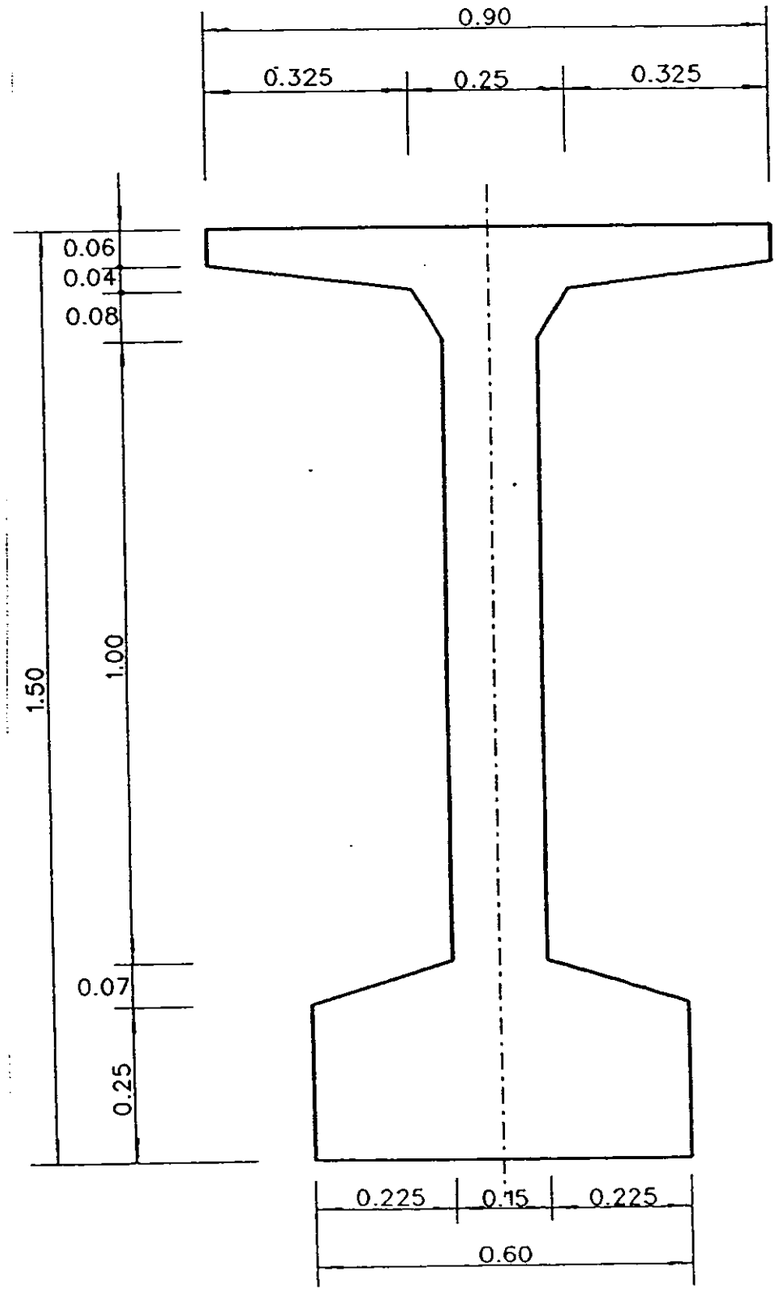
Es decir, menos del 5% de las estructuras tipo C experimentan un tipo de daño que en un puente es despreciable.

2. SECCIONES TIPO

2.1. Sección transversal del tablero.



2.2. Sección transversal de la viga.



2.3. Dimensiones y características del tablero.

LT	Longitud total del tablero (m)
L	Luz de cálculo (m)
BT	Anchura total de la plataforma.
E1	Espesor de la losa (m)
E2	Espesor de la losa de encofrado perdido (m)
BAI	Ancho de la acera izquierda sobre losa (m)
BAD	Ancho de la acera derecha sobre losa (m)
BATI	Ancho total de la acera izquierda (m)
BATD	Ancho total de la acera derecha (m)
VLOI	Vuelo lateral de la losa sobre la primera viga (lado izquierdo) (m)
VLOD	Vuelo lateral de la losa sobre la primera viga (lado derecho) (m)
ESV	Esviaje del tablero
NU	Coeficiente de Poisson

3. CARGAS Y SOBRECARGAS.

3.1. Cargas actuantes sobre las vigas.

a) Peso propio de la viga.

Según características de la viga con densidad 2,5

b) Peso de la losa de compresión.

Según espesor total de la losa p = (E1 + E2) x 2,5

3.2. Cargas actuantes sobre el tablero (vigas + losa).

c) Carga permanente.

Los pesos de aceras, impostas, barandillas y pavimento se indican en el listado de salida.

d) Sobrecarga uniforme de 400 kg/m^2

e) Sobrecarga de vehículo pesado 60 t.

6 cargas de 10 t.

4. CALCULO DEL TABLERO

El tablero se calcula mediante un programa cuya descripción se indica a continuación.

4.1. Datos de entrada.

El programa consta de una entrada en la que se definen la geometría en planta del tablero, el sistema de cargas, las características de la sección transversal y las características resistentes de los materiales.

La geometría en planta se define por medio de la luz de cálculo, el ancho de la losa y el ángulo de esviaje. Para definir la sección transversal se da la sección de la viga, el espesor de la losa y los vuelos de ésta sobre los bordes de las vigas exteriores, siendo opcional dar el número de vigas o dejar que el programa lo calcule. También se incluyen en la definición de la sección transversal la delimitación del ancho destinado al tráfico de vehículos y las zonas de uso peatonal, así como los anchos de éstas a ambos lados de la losa.

El programa calcula el peso propio de los elementos resistentes y hay que suministrarle el resto de las cargas muertas así como las sobrecargas. El programa tiene incorporados los trenes de carga definidos en los Códigos de uso más frecuente, que son generados automáticamente solo con introducir la clave correspondiente. Aparte de estos trenes de carga puede introducirse cualquier otro, definiendo el número de ejes, las cargas y separación de los mismos.

Las características de los materiales que se dan al programa son las resistencias características de los hormigones de viga y losa, la primera en situación de servicio y al aplicar el pretensado, el límite de fluencia del acero pasivo, así como la sección y carga de rotura de los cordones de pretensado.

En el caso de utilizar armadura de pretensado postesa hay que dar también el diámetro de la vaina, los coeficientes de rozamiento y la penetración de cuñas.

Los datos para calcular los efectos diferidos, retracción, fluencia y relajación, se pueden introducir como dato o bien adoptar los valores por defecto introducidos en

el programa.

Se incluyen además una serie de coeficientes que permiten minorar las fuerzas de pretensado y sus pérdidas, minorar las resistencias de los materiales, mayorar las cargas, con valores distintos para cargas permanentes y sobrecargas, para el cálculo en agotamiento, de forma que el cálculo se pueda adaptar a los requisitos de las normas de uso más frecuente.

Por último se han introducido claves que permiten determinar el tipo de comprobación que se hace en el cálculo en tensiones (si se admiten o no tracciones en el hormigón) o para definir el tipo de salida que se desea, y coeficientes que permiten tener en cuenta efectos poco frecuentes como el considerar un ancho eficaz de la losa inferior a su ancho real o que parte de su peso actúe sobre la sección compuesta en lugar de hacerlo sobre la viga sola como es habitual.

4.2. Calculo de esfuerzos.

Si no se ha especificado el número de vigas, el primer paso es fijar por un procedimiento aproximado dicho número efectuando un cálculo de esfuerzos por el método de Guyon-Massonett con cuyo resultado se comprueban las vigas corrigiendo su número si es necesario y repitiendo el proceso hasta obtener un resultado aceptable.

En su funcionamiento normal el programa distribuye las vigas igualmente separadas entre sí, pero el usuario puede fijar fácilmente una distribución distinta así como variar las características geométricas de las vigas que desee, lo que permite el empleo en una misma sección de varios tipos de vigas. Igualmente es posible modificar las características de las barras transversales para tener en cuenta la existencia de diafragmas entre las vigas.

Una vez establecido el número definitivo de vigas se genera un emparrillado para un cálculo más preciso. Este emparrillado consta de dos familias de barras de las que una de ellas representa las vigas y la segunda el efecto transversal de la losa superior. La disposición de las barras de esta segunda familia es perpendicular a la primera en los tableros rectos mientras que en los esviados se puede optar por una disposición paralela a las líneas de apoyos o bien por una perpendicular a las vigas.

El número de líneas transversales se fija por programa dependiendo de la luz de cálculo.

Sobre el emparrillado generado se aplican las cargas divididas en tres grupos:

- Cargas permanentes (salvo peso propio)
- Sobrecarga uniforme por franjas
- Sobrecarga de vehículos

El cálculo se efectúa por medio del programa Sap IV.

Aparte del listado de resultados por impresora se puede pedir el dibujo por Plotter de la geometría del tablero, el emparrillado de cálculo y la posición sobre éste de las cargas representativas de las hipótesis de sobrecarga de vehículos.

A partir de los resultados para las hipótesis individuales se obtiene la envolvente de esfuerzos en cada elemento para cada uno de los grupos de carga teniendo en cuenta la compatibilidad entre las distintas hipótesis y a partir de estas envolventes los esfuerzos de cálculo que se utilizan en etapas posteriores.

En el caso de las barras transversales que representan la losa se calculan los esfuerzos por unidad de ancho a los que se añaden los producidos por las cargas concentradas cuando actúan entre dos vigas, que son calculados por el propio programa por el método de Westergaard.

Con estos esfuerzos el programa calcula las armaduras superior e inferior de la losa.

Este cálculo de armaduras se puede hacer para toda la losa o para distintas zonas a elección del usuario.

Por su parte, con los resultados correspondientes a las vigas se obtienen los esfuerzos más desfavorables para cada grupo de vigas que se quiere calcular y que como mínimo serán una exterior y una interior, con los que se pasa a la siguiente fase del programa.

calcula la armadura requerida para evitar la fisuración en aquellas secciones en que existen tracciones en el hormigón de acuerdo con la Instrucción Española EP-80.

Tras este cálculo a fisuración el programa efectúa un cálculo de las secciones en agotamiento.

Este cálculo se efectúa partiendo del estado de la sección en la fase 7, es decir tras producirse las pérdidas finales de pretensado. A partir de este estado se aplica una deformación plana caracterizada por una rotación y una deformación axil hasta alcanzar en alguna de las fibras extremas la deformación límite, 3‰ para el hormigón a compresión y 1% en el hormigón a la altura de la armadura de tracción. A partir de esta deformada se calcula la resultante de las tensiones considerando una ley tensión deformación bilineal para el hormigón, formada por una recta inicial de pendiente E_b y otra horizontal de valor 0,85 f_{cd}. Para el acero la ley es igualmente bi-lineal con la rama horizontal de valor f_{yd}.

El momento de las tensiones en la sección referido al centro de gravedad de la armadura extrema se compara con el de las cargas mayoradas y se modifica la orientación del plano de la deformada hasta que la diferencia sea inferior a un 2%, calculando entonces la diferencia entre la resultante de compresiones en el hormigón y de tracciones en el acero. En caso de ser mayor la compresión se calcula el área de acero pasivo que trabajando a la tensión que corresponde a su deformación equilibre la diferencia. Si son mayores las tracciones significa que la seguridad al agotamiento es superior a la especificada sin necesidad de armadura suplementaria.

Finalmente se efectúa el cálculo a esfuerzos tangenciales que comprende el cálculo a esfuerzo cortante, el esfuerzo rasante entre viga y losa y los cortantes de ala en las alas superior e inferior.

En primer lugar se calcula el esfuerzo cortante mayorado al que se le resta la componente vertical del esfuerzo de pretensado cuando hay cables parabólicos. A continuación se comprueba el esfuerzo cortante máximo admisible por aplastamiento del alma. Este cálculo se efectúa descontando el diámetro de la vaina del espesor del alma. En caso de ser este esfuerzo admisible inferior al calculado en primer lugar habría que aumentar el ancho del alma de la viga.

En el caso normal en que la capacidad resistente por aplastamiento sea suficiente, se calcula la componente resistida por el hormigón y la armadura necesaria para resistir el resto. Esta armadura se define dando el diámetro comercial de los cercos y su separación, y es múltiplo de 2,5 cm con un mínimo de 10 cm.

Este cálculo se efectúa de acuerdo con la Instrucción EP-80, aunque el sistema de coeficientes utilizados permite adaptarlo a la práctica totalidad de las normas de uso frecuente. Aunque en el caso de las normas americanas no está prevista la utilización de los coeficientes reductores Ø, su efecto se tiene en cuenta multiplicando los coeficientes de mayoración de acciones por el valor de 1/0,85 que corresponde al coeficiente Ø de esfuerzo cortante. Esto da una seguridad algo mayor de la requerida en flexión, pero dado que ésta no es determinante en el dimensionamiento, el hecho carece de importancia.

Para el cálculo de la armadura de conexión entre viga y losa se parte del esfuerzo cortante mayorado sin deducir la componente del pretensado, y a partir de éste se calcula el esfuerzo tangencial de acuerdo con la teoría de la Resistencia de materiales en fase elástica. A partir de este esfuerzo tangencial se calcula la armadura necesaria por la regla de cortante-fricción con un coeficiente de rozamiento entre ambos hormigones igual a 1. Esta armadura está formada por la prolongación de los cercos y por una armadura suplementaria dispuesta con la misma modulación.

En el cálculo de los cortantes de ala se procede análogamente, pero teniendo en cuenta la componente vertical del pretensado.

4.3. Calculo de vigas.

El programa permite la utilización de armaduras pretesas y postesas así como ambos tipos simultáneamente. En el caso de utilizar armaduras postesas una parte se puede tesar sobre la viga sola y otra sobre la estructura compuesta formada por la viga con la losa, una vez endurecido el hormigón de ésta.

También hay la opción de comprobar la viga con un pretensado definido en los datos de entrada o bien calcular éste mediante el programa. En este último caso se procede por tanteos partiendo de un pretensado inicial, que con unas pérdidas del 20% hace que la tensión de la fibra inferior de la sección central cumpla estrictamente las condiciones de tensión establecidas, y a partir de este pretensado se efectúa el cálculo según el procedimiento más exacto descrito más adelante hasta obtener las tensiones en cada fase y comprobar si son admisibles. En caso de no serlo se corrige el valor inicial del pretensado, repitiendo el proceso hasta lograr un resultado correcto, lo que se consigue normalmente en 2 ó 3 pasadas.

En el caso de utilizar conjuntamente armaduras pre y postesas la distribución del pretensado entre ambos tipos se hace con el criterio de que la armadura pretesa sea la máxima que, actuando antes de producirse las pérdidas diferidas conjuntamente con el peso propio de la viga, da lugar en la mitad central de la viga a tensiones admisibles para la resistencia del hormigón en esa fase.

Una vez definido el pretensado se procede al cálculo de las tensiones que se producen en la viga en las distintas fases por las que pasa desde su fabricación hasta su situación en servicio tras las pérdidas de pretesado y bajo las acciones de proyecto.

El proceso de cálculo se desarrolla por fases que tratan de reproducir la historia de las vigas, lo que incluye la consideración de las pérdidas diferidas en dos fases, una antes de hormigonar la losa y la segunda una vez endurecida ésta. Para ello los datos de retracción, fluencia y relajación figuran en las entradas con los valores que corresponden a estas dos fases.

El cálculo de la variación de tensiones en cada fase se efectúa a partir de las características de la sección, pero a diferencia del procedimiento habitual, no se utiliza la sección homogeneizada en la que el acero es tenido en cuenta a través de un coeficiente de equivalencia, sino que ambos materiales se consideran por separado, aunque cumpliendo la condición de deformarse solidariamente.
Las tensiones se calculan, para las siguientes etapas:

1. Después de la transmisión a la viga de la fuerza de pretesado aplicada sobre la armadura pretesa.
2. Tras el tesado de las armaduras postesadas en taller.
3. Después que se ha producido la primera fase de las pérdidas de pretensado.
4. Tras la aplicación del peso de la losa.
5. Tras el tesado de la armadura postesa restante.
6. Después de la aplicación de las cargas permanentes.
7. Después de producirse las pérdidas finales de pretensado.
8. Bajo la acción de las sobrecargas.
9. Igual que la anterior con las tensiones debidas al pretensado afectadas de los coeficientes especificados, según la norma aplicada.

En las etapas 1 a 4 se calcula partiendo de la sección de la viga sola, mientras que a partir de la etapa 5 se considera la sección compuesta formada por la viga y la losa.

Este proceso se repite para distintas secciones de la viga situadas a una distancia fijada en los datos de entrada.

En el caso de utilizar armaduras pretesas el programa calcula un sistema de envainado de la parte extrema de algunos cordones a fin de anular su adherencia y evitar que, al disminuir el momento de peso propio hacia los extremos de la viga, el pretensado inicial pueda dar lugar a tensiones no admisibles.

Una vez efectuado el cálculo de tensiones en todas las secciones el programa

TABLERO

LAV ZARAGOZA-LLEIDA ESTRUCUTURA 6-461
==========

SECCION LONGITUDINAL
==========

LUZ DE LA VIGA = 36.000 M.
LUZ DE CALCULO = 35.000 M.
ESVIAJE = 68.000 GR

SECCION TRANSVERSAL
==========

ANCHO TOTAL DE LA PLATAFORMA = 11.700 M.
ANCHO TOTAL DE LA LOSA = 11.700 M.
ANCHO ACERA IZQUIERDA SOBRE LOSA = 2.350 M.
ANCHO ACERA DERECHA SOBRE LOSA = 2.350 M.
ANCHO TOTAL ACERA IZQUIERDA = 2.350 M.
ANCHO TOTAL ACERA DERECHA = 2.350 M.
VUELO DE LOSA SOBRE EXT. VIGA IZQ. = .000 M.
VUELO DE LOSA SOBRE EXT. VIGA DER. = .000 M.

SOLUCION ADOPTADA
==========

NUMERO DE VIGAS = 10
CANTO DE LA VIGA = 1.500 M.
CANTO DE LA LOSA = .200 M.
CANTO DE LA LOSA DE ENCOFRADO = .040 M.
INTEREJE DE VIGAS = 1.200 M.
ANCHO DE LOSA VIGA CENTRAL = 1.200 M.
ANCHO DE LOSA VIGA BORDE IZQ. = 1.050 M.
ANCHO DE LOSA VIGA BORDE DER. = 1.050 M.

LAV ZARAGOZA-LLEIDA ESTRUCUTURA 6-461
==========

COEFICIENTES DE SEGURIDAD DE MATERIALES
==========

COEF. SEGURIDAD DEL ACERO = 1.100

COEFICIENTES DE SEGURIDAD DE ACCIONES
==========

COEF. MAYORACION CARGAS PERMANENTES = 1.600
COEF. MAYORACION DE SOBRECARGAS = 1.600

CARACTERISTICAS DE LOS MATERIALES
==========

RESISTENCIA DEL HORMIGON DE LA VIGA = 450.000 KG/CM2
RESISTENCIA DEL HORMIGON DE LA LOSA = 250.000 KG/CM2
LIMITE ELASTICO DEL ACERO = 5100.000 KG/CM2

LAV ZARAGOZA-LLEIDA ESTRUCUTURA 6-461

ACCIONES A CONSIDERAR

PESO PROPIO DE LA VIGA = 1.047 T/ML
PESO PROPIO DE LA LOSA = .600 T/M2

CARGAS PERMANENTES

PAVIMENTO = .200 T/M2
ACERA IZQUIERDA = .000 T/M2
ACERA DERECHA = .000 T/M2
IMPOSTA + BARAND. ACERA IZQ. = 1.650 T/M
IMPOSTA + BARAND. ACERA DER. = 1.650 T/M

SOBRECARGAS - NORMA M.O.P.U. (CARRETERAS)

SOBRECARGA UNIF. ZONA N. 1 = .400 T/M2 (3)
SOBRECARGA UNIF. ZONA N. 2 = .400 T/M2 (4)
SOBRECARGA UNIF. ZONA N. 3 = .400 T/M2 (3)

CAMION EJE N. 1 = 20.000 T
CAMION EJE N. 2 = 20.000 T
CAMION EJE N. 3 = 20.000 T

DEFINICION GEOMETRICA

NUDO	X	Y	NUDO	X	Y
1	.0000	.4500	2	.4848	.4500
3	.4848	1.6500	4	.9697	.4500
5	.9697	1.6500	6	.9697	2.8500
7	1.4545	.4500	8	1.4545	1.6500
9	1.4545	2.8500	10	1.4545	4.0500
11	1.9393	.4500	12	1.9393	1.6500
13	1.9393	2.8500	14	1.9393	4.0500
15	1.9393	5.2500	16	2.4241	.4500
17	2.4241	1.6500	18	2.4241	2.8500
19	2.4241	4.0500	20	2.4241	5.2500
21	2.4241	6.4500	22	2.9090	.4500
23	2.9090	1.6500	24	2.9090	2.8500
25	2.9090	4.0500	26	2.9090	5.2500
27	2.9090	6.4500	28	2.9090	7.6500
29	3.3938	.4500	30	3.3938	1.6500
31	3.3938	2.8500	32	3.3938	4.0500
33	3.3938	5.2500	34	3.3938	6.4500
35	3.3938	7.6500	36	3.3938	8.8500
37	3.8786	.4500	38	3.8786	1.6500
39	3.8786	2.8500	40	3.8786	4.0500
41	3.8786	5.2500	42	3.8786	6.4500
43	3.8786	7.6500	44	3.8786	8.8500
45	3.8786	10.0500	46	4.3635	.4500
47	4.3635	1.6500	48	4.3635	2.8500
49	4.3635	4.0500	50	4.3635	5.2500
51	4.3635	6.4500	52	4.3635	7.6500
53	4.3635	8.8500	54	4.3635	10.0500
55	4.3635	11.2500	56	8.7401	.4500
57	8.7401	1.6500	58	8.7401	2.8500
59	8.7401	4.0500	60	8.7401	5.2500
61	8.7401	6.4500	62	8.7401	7.6500
63	8.7401	8.8500	64	8.7401	10.0500
65	8.7401	11.2500	66	13.1168	.4500
67	13.1168	1.6500	68	13.1168	2.8500
69	13.1168	4.0500	70	13.1168	5.2500
71	13.1168	6.4500	72	13.1168	7.6500
73	13.1168	8.8500	74	13.1168	10.0500
75	13.1168	11.2500	76	17.4934	.4500
77	17.4934	1.6500	78	17.4934	2.8500
79	17.4934	4.0500	80	17.4934	5.2500
81	17.4934	6.4500	82	17.4934	7.6500
83	17.4934	8.8500	84	17.4934	10.0500
85	17.4934	11.2500	86	21.8701	.4500
87	21.8701	1.6500	88	21.8701	2.8500

DEFINICION GEOMETRICA

NUDO	X	Y	NUDO	X	Y
89	21.8701	4.0500	90	21.8701	5.2500
91	21.8701	6.4500	92	21.8701	7.6500
93	21.8701	8.8500	94	21.8701	10.0500
95	21.8701	11.2500	96	26.2467	.4500
97	26.2467	1.6500	98	26.2467	2.8500
99	26.2467	4.0500	100	26.2467	5.2500
101	26.2467	6.4500	102	26.2467	7.6500
103	26.2467	8.8500	104	26.2467	10.0500
105	26.2467	11.2500	106	30.6234	.4500
107	30.6234	1.6500	108	30.6234	2.8500
109	30.6234	4.0500	110	30.6234	5.2500
111	30.6234	6.4500	112	30.6234	7.6500
113	30.6234	8.8500	114	30.6234	10.0500
115	30.6234	11.2500	116	35.0000	.4500
117	35.0000	1.6500	118	35.0000	2.8500
119	35.0000	4.0500	120	35.0000	5.2500
121	35.0000	6.4500	122	35.0000	7.6500
123	35.0000	8.8500	124	35.0000	10.0500
125	35.0000	11.2500	126	35.4848	1.6500
127	35.4848	2.8500	128	35.4848	4.0500
129	35.4848	5.2500	130	35.4848	6.4500
131	35.4848	7.6500	132	35.4848	8.8500
133	35.4848	10.0500	134	35.4848	11.2500
135	35.9697	2.8500	136	35.9697	4.0500
137	35.9697	5.2500	138	35.9697	6.4500
139	35.9697	7.6500	140	35.9697	8.8500
141	35.9697	10.0500	142	35.9697	11.2500
143	36.4545	4.0500	144	36.4545	5.2500
145	36.4545	6.4500	146	36.4545	7.6500
147	36.4545	8.8500	148	36.4545	10.0500
149	36.4545	11.2500	150	36.9393	5.2500
151	36.9393	6.4500	152	36.9393	7.6500
153	36.9393	8.8500	154	36.9393	10.0500
155	36.9393	11.2500	156	37.4241	6.4500
157	37.4241	7.6500	158	37.4241	8.8500
159	37.4241	10.0500	160	37.4241	11.2500
161	37.9090	7.6500	162	37.9090	8.8500
163	37.9090	10.0500	164	37.9090	11.2500
165	38.3938	8.8500	166	38.3938	10.0500
167	38.3938	11.2500	168	38.8786	10.0500
169	38.8786	11.2500	170	39.3635	11.2500

DEFINICION DE BARRAS TRANSVERSALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
1	1	3	1	1	2	3	6	1	1
3	6	10	1	1	4	10	15	1	1
5	15	21	1	1	6	21	28	1	1
7	28	36	1	1	8	36	45	1	1
9	45	55	1	1	10	2	3	1	2
11	4	5	1	3	12	5	6	1	3
13	7	8	1	4	14	8	9	1	4
15	9	10	1	4	16	11	12	1	5
17	12	13	1	5	18	13	14	1	5
19	14	15	1	5	20	16	17	1	6
21	17	18	1	6	22	18	19	1	6
23	19	20	1	6	24	20	21	1	6
25	22	23	1	7	26	23	24	1	7
27	24	25	1	7	28	25	26	1	7
29	26	27	1	7	30	27	28	1	7
31	29	30	1	8	32	30	31	1	8
33	31	32	1	8	34	32	33	1	8
35	33	34	1	8	36	34	35	1	8
37	35	36	1	8	38	37	38	1	9
39	38	39	1	9	40	39	40	1	9
41	40	41	1	9	42	41	42	1	9
43	42	43	1	9	44	43	44	1	9
45	44	45	1	9	46	46	47	1	10
47	47	48	1	10	48	48	49	1	10
49	49	50	1	10	50	50	51	1	10
51	51	52	1	10	52	52	53	1	10
53	53	54	1	10	54	54	55	1	10
55	56	57	1	11	56	57	58	1	11
57	58	59	1	11	58	59	60	1	11
59	60	61	1	11	60	61	62	1	11
61	62	63	1	11	62	63	64	1	11
63	64	65	1	11	64	66	67	1	12
65	67	68	1	12	66	68	69	1	12
67	69	70	1	12	68	70	71	1	12
69	71	72	1	12	70	72	73	1	12
71	73	74	1	12	72	74	75	1	12
73	76	77	1	13	74	77	78	1	13
75	78	79	1	13	76	79	80	1	13
77	80	81	1	13	78	81	82	1	13
79	82	83	1	13	80	83	84	1	13
81	84	85	1	13	82	86	87	1	14
83	87	88	1	14	84	88	89	1	14
85	89	90	1	14	86	90	91	1	14
87	91	92	1	14	88	92	93	1	14

DEFINICION DE BARRAS TRANSVERSALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
89	93	94	1	14	90	94	95	1	14
91	96	97	1	15	92	97	98	1	15
93	98	99	1	15	94	99	100	1	15
95	100	101	1	15	96	101	102	1	15
97	102	103	1	15	98	103	104	1	15
99	104	105	1	15	100	106	107	1	16
101	107	108	1	16	102	108	109	1	16
103	109	110	1	16	104	110	111	1	16
105	111	112	1	16	106	112	113	1	16
107	113	114	1	16	108	114	115	1	16
109	116	117	1	17	110	117	118	1	17
111	118	119	1	17	112	119	120	1	17
113	120	121	1	17	114	121	122	1	17
115	122	123	1	17	116	123	124	1	17
117	124	125	1	17	118	126	127	1	18
119	127	128	1	18	120	128	129	1	18
121	129	130	1	18	122	130	131	1	18
123	131	132	1	18	124	132	133	1	18
125	133	134	1	18	126	135	136	1	19
127	136	137	1	19	128	137	138	1	19
129	138	139	1	19	130	139	140	1	19
131	140	141	1	19	132	141	142	1	19
133	143	144	1	20	134	144	145	1	20
135	145	146	1	20	136	146	147	1	20
137	147	148	1	20	138	148	149	1	20
139	150	151	1	21	140	151	152	1	21
141	152	153	1	21	142	153	154	1	21
143	154	155	1	21	144	156	157	1	22
145	157	158	1	22	146	158	159	1	22
147	159	160	1	22	148	161	162	1	23
149	162	163	1	23	150	163	164	1	23
151	165	166	1	24	152	166	167	1	24
153	168	169	1	25	154	116	126	1	26
155	126	135	1	26	156	135	143	1	26
157	143	150	1	26	158	150	156	1	26
159	156	161	1	26	160	161	165	1	26
161	165	168	1	26	162	168	170	1	26

DEFINICION DE BARRAS LONGITUDINALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
163	1	2	2	27	164	2	4	2	27
165	4	7	2	27	166	7	11	2	27
167	11	16	2	27	168	16	22	2	27
169	22	29	2	27	170	29	37	2	27
171	37	46	2	27	172	46	56	2	27
173	56	66	2	27	174	66	76	2	27
175	76	86	2	27	176	86	96	2	27
177	96	106	2	27	178	106	116	2	27
179	3	5	2	28	180	5	8	2	28
181	8	12	2	28	182	12	17	2	28
183	17	23	2	28	184	23	30	2	28
185	30	38	2	28	186	38	47	2	28
187	47	57	2	28	188	57	67	2	28
189	67	77	2	28	190	77	87	2	28
191	87	97	2	28	192	97	107	2	28
193	107	117	2	28	194	117	126	2	28
195	6	9	2	29	196	9	13	2	29
197	13	18	2	29	198	18	24	2	29
199	24	31	2	29	200	31	39	2	29
201	39	48	2	29	202	48	58	2	29
203	58	68	2	29	204	68	78	2	29
205	78	88	2	29	206	88	98	2	29
207	98	108	2	29	208	108	118	2	29
209	118	127	2	29	210	127	135	2	29
211	10	14	2	30	212	14	19	2	30
213	19	25	2	30	214	25	32	2	30
215	32	40	2	30	216	40	49	2	30
217	49	59	2	30	218	59	69	2	30
219	69	79	2	30	220	79	89	2	30
221	89	99	2	30	222	99	109	2	30
223	109	119	2	30	224	119	128	2	30
225	128	136	2	30	226	136	143	2	30
227	15	20	2	31	228	20	26	2	31
229	26	33	2	31	230	33	41	2	31
231	41	50	2	31	232	50	60	2	31
233	60	70	2	31	234	70	80	2	31
235	80	90	2	31	236	90	100	2	31
237	100	110	2	31	238	110	120	2	31
239	120	129	2	31	240	129	137	2	31
241	137	144	2	31	242	144	150	2	31
243	21	27	2	32	244	27	34	2	32
245	34	42	2	32	246	42	51	2	32
247	51	61	2	32	248	61	71	2	32
249	71	81	2	32	250	81	91	2	32

DEFINICION DE BARRAS LONGITUDINALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
251	91	101	2	32	252	101	111	2	32
253	111	121	2	32	254	121	130	2	32
255	130	138	2	32	256	138	145	2	32
257	145	151	2	32	258	151	156	2	32
259	28	35	2	33	260	35	43	2	33
261	43	52	2	33	262	52	62	2	33
263	62	72	2	33	264	72	82	2	33
265	82	92	2	33	266	92	102	2	33
267	102	112	2	33	268	112	122	2	33
269	122	131	2	33	270	131	139	2	33
271	139	146	2	33	272	146	152	2	33
273	152	157	2	33	274	157	161	2	33
275	36	44	2	34	276	44	53	2	34
277	53	63	2	34	278	63	73	2	34
279	73	83	2	34	280	83	93	2	34
281	93	103	2	34	282	103	113	2	34
283	113	123	2	34	284	123	132	2	34
285	132	140	2	34	286	140	147	2	34
287	147	153	2	34	288	153	158	2	34
289	158	162	2	34	290	162	165	2	34
291	45	54	2	35	292	54	64	2	35
293	64	74	2	35	294	74	84	2	35
295	84	94	2	35	296	94	104	2	35
297	104	114	2	35	298	114	124	2	35
299	124	133	2	35	300	133	141	2	35
301	141	148	2	35	302	148	154	2	35
303	154	159	2	35	304	159	163	2	35
305	163	166	2	35	306	166	168	2	35
307	55	65	2	36	308	65	75	2	36
309	75	85	2	36	310	85	95	2	36
311	95	105	2	36	312	105	115	2	36
313	115	125	2	36	314	125	134	2	36
315	134	142	2	36	316	142	149	2	36
317	149	155	2	36	318	155	160	2	36
319	160	164	2	36	320	164	167	2	36
321	167	169	2	36	322	169	170	2	36

CARACTERISTICAS DE LOS MATERIALES

TIPO		MOD. ELASTICIDAD (TN/M2)	POISSON
1	LOSA	3320392.00	.15
2	VIGA	4454773.00	.15

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS TRANSVERSALES

SECC.	AREA	M. TORSION	M. INERCIA
1	.04495262	.00029968	.00014984
2	.09696593	.00064644	.00032322
3	.09696593	.00064644	.00032322
4	.09696593	.00064644	.00032322
5	.09696593	.00064644	.00032322
6	.09696593	.00064644	.00032322
7	.09696593	.00064644	.00032322
8	.09696593	.00064644	.00032322
9	.09696593	.00064644	.00032322
10	.48614770	.00324098	.00162049
11	.87532950	.00583553	.00291777
12	.87532950	.00583553	.00291777
13	.87532950	.00583553	.00291777
14	.87532950	.00583553	.00291777
15	.87532950	.00583553	.00291777
16	.87532950	.00583553	.00291777
17	.48614770	.00324098	.00162049
18	.09696593	.00064644	.00032322
19	.09696593	.00064644	.00032322
20	.09696593	.00064644	.00032322
21	.09696593	.00064644	.00032322
22	.09696593	.00064644	.00032322
23	.09696593	.00064644	.00032322
24	.09696593	.00064644	.00032322
25	.09696593	.00064644	.00032322
26	.04495262	.00029968	.00014984

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS LONGITUDINALES

SECC.	AREA	M. TORSION	M. INERCIA
27	.60004650	.00523481	.23519050
28	.62017110	.00553176	.24456370

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS LONGITUDINALES

SECC.	AREA	M. TORSION	M. INERCIA
29	.62017110	.00553176	.24456370
30	.62017110	.00553176	.24456370
31	.62017110	.00553176	.24456370
32	.62017110	.00553176	.24456370
33	.62017110	.00553176	.24456370
34	.62017110	.00553176	.24456370
35	.62017110	.00553176	.24456370
36	.60004650	.00523481	.23519050

HIPOTESIS CARGA PERMANENTE (HIP = 1)

163	A	178	FZ	-1.650	T/M
163	A	178	MX	.742	TXM/M
179	A	194	FZ	-.021	T/M
195	A	210	FZ	-.199	T/M
211	A	226	FZ	-.240	T/M
227	A	242	FZ	-.240	T/M
243	A	258	FZ	-.240	T/M
259	A	274	FZ	-.240	T/M
275	A	290	FZ	-.199	T/M
291	A	306	FZ	-.021	T/M
307	A	322	FZ	-1.650	T/M
307	A	322	MX	-.743	TXM/M

HIPOTESIS SC. UNIF. ZONA 1 (HIP = 2)

163	A	178	FZ	-.420	T/M
163	A	178	MX	-.007	TXM/M
179	A	194	FZ	-.480	T/M
195	A	210	FZ	-.420	T/M
211	A	226	FZ	-.060	T/M

HIPOTESIS SC. UNIF. ZONA 2 (HIP = 3)

211	A	226	FZ	-.420	T/M
195	A	210	FZ	-.060	T/M
227	A	242	FZ	-.480	T/M
243	A	258	FZ	-.480	T/M
259	A	274	FZ	-.420	T/M
275	A	290	FZ	-.060	T/M

HIPOTESIS SC. UNIF. ZONA 3 (HIP = 4)

275	A	290	FZ	-.420	T/M
259	A	274	FZ	-.060	T/M
291	A	306	FZ	-.480	T/M
307	A	322	FZ	-.420	T/M
307	A	322	MX	.007	TXM/M

HIPOTESIS TANQUE POSICION = 1 (HIP = 9)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
51	9.3975	52	4.6988	53	14.0963	61	10.6025
62	5.3013	63	15.9038				

HIPOTESIS TANQUE POSICION = 2 (HIP = 10)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
51	11.6130	52	5.8065	53	17.4195	61	8.3870
62	4.1935	63	12.5805				

HIPOTESIS TANQUE POSICION = 3 (HIP = 11)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
81	5.2590	82	2.6295	83	7.8885	91	13.9432
92	6.9717	93	20.9149	101	.7978	102	.3989
103	1.1967						

HIPOTESIS TANQUE POSICION = 4 (HIP = 12)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
81	5.2590	82	2.6295	83	7.8885	91	13.9432
92	6.9716	93	20.9148	101	.7978	102	.3989
103	1.1967						

HIPOTESIS TANQUE POSICION = 5 (HIP = 13)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
80	6.7360	81	3.3680	82	10.1040	90	13.2047
91	6.6024	92	19.8071	100	.0593	101	.0296
102	.0889						

HIPOTESIS TANQUE POSICION = 6 (HIP = 14)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
80	.0000	81	13.3384	82	4.4461	83	8.8922
90	.0000	91	16.6616	92	5.5539	93	11.1077

HIPOTESIS TANQUE POSICION = 7 (HIP = 15)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
81	10.0000	82	5.0000	83	15.0000	91	10.0000
92	5.0000	93	15.0000				

REACCIONES EN APOYOS

HIP(IDENTIF)			N 1 REACCION	N 3 REACCION	N 6 REACCION	N 10 REACCION	N 15 REACCION	N 21 REACCION
1	C.PE	1	21.549	7.489	6.061	4.082	3.287	3.216
2	SU	1	7.641	6.753	5.479	3.222	1.621	.693
3	SU	2	.363	1.709	2.855	4.827	6.038	6.290
4	SU	3	-.563	-.246	-.023	.296	.727	1.398
5	SU	1+2	8.005	8.461	8.334	8.049	7.659	6.983
6	SU	1+3	7.078	6.507	5.456	3.517	2.348	2.091
7	SU	2+3	-.200	1.462	2.832	5.123	6.765	7.687
8	SU	1+2+3	7.441	8.215	8.311	8.344	8.386	8.381
9	T	9	-.378	.081	.427	1.121	3.617	10.811
10	T	10	-.330	.072	.376	.960	3.388	11.459
11	T	11	-.861	.501	1.358	2.335	3.145	3.787
12	T	12	-.861	.501	1.358	2.335	3.145	3.787
13	T	13	-.300	1.373	2.276	3.161	3.800	4.239
14	T	14	-.776	.750	1.717	2.779	3.547	4.153
15	T	15	-.892	.484	1.379	2.443	3.367	4.144
RMA	SU+T		7.705	9.834	10.611	11.505	12.185	19.840
RMI	SU+T		-1.455	-.174	.353	1.255	3.872	4.480

REACCIONES EN APOYOS

HIP(IDENTIF)			N 28 REACCION	N 36 REACCION	N 45 REACCION	N 55 REACCION	N 116 REACCION	N 126 REACCION
1	C.PE	1	3.433	6.160	.322	26.648	26.657	.308
2	SU	1	.157	-.226	-.131	-1.056	9.801	5.254
3	SU	2	5.685	3.568	3.208	-.943	-.942	3.209
4	SU	3	2.525	4.977	5.261	9.796	-1.057	-.130
5	SU	1+2	5.842	3.342	3.076	-1.999	8.860	8.462
6	SU	1+3	2.682	4.751	5.130	8.740	8.745	5.123
7	SU	2+3	8.210	8.545	8.469	8.853	-1.998	3.079
8	SU	1+2+3	8.367	8.319	8.338	7.797	7.803	8.332
9	T	9	12.422	19.114	6.577	-.123	-.809	.728
10	T	10	12.395	20.537	5.817	-.173	-.702	.642
11	T	11	4.382	4.790	6.161	3.711	-2.738	1.646
12	T	12	4.381	4.790	6.161	3.711	-2.738	1.646
13	T	13	4.740	4.542	5.675	-.199	-2.520	3.311
14	T	14	4.877	5.168	6.366	2.113	-2.763	2.178
15	T	15	4.867	5.267	6.704	3.622	-2.713	1.710
RMA	SU+T		20.789	29.082	15.173	13.507	9.099	11.774
RMI	SU+T		4.539	4.316	5.544	-2.197	-4.761	.512

REACCIONES EN APOYOS

HIP(IDENTIF)			N 135 REACCION	N 143 REACCION	N 150 REACCION	N 156 REACCION	N 161 REACCION	N 165 REACCION
1	C.PE	1	6.158	3.443	3.213	3.284	4.094	6.059
2	SU	1	4.974	2.533	1.395	.727	.296	-.024
3	SU	2	3.559	5.693	6.287	6.036	4.834	2.849
4	SU	3	-.227	.158	.693	1.618	3.230	5.475
5	SU	1+2	8.533	8.226	7.682	6.763	5.129	2.825
6	SU	1+3	4.747	2.690	2.088	2.346	3.526	5.451
7	SU	2+3	3.332	5.851	6.981	7.654	8.063	8.324
8	SU	1+2+3	8.306	8.383	8.376	8.382	8.359	8.300
9	T	9	.571	.836	.844	.793	.746	.771
10	T	10	.501	.728	.732	.687	.647	.667
11	T	11	1.656	3.453	4.507	4.950	4.717	4.404
12	T	12	1.656	3.453	4.507	4.950	4.717	4.404
13	T	13	3.291	4.758	5.037	4.663	4.160	3.572
14	T	14	2.218	3.956	4.501	4.505	4.221	3.942
15	T	15	1.689	3.330	4.182	4.473	4.220	4.007
RMA	SU+T		11.825	13.142	13.412	13.332	13.076	12.728
RMI	SU+T		.274	.886	1.425	1.415	.942	.643

REACCIONES EN APOYOS

HIP(IDENTIF)			N 168 REACCION	N 170 REACCION
1	C.PE	1	7.475	21.558
2	SU	1	-.245	-.564
3	SU	2	1.709	.364
4	SU	3	6.746	7.646
5	SU	1+2	1.464	-.200
6	SU	1+3	6.501	7.082
7	SU	2+3	8.456	8.010
8	SU	1+2+3	8.210	7.446
9	T	9	.904	.947
10	T	10	.782	.817
11	T	11	4.337	3.760
12	T	12	4.337	3.760
13	T	13	3.026	1.395
14	T	14	3.731	2.819
15	T	15	4.054	3.663
RMA	SU+T		12.793	11.770
RMI	SU+T		.537	.253

RESUMEN DE ESFUERZOS VIGA DE BORDE DERECHA
==========

SECCION APOYOS BARRA = 164
==========

C. PERMANENTE	CORTANTE =	18.052 TN	M. FLECTOR =	.000	M X TN
SOBRECARGA	CORTANTE =	8.133 TN	M. FLECTOR =	.000	M X TN

SECCION CENTRAL BARRA = 175
==========

C. PERMANENTE	CORTANTE =	2.305 TN	M. FLECTOR =	118.327	M X TN
SOBRECARGA	CORTANTE =	.366 TN	M. FLECTOR =	78.518	M X TN

RESUMEN DE ESFUERZOS VIGA CENTRAL
==========

SECCION APOYOS BARRA = 275
==========

C. PERMANENTE	CORTANTE =	6.160 TN	M. FLECTOR =	.000	M X TN
SOBRECARGA	CORTANTE =	29.082 TN	M. FLECTOR =	.000	M X TN

SECCION CENTRAL BARRA = 281
==========

C. PERMANENTE	CORTANTE =	.648 TN	M. FLECTOR =	66.375	M X TN
SOBRECARGA	CORTANTE =	8.442 TN	M. FLECTOR =	163.112	M X TN

RESUMEN DE ESFUERZOS VIGA DE BORDE IZQUIERDA
==========

SECCION APOYOS BARRA = 307
==========

C. PERMANENTE	CORTANTE =	26.648 TN	M. FLECTOR =	.000	M X TN
SOBRECARGA	CORTANTE =	13.507 TN	M. FLECTOR =	.000	M X TN

SECCION CENTRAL BARRA = 310
==========

C. PERMANENTE	CORTANTE =	2.305 TN	M. FLECTOR =	118.328	M X TN
SOBRECARGA	CORTANTE =	.658 TN	M. FLECTOR =	125.824	M X TN

RESUMEN DE ESFUERZOS PARA CALCULO DE LA LOSA
==========

ZONA (1) LINEAS TRANSVERSALES 1 A 26
==========

BARRA = 162 M. FLECTOR POSITIVO = 2.677 M X TN / M

BARRA = 153 M. FLECTOR NEGATIVO = -3.558 M X TN / M

CALCULO DE ESFUERZOS LOCALES - WESTERGAARD
==========

MOMENTO LONGITUDINAL = 1.070 M X TN

MOMENTO TRANSVERSAL EN CENTRO DE VANO = 1.344 M X TN / M
MOMENTO TRANSVERSAL SOBRE APOYO = -.821 M X TN / M

ARMADURA DE LOSA ZONA = 1
==========
(*) ESFUERZOS MAYORADOS

CARA INFERIOR

MOMENTO TRANSVERSAL	P.P. PERM. SOB.	=	.11 M X TN
	FLEXION GENERAL	=	4.28 M X TN
	CARGA PUNTUAL	=	2.15 M X TN
			6.54 M X TN

MOMENTO LONGITUDINAL CARGA PUNTUAL = 1.71 M X TN

ARMADURA TRANSVERSAL (H-D = 3.0 CM) = 8.95 CM2/M

ARMADURA LONGITUDINAL (H-D = 4.5 CM) = 2.44 CM2/M

CARA SUPERIOR

MOMENTO TRANSVERSAL C. VANO	P.P. PERM. SOB.	=	.11 M X TN
	FLEXION GENERAL	=	-5.69 M X TN
			-5.59 M X TN

MOMENTO TRANSVERSAL APOYO	P.P. PERM. SOB.	=	-.21 M X TN
	FLEXION GENERAL	=	-5.69 M X TN
			-5.90 M X TN

ARMADURA TRANSVERSAL (H-D = 3.0 CM) = 8.02 CM2/M

ARMADURA LONGITUDINAL (H-D = 4.5 CM) = 2.52 CM2/M

VIGA DE BORDE

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION DE VIGAS PRETENSADAS

DATOS GENERALES

LONGITUD TOTAL	=	36.00 M.
LUZ DE CALCULO	=	35.00 M.
ANCHURA DE LOSA	=	1.05 M.
ESPESOR DE LOSA	=	.24 M.

DEFINICION DE LA SECCION DE VIGAS

ALTURA (M)	ANCHO (M)
.000	.600
.250	.600
.320	.150
1.320	.150
1.400	.250
1.441	.900
1.500	.900

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA DEL HORMIGON INICIAL DE LA VIGA	350.	KG/CM2
RESISTENCIA DEL HORMIGON FINAL DE LA VIGA	450.	KG/CM2
RESISTENCIA DEL HORMIGON DE LA LOSA	250.	KG/CM2
LIMITE DE ELASTICIDAD DEL ACERO PASIVO	5100.	KG/CM2

COMPORTAMIENTO DIFERIDO DE LOS MATERIALES

	RETRACCION	FLUENCIA	RELAJACION
AL HORMIGONAR LA LOSA	.00010	1.00000	.00000
VALOR FINAL	.00025	2.50000	.04000

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

DEFINICION DE ARMADURAS PRETESAS

CARGA DE ROTURA DE LOS CORDONES	26.581 TN.
SECCION DE LOS CORDONES	1.393 CM2

DISPOSICION DE LOS CORDONES PRETESOS

SEPARACION MINIMA DE CAPA INFERIOR A BORDE	.060 M.
SEPARACION VERTICAL MINIMA ENTRE CAPAS	.050 M.
NUMERO DE CORDONES EN LA ARMADURA SUPERIOR	0
ALTURA C.D.G. DE LA ARMADURA SUPERIOR	1.450 M.

NUMERO DE CORDONES POR CAPA

9 9 9 0 0 0 0 0 0 0

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ESFUERZOS CARGAS EXTERIORES(SIN PESO PROPIO)

	DISTANCIA	AXIL	MOMENTO	CORTANTE
CARGAS PERMANENTES	.000	.000	118.328	.000
SOBRECARGAS	.000	.000	125.824	.658
CARGAS PERMANENTES	17.500	.000	.000	26.648
SOBRECARGAS	17.500	.000	.000	13.507

FRAC. PESO LOSA RESISTIDO POR LA VIGA 1.000
MAXIMA FISURA CON CARGA TOTAL .100 MM.

COEFICIENTES DE SEGURIDAD DE MATERIALES

COEF. MINORACION DEL HORMIGON EN ROTURA = 1.500
COEF. MINORACION DEL ACERO = 1.100

COEFICIENTES DE SEGURIDAD DE ACCIONES EXTERIORES

COEF. MAYORACION DE CARGAS PERMANENTES = 1.600
COEF. MAYORACION DE SOBRECARGAS = 1.600

COEFICIENTES DE SEGURIDAD PARA EL PRETENSADO

COEF. MINORACION DE LA FUERZA DE PRET. INICIAL = .900
COEF. MINORACION/MAYORACION DE LAS PERDIDAS = .900

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

RESULTADOS DE CALCULO

CARACTERISTICAS DE LA SECCION

	AREA(M2)	AL.C.D.G.(M.)	INERCIA(M4)
SECCION BRUTA DE LA VIGA	.4189250	.6744017	.1204052
SECCION COMPUESTA	.6067547	.9671253	.2372648
SECCION NETA DE LA VIGA	.4151638	.6795148	.1191962
SECCION NETA COMPUESTA	.6029935	.9724715	.2344844

DEFINICION DEL PRETENSADO

		PRETENSADO INFERIOR	PRETENSADO SUPERIOR	PRETENSADO TOTAL
NUMERO DE CORDONES		27	0	27
SECCION DE ACERO	(CM2)	37.611	.000	37.611
TENSION EN BANCADA POR CORDON	(TN)	19.936	.000	
TENSION TOTAL EN BANCADA	(TN)	538.272	.000	538.272
ALTURA DEL C.D.G.	(M.)	.110	1.450	.110

DISTANCIA DEL LIMITE DE ENVAINADO AL APOYO	NUMERO DE CORDONES ENVAINADOS
7.300	8
1.500	8
.700	2

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

CLASE DE COMPROBACION 2
COEF. ESTADO LIM. DECOMPRESION .560
COEF. ESTADO LIM. FORM. FISURAS 1.000

NOTA.-DEFINICION DE FASES

FASE 1 : AL DESTESAR

FASE 2 : POSTESADO 1 FASE

FASE 3 : A PIE DE OBRA

FASE 4 : AL HORMIGONAR LA LOSA (*)

FASE 5 : POSTESADO 2 FASE

FASE 6 : BAJO CARGAS PERMANENTES

FASE 7 : TRAS PERDIDAS FINALES

FASE 8 : CON CARGA TOTAL Y PRETENSADO TEORICO

FASE 9 : CON CARGA TOTAL Y PRETENSADO MINORADO

NOTA.-(*)
SE CONSIDERA SOLO LA FRACCION DE PESO
PROPIO DE LA LOSA RESISTIDO POR LA VIGA.
EL RESTO SE SUMA A LA CARGA PERMANENTE

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	502.3	502.3	466.6	474.1	474.1	481.1	434.2	441.7

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-1926.47	-344.64		
FASE 2	-1926.47	-344.64		
FASE 3	-1724.71	-398.57		
FASE 4	-1216.77	-1051.38		
FASE 5	-1216.77	-1051.38	.00	.00
FASE 6	-762.97	-1315.60	-264.72	-381.19
FASE 7	-517.24	-1328.83	-274.59	-421.94
FASE 8	-34.70	-1609.79	-556.08	-827.28
FASE 9	212.52	-1680.32	-555.24	-823.82

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	501.7	501.7	465.6	472.8	472.8	479.5	431.2	438.4

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1959.91	-301.32		
FASE	2	-1959.91	-301.32		
FASE	3	-1755.61	-355.93		
FASE	4	-1267.99	-982.63		
FASE	5	-1267.99	-982.63	.00	.00
FASE	6	-832.35	-1236.28	-254.14	-365.95
FASE	7	-579.48	-1249.89	-264.29	-407.88
FASE	8	-116.24	-1519.61	-534.52	-797.00
FASE	9	129.39	-1589.90	-533.65	-793.40

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	500.1	500.1	462.6	468.9	468.9	474.8	422.4	428.7

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-2060.24	-171.36		
FASE	2	-2060.24	-171.36		
FASE	3	-1848.34	-228.00		
FASE	4	-1421.67	-776.36		
FASE	5	-1421.67	-776.36	.00	.00
FASE	6	-1040.48	-998.30	-222.37	-320.20
FASE	7	-766.19	-1013.08	-233.38	-365.68
FASE	8	-360.85	-1249.08	-469.83	-706.17
FASE	9	-120.02	-1318.64	-468.86	-702.14

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	498.3	498.3	459.4	464.7	464.7	469.7	412.9	418.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-2167.70	-32.17		
FASE 2	-2167.70	-32.17		
FASE 3	-1947.65	-90.98		
FASE 4	-1586.27	-555.44		
FASE 5	-1586.27	-555.44	.00	.00
FASE 6	-1263.40	-743.43	-188.35	-271.21
FASE 7	-966.16	-759.44	-200.28	-320.50
FASE 8	-622.84	-959.33	-400.55	-608.89
FASE 9	-387.14	-1028.11	-399.47	-604.40

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	360.4	360.4	340.4	344.0	344.0	347.3	315.8	319.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-1391.29	-236.34		
FASE 2	-1391.29	-236.34		
FASE 3	-1280.63	-263.67		
FASE 4	-937.21	-697.25		
FASE 5	-937.21	-697.25	.00	.00
FASE 6	-630.55	-872.23	-175.18	-252.98
FASE 7	-467.98	-879.64	-180.70	-278.77
FASE 8	-141.90	-1065.71	-366.98	-547.78
FASE 9	33.98	-1112.05	-366.49	-545.48

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	357.6	357.6	335.4	337.5	337.5	339.4	300.9	303.0

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1625.79	61.42		
FASE	2	-1625.79	61.42		
FASE	3	-1502.47	30.97		
FASE	4	-1301.12	-223.25		
FASE	5	-1301.12	-223.25	.00	.00
FASE	6	-1121.31	-325.84	-102.71	-148.33
FASE	7	-922.70	-334.89	-109.46	-179.84
FASE	8	-731.50	-443.99	-218.68	-337.57
FASE	9	-563.55	-489.25	-218.04	-334.58

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	356.2	356.2	332.8	334.1	334.1	335.3	293.1	294.5

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1747.31	215.73		
FASE	2	-1747.31	215.73		
FASE	3	-1617.44	183.67		
FASE	4	-1489.70	22.40		
FASE	5	-1489.70	22.40	.00	.00
FASE	6	-1375.64	-42.68	-65.16	-94.09
FASE	7	-1158.34	-52.59	-72.54	-128.57
FASE	8	-1037.06	-121.79	-141.82	-228.63
FASE	9	-873.21	-166.49	-141.11	-225.28

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	211.7	211.7	202.5	203.0	203.0	203.5	183.7	184.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1003.59	85.93		
FASE	2	-1003.59	85.93		
FASE	3	-953.24	74.28		
FASE	4	-865.88	-34.02		
FASE	5	-865.88	-34.02	.00	.00
FASE	6	-787.89	-77.60	-43.61	-63.16
FASE	7	-687.29	-81.56	-46.56	-78.58
FASE	8	-604.36	-127.90	-92.92	-145.75
FASE	9	-503.56	-153.12	-92.64	-144.25

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	174.0	174.0	167.1	167.3	167.3	167.5	151.5	151.7

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-879.49	136.59		
FASE	2	-879.49	136.59		
FASE	3	-841.62	127.70		
FASE	4	-799.63	75.91		
FASE	5	-799.63	75.91	.00	.00
FASE	6	-762.16	55.08	-20.84	-30.21
FASE	7	-680.41	51.76	-23.31	-42.83
FASE	8	-640.56	29.61	-45.48	-74.96
FASE	9	-557.19	8.48	-45.23	-73.71

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	173.6	173.6	166.4	166.4	166.4	166.4	149.3	149.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-949.04	222.63		
FASE 2	-949.04	222.63		
FASE 3	-909.34	213.32		
FASE 4	-909.34	213.32		
FASE 5	-909.34	213.32	.00	.00
FASE 6	-909.34	213.32	.00	.00
FASE 7	-822.33	209.79	-2.63	-13.43
FASE 8	-822.33	209.79	-2.63	-13.43
FASE 9	-740.10	188.81	-2.37	-12.09

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.347	M
MODULO RESISTENTE	.241	M3
SECCION PRETENSADO	37.611	CM2
CAPACIDAD MECANICA DEL PRETENSADO	581.326	TN
CAPACIDAD MECANICA REQUERIDA	35.792	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.168	M
AREA TRACCIONADA	.101	M2
AREA TOTAL DE ACERO	5.052	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.347	M
MODULO RESISTENTE	.241	M3
SECCION PRETENSADO	37.611	CM2
CAPACIDAD MECANICA DEL PRETENSADO	581.326	TN
CAPACIDAD MECANICA REQUERIDA	35.792	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.113	M
AREA TRACCIONADA	.068	M2
AREA TOTAL DE ACERO	3.386	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.347	M
MODULO RESISTENTE	.241	M3
SECCION PRETENSADO	26.467	CM2
CAPACIDAD MECANICA DEL PRETENSADO	409.082	TN
CAPACIDAD MECANICA REQUERIDA	35.792	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.044	M
AREA TRACCIONADA	.027	M2
AREA TOTAL DE ACERO	1.334	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.055	M
AREA TRACCIONADA	.045	M2
AREA TOTAL DE ACERO	2.269	CM2
AREA DE ACERO PASIVO	2.269	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.165	M
AREA TRACCIONADA	.086	M2
AREA TOTAL DE ACERO	4.325	CM2
AREA DE ACERO PASIVO	4.325	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.118	M
AREA TRACCIONADA	.077	M2
AREA TOTAL DE ACERO	3.864	CM2
AREA DE ACERO PASIVO	3.864	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.202	M
AREA TRACCIONADA	.092	M2
AREA TOTAL DE ACERO	4.608	CM2
AREA DE ACERO PASIVO	4.608	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

FISURACION

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.285	M
AREA TRACCIONADA	.105	M2
AREA TOTAL DE ACERO	5.233	CM2
AREA DE ACERO PASIVO	5.233	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

MOMENTO MAYORADO REF. ARMADURA	801.585	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.008089	-.001661	-.001423	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	572.574	TN
MOMENTO REF. ARMADURA	826.679	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	587.198	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	826.679	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

MOMENTO MAYORADO REF. ARMADURA 769.521 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.008258	-.001620	-.001398	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL 566.548 TN

MOMENTO REF. ARMADURA 818.999 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL 587.198 TN

MOMENTO REF. ARMADURA .000 M*TN

AREA ACERO PASIVO .000 CM2

MOMENTO DE AGOTAMIENTO 818.999 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

MOMENTO MAYORADO REF. ARMADURA 673.331 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.006950	-.001748	-.001574	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL 591.399 TN

MOMENTO REF. ARMADURA 850.005 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL 587.198 TN

MOMENTO REF. ARMADURA .000 M*TN

AREA ACERO PASIVO .000 CM2

MOMENTO DE AGOTAMIENTO 850.005 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

MOMENTO MAYORADO REF. ARMADURA 570.310 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.006265	-.001786	-.001664	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL 601.559 TN

MOMENTO REF. ARMADURA 862.160 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL 587.198 TN

MOMENTO REF. ARMADURA .000 M*TN

AREA ACERO PASIVO .000 CM2

MOMENTO DE AGOTAMIENTO 862.160 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

MOMENTO MAYORADO REF. ARMADURA 529.268 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000985	-.000827	-.002601

ESFUERZOS EN EL PRETENSADO

PRE I 413.214 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL 434.879 TN

MOMENTO REF. ARMADURA 633.995 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL 413.214 TN

MOMENTO REF. ARMADURA .000 M*TN

AREA ACERO PASIVO .000 CM2

MOMENTO DE AGOTAMIENTO 633.995 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

MOMENTO MAYORADO REF. ARMADURA 310.321 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.001000	-.000953	-.002760

ESFUERZOS EN EL PRETENSADO

PRE I 413.214 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	446.042 TN
MOMENTO REF. ARMADURA	649.442 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	413.214 TN
MOMENTO REF. ARMADURA	.000 M*TN
AREA ACERO PASIVO	.000 CM2
MOMENTO DE AGOTAMIENTO	649.442 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

MOMENTO MAYORADO REF. ARMADURA 196.856 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000554	-.000565	-.002316

ESFUERZOS EN EL PRETENSADO

PRE I 413.214 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	347.301 TN
MOMENTO REF. ARMADURA	515.653 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	413.214 TN
MOMENTO REF. ARMADURA	.000 M*TN
AREA ACERO PASIVO	.000 CM2
MOMENTO DE AGOTAMIENTO	515.653 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

MOMENTO MAYORADO REF. ARMADURA 131.525 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000082	-.000077	-.001725

ESFUERZOS EN EL PRETENSADO

PRE I 239.229 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	227.804 TN
MOMENTO REF. ARMADURA	343.163 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	239.229 TN
MOMENTO REF. ARMADURA	.000 M*TN
AREA ACERO PASIVO	.000 CM2
MOMENTO DE AGOTAMIENTO	343.163 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A ROTURA POR FLEXION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

MOMENTO MAYORADO REF. ARMADURA 62.844 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	.000093	.000072	-.001548

ESFUERZOS EN EL PRETENSADO

PRE I 195.733 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	192.356 TN
MOMENTO REF. ARMADURA	292.214 M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	195.733 TN
MOMENTO REF. ARMADURA	.000 M*TN
AREA ACERO PASIVO	.000 CM2
MOMENTO DE AGOTAMIENTO	292.214 M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	1.053	TN
CORTANTE C.PERM. SIN MAY.	.000	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	801.585	M*TN
TENSION AXIL EN EL C.D.G	-748.230	TN/M2
COTANGENTE -O-	1.957	
LIM. COMPRESION ALMA	178.300	TN
COLABORACION CERCOS	.000	TN
SECCION DE ACERO	3.214	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

RASANTE MAYORADO	.546	TN/M
SECCION TOTAL ACERO	.130	CM2/M
SECCION DE ACERO EN CERCOS	3.214	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	.071	TN/M
SECCION NECESARIA	.017	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.350	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	.234	TN/M
SECCION NECESARIA	.056	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.350	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	22.607	TN
CORTANTE C.PERM. SIN MAY.	10.901	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	769.521	M*TN
TENSION AXIL EN EL C.D.G	-751.979	TN/M2
COTANGENTE -O-	1.961	
LIM. COMPRESION ALMA	178.106	TN
COLABORACION CERCOS	8.316	TN
SECCION DE ACERO	3.214	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

RASANTE MAYORADO	8.836	TN/M
SECCION TOTAL ACERO	2.104	CM2/M
SECCION DE ACERO EN CERCOS	3.214	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	2.812	TN/M
SECCION NECESARIA	.670	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.350	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	5.571	TN/M
SECCION NECESARIA	1.326	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.350	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	44.160	TN
CORTANTE C.PERM. SIN MAY.	21.803	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	673.331	M*TN
TENSION AXIL EN EL C.D.G	-763.227	TN/M2
COTANGENTE -O-	1.972	
LIM. COMPRESION ALMA	177.530	TN
COLABORACION CERCOS	37.147	TN
SECCION DE ACERO	3.214	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

RASANTE MAYORADO	17.126	TN/M
SECCION TOTAL ACERO	4.078	CM2/M
SECCION DE ACERO EN CERCOS	3.214	CM2/M
SECCION ADICIONAL	.863	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	5.554	TN/M
SECCION NECESARIA	1.322	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.350	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	10.907	TN/M
SECCION NECESARIA	2.597	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	58.940	TN
CORTANTE C.PERM. SIN MAY.	29.278	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	570.310	M*TN
TENSION AXIL EN EL C.D.G	-775.274	TN/M2
COTANGENTE -O-	1.983	
LIM. COMPRESION ALMA	176.918	TN
COLABORACION CERCOS	57.060	TN
SECCION DE ACERO	5.024	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.200	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

RASANTE MAYORADO	22.810	TN/M
SECCION TOTAL ACERO	5.431	CM2/M
SECCION DE ACERO EN CERCOS	5.024	CM2/M
SECCION ADICIONAL	.407	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.400	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	7.434	TN/M
SECCION NECESARIA	1.770	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.200	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	14.566	TN/M
SECCION NECESARIA	3.468	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.200	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .200 M.)

(ZONA C)

CORTANTE MAYORADO	63.867	TN
CORTANTE C.PERM. SIN MAY.	31.770	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	529.268	M*TN
TENSION AXIL EN EL C.D.G	-560.391	TN/M2
COTANGENTE -O-	1.767	
LIM. COMPRESION ALMA	186.234	TN
COLABORACION CERCOS	58.548	TN
SECCION DE ACERO	5.742	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

RASANTE MAYORADO	24.705	TN/M
SECCION TOTAL ACERO	5.882	CM2/M
SECCION DE ACERO EN CERCOS	5.742	CM2/M
SECCION ADICIONAL	.140	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	8.061	TN/M
SECCION NECESARIA	1.919	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	15.786	TN/M
SECCION NECESARIA	3.759	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	85.421	TN
CORTANTE C.PERM. SIN MAY.	42.671	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	310.321	M*TN
TENSION AXIL EN EL C.D.G	-601.255	TN/M2
COTANGENTE -O-	1.810	
LIM. COMPRESION ALMA	183.891	TN
COLABORACION CERCOS	64.520	TN
SECCION DE ACERO	6.699	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

RASANTE MAYORADO	32.995	TN/M
SECCION TOTAL ACERO	7.856	CM2/M
SECCION DE ACERO EN CERCOS	6.699	CM2/M
SECCION ADICIONAL	1.157	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.300	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	10.802	TN/M
SECCION NECESARIA	2.572	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	21.123	TN/M
SECCION NECESARIA	5.029	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .150 M.)

(ZONA AB)

CORTANTE MAYORADO	94.658	TN
CORTANTE C.PERM. SIN MAY.	47.343	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	196.856	M*TN
TENSION AXIL EN EL C.D.G	-622.432	TN/M2
COTANGENTE -O-	1.832	
LIM. COMPRESION ALMA	182.703	TN
COLABORACION CERCOS	73.757	TN
SECCION DE ACERO	6.699	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

RASANTE MAYORADO	36.547	TN/M
SECCION TOTAL ACERO	8.702	CM2/M
SECCION DE ACERO EN CERCOS	6.699	CM2/M
SECCION ADICIONAL	2.003	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.150	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	11.977	TN/M
SECCION NECESARIA	2.852	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	23.410	TN/M
SECCION NECESARIA	5.574	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

CANTO UTIL = 1.594 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .150 M.)

(ZONA AB)

CORTANTE MAYORADO	99.585	TN
CORTANTE C.PERM. SIN MAY.	49.835	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	158.702	M*TN
TENSION AXIL EN EL C.D.G	-388.518	TN/M2
COTANGENTE -O-	1.572	
LIM. COMPRESION ALMA	194.877	TN
COLABORACION CERCOS	78.883	TN
SECCION DE ACERO	8.971	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

RASANTE MAYORADO	38.442	TN/M
SECCION TOTAL ACERO	9.153	CM2/M
SECCION DE ACERO EN CERCOS	8.971	CM2/M
SECCION ADICIONAL	.181	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	12.604	TN/M
SECCION NECESARIA	3.001	CM2/M
DIAMETRO DE LAS BARRAS	10.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	24.629	TN/M
SECCION NECESARIA	5.864	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

CANTO UTIL = 1.597 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	104.511	TN
CORTANTE C.PERM. SIN MAY.	52.326	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	166.870	M*TN
TENSION AXIL EN EL C.D.G	-336.965	TN/M2
COTANGENTE -O-	1.508	
LIM. COMPRESION ALMA	198.541	TN
COLABORACION CERCOS	83.770	TN
SECCION DE ACERO	10.467	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

RASANTE MAYORADO	40.337	TN/M
SECCION TOTAL ACERO	9.604	CM2/M
SECCION DE ACERO EN CERCOS	10.467	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	13.231	TN/M
SECCION NECESARIA	3.150	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	25.849	TN/M
SECCION NECESARIA	6.155	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

COMPROBACION A CORTANTE

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

CANTO UTIL = 1.597 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .150 M.)

(ZONA AB)

CORTANTE MAYORADO	108.822	TN
CORTANTE C.PERM. SIN MAY.	54.507	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	173.752	M*TN
TENSION AXIL EN EL C.D.G	-354.771	TN/M2
COTANGENTE -O-	1.531	
LIM. COMPRESION ALMA	197.398	TN
COLABORACION CERCOS	88.081	TN
SECCION DE ACERO	10.467	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. BORDE

ARMADURA DE CONEXION

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

RASANTE MAYORADO	41.995	TN/M
SECCION TOTAL ACERO	9.999	CM2/M
SECCION DE ACERO EN CERCOS	10.467	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	13.779	TN/M
SECCION NECESARIA	3.281	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	26.916	TN/M
SECCION NECESARIA	6.409	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

VIGA INTERMEDIA

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION DE VIGAS PRETENSADAS

DATOS GENERALES

LONGITUD TOTAL	= 36.00 M.
LUZ DE CALCULO	= 35.00 M.
ANCHURA DE LOSA	= 1.20 M.
ESPESOR DE LOSA	= .24 M.

DEFINICION DE LA SECCION DE VIGAS

ALTURA (M)	ANCHO (M)
.000	.600
.250	.600
.320	.150
1.320	.150
1.400	.250
1.441	.900
1.500	.900

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA DEL HORMIGON INICIAL DE LA VIGA	350. KG/CM2
RESISTENCIA DEL HORMIGON FINAL DE LA VIGA	450. KG/CM2
RESISTENCIA DEL HORMIGON DE LA LOSA	250. KG/CM2
LIMITE DE ELASTICIDAD DEL ACERO PASIVO	5100. KG/CM2

COMPORTAMIENTO DIFERIDO DE LOS MATERIALES

	RETRACCION	FLUENCIA	RELAJACION
AL HORMIGONAR LA LOSA	.00010	1.00000	.00000
VALOR FINAL	.00025	2.50000	.04000

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

DEFINICION DE ARMADURAS PRETESAS

CARGA DE ROTURA DE LOS CORDONES	26.581 TN.
SECCION DE LOS CORDONES	1.393 CM2

DISPOSICION DE LOS CORDONES PRETESOS

SEPARACION MINIMA DE CAPA INFERIOR A BORDE	.060 M.
SEPARACION VERTICAL MINIMA ENTRE CAPAS	.050 M.
NUMERO DE CORDONES EN LA ARMADURA SUPERIOR	0
ALTURA C.D.G. DE LA ARMADURA SUPERIOR	1.450 M.

NUMERO DE CORDONES POR CAPA

9 9 9 0 0 0 0 0 0 0

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ESFUERZOS CARGAS EXTERIORES(SIN PESO PROPIO)

	DISTANCIA	AXIL	MOMENTO	CORTANTE
CARGAS PERMANENTES	.000	.000	66.375	.000
SOBRECARGAS	.000	.000	163.112	8.442
CARGAS PERMANENTES	17.500	.000	.000	6.160
SOBRECARGAS	17.500	.000	.000	29.082

FRAC. PESO LOSA RESISTIDO POR LA VIGA 1.000
MAXIMA FISURA CON CARGA TOTAL .100 MM.

COEFICIENTES DE SEGURIDAD DE MATERIALES

COEF. MINORACION DEL HORMIGON EN ROTURA = 1.500
COEF. MINORACION DEL ACERO = 1.100

COEFICIENTES DE SEGURIDAD DE ACCIONES EXTERIORES

COEF. MAYORACION DE CARGAS PERMANENTES = 1.600
COEF. MAYORACION DE SOBRECARGAS = 1.600

COEFICIENTES DE SEGURIDAD PARA EL PRETENSADO

COEF. MINORACION DE LA FUERZA DE PRET. INICIAL = .900
COEF. MINORACION/MAYORACION DE LAS PERDIDAS = .900

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

RESULTADOS DE CALCULO

CARACTERISTICAS DE LA SECCION

	AREA(M2)	AL.C.D.G.(M.)	INERCIA(M4)
SECCION BRUTA DE LA VIGA	.4189250	.6744017	.1204052
SECCION COMPUESTA	.6335875	.9947750	.2483466
SECCION NETA DE LA VIGA	.4151638	.6795148	.1191962
SECCION NETA COMPUESTA	.6298264	1.0000590	.2453847

DEFINICION DEL PRETENSADO

		PRETENSADO INFERIOR	PRETENSADO SUPERIOR	PRETENSADO TOTAL
NUMERO DE CORDONES		27	0	27
SECCION DE ACERO	(CM2)	37.611	.000	37.611
TENSION EN BANCADA POR CORDON	(TN)	19.936	.000	
TENSION TOTAL EN BANCADA	(TN)	538.272	.000	538.272
ALTURA DEL C.D.G.	(M.)	.110	1.450	.110

DISTANCIA DEL LIMITE DE ENVAINADO AL APOYO	NUMERO DE CORDONES ENVAINADOS
7.300	8
1.500	8
.700	2

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

CLASE DE COMPROBACION 2
COEF. ESTADO LIM. DECOMPRESION .634
COEF. ESTADO LIM. FORM. FISURAS 1.000

NOTA.-DEFINICION DE FASES

FASE 1 : AL DESTESAR

FASE 2 : POSTESADO 1 FASE

FASE 3 : A PIE DE OBRA

FASE 4 : AL HORMIGONAR LA LOSA (*)

FASE 5 : POSTESADO 2 FASE

FASE 6 : BAJO CARGAS PERMANENTES

FASE 7 : TRAS PERDIDAS FINALES

FASE 8 : CON CARGA TOTAL Y PRETENSADO TEORICO

FASE 9 : CON CARGA TOTAL Y PRETENSADO MINORADO

NOTA.-(*)
SE CONSIDERA SOLO LA FRACCION DE PESO
PROPIO DE LA LOSA RESISTIDO POR LA VIGA.
EL RESTO SE SUMA A LA CARGA PERMANENTE

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	502.3	502.3	466.6	475.1	475.1	479.0	429.3	438.9

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-1926.47	-344.64		
FASE 2	-1926.47	-344.64		
FASE 3	-1724.71	-398.57		
FASE 4	-1144.21	-1144.64		
FASE 5	-1144.21	-1144.64	.00	.00
FASE 6	-894.06	-1278.99	-134.57	-196.96
FASE 7	-634.54	-1290.22	-142.94	-237.62
FASE 8	-19.82	-1620.38	-473.65	-721.63
FASE 9	224.96	-1691.16	-472.88	-717.89

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	501.7	501.7	465.6	473.8	473.8	477.5	426.5	435.7

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1959.91	-301.32		
FASE	2	-1959.91	-301.32		
FASE	3	-1755.61	-355.93		
FASE	4	-1198.33	-1072.16		
FASE	5	-1198.33	-1072.16	.00	.00
FASE	6	-958.19	-1201.13	-129.19	-189.08
FASE	7	-692.15	-1212.64	-137.77	-230.76
FASE	8	-102.01	-1529.59	-455.25	-695.42
FASE	9	141.28	-1600.14	-454.46	-691.55

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	500.1	500.1	462.6	469.8	469.8	473.0	418.3	426.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-2060.24	-171.36		
FASE	2	-2060.24	-171.36		
FASE	3	-1848.34	-228.00		
FASE	4	-1360.72	-854.70		
FASE	5	-1360.72	-854.70	.00	.00
FASE	6	-1150.60	-967.55	-113.04	-165.45
FASE	7	-864.96	-979.91	-122.25	-210.20
FASE	8	-348.59	-1257.24	-400.05	-616.77
FASE	9	-109.78	-1327.09	-399.18	-612.56

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	498.3	498.3	459.4	465.4	465.4	468.2	409.4	416.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-2167.70	-32.17		
FASE 2	-2167.70	-32.17		
FASE 3	-1947.65	-90.98		
FASE 4	-1534.64	-621.80		
FASE 5	-1534.64	-621.80	.00	.00
FASE 6	-1356.67	-717.38	-95.75	-140.13
FASE 7	-1050.05	-730.65	-105.63	-188.17
FASE 8	-612.69	-965.55	-340.93	-532.53
FASE 9	-378.68	-1034.64	-339.98	-527.96

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

	FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE I	360.4	360.4	340.4	344.5	344.5	346.3	313.4	318.0

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

	VIGA		LOSA	
	FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE 1	-1391.29	-236.34		
FASE 2	-1391.29	-236.34		
FASE 3	-1280.63	-263.67		
FASE 4	-888.15	-759.20		
FASE 5	-888.15	-759.20	.00	.00
FASE 6	-719.11	-848.14	-89.04	-130.72
FASE 7	-550.04	-854.17	-93.53	-156.09
FASE 8	-134.64	-1072.75	-312.32	-477.32
FASE 9	40.09	-1119.26	-311.90	-474.92

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.352	M
MODULO RESISTENTE	.245	M3
SECCION PRETENSADO	26.467	CM2
CAPACIDAD MECANICA DEL PRETENSADO	409.082	TN
CAPACIDAD MECANICA REQUERIDA	36.308	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.052	M
AREA TRACCIONADA	.031	M2
AREA TOTAL DE ACERO	1.556	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	357.6	357.6	335.4	337.8	337.8	338.9	299.5	302.1

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1625.79	61.42		
FASE	2	-1625.79	61.42		
FASE	3	-1502.47	30.97		
FASE	4	-1272.35	-259.56		
FASE	5	-1272.35	-259.56	.00	.00
FASE	6	-1173.24	-311.72	-52.20	-76.64
FASE	7	-971.17	-318.92	-57.57	-106.97
FASE	8	-727.61	-447.08	-185.86	-295.31
FASE	9	-560.29	-492.54	-185.33	-292.36

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	356.2	356.2	332.8	334.3	334.3	335.0	292.2	293.9

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1747.31	215.73		
FASE	2	-1747.31	215.73		
FASE	3	-1617.44	183.67		
FASE	4	-1471.46	-.64		
FASE	5	-1471.46	-.64	.00	.00
FASE	6	-1408.58	-33.72	-33.12	-48.62
FASE	7	-1189.40	-41.53	-38.94	-81.51
FASE	8	-1034.90	-122.84	-120.32	-200.99
FASE	9	-871.43	-167.75	-119.74	-197.75

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	211.7	211.7	202.5	203.1	203.1	203.4	183.4	184.1

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-1003.59	85.93		
FASE	2	-1003.59	85.93		
FASE	3	-953.24	74.28		
FASE	4	-853.40	-49.49		
FASE	5	-853.40	-49.49	.00	.00
FASE	6	-810.41	-71.63	-22.16	-32.64
FASE	7	-709.09	-74.66	-24.42	-47.34
FASE	8	-603.45	-129.09	-78.87	-127.55
FASE	9	-502.79	-154.41	-78.65	-126.10

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	174.0	174.0	167.1	167.3	167.3	167.5	151.3	151.6

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-879.49	136.59		
FASE	2	-879.49	136.59		
FASE	3	-841.62	127.70		
FASE	4	-793.64	68.51		
FASE	5	-793.64	68.51	.00	.00
FASE	6	-772.98	57.92	-10.59	-15.61
FASE	7	-691.09	55.38	-12.48	-27.58
FASE	8	-640.32	29.37	-38.51	-65.94
FASE	9	-557.00	8.16	-38.32	-64.75

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

COEF. GLOBAL DE MINORACION DEL PRETENSADO = .900

VARIACION DE LA FUERZA DE PRETENSADO(TN.)

		FASE 1	FASE 2	FASE 3	FASE 4	FASE 5	FASE 6	FASE 7	FASE 8
PRE	I	173.6	173.6	166.4	166.4	166.4	166.4	149.3	149.3

TENSIONES EN EL HORMIGON EN LAS DISTINTAS FASES (TN/M2)

		VIGA		LOSA	
		FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
FASE	1	-949.04	222.63		
FASE	2	-949.04	222.63		
FASE	3	-909.34	213.32		
FASE	4	-909.34	213.32		
FASE	5	-909.34	213.32	.00	.00
FASE	6	-909.34	213.32	.00	.00
FASE	7	-822.63	210.63	-2.01	-12.67
FASE	8	-822.63	210.63	-2.01	-12.67
FASE	9	-740.36	189.57	-1.81	-11.40

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.352	M
MODULO RESISTENTE	.245	M3
SECCION PRETENSADO	37.611	CM2
CAPACIDAD MECANICA DEL PRETENSADO	581.326	TN
CAPACIDAD MECANICA REQUERIDA	36.308	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.176	M
AREA TRACCIONADA	.106	M2
AREA TOTAL DE ACERO	5.283	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

BRAZO MECANICO	1.352	M
MODULO RESISTENTE	.245	M3
SECCION PRETENSADO	37.611	CM2
CAPACIDAD MECANICA DEL PRETENSADO	581.326	TN
CAPACIDAD MECANICA REQUERIDA	36.308	TN
ARMADURA PASIVA REQUERIDA	.000	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.122	M
AREA TRACCIONADA	.073	M2
AREA TOTAL DE ACERO	3.651	CM2
AREA DE ACERO PASIVO	.000	CM2

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

CABEZA SUPERIOR

- NO HAY TRACCIONES -

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.285	M
AREA TRACCIONADA	.105	M2
AREA TOTAL DE ACERO	5.233	CM2
AREA DE ACERO PASIVO	5.233	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

MOMENTO MAYORADO REF. ARMADURA	800.171	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.009972	-.001441	-.001168	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	577.231	TN
MOMENTO REF. ARMADURA	843.484	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	587.198	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	843.484	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.055	M
AREA TRACCIONADA	.045	M2
AREA TOTAL DE ACERO	2.269	CM2
AREA DE ACERO PASIVO	2.269	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.165	M
AREA TRACCIONADA	.086	M2
AREA TOTAL DE ACERO	4.325	CM2
AREA DE ACERO PASIVO	4.325	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.118	M
AREA TRACCIONADA	.077	M2
AREA TOTAL DE ACERO	3.864	CM2
AREA DE ACERO PASIVO	3.864	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

FISURACION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

CABEZA SUPERIOR

BRAZO MECANICO	1.177	M
MODULO RESISTENTE	.145	M3
SECCION PRETENSADO	.000	CM2
CAPACIDAD MECANICA DEL PRETENSADO	.000	TN
CAPACIDAD MECANICA REQUERIDA	24.685	TN
ARMADURA PASIVA REQUERIDA	5.324	CM2

CALCULO BASADO EN EL AREA TRACCIONADA

PROF.ZONA TRACCIONADA	.202	M
AREA TRACCIONADA	.092	M2
AREA TOTAL DE ACERO	4.608	CM2
AREA DE ACERO PASIVO	4.608	CM2

CABEZA INFERIOR

- NO HAY TRACCIONES -

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

MOMENTO MAYORADO REF. ARMADURA	768.164	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.009454	-.001493	-.001238	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	590.345	TN
MOMENTO REF. ARMADURA	860.795	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	587.198	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	860.795	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

MOMENTO MAYORADO REF. ARMADURA	672.143	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.008831	-.001521	-.001319	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	600.160	TN
MOMENTO REF. ARMADURA	873.591	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	587.198	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	873.591	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

MOMENTO MAYORADO REF. ARMADURA 569.304 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.008221	-.001544	-.001397	-.003000

ESFUERZOS EN EL PRETENSADO

PRE I 587.198 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	608.360	TN
MOMENTO REF. ARMADURA	884.113	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	587.198	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	884.113	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

MOMENTO MAYORADO REF. ARMADURA 528.335 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000794	-.000613	-.002349

ESFUERZOS EN EL PRETENSADO

PRE I 413.214 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	430.390	TN
MOMENTO REF. ARMADURA	634.204	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	413.214	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	634.204	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

MOMENTO MAYORADO REF. ARMADURA	309.774	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000729	-.000669	-.002428

ESFUERZOS EN EL PRETENSADO

PRE I	413.214	TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	428.610	TN
MOMENTO REF. ARMADURA	632.550	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	413.214	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	632.550	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

MOMENTO MAYORADO REF. ARMADURA	196.509	M*TN
ARMADURA PASIVA MINIMA	.000	CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	-.000424	-.000426	-.002154

ESFUERZOS EN EL PRETENSADO

PRE I	413.214	TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	355.381	TN
MOMENTO REF. ARMADURA	531.820	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	413.214	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	531.820	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

MOMENTO MAYORADO REF. ARMADURA 131.293 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	.000014	.000025	-.001606

ESFUERZOS EN EL PRETENSADO

PRE I 239.229 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	232.867	TN
MOMENTO REF. ARMADURA	352.359	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	239.229	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	352.359	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A ROTURA POR FLEXION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

MOMENTO MAYORADO REF. ARMADURA 62.733 M*TN
ARMADURA PASIVA MINIMA .000 CM2

DEFORMACION EN ROTURA

VIGA		LOSA	
FIB. INF.	FIB. SUP.	FIB. INF.	FIB. SUP.
.010000	.000179	.000161	-.001445

ESFUERZOS EN EL PRETENSADO

PRE I 195.733 TN

RESULTANTE DE LAS TENSIONES EN EL HORMIGON

AXIL	195.608	TN
MOMENTO REF. ARMADURA	298.184	M*TN

RESULTANTE ESFUERZOS DE PRETENSADO

AXIL	195.733	TN
MOMENTO REF. ARMADURA	.000	M*TN
AREA ACERO PASIVO	.000	CM2
MOMENTO DE AGOTAMIENTO	298.184	M*TN

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	13.507	TN
CORTANTE C.PERM. SIN MAY.	.000	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	800.171	M*TN
TENSION AXIL EN EL C.D.G	-744.886	TN/M2
COTANGENTE -O-	1.954	
LIM. COMPRESION ALMA	178.472	TN
COLABORACION CERCOS	.000	TN
SECCION DE ACERO	3.214	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 1 DISTANCIA AL CENTRO = .000 M.

RASANTE MAYORADO	7.325	TN/M
SECCION TOTAL ACERO	1.744	CM2/M
SECCION DE ACERO EN CERCOS	3.214	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	.818	TN/M
SECCION NECESARIA	.195	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.350	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	2.970	TN/M
SECCION NECESARIA	.707	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.350	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	31.470	TN
CORTANTE C.PERM. SIN MAY.	7.098	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	768.164	M*TN
TENSION AXIL EN EL C.D.G	-748.719	TN/M2
COTANGENTE -O-	1.958	
LIM. COMPRESION ALMA	178.274	TN
COLABORACION CERCOS	20.036	TN
SECCION DE ACERO	3.214	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 2 DISTANCIA AL CENTRO = 3.500 M.

RASANTE MAYORADO	13.885	TN/M
SECCION TOTAL ACERO	3.306	CM2/M
SECCION DE ACERO EN CERCOS	3.214	CM2/M
SECCION ADICIONAL	.092	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	3.329	TN/M
SECCION NECESARIA	.793	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.350	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	7.511	TN/M
SECCION NECESARIA	1.788	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA C)

CORTANTE MAYORADO	49.432	TN
CORTANTE C.PERM. SIN MAY.	14.197	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	672.143	M*TN
TENSION AXIL EN EL C.D.G	-760.221	TN/M2
COTANGENTE -O-	1.969	
LIM. COMPRESION ALMA	177.684	TN
COLABORACION CERCOS	44.103	TN
SECCION DE ACERO	3.768	CM2/M
DIAMETRO CERCOS	6.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 3 DISTANCIA AL CENTRO = 7.000 M.

RASANTE MAYORADO	20.445	TN/M
SECCION TOTAL ACERO	4.868	CM2/M
SECCION DE ACERO EN CERCOS	3.768	CM2/M
SECCION ADICIONAL	1.100	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.300	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	5.841	TN/M
SECCION NECESARIA	1.391	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.300	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	12.052	TN/M
SECCION NECESARIA	2.870	CM2/M
DIAMETRO DE LAS BARRAS	6.000	MM
SEPARAC. DE LAS BARRAS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

CANTO UTIL = 1.630 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .150 M.)

(ZONA C)

CORTANTE MAYORADO	61.749	TN
CORTANTE C.PERM. SIN MAY.	19.065	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	569.304	M*TN
TENSION AXIL EN EL C.D.G	-772.538	TN/M2
COTANGENTE -O-	1.981	
LIM. COMPRESION ALMA	177.056	TN
COLABORACION CERCOS	60.746	TN
SECCION DE ACERO	5.024	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.200	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 4 DISTANCIA AL CENTRO = 9.400 M.

RASANTE MAYORADO	24.943	TN/M
SECCION TOTAL ACERO	5.939	CM2/M
SECCION DE ACERO EN CERCOS	5.024	CM2/M
SECCION ADICIONAL	.915	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.400	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	7.563	TN/M
SECCION NECESARIA	1.801	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.200	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	15.166	TN/M
SECCION NECESARIA	3.611	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.200	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .200 M.)

(ZONA C)

CORTANTE MAYORADO	65.855	TN
CORTANTE C.PERM. SIN MAY.	20.687	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	528.335	M*TN
TENSION AXIL EN EL C.D.G	-559.615	TN/M2
COTANGENTE -O-	1.766	
LIM. COMPRESION ALMA	186.279	TN
COLABORACION CERCOS	61.104	TN
SECCION DE ACERO	5.742	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 5 DISTANCIA AL CENTRO = 10.200 M.

RASANTE MAYORADO	26.443	TN/M
SECCION TOTAL ACERO	6.296	CM2/M
SECCION DE ACERO EN CERCOS	5.742	CM2/M
SECCION ADICIONAL	.554	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	8.138	TN/M
SECCION NECESARIA	1.938	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	16.204	TN/M
SECCION NECESARIA	3.858	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	83.817	TN
CORTANTE C.PERM. SIN MAY.	27.786	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	309.774	M*TN
TENSION AXIL EN EL C.D.G	-600.524	TN/M2
COTANGENTE -O-	1.809	
LIM. COMPRESION ALMA	183.933	TN
COLABORACION CERCOS	62.916	TN
SECCION DE ACERO	5.742	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 6 DISTANCIA AL CENTRO = 13.700 M.

RASANTE MAYORADO	33.003	TN/M
SECCION TOTAL ACERO	7.858	CM2/M
SECCION DE ACERO EN CERCOS	5.742	CM2/M
SECCION ADICIONAL	2.116	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.175	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	10.649	TN/M
SECCION NECESARIA	2.536	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	20.745	TN/M
SECCION NECESARIA	4.939	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

CANTO UTIL = 1.609 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	91.515	TN
CORTANTE C.PERM. SIN MAY.	30.828	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	196.509	M*TN
TENSION AXIL EN EL C.D.G	-621.724	TN/M2
COTANGENTE -O-	1.831	
LIM. COMPRESION ALMA	182.742	TN
COLABORACION CERCOS	70.614	TN
SECCION DE ACERO	6.699	CM2/M
DIAMETRO CERCOS	8.000	MM
SEPARACION CERCOS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 7 DISTANCIA AL CENTRO = 15.200 M.

RASANTE MAYORADO	35.814	TN/M
SECCION TOTAL ACERO	8.527	CM2/M
SECCION DE ACERO EN CERCOS	6.699	CM2/M
SECCION ADICIONAL	1.828	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.150	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	11.726	TN/M
SECCION NECESARIA	2.792	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	22.691	TN/M
SECCION NECESARIA	5.403	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.150	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

CANTO UTIL = 1.594 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .150 M.)

(ZONA AB)

CORTANTE MAYORADO	95.621	TN
CORTANTE C.PERM. SIN MAY.	32.450	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	152.385	M*TN
TENSION AXIL EN EL C.D.G	-388.559	TN/M2
COTANGENTE -O-	1.572	
LIM. COMPRESION ALMA	194.874	TN
COLABORACION CERCOS	74.919	TN
SECCION DE ACERO	8.971	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 8 DISTANCIA AL CENTRO = 16.000 M.

RASANTE MAYORADO	37.313	TN/M
SECCION TOTAL ACERO	8.884	CM2/M
SECCION DE ACERO EN CERCOS	8.971	CM2/M
SECCION ADICIONAL	.000	CM2/M
DIAMETRO CERCOS ADICIONAL	.000	MM
SEPARAC. CERCOS ADICIONAL	.000	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	12.300	TN/M
SECCION NECESARIA	2.928	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	23.729	TN/M
SECCION NECESARIA	5.650	CM2/M
DIAMETRO DE LAS BARRAS	8.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

CANTO UTIL = 1.597 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	99.727	TN
CORTANTE C.PERM. SIN MAY.	34.073	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	159.230	M*TN
TENSION AXIL EN EL C.D.G	-336.946	TN/M2
COTANGENTE -O-	1.508	
LIM. COMPRESION ALMA	198.542	TN
COLABORACION CERCOS	78.985	TN
SECCION DE ACERO	8.971	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 9 DISTANCIA AL CENTRO = 16.800 M.

RASANTE MAYORADO	38.813	TN/M
SECCION TOTAL ACERO	9.241	CM2/M
SECCION DE ACERO EN CERCOS	8.971	CM2/M
SECCION ADICIONAL	.270	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	12.874	TN/M
SECCION NECESARIA	3.065	CM2/M
DIAMETRO DE LAS BARRAS	10.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	24.767	TN/M
SECCION NECESARIA	5.897	CM2/M
DIAMETRO DE LAS BARRAS	10.000	MM
SEPARAC. DE LAS BARRAS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

COMPROBACION A CORTANTE

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

CANTO UTIL = 1.597 M
ANCHO ALMA = .150 M

SECCION DE CERCOS MINIMA 3.214 CM2/M (CERCOS -O- 6 A .175 M.)

(ZONA AB)

CORTANTE MAYORADO	103.319	TN
CORTANTE C.PERM. SIN MAY.	35.492	TN
CORTANTE DEBIDO PRETENSADO	.000	TN
MOMENTO COMPATIBLE	164.966	M*TN
TENSION AXIL EN EL C.D.G	-354.552	TN/M2
COTANGENTE -O-	1.530	
LIM. COMPRESION ALMA	197.412	TN
COLABORACION CERCOS	82.578	TN
SECCION DE ACERO	8.971	CM2/M
DIAMETRO CERCOS	10.000	MM
SEPARACION CERCOS	.175	M

LAV ZARAGOZA-LLEIDA E:6-461 V. INTERMEDIA

ARMADURA DE CONEXION

SECCION = 10 DISTANCIA AL CENTRO = 17.500 M.

RASANTE MAYORADO	40.125	TN/M
SECCION TOTAL ACERO	9.554	CM2/M
SECCION DE ACERO EN CERCOS	8.971	CM2/M
SECCION ADICIONAL	.582	CM2/M
DIAMETRO CERCOS ADICIONAL	6.000	MM
SEPARAC. CERCOS ADICIONAL	.350	M

CORTANTES DE ALA EN CABEZA SUPERIOR

RASANTE MAYORADO	13.376	TN/M
SECCION NECESARIA	3.185	CM2/M
DIAMETRO DE LAS BARRAS	10.000	MM
SEPARAC. DE LAS BARRAS	.175	M

CORTANTES DE ALA EN CABEZA INFERIOR

RASANTE MAYORADO	25.675	TN/M
SECCION NECESARIA	6.113	CM2/M
DIAMETRO DE LAS BARRAS	10.000	MM
SEPARAC. DE LAS BARRAS	.175	M

APARATOS DE APOYO

a) Peso propio + c. permanentes

P. viga = 1.047 t/m · 18.00 = 18.85 t

P. losa:

V. borde = 0.60 t/m² · 1.05 · 18.00 = 11.34 t

V. Interm. = 0.60 t/m² 1.20 · 18.00 = 12.96 t

C. Permanentes.

V. borde 1 = (0.75 · 1.05 + 0.20) · 18.00 = 17.78 t

V. Interim(1) = (0.69 · 1.20 + 0.10) · 18.00 = 16.70 t

V. Interim = 1.20 · 0.20 · 18.00 = 4.32 t

b) Sobrecargas

SCU + T.	V. borde =	13.51 t
	V. Interm. =	29.08 t
	V. borde =	7.70 t
	V. Interm. =	4.32 t

$R_{máx}$ = 65.21 t

$R_{mín}$ = 40.45 t

Se disponen aparatos de apoyo de 200 · 300 mm.

$\sigma_{máx} = \frac{65.21}{20 \cdot 30} = 108.68$ kg/cm²

$\sigma_{mín} = \frac{40.45}{20 \cdot 30} = 67.42$ kg/cm²

Altura del neopreno

$F = \frac{1}{20}\left[0.40 \cdot 7.00 \cdot 36.00 + 6.00\right] = 0.50 \cdot 4.02\,t + 6.00\,t$

$F = \frac{6.00}{10} = 0.60$ t/apoyo

Reológicos y térmicos

$\Delta l = 70 \cdot 10^{-5} \cdot 36.00 \cdot 0.50 = 12.60 \cdot 10^{-3}$ m

$12.60 + \frac{0.50 \cdot h}{200 - 0.20 - 0.30} = 0.7\,h \qquad h = 19.38$ mm

Se disponen aparatos de apoyo de

200 · 300 · 41 (29)

ESTRIBOS

ESTRIBOS

a) Carga vertical

Peso viga	18,85 · 10	= 188.50 t
Peso losa	11.34 · 2 + 12.96 · 8	= 126,36 t
C. lateral	17.78 · 2 + 15.70 · 2 + 4.32 · 6	= 94.88 t
	PP + CP	= 409.74 t
sc. uniforme	0.40 · 1.05 · 18.00 · 2	= 15.12 t
	0.40 · 1.20 · 18.00 · 8	= 69.12 t
sc tanque		= 54.50 t
	SC	= 138.74

b) carga horizontal

Frenado: 6,00 t

Retracción y fluencia:

$\Delta l = 17.60 \cdot 10^{-3}$

$F_{RET} = 100 \cdot \frac{0.20 \cdot 0.30 \cdot 10}{0,029} \times 17.6 \cdot 10^{-3} = 26,07$ t

Viento:

$S_2 = 1.50 + 0.24 + 0,30 + 2,50 = 4.54$ m²

$\frac{a_2}{d_2} = \frac{1.20}{1.50} = 0,80$

$\varphi_2 = 1 - \frac{2}{3}\left[1.5 - 0.30 - 0.8\right] = 0.16$

$S = 4.54 + 1.00 + 9 \times 1,5 \times 0,16 = 7.70$ m²

$V = 0,20 \cdot 7.70 \cdot 18.00 = 27.72$ t

Momento transversal de tanque:

$M_T = (7.00 + 0.5 - 1.50) \cdot 50 = 120$ mt

LAV ZARAGOZA-LLEIDA E: 6 - 461 ESTRIBOS

CARACTERISTICAS DEL RELLENO

PESO ESPECIFICO (TN/M3)		=	1.90
ANGULO DE ROZAMIENTO FI		=	30.00
ANGULO ROZAMIENTO TERRENO-MURO		=	.00
SOBRECARGA (TN/M2)		=	1.00
COEFICIENTE SISMICO BASICO	C	=	.080
COEFICIENTE SISMICO	S	=	.080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		=	.360
COEFICIENTE DE EMPUJE ACTIVO		=	.333

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250.	KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100.	KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.040	M

CARGAS SOBRE EL ESTRIBO

CARGA VERTICAL DE TABLERO PESO PROPIO Y CARGA PERMANENTE	409.7 TN
CARGA VERTICAL DE SOBRECARGAS	138.7 TN
FUERZA LONGITUDINAL DE FRENADO RETRACCION Y TEMPERATURA	32.1 TN
FUERZA TRANSVERSAL DE VIENTO	27.7 TN
MOMENTO TRANSVERSAL DE SOBRECARGAS	120.0 MT
FUERZA LONGITUDINAL DE SISMO	32.8 TN
FUERZA TRANSVERSAL DE SISMO	.0 TN

GEOMETRIA DEL ESTRIBO

ANCHURA DEL ESTRIBO	B	=	11.75
ESVIAJE (GRADOS SEXAGESIMALES)	BETA	=	.00

ALZADO DEL ESTRIBO

ESPESOR DEL FALDON	A3	=	.25
ALTURA DEL FALDON	A6	=	1.74
DISTANCIA DE APOYO A BORDE ESTRIBO	A5	=	.50
ESPESOR DEL ESTRIBO	A2	=	1.30
ESPESOR DE LAS ALETAS	A7	=	.80
ALTURA TOTAL DEL ESTRIBO	H + C	=	12.20
ALTURA DE TIERRAS	H	=	10.45

ZAPATA

VUELO DELANTERO	A1	=	2.50
VUELO TRASERO	A4	=	4.80
LONGITUD TOTAL	L	=	8.60
CANTO	C	=	1.75
RESGUARDO SOBRE ZAPATA		=	0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		=	40.00 TN/M2

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 38.6 CM2/M	(FI 25 A .125 M)
		AH.= 10.5 CM2/M	(FI 16 A .175 M)
	5.9 M. SUPERIORES	AV.= 19.3 CM2/M	(FI 25 A .250 M)
		AH.= 10.5 CM2/M	(FI 16 A .175 M)
INTRADOS		AV.= 4.2 CM2/M	(FI 12 A .250 M)
		AH.= 10.5 CM2/M	(FI 16 A .175 M)
FALDON	TRASDOS	AV.= 3.2 CM2/M	(FI 12 A .250 M)
		AH.= 50.8 CM2/M	(FI 25 A .087 M)
	INTRADOS	AV.= 3.2 CM2/M	(FI 12 A .250 M)
		AH.= 1.3 CM2/M	(FI 8 A .200 M)
ALETAS	TRASDOS	AV.= 13.4 CM2/M	(FI 20 A .225 M)
		AH.= 18.5 CM2/M	(FI 20 A .150 M)
	INTRADOS	AV.= 6.7 CM2/M	(FI 12 A .150 M)
		AH.= 9.3 CM2/M	(FI 16 A .200 M)

ARMADURA DE ZAPATA

CARA INFERIOR.	A. PRINCIPAL =	25.7 CM2/M	(FI 25 A .175 M)
	A. DE REPARTO =	7.7 CM2/M	(FI 16 A .250 M)
CARA SUPERIOR.	A. PRINCIPAL =	25.7 CM2/M	(FI 25 A .175 M)
	A. DE REPARTO =	7.7 CM2/M	(FI 16 A .250 M)

ESTRIBO CON RELLENO DE TIERRAS Y SIN TABLERO
==========

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 19.4

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S1 = 24.3 SA = 21.5 SB = 20.0 S2 = 14.6

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.35

COEFICIENTE DE SEGURIDAD AL VUELCO = 4.04

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 18.8

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

S11 = 28.2 SA1 = 23.1 SB1 = 20.5 S21 = 10.7

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.05

COEFICIENTE DE SEGURIDAD AL VUELCO = 3.30

ESTRIBO CON PUENTE EN SERVICIO

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO.

TENSION MEDIA EXIGIBLE EN EL TERRENO = 31.2

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS1 = 36.9 SSA = 29.9 SSB = 26.3 SS2 = 12.8

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 39.0 SMIN = 10.7

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.59

COEFICIENTE DE SEGURIDAD AL VUELCO = 4.14

TENSIONES EN EL TERRENO (TN/M2) CON SISMO

TENSION MEDIA EXIGIBLE EN EL TERRENO = 28.0

TENSIONES MEDIAS EN EL EJE DEL ESTRIBO

SS11= 40.6 SSA1= 30.7 SSB1= 25.5 SS21= 6.4

TENSIONES PUNTA MAXIMA Y MINIMA

SMAX = 42.1 SMIN = 4.9

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO = 1.17

COEFICIENTE DE SEGURIDAD AL VUELCO = 3.04

MEDICION DEL ESTRIBO

HORMIGON

ZAPATA		176.84
ALZADO		133.05
FALDON TRASERO		5.11
ALETAS		40.13
TOTAL M3	=	355.12

ARMADURAS

	DIAMETRO	NUMERO	LONGITUD	PESO	PESO TOTAL
FALDON					
	12.	47	5.53	.89	230.92
	25.	19	11.95	3.86	875.56
	8.	9	11.95	.39	42.47
ZAPATA					
	25.	67	11.80	3.86	3048.75
	25.	67	11.80	3.86	3048.75
	16.	35	14.95	1.58	826.48
	16.	35	14.95	1.58	826.48
ALZADO					
	25.	94	11.76	3.86	4262.85
	12.	47	10.46	.89	436.79
	16.	58	14.05	1.58	1287.15
	16.	50	14.05	1.58	1109.61
	16.	32	14.05	1.58	710.15
A DEDUCIR					
	25.	47	5.51	3.86	-998.65
	16.	32	14.05	1.58	-710.15
ALETAS					
	25.	64	12.30	3.86	3035.64
	25.	208	6.45	3.86	5173.55
	20.	48	12.30	2.47	1457.11
	20.	166	6.45	2.47	2642.49
				TOTAL KG =	27305.96

CARACTERISTICAS DEL RELLENO
==========

PESO ESPECIFICO (TN/M3)		=	1.90
ANGULO DE ROZAMIENTO FI		=	30.00
ANGULO ROZAMIENTO TERRENO-MURO		=	.00
ANGULO DE TALUD DEL TERRENO		=	.00
SOBRECARGA (TN/M2)		=	1.00
PENDIENTE DE INCLINACION DEL TRASDOS		=	.0900
COEFICIENTE SISMICO BASICO	C	=	.080
COEFICIENTE SISMICO	S	=	.080
COEFICIENTE DE EMPUJE ACTIVO CON SISMO		=	.397
COEFICIENTE DE EMPUJE ACTIVO		=	.368
COEFICIENTE DE EMPUJE ACTIVO VERTICAL		=	.033

CARACTERISTICAS DE LOS MATERIALES
==========

RESISTENCIA CARACTERISTICA DEL HORMIGON	=	250. KG/CM2
LIMITE ELASTICO DEL ACERO	=	5100. KG/CM2
RECUBRIMIENTO DE LAS ARMADURAS	=	.040 M

GEOMETRIA DEL MURO
==========

ALZADO DEL MURO

ANCHO EN CORONACION	A3	=	.40
ANCHO EN LA BASE	A2	=	1.34
INCLINACION DEL TRASDOS	CTG(ALFA)	=	.09000
ALTURA TOTAL	H1	=	10.40
ALTURA DE TIERRAS	H	=	10.10

ZAPATA

VUELO DELANTERO	A1	=	1.20
VUELO TRASERO	A4	=	4.56
LONGITUD TOTAL	L	=	7.10
CANTO	C	=	1.20
RESGUARDO SOBRE ZAPATA		=	0.30
TENSION MEDIA PEDIDA SOBRE TERRENO		=	LIBRE

ARMADURAS DEL ALZADO

TRASDOS.	ZONA INFERIOR	AV.= 38.2 CM2/M	(FI 25 A	.125 M)
		AH.= 10.8 CM2/M	(FI 16 A	.175 M)
	5.3 M. SUPERIORES	AV.= 19.1 CM2/M	(FI 25 A	.250 M)
		AH.= 8.5 CM2/M	(FI 16 A	.225 M)
INTRADOS		AV.= 4.3 CM2/M	(FI 12 A	.250 M)
		AH.= 10.8 CM2/M	(FI 16 A	.175 M)

ARMADURA DE ZAPATA

CARA INFERIOR.	A. PRINCIPAL =	9.0 CM2/M	(FI 16 A	.200 M)
	A. DE REPARTO =	2.7 CM2/M	(FI 12 A	.250 M)
CARA SUPERIOR.	A. PRINCIPAL =	39.0 CM2/M	(FI 25 A	.125 M)
	A. DE REPARTO =	11.7 CM2/M	(FI 20 A	.250 M)

TENSIONES EN EL TERRENO (TN/M2) SIN SISMO. (S. ADM.= 28.76)

S1 = 35.95 SA = 30.73 SB = 24.90 S2 = 5.06

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO	= 1.72
COEFICIENTE DE SEGURIDAD AL VUELCO	= 3.02

TENSIONES EN EL TERRENO (TN/M2) CON SISMO. (S. ADM.= 27.16)

S11= 40.74 SA1= 33.90 SB1= 26.27 S21= .28

COEFICIENTE DE SEGURIDAD AL DESLIZAMIENTO	= 1.41
COEFICIENTE DE SEGURIDAD AL VUELCO	= 2.50

VOLUMEN DE HORMIGON = 17.57 M3. PESO DE ACERO = 952.1 KG

PRUEBA DE CARGA

Introducción.

La estructura está formada por un puente isostático cuya sección transversal consta de 10 vigas de 36.00 m de luz.

La estructura ha sido calculado para el tren de cargas indicado en la "Instrucción de Puentes de Carreteras" del Ministerio de Obras Públicas de Febrero de 1972.

Ante la dificultad de reproducir este mismo tren de cargas se le ha sustituido por otro constituido por camiones de los utilizados en obra, con una carga total por camión de 34.00 Tn, distribuyendo las cargas por eje de la siguiente manera: 2 ejes traseros de 8.20 t cada uno, eje intermedio 12.90 t y eje delantero 4.70 t.

Descripción.

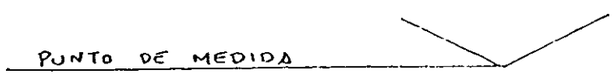
A) Se realiza una prueba de carga con cuatro camiones de los descritos en la introducción, situados de la siguiente forma sobre la calzada:

- Dos filas de dos camiones centrados longitudinal y transversalmente en el tablero y en direcciones opuestas.

Se medirán las deformaciones producidas en la sección central del puente, descargando a continuación el tablero para medir la recuperación del mismo y estimar si está dentro de los límites previstos.

Los instrumentos de medida utilizados serán flexímetros.

Disposición de Aparatos de Medida.

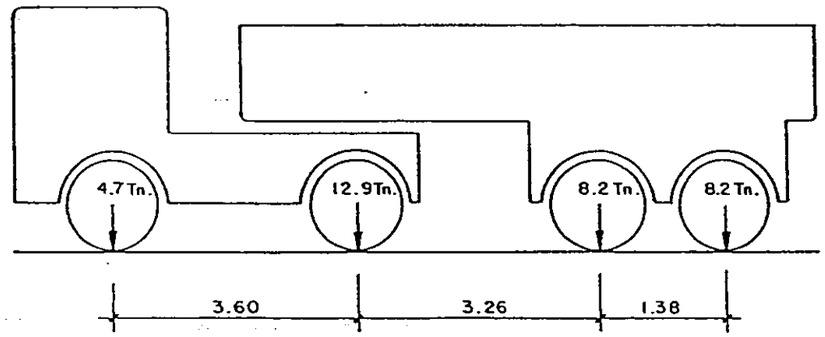


También se incluyen en el próximo apartado, las disposiciones de camiones en cada una de las fases de las pruebas de carga.

Camión utilizado para P.C.

Se describe a continuación el camión para el proyecto de la prueba de carga.

Peso total:	34.000 Kg
Eje trasero:	16.400 Kg
Eje intermedio:	12.900 Kg
Eje delantero:	4.700 Kg



P1 = 2 x 2.35 t =	4.70 t
P1 = 2 x 6.35 t =	12.90 t
P3 = 2 x 4.10 t =	8.20 t
P4 = 2 x 4.10 t =	8.20 t
	34.00 t

B) Condiciones generales para la realización de la P.C.

Antes de comenzar el ensayo se comprobarán las características, dimensiones separación y pesos por eje, así como el peso real de cada uno de los vehículos utilizados, con una precisión no inferior al 5%.

- Una vez situado el tren de cargas correspondiente se realizarán lecturas cada 10 minutos hasta que la diferencia de medidas, entre dos consecutivas, no supere el 5% del valor de la primera de las dos, momento en el que se considerará estabilizado el proceso de carga y se realizará la lectura final en todos los puntos de medida.

- Después de descargada la estructura se esperará hasta que los valores de las medidas estén estabilizados, se considera que como mínimo debe recuperar un 90% quedando como valor remanente un máximo del 10%.

- Igualmente una vez finalizada la prueba de carga se realizará una nivelación general de la obra definitiva, referida a puntos fijos que deberán quedar materializados en el terreno circundante.

- Por último en caso de no cumplirse alguna de las limitaciones fijadas, el proceso a seguir se atendrá a lo dispuesto en la publicación del M.O.P.U. "Pruebas de carga en puentes de Carreteras" de Marzo de 1988, salvo que el ingeniero Director disponga otra cosa.

Estudio de esfuerzos y desplazamientos.

Para el estudio de la respuesta estructural durante las pruebas de carga nos hemos auxiliado de programa en un ordenador.

La losa del tablero se ha asimilado a un emparrillado plano en el que las barras longitudinales corresponden los ejes principales y las transversales a cada una de las fracciónes en que dividimos la losa del tablero.

A continuación se incluye el resultado de flechas y esfuerzos obtenidos en el ordenador.

M1	M2	%
163.11	124.18	76

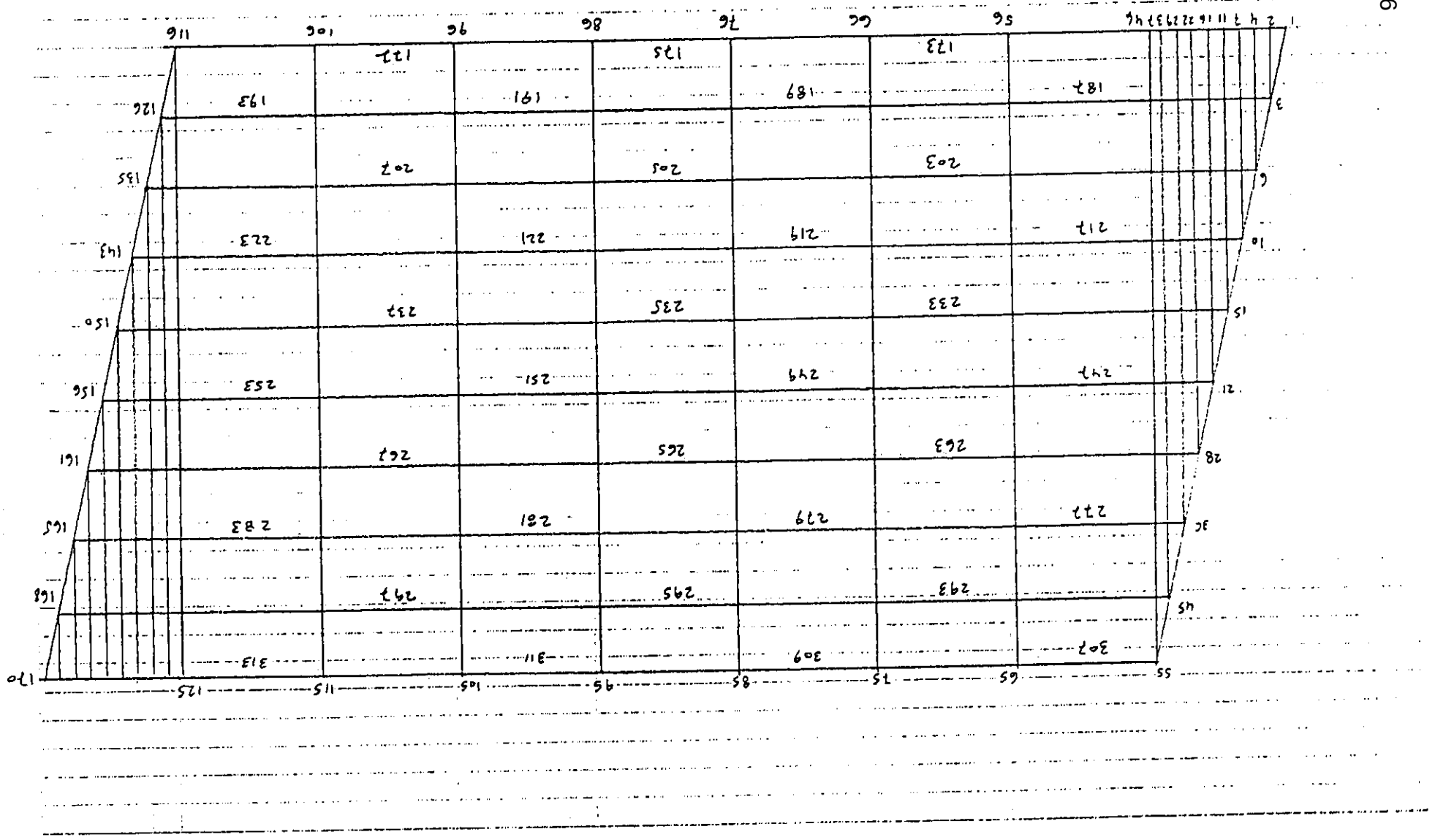
Siendo:

M_1 = Momento máximo de sobrecarga producido por el tren de la instrucción.

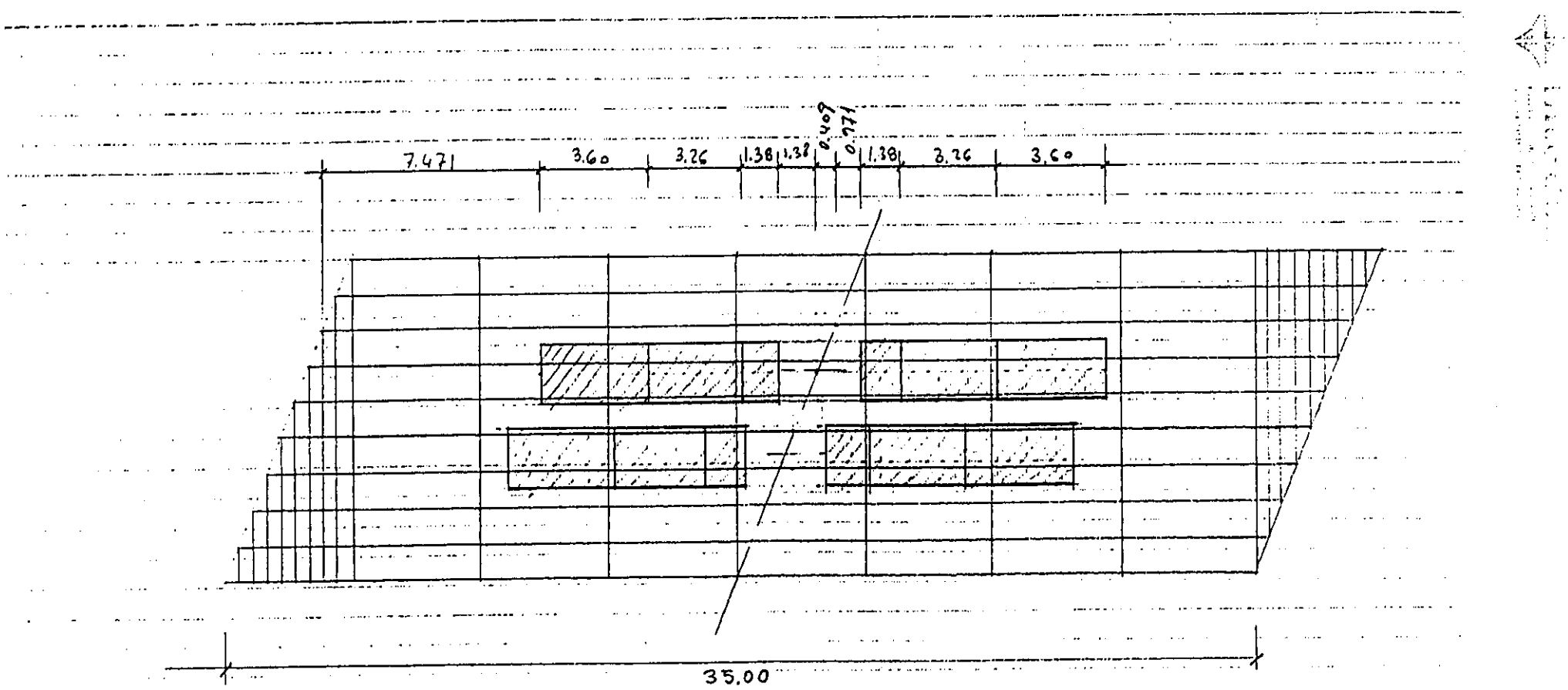
M_2 = Momento producido por la carga de camiones.

Punto	Flecha (mm)
1	4.72
2	7.46
3	10.10
4	12.20
5	13.40
6	13.31
7	12.05
8	9.95
9	7.33
10	4.60

Esquema de nudos y barras



Croquis de situaciones de carga


7.471
3.60
3.26
1.38
1.38
0.407
0.271
1.38
3.26
3.60
35.00

Resultados de ordenador

SECCION LONGITUDINAL

LUZ DE LA VIGA	=	36.000 M.
LUZ DE CALCULO	=	35.000 M.
ESVIAJE	=	68.000 GR

SECCION TRANSVERSAL

ANCHO TOTAL DE LA PLATAFORMA	=	11.700 M.
ANCHO TOTAL DE LA LOSA	=	11.700 M.
ANCHO ACERA IZQUIERDA SOBRE LOSA	=	2.350 M.
ANCHO ACERA DERECHA SOBRE LOSA	=	2.350 M.
ANCHO TOTAL ACERA IZQUIERDA	=	2.350 M.
ANCHO TOTAL ACERA DERECHA	=	2.350 M.
VUELO DE LOSA SOBRE EXT. VIGA IZQ.	=	.000 M.
VUELO DE LOSA SOBRE EXT. VIGA DER.	=	.000 M.

SOLUCION ADOPTADA

NUMERO DE VIGAS	=	10
CANTO DE LA VIGA	=	1.500 M.
CANTO DE LA LOSA	=	.200 M.
CANTO DE LA LOSA DE ENCOFRADO	=	.040 M.
INTEREJE DE VIGAS	=	1.200 M.
ANCHO DE LOSA VIGA CENTRAL	=	1.200 M.
ANCHO DE LOSA VIGA BORDE IZQ.	=	1.050 M.
ANCHO DE LOSA VIGA BORDE DER.	=	1.050 M.

LAV ZARAGOZA-LLEIDA ESTRUCTURA 6-461 PRUEBA DE CARGA

COEFICIENTES DE SEGURIDAD DE MATERIALES

COEF. SEGURIDAD DEL ACERO	=	1.100

COEFICIENTES DE SEGURIDAD DE ACCIONES

COEF. MAYORACION CARGAS PERMANENTES	=	1.600
COEF. MAYORACION DE SOBRECARGAS	=	1.600

CARACTERISTICAS DE LOS MATERIALES

RESISTENCIA DEL HORMIGON DE LA VIGA	=	450.000 KG/CM2
RESISTENCIA DEL HORMIGON DE LA LOSA	=	250.000 KG/CM2
LIMITE ELASTICO DEL ACERO	=	350.000 KG/CM2

LAV ZARAGOZA-LLEIDA ESTRUCTURA 6-461 PRUEBA DE CARGA

ACCIONES A CONSIDERAR

PESO PROPIO DE LA VIGA = 1.047 T/ML
PESO PROPIO DE LA LOSA = .600 T/M2

SOBRECARGAS - PRUEBA DE CARGA

CARRIL	1	EJE N.	1 =	4.700 T	X =	.000 M	Y =	1.000 M
CARRIL	1	EJE N.	2 =	12.900 T	X =	3.600 M	Y =	1.000 M
CARRIL	1	EJE N.	3 =	8.200 T	X =	6.860 M	Y =	1.000 M
CARRIL	1	EJE N.	4 =	8.200 T	X =	8.240 M	Y =	1.000 M
CARRIL	1	EJE N.	5 =	8.200 T	X =	11.000 M	Y =	1.000 M
CARRIL	1	EJE N.	6 =	8.200 T	X =	12.380 M	Y =	1.000 M
CARRIL	1	EJE N.	7 =	12.900 T	X =	15.640 M	Y =	1.000 M
CARRIL	1	EJE N.	8 =	4.700 T	X =	19.240 M	Y =	1.000 M
CARRIL	2	EJE N.	1 =	4.700 T	X =	.000 M	Y =	4.000 M
CARRIL	2	EJE N.	2 =	12.900 T	X =	3.600 M	Y =	4.000 M
CARRIL	2	EJE N.	3 =	8.200 T	X =	6.860 M	Y =	4.000 M
CARRIL	2	EJE N.	4 =	8.200 T	X =	8.240 M	Y =	4.000 M
CARRIL	2	EJE N.	5 =	8.200 T	X =	11.000 M	Y =	4.000 M
CARRIL	2	EJE N.	6 =	8.200 T	X =	12.380 M	Y =	4.000 M
CARRIL	2	EJE N.	7 =	12.900 T	X =	15.640 M	Y =	4.000 M
CARRIL	2	EJE N.	8 =	4.700 T	X =	19.240 M	Y =	4.000 M

DEFINICION GEOMETRICA

NUDO	X	Y	NUDO	X	Y
1	.0000	.4500	2	.4848	.4500
3	.4848	1.6500	4	.9697	.4500
5	.9697	1.6500	6	.9697	2.8500
7	1.4545	.4500	8	1.4545	1.6500
9	1.4545	2.8500	10	1.4545	4.0500
11	1.9393	.4500	12	1.9393	1.6500
13	1.9393	2.8500	14	1.9393	4.0500
15	1.9393	5.2500	16	2.4241	.4500
17	2.4241	1.6500	18	2.4241	2.8500
19	2.4241	4.0500	20	2.4241	5.2500
21	2.4241	6.4500	22	2.9090	.4500
23	2.9090	1.6500	24	2.9090	2.8500
25	2.9090	4.0500	26	2.9090	5.2500
27	2.9090	6.4500	28	2.9090	7.6500
29	3.3938	.4500	30	3.3938	1.6500
31	3.3938	2.8500	32	3.3938	4.0500
33	3.3938	5.2500	34	3.3938	6.4500
35	3.3938	7.6500	36	3.3938	8.8500
37	3.8786	.4500	38	3.8786	1.6500
39	3.8786	2.8500	40	3.8786	4.0500
41	3.8786	5.2500	42	3.8786	6.4500
43	3.8786	7.6500	44	3.8786	8.8500
45	3.8786	10.0500	46	4.3635	.4500
47	4.3635	1.6500	48	4.3635	2.8500
49	4.3635	4.0500	50	4.3635	5.2500
51	4.3635	6.4500	52	4.3635	7.6500
53	4.3635	8.8500	54	4.3635	10.0500
55	4.3635	11.2500	56	8.7401	.4500
57	8.7401	1.6500	58	8.7401	2.8500
59	8.7401	4.0500	60	8.7401	5.2500
61	8.7401	6.4500	62	8.7401	7.6500
63	8.7401	8.8500	64	8.7401	10.0500
65	8.7401	11.2500	66	13.1168	.4500
67	13.1168	1.6500	68	13.1168	2.8500
69	13.1168	4.0500	70	13.1168	5.2500
71	13.1168	6.4500	72	13.1168	7.6500
73	13.1168	8.8500	74	13.1168	10.0500
75	13.1168	11.2500	76	17.4934	.4500
77	17.4934	1.6500	78	17.4934	2.8500
79	17.4934	4.0500	80	17.4934	5.2500
81	17.4934	6.4500	82	17.4934	7.6500
83	17.4934	8.8500	84	17.4934	10.0500
85	17.4934	11.2500	86	21.8701	.4500
87	21.8701	1.6500	88	21.8701	2.8500

DEFINICION GEOMETRICA

NUDO	X	Y	NUDO	X	Y
89	21.8701	4.0500	90	21.8701	5.2500
91	21.8701	6.4500	92	21.8701	7.6500
93	21.8701	8.8500	94	21.8701	10.0500
95	21.8701	11.2500	96	26.2467	.4500
97	26.2467	1.6500	98	26.2467	2.8500
99	26.2467	4.0500	100	26.2467	5.2500
101	26.2467	6.4500	102	26.2467	7.6500
103	26.2467	8.8500	104	26.2467	10.0500
105	26.2467	11.2500	106	30.6234	.4500
107	30.6234	1.6500	108	30.6234	2.8500
109	30.6234	4.0500	110	30.6234	5.2500
111	30.6234	6.4500	112	30.6234	7.6500
113	30.6234	8.8500	114	30.6234	10.0500
115	30.6234	11.2500	116	35.0000	.4500
117	35.0000	1.6500	118	35.0000	2.8500
119	35.0000	4.0500	120	35.0000	5.2500
121	35.0000	6.4500	122	35.0000	7.6500
123	35.0000	8.8500	124	35.0000	10.0500
125	35.0000	11.2500	126	35.4848	1.6500
127	35.4848	2.8500	128	35.4848	4.0500
129	35.4848	5.2500	130	35.4848	6.4500
131	35.4848	7.6500	132	35.4848	8.8500
133	35.4848	10.0500	134	35.4848	11.2500
135	35.9697	2.8500	136	35.9697	4.0500
137	35.9697	5.2500	138	35.9697	6.4500
139	35.9697	7.6500	140	35.9697	8.8500
141	35.9697	10.0500	142	35.9697	11.2500
143	36.4545	4.0500	144	36.4545	5.2500
145	36.4545	6.4500	146	36.4545	7.6500
147	36.4545	8.8500	148	36.4545	10.0500
149	36.4545	11.2500	150	36.9393	5.2500
151	36.9393	6.4500	152	36.9393	7.6500
153	36.9393	8.8500	154	36.9393	10.0500
155	36.9393	11.2500	156	37.4241	6.4500
157	37.4241	7.6500	158	37.4241	8.8500
159	37.4241	10.0500	160	37.4241	11.2500
161	37.9090	7.6500	162	37.9090	8.8500
163	37.9090	10.0500	164	37.9090	11.2500
165	38.3938	8.8500	166	38.3938	10.0500
167	38.3938	11.2500	168	38.8786	10.0500
169	38.8786	11.2500	170	39.3635	11.2500

DEFINICION DE BARRAS TRANSVERSALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
1	1	3	1	1	2	3	6	1	1
3	6	10	1	1	4	10	15	1	1
5	15	21	1	1	6	21	28	1	1
7	28	36	1	1	8	36	45	1	1
9	45	55	1	1	10	2	3	1	2
11	4	5	1	3	12	5	6	1	3
13	7	8	1	4	14	8	9	1	4
15	9	10	1	4	16	11	12	1	5
17	12	13	1	5	18	13	14	1	5
19	14	15	1	5	20	16	17	1	6
21	17	18	1	6	22	18	19	1	6
23	19	20	1	6	24	20	21	1	6
25	22	23	1	7	26	23	24	1	7
27	24	25	1	7	28	25	26	1	7
29	26	27	1	7	30	27	28	1	7
31	29	30	1	8	32	30	31	1	8
33	31	32	1	8	34	32	33	1	8
35	33	34	1	8	36	34	35	1	8
37	35	36	1	8	38	37	38	1	9
39	38	39	1	9	40	39	40	1	9
41	40	41	1	9	42	41	42	1	9
43	42	43	1	9	44	43	44	1	9
45	44	45	1	9	46	46	47	1	10
47	47	48	1	10	48	48	49	1	10
49	49	50	1	10	50	50	51	1	10
51	51	52	1	10	52	52	53	1	10
53	53	54	1	10	54	54	55	1	10
55	56	57	1	11	56	57	58	1	11
57	58	59	1	11	58	59	60	1	11
59	60	61	1	11	60	61	62	1	11
61	62	63	1	11	62	63	64	1	11
63	64	65	1	11	64	66	67	1	12
65	67	68	1	12	66	68	69	1	12
67	69	70	1	12	68	70	71	1	12
69	71	72	1	12	70	72	73	1	12
71	73	74	1	12	72	74	75	1	12
73	76	77	1	13	74	77	78	1	13
75	78	79	1	13	76	79	80	1	13
77	80	81	1	13	78	81	82	1	13
79	82	83	1	13	80	83	84	1	13
81	84	85	1	13	82	86	87	1	14
83	87	88	1	14	84	88	89	1	14
85	89	90	1	14	86	90	91	1	14
87	91	92	1	14	88	92	93	1	14

DEFINICION DE BARRAS TRANSVERSALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
89	93	94	1	14	90	94	95	1	14
91	96	97	1	15	92	97	98	1	15
93	98	99	1	15	94	99	100	1	15
95	100	101	1	15	96	101	102	1	15
97	102	103	1	15	98	103	104	1	15
99	104	105	1	15	100	106	107	1	16
101	107	108	1	16	102	108	109	1	16
103	109	110	1	16	104	110	111	1	16
105	111	112	1	16	106	112	113	1	16
107	113	114	1	16	108	114	115	1	16
109	116	117	1	17	110	117	118	1	17
111	118	119	1	17	112	119	120	1	17
113	120	121	1	17	114	121	122	1	17
115	122	123	1	17	116	123	124	1	17
117	124	125	1	17	118	126	127	1	18
119	127	128	1	18	120	128	129	1	18
121	129	130	1	18	122	130	131	1	18
123	131	132	1	18	124	132	133	1	18
125	133	134	1	18	126	135	136	1	19
127	136	137	1	19	128	137	138	1	19
129	138	139	1	19	130	139	140	1	19
131	140	141	1	19	132	141	142	1	19
133	143	144	1	20	134	144	145	1	20
135	145	146	1	20	136	146	147	1	20
137	147	148	1	20	138	148	149	1	20
139	150	151	1	21	140	151	152	1	21
141	152	153	1	21	142	153	154	1	21
143	154	155	1	21	144	156	157	1	22
145	157	158	1	22	146	158	159	1	22
147	159	160	1	22	148	161	162	1	23
149	162	163	1	23	150	163	164	1	23
151	165	166	1	24	152	166	167	1	24
153	168	169	1	25	154	116	126	1	26
155	126	135	1	26	156	135	143	1	26
157	143	150	1	26	158	150	156	1	26
159	156	161	1	26	160	161	165	1	26
161	165	168	1	26	162	168	170	1	26

DEFINICION DE BARRAS LONGITUDINALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
163	1	2	2	27	164	2	4	2	27
165	4	7	2	27	166	7	11	2	27
167	11	16	2	27	168	16	22	2	27
169	22	29	2	27	170	29	37	2	27
171	37	46	2	27	172	46	56	2	27
173	56	66	2	27	174	66	76	2	27
175	76	86	2	27	176	86	96	2	27
177	96	106	2	27	178	106	116	2	27
179	3	5	2	28	180	5	8	2	28
181	8	12	2	28	182	12	17	2	28
183	17	23	2	28	184	23	30	2	28
185	30	38	2	28	186	38	47	2	28
187	47	57	2	28	188	57	67	2	28
189	67	77	2	28	190	77	87	2	28
191	87	97	2	28	192	97	107	2	28
193	107	117	2	28	194	117	126	2	28
195	6	9	2	29	196	9	13	2	29
197	13	18	2	29	198	18	24	2	29
199	24	31	2	29	200	31	39	2	29
201	39	48	2	29	202	48	58	2	29
203	58	68	2	29	204	68	78	2	29
205	78	88	2	29	206	88	98	2	29
207	98	108	2	29	208	108	118	2	29
209	118	127	2	29	210	127	135	2	29
211	10	14	2	30	212	14	19	2	30
213	19	25	2	30	214	25	32	2	30
215	32	40	2	30	216	40	49	2	30
217	49	59	2	30	218	59	69	2	30
219	69	79	2	30	220	79	89	2	30
221	89	99	2	30	222	99	109	2	30
223	109	119	2	30	224	119	128	2	30
225	128	136	2	30	226	136	143	2	30
227	15	20	2	31	228	20	26	2	31
229	26	33	2	31	230	33	41	2	31
231	41	50	2	31	232	50	60	2	31
233	60	70	2	31	234	70	80	2	31
235	80	90	2	31	236	90	100	2	31
237	100	110	2	31	238	110	120	2	31
239	120	129	2	31	240	129	137	2	31
241	137	144	2	31	242	144	150	2	31
243	21	27	2	32	244	27	34	2	32
245	34	42	2	32	246	42	51	2	32
247	51	61	2	32	248	61	71	2	32
249	71	81	2	32	250	81	91	2	32

DEFINICION DE BARRAS LONGITUDINALES

BARRA	N.IN.	N.FI.	MAT	SEC.	BARRA	N.IN.	N.FI.	MAT	SEC.
251	91	101	2	32	252	101	111	2	32
253	111	121	2	32	254	121	130	2	32
255	130	138	2	32	256	138	145	2	32
257	145	151	2	32	258	151	156	2	32
259	28	35	2	33	260	35	43	2	33
261	43	52	2	33	262	52	62	2	33
263	62	72	2	33	264	72	82	2	33
265	82	92	2	33	266	92	102	2	33
267	102	112	2	33	268	112	122	2	33
269	122	131	2	33	270	131	139	2	33
271	139	146	2	33	272	146	152	2	33
273	152	157	2	33	274	157	161	2	33
275	36	44	2	34	276	44	53	2	34
277	53	63	2	34	278	63	73	2	34
279	73	83	2	34	280	83	93	2	34
281	93	103	2	34	282	103	113	2	34
283	113	123	2	34	284	123	132	2	34
285	132	140	2	34	286	140	147	2	34
287	147	153	2	34	288	153	158	2	34
289	158	162	2	34	290	162	165	2	34
291	45	54	2	35	292	54	64	2	35
293	64	74	2	35	294	74	84	2	35
295	84	94	2	35	296	94	104	2	35
297	104	114	2	35	298	114	124	2	35
299	124	133	2	35	300	133	141	2	35
301	141	148	2	35	302	148	154	2	35
303	154	159	2	35	304	159	163	2	35
305	163	166	2	35	306	166	168	2	35
307	55	65	2	36	308	65	75	2	36
309	75	85	2	36	310	85	95	2	36
311	95	105	2	36	312	105	115	2	36
313	115	125	2	36	314	125	134	2	36
315	134	142	2	36	316	142	149	2	36
317	149	155	2	36	318	155	160	2	36
319	160	164	2	36	320	164	167	2	36
321	167	169	2	36	322	169	170	2	36

CARACTERISTICAS DE LOS MATERIALES

TIPO		MOD. ELASTICIDAD (TN/M2)	POISSON
1	LOSA	3320392.00	.15
2	VIGA	4454773.00	.15

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS TRANSVERSALES

SECC.	AREA	M. TORSION	M. INERCIA
1	.04495262	.00029968	.00014984
2	.09696593	.00064644	.00032322
3	.09696593	.00064644	.00032322
4	.09696593	.00064644	.00032322
5	.09696593	.00064644	.00032322
6	.09696593	.00064644	.00032322
7	.09696593	.00064644	.00032322
8	.09696593	.00064644	.00032322
9	.09696593	.00064644	.00032322
10	.48614770	.00324098	.00162049
11	.87532950	.00583553	.00291777
12	.87532950	.00583553	.00291777
13	.87532950	.00583553	.00291777
14	.87532950	.00583553	.00291777
15	.87532950	.00583553	.00291777
16	.87532950	.00583553	.00291777
17	.48614770	.00324098	.00162049
18	.09696593	.00064644	.00032322
19	.09696593	.00064644	.00032322
20	.09696593	.00064644	.00032322
21	.09696593	.00064644	.00032322
22	.09696593	.00064644	.00032322
23	.09696593	.00064644	.00032322
24	.09696593	.00064644	.00032322
25	.09696593	.00064644	.00032322
26	.04495262	.00029968	.00014984

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS LONGITUDINALES

SECC.	AREA	M. TORSION	M. INERCIA
27	.60004650	.00523481	.23519050
28	.62017110	.00553176	.24456370

CARACTERISTICAS GEOMETRICAS DE SECCIONES TIPO BARRAS LONGITUDINALES

SECC.	AREA	M. TORSION	M. INERCIA
29	.62017110	.00553176	.24456370
30	.62017110	.00553176	.24456370
31	.62017110	.00553176	.24456370
32	.62017110	.00553176	.24456370
33	.62017110	.00553176	.24456370
34	.62017110	.00553176	.24456370
35	.62017110	.00553176	.24456370
36	.60004650	.00523481	.23519050

HIPOTESIS TANQUE (HIP = 1)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
60	.1008	61	1.1084	62	.5038	63	.7053
70	.4670	71	5.1372	72	2.3351	73	3.2691
80	.7054	81	7.7598	82	3.5272	83	4.9381
90	.7195	91	7.9141	92	3.5973	93	5.0362
100	.6363	101	6.9996	102	3.1816	103	4.4543
110	.2043	111	2.2476	112	1.0216	113	1.4303

HIPOTESIS TANQUE (HIP = 2)

NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)	NUDO	CARGA (T)
58	.5897	59	.4212	60	1.0274	61	1.1926
62	.5038	63	.7053	68	3.0673	69	2.1909
70	5.2870	71	5.5754	72	2.3351	73	3.2691
78	4.8491	79	3.4636	80	8.3254	81	8.4526
82	3.5272	83	4.9381	88	5.0420	89	3.6014
90	8.6425	91	8.6344	92	3.5973	93	5.0362
98	4.4219	99	3.1585	100	7.5850	101	7.6313
102	3.1816	103	4.4543	108	1.8635	109	1.3311
110	3.1327	111	2.5138	112	1.0216	113	1.4303

DESPLAZAMIENTOS

		NUDO 170			NUDO 169		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00010	-.00043	-.00021	-.00009	-.00043
2 T	2	.00000	-.00003	-.00043	-.00021	-.00001	-.00043

		NUDO 168			NUDO 167		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00016	-.00053	-.00042	-.00007	-.00043
2 T	2	.00000	-.00015	-.00064	-.00041	.00003	-.00042

		NUDO 166			NUDO 165		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00026	-.00015	-.00053	.00000	-.00021	-.00063
2 T	2	-.00031	-.00011	-.00064	.00000	-.00024	-.00088

		NUDO 164			NUDO 163		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00062	-.00004	-.00043	-.00052	-.00012	-.00053
2 T	2	-.00062	.00009	-.00042	-.00062	-.00005	-.00064

		NUDO 162			NUDO 161		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00031	-.00020	-.00063	.00000	-.00026	-.00068
2 T	2	-.00042	-.00021	-.00087	.00000	-.00035	-.00108

		NUDO 160			NUDO 159		
HIP(IDETIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00083	-.00001	-.00042	-.00077	-.00008	-.00053
2 T	2	-.00082	.00016	-.00042	-.00094	.00003	-.00064

DESPLAZAMIENTOS

		NUDO 158			NUDO 157		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00061	-.00018	-.00063	-.00033	-.00026	-.00068
2 T	2	-.00085	-.00014	-.00087	-.00052	-.00032	-.00108

		NUDO 156			NUDO 155		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00030	-.00066	-.00103	.00003	-.00042
2 T	2	.00000	-.00044	-.00121	-.00103	.00024	-.00042

		NUDO 154			NUDO 153		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00103	-.00004	-.00053	-.00092	-.00015	-.00063
2 T	2	-.00125	.00012	-.00064	-.00127	-.00007	-.00087

		NUDO 152			NUDO 151		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00066	-.00025	-.00068	-.00032	-.00030	-.00066
2 T	2	-.00104	-.00027	-.00107	-.00059	-.00043	-.00121

		NUDO 150			NUDO 149		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00029	-.00057	-.00124	.00007	-.00042
2 T	2	.00000	-.00051	-.00123	-.00123	.00032	-.00041

		NUDO 148			NUDO 147		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00129	.00000	-.00052	-.00122	-.00012	-.00062
2 T	2	-.00155	.00021	-.00063	-.00169	.00002	-.00087

DESPLAZAMIENTOS

		NUDO 146			NUDO 145		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00099	-.00025	-.00068	-.00064	-.00032	-.00066
2 T	2	-.00156	-.00021	-.00107	-.00117	-.00041	-.00120

		NUDO 144			NUDO 143		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00028	-.00031	-.00057	.00000	-.00025	-.00042
2 T	2	-.00060	-.00052	-.00123	.00000	-.00053	-.00113

		NUDO 142			NUDO 141		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00143	.00011	-.00041	-.00154	.00005	-.00052
2 T	2	-.00143	.00040	-.00041	-.00186	.00030	-.00063

		NUDO 140			NUDO 139		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00152	-.00008	-.00062	-.00132	-.00024	-.00068
2 T	2	-.00211	.00010	-.00086	-.00208	-.00015	-.00106

		NUDO 138			NUDO 137		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00096	-.00034	-.00066	-.00055	-.00035	-.00057
2 T	2	-.00175	-.00038	-.00120	-.00119	-.00053	-.00123

		NUDO 136			NUDO 135		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00020	-.00027	-.00042	.00000	-.00018	-.00027
2 T	2	-.00055	-.00055	-.00113	.00000	-.00049	-.00094

DESPLAZAMIENTOS

		NUDO 134			NUDO 133		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00163	.00015	-.00040	-.00179	.00009	-.00051
2 T	2	-.00162	.00048	-.00040	-.00216	.00040	-.00062

		NUDO 132			NUDO 131		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00182	-.00005	-.00061	-.00165	-.00023	-.00067
2 T	2	-.00253	.00019	-.00085	-.00259	-.00008	-.00106

		NUDO 130			NUDO 129		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00128	-.00036	-.00066	-.00082	-.00039	-.00056
2 T	2	-.00233	-.00035	-.00119	-.00178	-.00054	-.00122

		NUDO 128			NUDO 127		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00041	-.00031	-.00042	-.00013	-.00020	-.00027
2 T	2	-.00110	-.00059	-.00113	-.00046	-.00052	-.00094

		NUDO 126			NUDO 125		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00009	-.00013	-.00183	.00019	-.00040
2 T	2	.00000	-.00036	-.00069	-.00181	.00057	-.00039

		NUDO 124			NUDO 123		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00204	.00014	-.00051	-.00212	-.00002	-.00061
2 T	2	-.00246	.00049	-.00061	-.00294	.00028	-.00084

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		NUDO 122			NUDO 121		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00197	-.00022	-.00067	-.00160	-.00038	-.00065
2 T	2	-.00310	-.00001	-.00105	-.00291	-.00032	-.00118

		NUDO 120			NUDO 119		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00109	-.00043	-.00056	-.00061	-.00036	-.00042
2 T	2	-.00237	-.00055	-.00121	-.00164	-.00063	-.00112

		NUDO 118			NUDO 117		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00026	-.00024	-.00027	-.00006	-.00011	-.00013
2 T	2	-.00091	-.00058	-.00094	-.00034	-.00039	-.00069

		NUDO 116			NUDO 115		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00007	.00002	-.00339	.00058	-.00031
2 T	2	.00000	-.00033	-.00041	-.00335	.00132	-.00030

		NUDO 114			NUDO 113		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00407	.00053	-.00041	-.00458	.00029	-.00050
2 T	2	-.00493	.00128	-.00050	-.00636	.00105	-.00070

		NUDO 112			NUDO 111		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00469	-.00012	-.00056	-.00427	-.00057	-.00055
2 T	2	-.00738	.00061	-.00088	-.00776	.00000	-.00101

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		NUDO 110			NUDO 109		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00339	-.00085	-.00048	-.00234	-.00086	-.00036
2 T	2	-.00737	-.00065	-.00104	-.00629	-.00110	-.00097

		NUDO 108			NUDO 107		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00138	-.00073	-.00023	-.00059	-.00059	-.00011
2 T	2	-.00482	-.00130	-.00082	-.00324	-.00129	-.00062

		NUDO 106			NUDO 105		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00008	-.00053	.00001	-.00444	.00091	-.00017
2 T	2	-.00174	-.00122	-.00038	-.00437	.00193	-.00016

		NUDO 104			NUDO 103		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00552	.00086	-.00025	-.00641	.00055	-.00032
2 T	2	-.00669	.00192	-.00030	-.00889	.00167	-.00044

		NUDO 102			NUDO 101		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00674	-.00003	-.00036	-.00631	-.00070	-.00036
2 T	2	-.01059	.00112	-.00057	-.01147	.00029	-.00066

		NUDO 100			NUDO 99		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00514	-.00116	-.00032	-.00368	-.00123	-.00024
2 T	2	-.01123	-.00069	-.00070	-.00991	-.00143	-.00066

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		NUDO 98			NUDO 97		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00226	-.00111	-.00016	-.00101	-.00098	-.00008
2 T	2	-.00792	-.00184	-.00057	-.00559	-.00197	-.00044

		NUDO 96			NUDO 95		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00012	-.00091	.00001	-.00482	.00112	.00000
2 T	2	-.00323	-.00193	-.00029	-.00472	.00227	.00000

		NUDO 94			NUDO 93		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00615	.00107	-.00004	-.00727	.00072	-.00007
2 T	2	-.00746	.00228	-.00005	-.01010	.00203	-.00010

		NUDO 92			NUDO 91		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00776	.00006	-.00010	-.00736	-.00073	-.00011
2 T	2	-.01220	.00143	-.00015	-.01340	.00049	-.00020

		NUDO 90			NUDO 89		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00608	-.00129	-.00011	-.00442	-.00141	-.00009
2 T	2	-.01331	-.00065	-.00024	-.01193	-.00155	-.00025

		NUDO 88			NUDO 87		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00277	-.00132	-.00007	-.00126	-.00119	-.00004
2 T	2	-.00971	-.00210	-.00024	-.00701	-.00231	-.00020

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		NUDO 86			NUDO 85		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00013	-.00113	.00000	-.00447	.00114	.00016
2 T	2	-.00424	-.00229	-.00016	-.00435	.00226	.00016

		NUDO 84			NUDO 83		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00583	.00110	.00018	-.00700	.00076	.00019
2 T	2	-.00709	.00228	.00022	-.00974	.00206	.00026

		NUDO 82			NUDO 81		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00755	.00013	.00019	-.00725	-.00065	.00016
2 T	2	-.01191	.00150	.00029	-.01322	.00060	.00029

		NUDO 80			NUDO 79		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00607	-.00122	.00012	-.00448	-.00137	.00007
2 T	2	-.01327	-.00052	.00025	-.01205	-.00143	.00019

		NUDO 78			NUDO 77		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00285	-.00132	.00003	-.00132	-.00122	.00001
2 T	2	-.00995	-.00202	.00013	-.00733	-.00226	.00006

		NUDO 76			NUDO 75		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00010	-.00116	-.00001	-.00343	.00098	.00031
2 T	2	-.00460	-.00225	.00000	-.00332	.00188	.00030

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		NUDO 74			NUDO 73		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00460	.00095	.00037	-.00562	.00069	.00043
2 T	2	-.00561	.00191	.00045	-.00785	.00177	.00059

		NUDO 72			NUDO 71		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00615	.00018	.00044	-.00600	-.00045	.00040
2 T	2	-.00975	.00135	.00068	-.01098	.00063	.00072

		NUDO 70			NUDO 69		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00512	-.00094	.00031	-.00385	-.00112	.00021
2 T	2	-.01118	-.00029	.00068	-.01032	-.00109	.00058

		NUDO 68			NUDO 67		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00250	-.00112	.00013	-.00118	-.00106	.00005
2 T	2	-.00867	-.00162	.00045	-.00653	-.00187	.00030

		NUDO 66			NUDO 65		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00006	-.00102	-.00001	-.00186	.00066	.00040
2 T	2	-.00427	-.00188	.00016	-.00179	.00118	.00039

		NUDO 64			NUDO 63		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00265	.00065	.00051	-.00338	.00052	.00058
2 T	2	-.00324	.00123	.00062	-.00474	.00123	.00082

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		NUDO 62			NUDO 61		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00384	.00022	.00060	-.00387	-.00018	.00056
2 T	2	-.00612	.00103	.00096	-.00712	.00059	.00102

		NUDO 60			NUDO 59		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00343	-.00053	.00045	-.00267	-.00070	.00032
2 T	2	-.00748	-.00001	.00098	-.00711	-.00058	.00086

		NUDO 58			NUDO 57		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00178	-.00076	.00020	-.00087	-.00075	.00009
2 T	2	-.00615	-.00100	.00068	-.00478	-.00122	.00049

		NUDO 56			NUDO 55		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00003	-.00074	-.00001	.00000	.00025	.00044
2 T	2	-.00327	-.00127	.00029	.00000	.00033	.00042

		NUDO 54			NUDO 53		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00027	.00027	.00056	-.00063	.00032	.00065
2 T	2	-.00033	.00038	.00069	-.00089	.00055	.00092

		NUDO 52			NUDO 51		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00099	.00026	.00068	-.00123	.00012	.00063
2 T	2	-.00159	.00060	.00109	-.00228	.00052	.00117

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		NUDO 50			NUDO 49		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00128	-.00005	.00052	-.00112	-.00020	.00038
2 T	2	-.00279	.00030	.00113	-.00298	.00001	.00101

		NUDO 48			NUDO 47		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00082	-.00029	.00024	-.00043	-.00035	.00011
2 T	2	-.00283	-.00026	.00081	-.00238	-.00046	.00060

		NUDO 46			NUDO 45		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00001	-.00037	.00000	.00000	.00026	.00057
2 T	2	-.00177	-.00054	.00038	.00000	.00036	.00069

		NUDO 44			NUDO 43		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00032	.00031	.00065	-.00066	.00027	.00068
2 T	2	-.00045	.00050	.00092	-.00106	.00056	.00109

		NUDO 42			NUDO 41		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00093	.00015	.00064	-.00102	.00000	.00052
2 T	2	-.00171	.00051	.00117	-.00223	.00033	.00114

		NUDO 40			NUDO 39		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00094	-.00014	.00038	-.00071	-.00024	.00024
2 T	2	-.00249	.00008	.00101	-.00243	-.00018	.00082

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		NUDO 38			NUDO 37		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00038	-.00030	.00011	.00001	-.00033	.00000
2 T	2	-.00209	-.00037	.00060	-.00158	-.00046	.00039

		NUDO 36			NUDO 35		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	.00030	.00066	-.00033	.00027	.00069
2 T	2	.00000	.00047	.00092	-.00053	.00052	.00110

		NUDO 34			NUDO 33		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00062	.00018	.00064	-.00077	.00005	.00053
2 T	2	-.00114	.00050	.00118	-.00168	.00036	.00115

		NUDO 32			NUDO 31		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00075	-.00008	.00038	-.00059	-.00018	.00024
2 T	2	-.00200	.00014	.00102	-.00203	-.00009	.00083

		NUDO 30			NUDO 29		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00033	-.00025	.00011	.00001	-.00029	.00000
2 T	2	-.00180	-.00028	.00061	-.00139	-.00038	.00040

		NUDO 28			NUDO 27		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	.00027	.00069	-.00031	.00020	.00064
2 T	2	.00000	.00051	.00110	-.00057	.00049	.00118

DESPLAZAMIENTOS

		NUDO 26			NUDO 25		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00051	.00009	.00053	-.00056	-.00003	.00039
2 T	2	-.00112	.00039	.00115	-.00150	.00021	.00103

		NUDO 24			NUDO 23		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00047	-.00013	.00024	-.00027	-.00021	.00011
2 T	2	-.00163	-.00001	.00083	-.00150	-.00020	.00061

		NUDO 22			NUDO 21		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00025	.00000	.00000	.00022	.00064
2 T	2	-.00120	-.00030	.00040	.00000	.00049	.00118

		NUDO 20			NUDO 19		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00026	.00013	.00053	-.00038	.00002	.00039
2 T	2	-.00056	.00041	.00116	-.00100	.00026	.00103

		NUDO 18			NUDO 17		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00036	-.00008	.00024	-.00022	-.00016	.00011
2 T	2	-.00122	.00007	.00084	-.00121	-.00011	.00062

		NUDO 16			NUDO 15		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00021	.00000	.00000	.00015	.00053
2 T	2	-.00100	-.00022	.00041	.00000	.00043	.00116

DESPLAZAMIENTOS

		NUDO 14			NUDO 13		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00019	.00006	.00039	-.00024	-.00003	.00024
2 T	2	-.00050	.00031	.00103	-.00082	.00014	.00084

		NUDO 12			NUDO 11		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00016	-.00011	.00011	.00000	-.00017	.00000
2 T	2	-.00091	-.00003	.00062	-.00080	-.00015	.00041

		NUDO 10			NUDO 9		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	.00008	.00039	-.00012	.00001	.00025
2 T	2	.00000	.00033	.00103	-.00041	.00020	.00084

		NUDO 8			NUDO 7		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	-.00011	-.00007	.00011	.00000	-.00013	.00000
2 T	2	-.00060	.00005	.00062	-.00060	-.00008	.00041

		NUDO 6			NUDO 5		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	.00003	.00025	-.00005	-.00003	.00011
2 T	2	.00000	.00023	.00084	-.00030	.00011	.00062

		NUDO 4			NUDO 3		
HIP(IDENTIF)		DESP. Z	GIRO X	GIRO Y	DESP. Z	GIRO X	GIRO Y
1 T	1	.00000	-.00010	.00000	.00000	-.00001	.00011
2 T	2	-.00040	-.00003	.00041	.00000	.00015	.00062

DESPLAZAMIENTOS

HIP(IDENTIF)		NUDO 2 DESP. Z	NUDO 2 GIRO X	NUDO 2 GIRO Y	NUDO 1 DESP. Z	NUDO 1 GIRO X	NUDO 1 GIRO Y
1 T	1	.00000	-.00008	.00000	.00000	-.00007	.00000
2 T	2	-.00020	.00002	.00042	.00000	.00003	.00042

ESFUERZOS EN BARRA NUM. = 227

HIP(IDENTIF)		NUDO 15 CORTANTE	NUDO 15 TORSOR	NUDO 15 FLECTOR	NUDO 20 CORTANTE	NUDO 20 TORSOR	NUDO 20 FLECTOR
1 T	1	3.473	.453	.220	3.473	.453	-1.465
2 T	2	8.246	.308	.191	8.246	.308	-3.808
CMA SU+T		8.246	.308	.191	8.246	.308	-3.808
CMI SU+T		3.473	.453	.220	3.473	.453	-1.465
TMA SU+T		3.473	.453	.220	3.473	.453	-1.465
TMI SU+T		8.246	.308	.191	8.246	.308	-3.808
FMA SU+T		3.473	.453	.220	3.473	.453	-1.465
FMI SU+T		8.246	.308	.191	8.246	.308	-3.808

ESFUERZOS EN BARRA NUM. = 228

HIP(IDENTIF)		NUDO 20 CORTANTE	NUDO 20 TORSOR	NUDO 20 FLECTOR	NUDO 26 CORTANTE	NUDO 26 TORSOR	NUDO 26 FLECTOR
1 T	1	3.624	.805	-1.440	3.624	.805	-3.198
2 T	2	8.120	.491	-3.730	8.120	.491	-7.668
CMA SU+T		8.120	.491	-3.730	8.120	.491	-7.668
CMI SU+T		3.624	.805	-1.440	3.624	.805	-3.198
TMA SU+T		3.624	.805	-1.440	3.624	.805	-3.198
TMI SU+T		8.120	.491	-3.730	8.120	.491	-7.668
FMA SU+T		3.624	.805	-1.440	3.624	.805	-3.198
FMI SU+T		8.120	.491	-3.730	8.120	.491	-7.668

ESFUERZOS EN BARRA NUM. = 229

HIP(IDENTIF)		NUDO 26 CORTANTE	NUDO 26 TORSOR	NUDO 26 FLECTOR	NUDO 33 CORTANTE	NUDO 33 TORSOR	NUDO 33 FLECTOR
1 T	1	3.725	.986	-3.174	3.725	.986	-4.981
2 T	2	8.093	.598	-7.591	8.093	.598	-11.516
CMA SU+T		8.093	.598	-7.591	8.093	.598	-11.516
CMI SU+T		3.725	.986	-3.174	3.725	.986	-4.981
TMA SU+T		3.725	.986	-3.174	3.725	.986	-4.981
TMI SU+T		8.093	.598	-7.591	8.093	.598	-11.516
FMA SU+T		3.725	.986	-3.174	3.725	.986	-4.981
FMI SU+T		8.093	.598	-7.591	8.093	.598	-11.516

ESFUERZOS EN BARRA NUM. = 230

HIP(IDENTIF)		NUDO 33 CORTANTE	NUDO 33 TORSOR	NUDO 33 FLECTOR	NUDO 41 CORTANTE	NUDO 41 TORSOR	NUDO 41 FLECTOR
1 T	1	3.797	1.076	-4.957	3.797	1.076	-6.798
2 T	2	8.116	.659	-11.439	8.116	.659	-15.375
CMA SU+T		8.116	.659	-11.439	8.116	.659	-15.375
CMI SU+T		3.797	1.076	-4.957	3.797	1.076	-6.798
TMA SU+T		3.797	1.076	-4.957	3.797	1.076	-6.798
TMI SU+T		8.116	.659	-11.439	8.116	.659	-15.375
FMA SU+T		3.797	1.076	-4.957	3.797	1.076	-6.798
FMI SU+T		8.116	.659	-11.439	8.116	.659	-15.375

ESFUERZOS EN BARRA NUM. = 231

HIP(IDENTIF)		NUDO 41 CORTANTE	NUDO 41 TORSOR	NUDO 41 FLECTOR	NUDO 50 CORTANTE	NUDO 50 TORSOR	NUDO 50 FLECTOR
1 T	1	3.850	1.117	-6.775	3.850	1.117	-8.638
2 T	2	8.166	.691	-15.299	8.166	.691	-19.251
CMA SU+T		8.166	.691	-15.299	8.166	.691	-19.251
CMI SU+T		3.850	1.117	-6.775	3.850	1.117	-8.638
TMA SU+T		3.850	1.117	-6.775	3.850	1.117	-8.638
TMI SU+T		8.166	.691	-15.299	8.166	.691	-19.251
FMA SU+T		3.850	1.117	-6.775	3.850	1.117	-8.638
FMI SU+T		8.166	.691	-15.299	8.166	.691	-19.251

ESFUERZOS EN BARRA NUM. = 232

HIP(IDENTIF)		NUDO 50 CORTANTE	NUDO 50 TORSOR	NUDO 50 FLECTOR	NUDO 60 CORTANTE	NUDO 60 TORSOR	NUDO 60 FLECTOR
1 T	1	4.053	1.159	-8.522	4.053	1.159	-26.260
2 T	2	8.512	.753	-18.870	8.512	.753	-56.128
CMA SU+T		8.512	.753	-18.870	8.512	.753	-56.128
CMI SU+T		4.053	1.159	-8.522	4.053	1.159	-26.260
TMA SU+T		4.053	1.159	-8.522	4.053	1.159	-26.260
TMI SU+T		8.512	.753	-18.870	8.512	.753	-56.128
FMA SU+T		4.053	1.159	-8.522	4.053	1.159	-26.260
FMI SU+T		8.512	.753	-18.870	8.512	.753	-56.128

ESFUERZOS EN BARRA NUM. = 233

HIP(IDENTIF)		NUDO 60 CORTANTE	NUDO 60 TORSOR	NUDO 60 FLECTOR	NUDO 70 CORTANTE	NUDO 70 TORSOR	NUDO 70 FLECTOR
1 T	1	3.906	1.018	-26.105	3.906	1.018	-43.201
2 T	2	8.898	.706	-55.510	8.898	.706	-94.455
CMA SU+T		8.898	.706	-55.510	8.898	.706	-94.455
CMI SU+T		3.906	1.018	-26.105	3.906	1.018	-43.201
TMA SU+T		3.906	1.018	-26.105	3.906	1.018	-43.201
TMI SU+T		8.898	.706	-55.510	8.898	.706	-94.455
FMA SU+T		3.906	1.018	-26.105	3.906	1.018	-43.201
FMI SU+T		8.898	.706	-55.510	8.898	.706	-94.455

ESFUERZOS EN BARRA NUM. = 234

HIP(IDENTIF)		NUDO 70 CORTANTE	NUDO 70 TORSOR	NUDO 70 FLECTOR	NUDO 80 CORTANTE	NUDO 80 TORSOR	NUDO 80 FLECTOR
1 T	1	2.596	.676	-43.121	2.596	.676	-54.481
2 T	2	6.022	.547	-93.999	6.022	.547	-120.349
CMA SU+T		6.022	.547	-93.999	6.022	.547	-120.349
CMI SU+T		2.596	.676	-43.121	2.596	.676	-54.481
TMA SU+T		2.596	.676	-43.121	2.596	.676	-54.481
TMI SU+T		6.022	.547	-93.999	6.022	.547	-120.349
FMA SU+T		2.596	.676	-43.121	2.596	.676	-54.481
FMI SU+T		6.022	.547	-93.999	6.022	.547	-120.349

ESFUERZOS EN BARRA NUM. = 235

HIP(IDENTIF)		NUDO 80 CORTANTE	NUDO 80 TORSOR	NUDO 80 FLECTOR	NUDO 90 CORTANTE	NUDO 90 TORSOR	NUDO 90 FLECTOR
1 T	1	.409	.186	-54.481	.409	.186	-56.272
2 T	2	.880	.322	-120.170	.880	.322	-124.021
CMA SU+T		.880	.322	-120.170	.880	.322	-124.021
CMI SU+T		.409	.186	-54.481	.409	.186	-56.272
TMA SU+T		.880	.322	-120.170	.880	.322	-124.021
TMI SU+T		.409	.186	-54.481	.409	.186	-56.272
FMA SU+T		.409	.186	-54.481	.409	.186	-56.272
FMI SU+T		.880	.322	-120.170	.880	.322	-124.021

ESFUERZOS EN BARRA NUM. = 236

HIP(IDENTIF)		NUDO 90 CORTANTE	NUDO 90 TORSOR	NUDO 90 FLECTOR	NUDO 100 CORTANTE	NUDO 100 TORSOR	NUDO 100 FLECTOR
1 T	1	-1.948	-.334	-56.363	-1.948	-.334	-47.836
2 T	2	-4.431	.092	-124.182	-4.431	.092	-104.786
CMA SU+T		-1.948	-.334	-56.363	-1.948	-.334	-47.836
CMI SU+T		-4.431	.092	-124.182	-4.431	.092	-104.786
TMA SU+T		-4.431	.092	-124.182	-4.431	.092	-104.786
TMI SU+T		-1.948	-.334	-56.363	-1.948	-.334	-47.836
FMA SU+T		-1.948	-.334	-56.363	-1.948	-.334	-47.836
FMI SU+T		-4.431	.092	-124.182	-4.431	.092	-104.786

ESFUERZOS EN BARRA NUM. = 237

HIP(IDENTIF)		NUDO 100 CORTANTE	NUDO 100 TORSOR	NUDO 100 FLECTOR	NUDO 110 CORTANTE	NUDO 110 TORSOR	NUDO 110 FLECTOR
1 T	1	-3.926	-.766	-48.013	-3.926	-.766	-30.831
2 T	2	-9.188	-.102	-105.269	-9.188	-.102	-65.060
CMA SU+T		-3.926	-.766	-48.013	-3.926	-.766	-30.831
CMI SU+T		-9.188	-.102	-105.269	-9.188	-.102	-65.060
TMA SU+T		-9.188	-.102	-105.269	-9.188	-.102	-65.060
TMI SU+T		-3.926	-.766	-48.013	-3.926	-.766	-30.831
FMA SU+T		-3.926	-.766	-48.013	-3.926	-.766	-30.831
FMI SU+T		-9.188	-.102	-105.269	-9.188	-.102	-65.060

ESFUERZOS EN BARRA NUM. = 238

HIP(IDENTIF)		NUDO 110 CORTANTE	NUDO 110 TORSOR	NUDO 110 FLECTOR	NUDO 120 CORTANTE	NUDO 120 TORSOR	NUDO 120 FLECTOR
1 T	1	-4.770	-1.013	-31.093	-4.770	-1.013	-10.214
2 T	2	-10.539	-.228	-65.782	-10.539	-.228	-19.652
CMA SU+T		-4.770	-1.013	-31.093	-4.770	-1.013	-10.214
CMI SU+T		-10.539	-.228	-65.782	-10.539	-.228	-19.652
TMA SU+T		-10.539	-.228	-65.782	-10.539	-.228	-19.652
TMI SU+T		-4.770	-1.013	-31.093	-4.770	-1.013	-10.214
FMA SU+T		-4.770	-1.013	-31.093	-4.770	-1.013	-10.214
FMI SU+T		-10.539	-.228	-65.782	-10.539	-.228	-19.652

ESFUERZOS EN BARRA NUM. = 239

HIP(IDENTIF)		NUDO 120 CORTANTE	NUDO 120 TORSOR	NUDO 120 FLECTOR	NUDO 129 CORTANTE	NUDO 129 TORSOR	NUDO 129 FLECTOR
1 T	1	-5.067	-.988	-10.397	-5.067	-.988	-7.939
2 T	2	-10.336	-.278	-20.116	-10.336	-.278	-15.103
CMA SU+T		-5.067	-.988	-10.397	-5.067	-.988	-7.939
CMI SU+T		-10.336	-.278	-20.116	-10.336	-.278	-15.103
TMA SU+T		-10.336	-.278	-20.116	-10.336	-.278	-15.103
TMI SU+T		-5.067	-.988	-10.397	-5.067	-.988	-7.939
FMA SU+T		-5.067	-.988	-10.397	-5.067	-.988	-7.939
FMI SU+T		-10.336	-.278	-20.116	-10.336	-.278	-15.103

ESFUERZOS EN BARRA NUM. = 240

HIP(IDENTIF)		NUDO 129 CORTANTE	NUDO 129 TORSOR	NUDO 129 FLECTOR	NUDO 137 CORTANTE	NUDO 137 TORSOR	NUDO 137 FLECTOR
1 T	1	-5.179	-.923	-7.976	-5.179	-.923	-5.464
2 T	2	-10.372	-.268	-15.196	-10.372	-.268	-10.166
CMA SU+T		-5.179	-.923	-7.976	-5.179	-.923	-5.464
CMI SU+T		-10.372	-.268	-15.196	-10.372	-.268	-10.166
TMA SU+T		-10.372	-.268	-15.196	-10.372	-.268	-10.166
TMI SU+T		-5.179	-.923	-7.976	-5.179	-.923	-5.464
FMA SU+T		-5.179	-.923	-7.976	-5.179	-.923	-5.464
FMI SU+T		-10.372	-.268	-15.196	-10.372	-.268	-10.166

ESFUERZOS EN BARRA NUM. = 241

HIP(IDENTIF)		NUDO 137 CORTANTE	NUDO 137 TORSOR	NUDO 137 FLECTOR	NUDO 144 CORTANTE	NUDO 144 TORSOR	NUDO 144 FLECTOR
1 T	1	-5.378	-.757	-5.501	-5.378	-.757	-2.898
2 T	2	-10.529	-.217	-10.260	-10.529	-.217	-5.163
CMA SU+T		-5.378	-.757	-5.501	-5.378	-.757	-2.898
CMI SU+T		-10.529	-.217	-10.260	-10.529	-.217	-5.163
TMA SU+T		-10.529	-.217	-10.260	-10.529	-.217	-5.163
TMI SU+T		-5.378	-.757	-5.501	-5.378	-.757	-2.898
FMA SU+T		-5.378	-.757	-5.501	-5.378	-.757	-2.898
FMI SU+T		-10.529	-.217	-10.260	-10.529	-.217	-5.163

ESFUERZOS EN BARRA NUM. = 242

HIP(IDENTIF)		NUDO 144 CORTANTE	TORSOR	FLECTOR	NUDO 150 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.739	-.397	-2.936	-5.739	-.397	-.152
2 T	2	-10.908	-.072	-5.257	-10.908	-.072	.033
CMA SU+T		-5.739	-.397	-2.936	-5.739	-.397	-.152
CMI SU+T		-10.908	-.072	-5.257	-10.908	-.072	.033
TMA SU+T		-10.908	-.072	-5.257	-10.908	-.072	.033
TMI SU+T		-5.739	-.397	-2.936	-5.739	-.397	-.152
FMA SU+T		-5.739	-.397	-2.936	-10.908	-.072	.033
FMI SU+T		-10.908	-.072	-5.257	-5.739	-.397	-.152

ESFUERZOS EN BARRA NUM. = 243

HIP(IDENTIF)		NUDO 21 CORTANTE	TORSOR	FLECTOR	NUDO 27 CORTANTE	TORSOR	FLECTOR
1 T	1	4.362	.303	.170	4.362	.303	-1.945
2 T	2	9.325	-.050	.036	9.325	-.050	-4.486
CMA SU+T		9.325	-.050	.036	9.325	-.050	-4.486
CMI SU+T		4.362	.303	.170	4.362	.303	-1.945
TMA SU+T		4.362	.303	.170	4.362	.303	-1.945
TMI SU+T		9.325	-.050	.036	9.325	-.050	-4.486
FMA SU+T		4.362	.303	.170	4.362	.303	-1.945
FMI SU+T		9.325	-.050	.036	9.325	-.050	-4.486

ESFUERZOS EN BARRA NUM. = 244

HIP(IDENTIF)		NUDO 27 CORTANTE	TORSOR	FLECTOR	NUDO 34 CORTANTE	TORSOR	FLECTOR
1 T	1	4.347	.505	-1.896	4.347	.505	-4.004
2 T	2	8.984	-.171	-4.401	8.984	-.171	-8.758
CMA SU+T		8.984	-.171	-4.401	8.984	-.171	-8.758
CMI SU+T		4.347	.505	-1.896	4.347	.505	-4.004
TMA SU+T		4.347	.505	-1.896	4.347	.505	-4.004
TMI SU+T		8.984	-.171	-4.401	8.984	-.171	-8.758
FMA SU+T		4.347	.505	-1.896	4.347	.505	-4.004
FMI SU+T		8.984	-.171	-4.401	8.984	-.171	-8.758

ESFUERZOS EN BARRA NUM. = 245

HIP(IDENTIF)		NUDO 34 CORTANTE	TORSOR	FLECTOR	NUDO 42 CORTANTE	TORSOR	FLECTOR
1 T	1	4.375	.612	-3.955	4.375	.612	-6.077
2 T	2	8.840	-.212	-8.673	8.840	-.212	-12.960
CMA SU+T		8.840	-.212	-8.673	8.840	-.212	-12.960
CMI SU+T		4.375	.612	-3.955	4.375	.612	-6.077
TMA SU+T		4.375	.612	-3.955	4.375	.612	-6.077
TMI SU+T		8.840	-.212	-8.673	8.840	-.212	-12.960
FMA SU+T		4.375	.612	-3.955	4.375	.612	-6.077
FMI SU+T		8.840	-.212	-8.673	8.840	-.212	-12.960

ESFUERZOS EN BARRA NUM. = 246

HIP(IDENTIF)		NUDO 42 CORTANTE	TORSOR	FLECTOR	NUDO 51 CORTANTE	TORSOR	FLECTOR
1 T	1	4.426	.665	-6.028	4.426	.665	-8.170
2 T	2	8.801	-.219	-12.875	8.801	-.219	-17.135
CMA SU+T		8.801	-.219	-12.875	8.801	-.219	-17.135
CMI SU+T		4.426	.665	-6.028	4.426	.665	-8.170
TMA SU+T		4.426	.665	-6.028	4.426	.665	-8.170
TMI SU+T		8.801	-.219	-12.875	8.801	-.219	-17.135
FMA SU+T		4.426	.665	-6.028	4.426	.665	-8.170
FMI SU+T		8.801	-.219	-12.875	8.801	-.219	-17.135

ESFUERZOS EN BARRA NUM. = 247

HIP(IDENTIF)		NUDO 51 CORTANTE	TORSOR	FLECTOR	NUDO 61 CORTANTE	TORSOR	FLECTOR
1 T	1	4.760	.743	-7.923	4.760	.743	-28.756
2 T	2	8.934	-.176	-16.712	8.934	-.176	-55.815
CMA SU+T		8.934	-.176	-16.712	8.934	-.176	-55.815
CMI SU+T		4.760	.743	-7.923	4.760	.743	-28.756
TMA SU+T		4.760	.743	-7.923	4.760	.743	-28.756
TMI SU+T		8.934	-.176	-16.712	8.934	-.176	-55.815
FMA SU+T		4.760	.743	-7.923	4.760	.743	-28.756
FMI SU+T		8.934	-.176	-16.712	8.934	-.176	-55.815

ESFUERZOS EN BARRA NUM. = 248

		NUDO 61			NUDO 71		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	5.273	.666	-28.324	5.273	.666	-51.405
2 T	2	9.085	-.086	-55.125	9.085	-.086	-94.889
CMA SU+T		9.085	-.086	-55.125	9.085	-.086	-94.889
CMI SU+T		5.273	.666	-28.324	5.273	.666	-51.405
TMA SU+T		5.273	.666	-28.324	5.273	.666	-51.405
TMI SU+T		9.085	-.086	-55.125	9.085	-.086	-94.889
FMA SU+T		5.273	.666	-28.324	5.273	.666	-51.405
FMI SU+T		9.085	-.086	-55.125	9.085	-.086	-94.889

ESFUERZOS EN BARRA NUM. = 249

		NUDO 71			NUDO 81		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	3.531	.475	-51.063	3.531	.475	-66.514
2 T	2	6.001	.061	-94.375	6.001	.061	-120.637
CMA SU+T		6.001	.061	-94.375	6.001	.061	-120.637
CMI SU+T		3.531	.475	-51.063	3.531	.475	-66.514
TMA SU+T		3.531	.475	-51.063	3.531	.475	-66.514
TMI SU+T		6.001	.061	-94.375	6.001	.061	-120.637
FMA SU+T		3.531	.475	-51.063	3.531	.475	-66.514
FMI SU+T		6.001	.061	-94.375	6.001	.061	-120.637

ESFUERZOS EN BARRA NUM. = 250

		NUDO 81			NUDO 91		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	.520	.203	-66.374	.520	.203	-68.651
2 T	2	.814	.271	-120.410	.814	.271	-123.974
CMA SU+T		.814	.271	-120.410	.814	.271	-123.974
CMI SU+T		.520	.203	-66.374	.520	.203	-68.651
TMA SU+T		.814	.271	-120.410	.814	.271	-123.974
TMI SU+T		.520	.203	-66.374	.520	.203	-68.651
FMA SU+T		.520	.203	-66.374	.520	.203	-68.651
FMI SU+T		.814	.271	-120.410	.814	.271	-123.974

ESFUERZOS EN BARRA NUM. = 251

		NUDO 91			NUDO 101		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	-2.394	-.083	-68.763	-2.394	-.083	-58.284
2 T	2	-4.411	.501	-124.086	-4.411	.501	-104.779
CMA SU+T		-2.394	-.083	-68.763	-2.394	-.083	-58.284
CMI SU+T		-4.411	.501	-124.086	-4.411	.501	-104.779
TMA SU+T		-4.411	.501	-124.086	-4.411	.501	-104.779
TMI SU+T		-2.394	-.083	-68.763	-2.394	-.083	-58.284
FMA SU+T		-2.394	-.083	-68.763	-2.394	-.083	-58.284
FMI SU+T		-4.411	.501	-124.086	-4.411	.501	-104.779

ESFUERZOS EN BARRA NUM. = 252

		NUDO 101			NUDO 111		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	-5.290	-.314	-58.637	-5.290	-.314	-35.490
2 T	2	-9.170	.695	-105.213	-9.170	.695	-65.086
CMA SU+T		-5.290	-.314	-58.637	-5.290	-.314	-35.490
CMI SU+T		-9.170	.695	-105.213	-9.170	.695	-65.086
TMA SU+T		-9.170	.695	-105.213	-9.170	.695	-65.086
TMI SU+T		-5.290	-.314	-58.637	-5.290	-.314	-35.490
FMA SU+T		-5.290	-.314	-58.637	-5.290	-.314	-35.490
FMI SU+T		-9.170	.695	-105.213	-9.170	.695	-65.086

ESFUERZOS EN BARRA NUM. = 253

		NUDO 111			NUDO 121		
HIP(IDENTIF)		CORTANTE	TORSOR	FLECTOR	CORTANTE	TORSOR	FLECTOR
1 T	1	-5.402	-.452	-35.994	-5.402	-.452	-12.349
2 T	2	-9.965	.779	-65.738	-9.965	.779	-22.120
CMA SU+T		-5.402	-.452	-35.994	-5.402	-.452	-12.349
CMI SU+T		-9.965	.779	-65.738	-9.965	.779	-22.120
TMA SU+T		-9.965	.779	-65.738	-9.965	.779	-22.120
TMI SU+T		-5.402	-.452	-35.994	-5.402	-.452	-12.349
FMA SU+T		-5.402	-.452	-35.994	-5.402	-.452	-12.349
FMI SU+T		-9.965	.779	-65.738	-9.965	.779	-22.120

ESFUERZOS EN BARRA NUM. = 254

HIP(IDENTIF)		NUDO 121 CORTANTE	TORSOR	FLECTOR	NUDO 130 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.163	-.484	-12.652	-5.163	-.484	-10.148
2 T	2	-9.546	.719	-22.536	-9.546	.719	-17.906
CMA SU+T		-5.163	-.484	-12.652	-5.163	-.484	-10.148
CMI SU+T		-9.546	.719	-22.536	-9.546	.719	-17.906
TMA SU+T		-9.546	.719	-22.536	-9.546	.719	-17.906
TMI SU+T		-5.163	-.484	-12.652	-5.163	-.484	-10.148
FMA SU+T		-5.163	-.484	-12.652	-5.163	-.484	-10.148
FMI SU+T		-9.546	.719	-22.536	-9.546	.719	-17.906

ESFUERZOS EN BARRA NUM. = 255

HIP(IDENTIF)		NUDO 130 CORTANTE	TORSOR	FLECTOR	NUDO 138 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.156	-.476	-10.209	-5.156	-.476	-7.708
2 T	2	-9.485	.685	-17.989	-9.485	.685	-13.389
CMA SU+T		-5.156	-.476	-10.209	-5.156	-.476	-7.708
CMI SU+T		-9.485	.685	-17.989	-9.485	.685	-13.389
TMA SU+T		-9.485	.685	-17.989	-9.485	.685	-13.389
TMI SU+T		-5.156	-.476	-10.209	-5.156	-.476	-7.708
FMA SU+T		-5.156	-.476	-10.209	-5.156	-.476	-7.708
FMI SU+T		-9.485	.685	-17.989	-9.485	.685	-13.389

ESFUERZOS EN BARRA NUM. = 256

HIP(IDENTIF)		NUDO 138 CORTANTE	TORSOR	FLECTOR	NUDO 145 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.205	-.444	-7.769	-5.205	-.444	-5.250
2 T	2	-9.456	.620	-13.473	-9.456	.620	-8.896
CMA SU+T		-5.205	-.444	-7.769	-5.205	-.444	-5.250
CMI SU+T		-9.456	.620	-13.473	-9.456	.620	-8.896
TMA SU+T		-9.456	.620	-13.473	-9.456	.620	-8.896
TMI SU+T		-5.205	-.444	-7.769	-5.205	-.444	-5.250
FMA SU+T		-5.205	-.444	-7.769	-5.205	-.444	-5.250
FMI SU+T		-9.456	.620	-13.473	-9.456	.620	-8.896

ESFUERZOS EN BARRA NUM. = 257

HIP(IDENTIF)		NUDO 145 CORTANTE	TORSOR	FLECTOR	NUDO 151 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.348	-.360	-5.311	-5.348	-.360	-2.717
2 T	2	-9.483	.509	-8.981	-9.483	.509	-4.381
CMA SU+T		-5.348	-.360	-5.311	-5.348	-.360	-2.717
CMI SU+T		-9.483	.509	-8.981	-9.483	.509	-4.381
TMA SU+T		-9.483	.509	-8.981	-9.483	.509	-4.381
TMI SU+T		-5.348	-.360	-5.311	-5.348	-.360	-2.717
FMA SU+T		-5.348	-.360	-5.311	-5.348	-.360	-2.717
FMI SU+T		-9.483	.509	-8.981	-9.483	.509	-4.381

ESFUERZOS EN BARRA NUM. = 258

HIP(IDENTIF)		NUDO 151 CORTANTE	TORSOR	FLECTOR	NUDO 156 CORTANTE	TORSOR	FLECTOR
1 T	1	-5.662	-.165	-2.778	-5.662	-.165	-.032
2 T	2	-9.625	.322	-4.467	-9.625	.322	.202
CMA SU+T		-5.662	-.165	-2.778	-5.662	-.165	-.032
CMI SU+T		-9.625	.322	-4.467	-9.625	.322	.202
TMA SU+T		-9.625	.322	-4.467	-9.625	.322	.202
TMI SU+T		-5.662	-.165	-2.778	-5.662	-.165	-.032
FMA SU+T		-5.662	-.165	-2.778	-9.625	.322	.202
FMI SU+T		-9.625	.322	-4.467	-5.662	-.165	-.032

RESUMEN DE ESFUERZOS VIGA DE BORDE DERECHA
==========

SECCION APOYOS BARRA = 167
==========

PRUEBA DE CARGA CORTANTE = 3.534 TN M. FLECTOR = .000 M X TN

SECCION CENTRAL BARRA = 175
==========

PRUEBA DE CARGA CORTANTE = .777 TN M. FLECTOR = 39.554 M X TN

RESUMEN DE ESFUERZOS VIGA CENTRAL
==========

SECCION APOYOS BARRA = 259
==========

PRUEBA DE CARGA CORTANTE = 11.305 TN M. FLECTOR = .000 M X TN

SECCION CENTRAL BARRA = 236
==========

PRUEBA DE CARGA CORTANTE = 4.431 TN M. FLECTOR = 124.182 M X TN

RESUMEN DE ESFUERZOS VIGA DE BORDE IZQUIERDA
==========

SECCION APOYOS BARRA = 319
==========

PRUEBA DE CARGA CORTANTE = 3.459 TN M. FLECTOR = .000 M X TN

SECCION CENTRAL BARRA = 310
==========

PRUEBA DE CARGA CORTANTE = .595 TN M. FLECTOR = 41.203 M X TN

PASO SUPERIOR 8+120

PASO SUPERIOR P.K. 8+120

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- CÁLCULOS

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  2. Datos de carga
  3. Desarrollo del cálculo
  4. Notación utilizada

  PROGRAMA DE MURO ARMADO

  1. Descripción
  2. Datos de entrada
  3. Calculo
  4. Resultados
  5. Ordenador

CALCULOS

ANEJO DE CALCULOS DE TABLERO DE PUENTE PARA CARRETERA

1.- Programa de cálculo :

Los cálculos del tablero se han desarrollado mediante el programa "**Puente Nervado**" en una Red Local, compuesta de varios ordenadores Personales (PCs) con memoria RAM de 8 Mb. y disco duro en cada uno de ellos.-

2.- Datos de cargas :

Se consideran los siguientes pesos específicos para la evaluación de las cargas permanentes y pesos propios:

Hormigón armado ó pretensado : 2,50 Tn/m^3
Hormigón en masa : 2,40 Tn/m^3
Pavimento asfáltico : 2,40 Tn/m^3

La carga permanente de aceras, barreras y barandillas se introduce en los cálculos como cargas lineales situadas longitudinalmente en el C. de G. de cada acera.

La sobrecarga considerada es la especificada en la "Instrucción relativa a las acciones a considerar en el proyecto de puentes de Carreteras" (**Orden del M.O.P. de 28 de Febrero de 1.972**) situado el carro en la posición pésima.

3.- Desarrollo del Cálculo :

Para la obtención de los esfuerzos en cada viga se aplica la teoria de la losa ortótropa equivalente, deduciendo los valores de coeficiente de excentricidad $K\alpha$ mediante la fórmula que lo expresa directamente, sin interpolaciones.

Por aplicación de estos coeficientes se hallan los momentos flectores y las tensiones correspondientes en las vigas de borde y 2ª, con el fin de estudiar la más desfavorable.

Se estudian a continuación las tensiones producidas por el pretensado tanto durante la fabricación (en el instante de la transferencia) como a largo plazo, considereando respectivamente unas pérdidas del 5% y 20% .

La adición de estas tensiones a las producidas por las cargas exteriores conduce a las tensiones reales (en fibra superior e inferior de la viga, y fibra superior de la losa) que aparecen en las distintas fases, fabricación, servicio bajo cargas permanentes, y servicio bajo máxima sobrecarga.

Se comprueba que las tracciones (si existen) son admisibles en función de la clase de comportamiento de la estructura y se obtiene la resistencia característica del hormigón en cada fase para soportar las compresiones exitentes.

Para el cálculo de la armadura pasiva transversal y comprobación del hormigón frente a esfuerzos cortantes se sigue la **NORMA "EP-93"** distinguiendo entre zona AB y zona C .

Los esfuerzos rasantes entre viga y losa se resisten exclusivamente con armadura pasiva, sin contar con la colaboración del hormigón.

La flexión transversal de la losa de reparto se obtiene evaluando la que corresponde a la deformación transversal general del tablero, **con 7 términos del desarrollo en serie de la carga**, y la local por efecto de las cargas puntuales.(**Método de Westergaard**) .

A = Area de la sección inicial homogeneizada
I = Inercia de la sección inicial homogeneizada
If = Inercia de la sección final homogeneizada

$$K(\text{Rasante}) = \frac{SR}{IF}$$: SR = Momento estático (en m^3.) de la losa respecto a la Fibra neutra de la sección final homogeneizada.

Reparto Transversal

K (FLEXION) = Parámetro de flexión θ

K (TORSION) = Parámetro de torsión $\sqrt{\alpha}$

$$Y(1) = \frac{Y3}{Bo/2}$$: Y3 = Distancia al eje del Tablero desde la carga lineal de una acera

$$Y(2) = \frac{Y4}{Bo/2}$$: Y4 = Distancia al eje del Tablero desde la carga lineal de otra acera

$$Y(3) = \frac{Y1}{Bo/2}$$: Y1 = Distancia al eje del Tablero desde un cuchillo de cargas puntuales

$$Y(4) = \frac{Y2}{Bo/2}$$: Y2 = Distancia al eje del Tablero desde otro cuchillo de cargas puntules

Bo = Ancho efectivo del Tablero

4.- Notación utilizada :

Para poder interpretar la salida de la impresora debe tenerse en cuenta la siguiente notación :

Datos Geométricos

B = Ancho real del tablero
B_o = Ancho eficaz del tablero
B_1 = Anchura de cada acera
D_1 = Distancia del eje de la última viga al borde del tablero.

Cargas

P_1 = Peso propio de la viga
P_2 = Peso de la losa correspondiente a una viga
P_3 = Peso del pavimento, por viga
P_3' = Carga permanente de 1 acera (Exceso sobre la carga de pavimento)
P_4 = Sobrecarga repartida (400 Kg/m^2), correspondiente a una viga

Caracteristísticas Mecánicas

Va_i = Distancia fibra superior viga a fibra neutra en sección inicial homogeneizada
Vb_i = Distancia fibra inferior viga a fibra neutra en sección inicial homogeneizada
Va_f = Distancia fibra superior viga a fibra neutra en sección final homogeneizada
Vb_f = Distancia fibra inferior viga a fibra neutra en sección final homogeneizada
Vc_i = Distancia fibra inferior Losa a fibra neutra en sección final homogeneizada

Esfuerzos Longitudinales

M_1 = Momento en el centro de la luz de la viga producido por p.p. de la viga.
M_2 = Momento en el centro de la luz de la viga producido por peso de la losa.
M_3 = Momento en el centro de la luz de la viga producido por la carga de Pavimento..
M_3' = Momento en el centro de la luz de la viga producido por la carga de aceras
M_4 = Momento en el centro de la luz de la viga producido por la sobrecarga uniforme
M_5 = Momento en el centro de la luz de la viga producido por sobrecarga puntual móvil

Cálculo de Tensiones

SA = Tensión en fibra superior de la viga
SB = Tensión en fibra inferior de la viga
SC = Tensión en fibra superior de la losa

Pretensado

N = Esfuerzo axil de pretensado inicial, en bancada.
Exc. = Excentridad del esfuerzo de pretensado con respecto a la fibra neutra de la sección inicial homogeneizada de la viga.
PA = Tensión en fibra superior de viga, producida por el pretensado.
PB = Tensión en fibra inferior de viga, producida por el pretensado.

Cálculo armadura cortantes

FY = Límite elástico del acero pasivo
FCTK = Resistencia a tracción del hormigón
U = Cortante máximo en la sección considerada
URD = Cortante mayorado
SIGMA CL, D = Tensión normal en fibra extrema más traccionada o menos comprimida, bajo la actuación de los esfuerzos normales de cálculo más desfavorables.

Armadura Rasante

ESF. RAS.: Esfuerzo cortante producido por las cargas que actúan exclusivamente sobre la sección final.
CAP. MEC. NEC. : Capacidad mecánica necesaria de armadura de conexión.
CAP. MEC. EXIST. ESTRIBOS DE CORTANTE : Capacidad mecánica de los estribos de cortante que se dejan vistos en la viga.
CAP. MEC. SUPL. : Capacidad mecánica de la armadura suplementaria a disponer.

Armadura de la Losa

RES. CARAC : Resistencia característica del hormigón de la losa de reparto
REC. : Recubrimiento de las armaduras de la losa de reparto.
ARM. MIN. : Capacidad mecánica mínima de armadura.
ARM. PRAL. : Armadura principal (Transversal a las vigas)
ARM. REP.. : Armadura de reparto (Longitudinal)

Placas Apoyo de Neopreno

MOD. ELAS. H. : Módulo elasticidad hormigón en Tn/m²
CARGA MIN. AP. : Carga vertical mínima por apoyo.
CARGA MAX. AP : Carga vertical máxima por apoyo.
CARGA DE FRE. AP : Carga horizontal de Frenado.
GIRO DE AP. : Giro del apoyo debido a las sobrecargas
DESPL. HOR. POR RETR. FLUENCIA Y TEMP. : Movimiento horizontal del apoyo por retracción y fluencia del hormigón y variaciones de temperatura.
TEN. MIN. COMP. : Tensión mínima de compresión en le apoyo de neopreno
TEN. MAX.COMP. : Tensión máxima de compresión en le apoyo de neopreno
GIRO POR CARGAS LENTAS TG. : Deformación del apoyo por cargas lentas (retracción, fluencia y temperatura) medida por la tangente del ángulo de giro, es decir, deformación horizontal del neopreno dividido por la altura del neopreno.

GIRO FREN. TG : Deformación del apoyo por cargas de frenado medida por la tangente del ángulo de giro, es decir, deformación horizontal del neopreno dividido por la altura del neopreno.
GIRO TOTAL TG. : Suma de los giros por cargas lentas y frenado.
FUERZA HOR. POR CARGA LENTA : Esfuerzo horizontal por unidad de apoyo por los conceptos de retracción, fluencia y temperatura.
COEF. 1 : Esfuerzo horizontal por unidad de apoyo por los conceptos de retracción, fluencia y temperatura dividido por la carga vertical mínima por apoyo.
COEF. 2 : Carga horizontal de frenado más esfuerzo horizontal por unidad de apoyo por los conceptos de retracción, fluencia y temperatura, dividido por carga vertical máxima por apoyo.

Oficina Técnica
A L V I S A

PUENTE NERVADO DE CARRETERA

CLIENTE:

OBRA : ZARAGOZA

HUESCA a

P U E N T E N E R V A D O

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(

ATOS GEOMETRICOS

olucion ..... = 4 H- 155
uz de Calculo .....[m] = 36
ntereje .....[m] = 2.22
is. eje V.Borde a Ex.Tablero [m] = .675

ncho del Tablero .....[m] = 8
ncho de las Aceras .....[m] = 1.5
ncho Eficaz [B0] .....[m] = 8.574

ngulo de Esviaje .....[g] = 0
spesor de la Losa .....[m] = .25
anto Total .....[m] = 1.8
spesor del Pavimento .....[cm] = 8

eso del Carro .....[Tn] = 60
i(an. del carro a la Acera [m] = .5
eso Aceras y Barandillas [Tn/ml] = 1.1

ARGAS [Tn/ml]

l = 1.6796
2 = 1.3875
3 = 0.4262
3'= 0.8120
4 = 0.8000

ARACTERISTICAS MECANICAS

INICIALES]

I ... [m] = .861064
VbI .... [m] = .6889359
AREA .. [m2] = .7029415
INERCIA [m4] = .2400755

FINALES]

VIGA No. 1

VaF ..... [m] = 0.537529
VbF ..... [m] = 1.012471
VcF ..... [m] = 0.787529
INER.FIN. [m4] = 0.466120
K (rasante)... = 0.507429

VIGA CENTRAL

VaF ..... [m] = 0.488476
VbF ..... [m] = 1.061523
VcF ..... [m] = 0.738476
INER.FIN. [m4] = 0.500556
K (rasante)... = 0.544162

(

P U E N T E N E R V A D O

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REPARTO TRANSVERSAL
K (Flexion) = 0.432010
K (Torsion) = 0.322348

	CARGA ACERA	CARRO EXCENTRI.	CARRO CENTRADO	CARRO OPCIONAL
Y 1	.7915606	.4664971	.2332485	
Y 2	-.7915606	0	-.2332485	

COEFICIENTES de EXCENTRICIDAD

Num. VIGA	C A R G A A C E R A	C A R R O EXCENTRICO	C A R R O C E N T R A D O	C A R R O OPCIONAL
1	1.08684	1.34129	.91572	
2	.91602	1.20696	1.07704	
3	.91648	.91145	1.07658	
4	1.08776	.52702	.91487	

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COEFICIENTES MAS DESFAVORABLES

Numero de VIGA	Y 1	Y 2	COEFICIENTE MAS DESFAVORABLE
1	.46649	0	1.3426
2	.46649	0	1.20814
3	0	-.4665	1.20814
4	0	-.4665	1.3426

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ESFUERZOS LONGITUDINALES [MTn.]

	[VIGA DE BORDE]	[VIGA NO. 2]
M1 =	272.0997	272.0997
M2 =	180.7312	224.7750
M3 =	69.0509	69.0509
M3'=	71.4836	60.2485
M4 =	129.6000	129.6000
M5 =	171.0145	154.0379

TENSIONES

TENSIONES DE FLEXION DEBIDO A LAS CARGAS EXTERIORES SIN PRETENSADO [Tn/m2]

Resumen

	EN FABRICA		EN SERVICIO			CON CARGAS MAXIMAS			
PUNTO	SA	SB	SA	SB	SC	SA	SB	SC	
18.00	975.9	780.9-	1908.2	1700.1-	190.7	2185.0	2301.6-	609.2	L/2
17.00	972.9	778.5-	1902.3	1694.9-	190.1	2178.3	2294.5-	607.3	
16.00	963.8	771.2-	1884.7	1679.1-	188.4	2158.1	2273.2-	601.6	
15.00	948.8	759.2-	1855.2	1652.9-	185.4	2124.3	2237.7-	592.2	
14.00	927.7	742.3-	1814.0	1616.2-	181.3	2077.1	2188.0-	579.1	
13.00	900.6	720.6-	1761.0	1568.9-	176.0	2016.4	2124.0-	562.2	
12.00	867.4	694.1-	1696.2	1511.2-	169.5	1942.2	2045.9-	541.5	
11.00	828.3	662.8-	1619.6	1443.0-	161.9	1854.6	1953.5-	517.0	
10.00	783.1	626.6-	1531.3	1364.3-	153.0	1753.4	1847.0-	488.8	
9.00	731.9	585.7-	1431.2	1275.1-	143.0	1638.8	1726.2-	456.9	
8.00	674.7	539.9-	1319.3	1175.4-	131.8	1510.6	1591.3-	421.1	
7.00	611.4	489.3-	1195.6	1065.2-	119.5	1369.0	1442.1-	381.6	
6.00	542.1	433.8-	1060.1	944.5-	105.9	1213.9	1278.7-	338.4	
5.00	466.8	373.6-	912.9	813.4-	91.2	1045.3	1101.1-	291.4	
4.00	385.5	308.5-	753.8	671.7-	75.3	863.2	909.3-	240.6	
3.00	298.1	238.6-	583.0	519.5-	58.2	667.6	703.3-	186.1	
2.00	204.8	163.9-	400.5	356.9-	40.0	458.5	483.1-	127.8	
1.00	105.4	84.4-	206.1	183.7-	20.6	236.0	248.7-	65.8	
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	APOYO

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CUADRO DE PRETENSADOS

FILA ->	1	2	3	4	5	6	7	8		
TIPO DE CABLE->	0.6	0.6	0.6	0.5						
RAZADO	RECTO	RECTO	RECTO	RECTO					N	EX
COTA->	4	9	14	151					(TN)	(Cm)
X	Num.	Num.	Num.	Num.						
l8	19	18	6	6					928	48
2	19	18	4	6					889	48
l	19	18	3	6					869	48
)	19	18	3	6					869	48

No se consideran los entubados cuya longitud es menor de 0.5 metros

P U E N T E N E R V A D O

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TENSIONES EN DIFERENTES PUNTOS A LO LARGO DE LA VIGA [Tn/m2]

FABRICA ..... = Peso Propio + Pretensado con Perdidas a Corto Plazo
SERVICIO ..... = Cargas Permanentes + Pretensado con Perdidas Totales
CARGAS MAXIMAS = Servicio + Sobrecargas Maximas

VIGA MAS DESFAVORABLE = VIGA n. 2

Resumen

	EN FABRICA		EN SERVICIO			CON CARGAS MAXIMAS			
PUNTO	SA	SB	SA	SB	SC	SA	SB	SC	
18.00	705.3	1693.2	1680.3	383.4	190.7	1957.1	218.1-	609.2	L/2
17.00	702.3	1695.6	1674.4	388.6	190.1	1950.4	211.0-	607.3	
16.00	693.2	1702.9	1656.8	404.4	188.4	1930.2	189.7-	601.6	
15.00	678.2	1714.9	1627.3	430.6	185.4	1896.4	154.2-	592.2	
14.00	657.1	1731.8	1586.1	467.3	181.3	1849.2	104.5-	579.1	
13.00	630.0	1753.5	1533.1	514.6	176.0	1788.5	40.5-	562.2	
12.00	596.8	1780.0	1468.3	572.3	169.5	1714.3	37.6	541.5	
11.00	557.7	1811.3	1391.7	640.5	161.9	1626.7	130.0	517.0	
10.00	512.5	1847.5	1303.4	719.2	153.0	1525.5	236.5	488.8	
9.00	461.3	1888.4	1203.3	808.4	143.0	1410.9	357.3	456.9	
8.00	404.1	1934.2	1091.4	908.1	131.8	1282.7	492.2	421.1	
7.00	340.8	1984.8	967.7	1018.3	119.5	1141.1	641.4	381.6	
6.00	271.5	2040.3	832.2	1139.0	105.9	986.0	804.8	338.4	
5.00	196.2	2100.5	685.0	1270.1	91.2	817.4	982.4	291.4	
4.00	114.9	2165.6	525.9	1411.8	75.3	635.3	1174.2	240.6	
3.00	27.5	2235.5	355.1	1564.0	58.2	439.7	1380.2	186.1	
2.00	45.5-	2198.6	189.7	1632.6	40.0	247.7	1506.4	127.8	
1.00	134.7-	2222.2	3.9	1758.7	20.6	33.8	1693.7	65.8	
0.00	240.1-	2306.6	202.2-	1942.4	0.0	202.2-	1942.4	0.0	APOYO

Calculo de las tensiones con el entubado real

RESISTENCIA DE HORMIGONES [Tn/m2]

AL DESTESAR .. = 3690.71
A LOS 28 DIAS = 3131.63 se dispone Hormigon de 4500
EN LOSA ..... = 974.73 '' '' '' '' 2500

RMADURAS DE CORTANTES [EP-93]

cero Fy ..... [Kg/cm2] >= 5100
spesor del Alma ... [cm] = 17.0
ct'K .....[Kg/cm2] = 264.2536
cuo ..... [Tn] = 26.6685
rmadura Minima..[cm2/ml] = 3.3000

ARMADURAS DE CORTANTES

TO	X	U	URD	SIGMA	COTAG	Z	VCU	A90	Diam	S
1	0	101.34	162.14	-208.36	1.67	AB	26.66	12.25	12	15
2	4	80.84	129.35	-62.88	2.15	AB	26.66	7.2	10	20
3	8	60.7	97.12	46.23	2.45	C	0	7.34	10	20
4	12	40.91	65.46	118.97	2.63	C	4.84	4.58	8	20
5	16	21.48	34.38	155.34	2.72	C	15.2	3.3	6	15

I M OLOGIA

O = Punto numero
= Distancia al apoyo en m.
= Cortante en seccion considerada en Tn.
D = Cortante mayorado en Tn.
GMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
TAG = Cotangente (Art. 48.1.2)
= Zona de comprobacion (Art. 48.1.3.3)
C = Contribucion hormigon resistencia esfuerzo cortante (Art. 48.1.3.4)
O = Area necesaria en estribos por metro lineal en cm2/ml.
am. = Diametro de la barra en estribos en mm.
= Separacion entre estribos en cm.

ARMADURAS DE RASANTE

ARMADURAS DE RASANTE

Punto	X	E.R.	C.M.N.	C.M.E.E.	C.M.S.	Diam.	S
1	0	46.13	37.65	69.85	0	--	--
2	4	37.9	30.93	36.62	0	--	--
3	8	30.03	24.51	36.62	0	--	--
4	12	22.51	18.37	23.18	0	--	--
5	16	15.35	12.53	17.3	0	--	--

S I M B O L O G I A

Punto = Punto numero
X = Distancia al apoyo en m.
E.R. = Esfuerzo de rasante en T.
C.M.N. = Capacidad mecanica necesaria en T.
C.M.E.E. = Capacidad mecanica existente estribos de cortante en T.
C.M.S. = Capacidad mecanica suplementaria en T.
Diam. = Diametro de las barras en mm.
S = Separacion entre barras en cm

FLEXION TRANSVERSAL LOSA REPARTO

M O M E N T O S

	POSITIVOS [MTn.]	NEGATIVOS [MTn.]
DEFORMACION TRANSVERSAL	3.1635	-.31636
FLEXION LOCALIZADA	2.15721	-1.1064
T O T A L E S	5.32072	-1.42274

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos.
FLEXION LOCALIZADA .... : Obtenida por el metodo de Westergaard.

ARMADO LOSA

Res. Caract. del Hormigon [Tn/m2] = 2500
Res. Acero de la Losa [Tn/m2] = 51000
Recubrimiento ..... [cm] = 4.0
Armadura Minima ..... [Tn] = 14.0000

[CARA SUPERIOR]
Armadura Principal= 14 Tn/ml se dispone 4 Φ 10 por ml
Armadura Reparto = 3.5 Tn/ml se dispone 4 Φ 8 por ml

[CARA INFERIOR]
Armadura Principal= 43.87721 Tn/ml se dispone 5 Φ 16 por ml
Armadura Reparto = 10.9693 Tn/ml se dispone 4 Φ 10 por ml

PLACAS DE APOYO DE NEOPRENO

Modulo Elasticidad Hormigon [Tn/m2] = 3000000
Carga Minima en Apoyo..... [Tn] = 69.5749
Carga Maxima en Apoyo..... [Tn] = 121.8421
Carga de Frenado en Apoyo..... [Tn] = 1.1050
Giro de Apoyo..... [Min.] = 1.7431
Des. Hori.[Retra. Fluen. Temp.] [cm]= 1.2600

APOYO de 250 mm X 500 mm. en Planta y 43 mm. de Altura

[COMPROBACION]

Tension Minima de Compresion [Kg/cm2] = 55.6599
Tension Maxima de Compresion [Kg/cm2] = 97.4737
Giro por Cargas Lentas TG ..... = 0.4200
Giro de Frenado TG..... = 0.0442
Giro Total TG..... = 0.4642
Fuerza Horizontal Carga Lenta [Kg] = 4200.0000
Coeficiente 1 = 0.0604
Coeficiente 2 = 0.0435
Giro Admisible de Apoyo .....[Min] = 49.4928

[PLACA VALIDA]

FLECHAS DE LAS VIGAS [cm.]

Flecha en Fabrica ..... = -4.8186
Flecha con Losa Hormigonada..... = -1.4138
Flecha en Servicio sin Sobrecarga = 0.7492
Flecha en Servicio con Sobrecarga = 2.4664

CALCULO A ROTURA

Pasiva en Traccion ..... [Tn] = 0.00
Armadura Activa ..... [Tn] = 895.15
Capacidad total en traccion N.. [Tn] = 895.15
Pasiva en Compresion ..... [Tn] = 0.00
Recubrimiento Pasiva Compresion [cm] = 2.00
Zona ..... = II
Ancho Eficaz ..... [m] = 2.00
Capa Compresion ..... [cm] = 25.00
Ancho del Ala ..... [m] = 1.35
Profundidad del Ala ..... [m] = 0.08
Dis. CDG Compre. a Fibra Super. [cm] = 15.64
Profundidad de Compresiones ... [cm] = 30.06
Dis. CDG Trac. a Fibra Inferior [cm] = 7.49
Canto Resistente ..... [m] = 1.57
Momento de Rotura (MR+) .. [MTn.] =1404.26

COEFICIENTE DE SEGURIDAD A ROTURA = [1.54]

[MOMENTOS [MTn.]]

M1 ... = 272.099
M2 ... = 224.775
M3 ... = 69.050
M3'... = 60.248
M4 ... = 129.600
M5 ... = 154.037
M TOTAL= 909.811

[VOLUMEN DE TRACCIONES]

SA [Tn/m2] = 1957.27008
SB [Tn/m2] = -218.00058
X [m] = 0.15533

Ancho Cabeza Inferior [cm] = 105.0
Volumen de Tracciones [Tn] = 17.8

Fdo: Jesús Montaner Fragüet.
Ingeniero de Caminos.

PROGRAMA MURO ARMADO

1.- DESCRIPCION.

El programa aborda el cálculo de un muro de hormigón armado cuya definición geométrica viene definida en la figura que el propio programa genera.

Sobre este muro actúan las cargas correspondientes al empuje del terreno, pudiendo ser éste horizontal en la coronación del muro o bien formar un ángulo con dicha horizontal. Dicho ángulo (BO) viene especificado en el apartado de características.

Sobre el terreno actúa una sobrecarga uniforme y sobre el propio muro actúa una carga vertical máxima y otra mínima, así como una carga horizontal en cabeza debida a esfuerzos de frenado, retracción y fluencia y sismo. Todas estas cargas se consideran por metro lineal de longitud de coronación de muro.

En la figura existente el programa materializa el valor y la posición de la resultante del empuje de tierras.

El programa efectúa el cálculo de los coeficientes de seguridad al vuelco y deslizamiento del muro planteado, así como las tensiones en el cimiento en las hipótesis de carga máxima, carga mínima y sismo en su caso. Asimismo, efectúa el dimensionamiento de las 5 secciones principales del muro reflejadas en el segundo croquis, con su correspondiente comprobación de cuantías mínimas, tanto geométricas como mecánicas.

Con todo lo anterior, procede al armado del muro que figura en el croquis nº 3.

2.- DATOS DE ENTRADA.

Consisten en :

- Descripción geométrica del muro.
- Angulo BO que forma el terreno con la horizontal en la coronación del muro.
- Angulo de rozamiento del terreno.
- Densidad, características de hormigón y acero.
- Sobrecargas repartidas sobre el terreno en la coronación del muro.
- Cargas verticales y horizontales en cota de apoyo.
- Grado sísmico, en su caso.

3.- CÁLCULO.

El programa aplica la teoría de Rankine para el empuje del terreno, suponiendo éste sin cohesión.

En el caso de la existencia del sismo, se aplica lo contenido en la Norma Sismorresistente NCSE-94, Real Decreto 2543/1.994 de 29 de diciembre.

4.- RESULTADOS.

El programa efectúa el cálculo de los coeficientes de seguridad al vuelco y deslizamiento, comprueba las tensiones sobre la cimentación en todos los casos, y efectúa el cálculo del armado del muro.

5.- ORDENADOR.

El programa se ha procesado en una Red Local, compuesta de varios ordenadores Personales (PCs) con memoria RAM de 32 Mb. y disco duro en cada uno de ellos.

M U R O A R M A D O

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D A T O S G E N E R A L E S

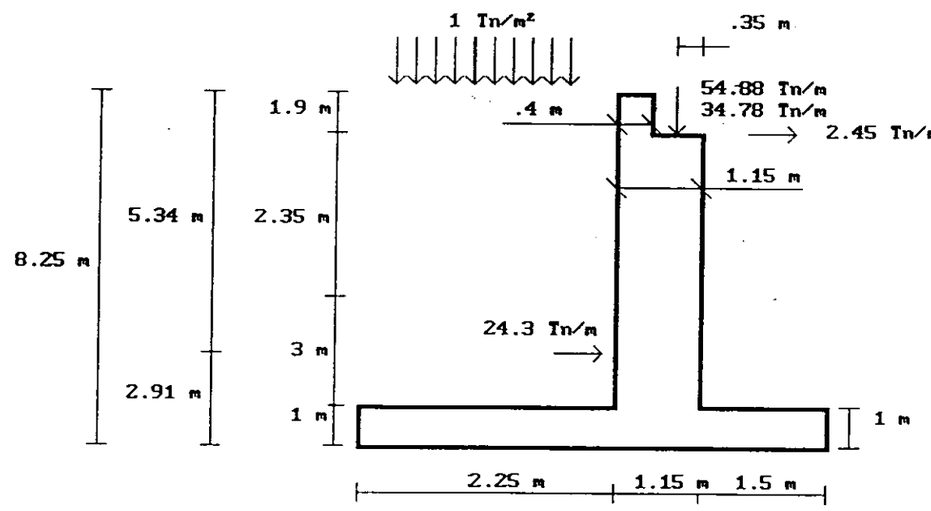
Cliente .....

Lugar de la obra ..... ZARAGOZA

Fecha .....

C A R A C T E R I S T I C A S G E O M E T R I C A S

S E C C I O N M U R O A R M A D O



M U R O A R M A D O

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Caracteristicas y Coeficientes

[Caracteristicas varias]

Angulo B0 ..... = 0
Angulo Rozamiento [Sex.] = 30
Densidad terreno [Tn/m3] = 1.9
Fck ..... [Tn/m²] = 2000
Tipo acero ..... = AEH-500N
Recubrimiento ..... [Cm] = 5

[Coeficientes de Seguridad]

Vuelco ..... = 2.9411
Deslizamiento = 2.1863

Tensiones.-

[EMPUJE MAYORADO CON 1.5]

Resultante fuera del nucleo

Profundidad de compresiones [m] = 4.1603
Tensión en puntera .....[Tn/m²] = 55.9922

[EMPUJE SIN MAYORAR]

esultante dentro del nucleo central

Tensión en puntera ..[Tn/m²] = 43.9359
Tensión en tacon ....[Tn/m²] = 3.6043

M U R O A R M A D O

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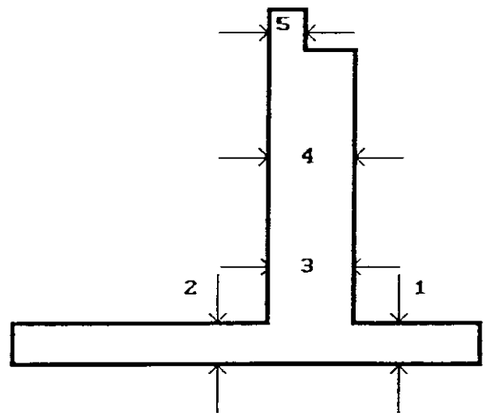
Armado de secciones .-

SITUACION SECCIONES



A R M A D O

SECCION		M O M E N T O S		A R M A D U R A S			
Num	Canto	Flector	TOPE	Flexion	Mecanica	Geometrica	Reparto
1	1.00	49.43	421.17	86.06	50.67	31.93	21.51
2	1.00	41.20	421.17	70.99	50.67	31.93	17.75
3	1.15	62.09	508.20	93.60	52.80	30.60	54.40
4	1.15	16.87	508.20	24.25	52.80	30.60	54.40
5	0.40	1.33	51.45	5.96	16.80	10.64	18.92

Armadura Paramento Visto

Vertical : 15.3 Tn.
Horizontal : 27.2 Tn.

Fdo: Jesús Montaner Fragüet.
Ingeniero de Caminos.

SIMBOLOGIA

Datos de la viga:

Vla = Distancia de la fibra neutra a la fibra superior de la viga (en sección inicial).
VFc = Distancia de la fibra neutra a la fibra superior de la losa (en sección final).

Pretensado :

N = Esfuerzo de pretensado introducido en la viga.
Exc = Distancia entre la fibra neutra y el c.d.g. de la armadura de pretensado (en sección inicial)
Pa = Tensiones debidas al pretensado en fibra superior de viga.
Pb = Tensiones debidas al pretensado en fibra inferior de viga.
SA = Tensiones resultantes en fibra superior de viga.
SB = Tensiones resultantes en fibra inferior de viga.
SC = Tensiones resultantes en fibra superior de losa.

Cálculo a rotura :

N = Capacidad mecánica de la armadura de pretensado inferior más la pasiva, consideradas a rotura.
MR+ = Momento de rotura de la viga con armadura considerada.

Cálculo armadura cortante (EP-93)

FCT´K = Resistencia característica a tracción del hormigón.
VCUO = Colaboración del hormigón a resistir el esfuerzo cortante.
ARM. MIN. = Cuantías mínimas.
U = Cortante en la sección dada.
URD = Cortante mayorado.
A90 = Cuantía de armadura necesaria.

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CARGAS CONSIDERADAS.

Peso propio de viga	2,24 T/ml.
Peso de losa de cierre	0,23 T/ml.
Cargas en el interior del cajón	0,80 T/ml.
Sobrecarga 0,4 T/m2	0,96 T/ml.
Barandillas	0,30 T/ml.

C O R T A N T E

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Cliente :
Obra : **A V E MADRID - ZARAGOZA**
Fecha :

CARACTERISTICAS DE LA VIGA

1] Datos Geométricos

Tipo de la Viga	C-168 E
Canto de la Viga .....[m]	1.68
Luz de Calculo .....[m]	36
Espesor de la Losa .....[m]	0
Ancho de Alma .....[m]	.15

2] Caracteristicas Mecánicas

[INICIALES]	[FINALES]
Area ...[m²] = .8957	Inercia [m4] = .3197
Inercia [m4] = .3197	VcF ... [m] = .839354
ViA .... [m] = .839354	

3] Resistencias Hormigón

Fck de la Viga .... [Tn/m²] 4500

ESFUERZOS

4] Momentos [Mtn.]

Peso propio ..... =	362.76
Cargas permanentes =	215.39
Sobrecarga uso ... =	155.46

5] Cortantes [Tn.]

Peso propio ..... =	40.31
Cargas permanentes =	23.93
Sobrecarga uso ... =	17.27

TENSIONES

PRETENSADO [Centro Viga]

FILA	No. CABLES	TIPO	COTA
1	23	0.6	4
2	18	0.6	9
3	6	0.5	164

N .....[Tn]	=	888.8768
Excentrici. [m]	=	0.6273
0.95 Pa [Tn/m²]	=	-447.9681
0.80 Pb [Tn/m²]	=	1966.8510
SB .....[Tn/m²]	=	-1929.0156

PRETENSADO [Extremo Viga]

FILA	No. CABLES	TIPO	COTA
1	23	0.6	4
2	4	0.6	9
3	6	0.5	164

N .....[Tn]	=	614.4768
Excentrici. [m]	=	0.5722
0.95 Pa [Tn/m²]	=	-225.2607
0.80 Pb [Tn/m²]	=	1288.4775
SB .....[Tn/m²]	=	-1929.0156

RESUMEN DE TENSIONES [Tn/m²]

EN FABRICACION (extremo de viga)

SA	=	-225.2607
SB	=	1530.0670

EN SERVICIO CON CARGAS PERMANENTES (centro de viga)

SA	=	1140.6633
SB	=	446.6149

CON CARGAS MAXIMAS

SA	=	1548.8147
SB	=	37.8354

RESISTENCIA DE HORMIGONES

Al destesar en viga 2318.283 Tn/m² se dispone hormigón 4500 Tn/m²

CALCULO A ROTURA

Pasiva de Tracción ..... [Tn] = 30
N ..... [Tn] = 883.5134
ZONA ..... = VI
Armadura Compresión ..... [Tn] = 0
Rec . armadura compresión..... [m] = .01
Ancho eficaz ..... [cm] = 1
Capa de compresión ..... [cm] = 1
Ancho de ALA ..... [cm] = 95
Profundidad del ALA ..... [cm] = 18
TRAPECIO 1 : Ancho Inferior [cm] = 50
Profundidad ..... [cm] = 10
TRAPECIO 2 : Ancho Inferior [cm] = 30
Profundidad ..... [cm] = 10
Profundidad de compresiones [cm] = 45.23
Dis. CDG Compr. Fibra Superior [cm] = 19.89
Dis. CDG Tracc. Fibra Inferior [cm] = 6.12
Canto Resistente ..... [cm] = 141.9902
Momentos [MR+] ..... [MTn] = 1254.5

[Coeficiente de seguridad a rotura 1.71 (admisible)]

1... [MTn] = 362.76
3... [MTn] = 215.39
4... [MTn] = 155.46
total [MTn] = 733.61

CALCULO ARMADURA CORTANTES [EP-93]

ACERO Fy ..... [Kg/cm²] >= 5000
Fct'k ..... [Tn/m²] = 264.2536
Vcuo ..... [Tn] = 21.91751
Armadura Minima [cm²/ml] = 3.375

ARMADURAS DE CORTANTES

Pto	X	U	URD	SIGMA	COTAG	Z	VCU	A90	Diam	S
1	0	81.51	130.41	-128.85	1.75	AB	21.91	9.69	8	10
2	3.6	67.2	107.53	-17.74	1.75	AB	21.91	7.65	8	10
3	7.2	52.9	84.64	68.68	1.75	C	.74	8.15	8	10
4	10.8	38.6	61.76	130.41	1.75	C	7.17	5.3	8	15
5	14.4	24.3	38.88	167.44	1.75	C	13.44	3.37	8	25

S I M B O L O G I A

Pto = Punto número
X = Distancia al apoyo en m.
U = Cortante en sección considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tensión normal en fibra extrema en Kg/cm² (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobación (Art. 48.1.3.3)
VCU = Contribución hormigón resistencia esfuerzo cortante (Art. 48.1.3.4)
A90 = Area necesaria en estribos por metro lineal en cm²/ml.
Diam = Diametro de la barra en estribos en mm.
S = Separación entre estribos en cm.

FLECHAS DE LAS VIGAS [cm]

Flecha en Fabrica ..... -4.75032
Flecha en servicio sin sobrecarga -1.26727
Flecha en servicio con sobrecarga .24907

Distancia al ENTUBAR : 6 m. COTA : 8.999997 cm.

Fdo: Jesús Montaner Fragüet.
Ingeniero de Caminos.

Paso Inferior Carretera De La Cartuja

PASO INFERIOR CARRETERA DE LA CARTUJA

ÍNDICE

- GENERALIDADES
- INTRODUCCIÓN
- CÁLCULOS
  - Hipótesis I
  - Hipótesis II
  - Hipótesis III
  - Hipótesis IV

L.A.V. ZARAGOZA - LLEIDA
SUBTRAMO-I

PASO INFERIOR "LA CARTUJA"

GENERALIDADES.

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Unión Internationale des Chemins de Fer" (U.I.C.).

- "Instrucción EH- 91, para el proyecto y ejecución de obras de hormigón en masa y armado".

- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- En Limpieza y nivelación. . . . . $f_{ck} \geq 125$ kp/cm^2
- En Marcos. . . . . $f_{ck} \geq 250$ kp/cm^2
- En Zapatas. . . . . $f_{ck} \geq 250$ kp/cm^2
- En Alzados . . . . . $f_{ck} \geq 250$ kp/cm^2
- Coeficiente de seguridad. . . . . $\gamma_c = 1,5$

Armaduras pasivas

- Límite elástico ≥ 5100 kp/cm^2
- Coeficiente de seguridad $\gamma_s = 1.15$

Cargas

- Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

Características del terreno

- Tensión admisible de cimentación 2,5 kgr/cm^2
- Densidad de tierras: 1,90 t/m^3
- Empuje de tierras: λ activo = 0,30
  λ reposo = 0,45
- Módulo de deformación: 5000 t/m^3

3.- Criterios generales de cálculo

Para el cálculo de los pórticos se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

En el cálculo se han considerado cuatro hipótesis de carga diferentes:

1.- Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel.
2.- Empuje máximo, sobrecarga mínima.
3.- Empuje mínimo, sobrecarga máxima.
4.- Empuje máximo, sobrecarga máxima.

La obtención de los esfuerzos en la sección transversal de los marcos, se ha realizado con la ayuda del programa de cálculo comercializado con el título "PROGRAMA ARCO" para Cálculo de Arcos, Pasos Inferiores y Galerías Enterradas © Copyright J. Díaz del Valle, 1.998.

Este programa obtiene los esfuerzos en la sección de cálculo, mediante la discretización de la estructura en barras (en este caso, se han tomado 40 elementos) y utilizando un cálculo matricial, basado en el método de la rigidez, obtiene los esfuerzos en cada punto para cada una de las hipótesis estudiadas.

El marco se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. La armadura longitudinal se dispone según EH-91.

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura dado que los pórticos van a estar cubiertos por las tierras.

El módulo de deformación del terreno adoptado, ha sido de 5000 t/m^3, teniendo en cuenta que el tipo de terreno a colocar bajo la solera del Pórtico se trata de un material granular, tipo zahorra natural procedente de la 2ª terraza del Ebro (préstamo denominado Acampo del Marqués de Ayerbe), que se corresponde con un valor del coeficiente de balasto de tipo medio, análogo a valores utilizados en multitud de cálculos similares al que nos ocupa y sabiendo, además, que una variación razonable de este módulo en ± 1000 t/m^3 va a influir muy poco en la distribución de los esfuerzos en la estructura.

Los posibles desplazamientos originados por las fuerzas horizontales -frenados, fuerza centrífuga- se consideran impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierras bajo la solera para un coeficiente de balasto medio.

No se considera en los cálculos la acción sísmica, ya que según la "Norma de Construcción Sismorresistente N.C.S.E.-94", las obras se encuentran en una zona con aceleración básica inferior a "0,04 g". Teniendo en cuenta dicho valor y un coeficiente de riesgo de 1,30 (construcciones de especial importancia) resulta una aceleración sísmica de cálculo inferior a "0,052 g" < "0,06 g".

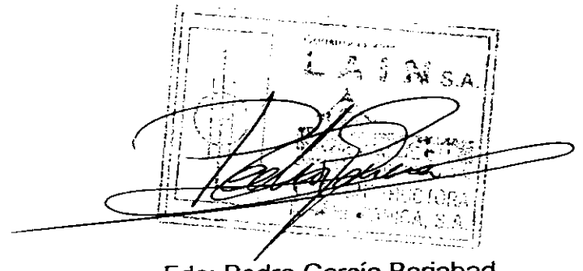
Dado que este paso inferior se encuentra situado en una zona susceptible de posible formación de simas, y aún teniendo en cuenta que se sustituirá el terreno existente bajo la solera con un relleno granular tipo zahorra natural procedente de préstamo, se ha considerado conveniente ampliar la superficie de apoyo de dicho pórtico prolongando a izquierda y derecha la losa inferior a modo de talón en una longitud, por cada lado, aproximadamente igual a la altura del terreno a sustituir bajo solera, para minimizar las posibles consecuencias que la aparición de un sima en esta zona pudiera originar al pórtico proyectado, la sección de apoyo de dicha solera inferior se incrementa con estos talones un 66 %. Dado que con esta medida se trata únicamente de reforzar el comportamiento del pórtico ante la posible aparición de una sima bajo el terreno, dichos talones no se tienen en cuenta en el cálculo estructural del pórtico.

4.- Equipo redactor

El cálculo de este pórtico ha sido realizado por la Oficina Técnica de LAHISCO AVE, U.T.E. (Construcciones Lain, S.A.; Corsan Empresa Constructora, S.A. y Constructora Hispánica, S.A., en Agrupación Temporal de Empresas) adjudicatario de la obra: Proyecto de "Línea de Alta Velocidad Madrid-Barcelona-frontera francesa. Tramo: Zaragoza-Lleida. Subtramo-I".

Estos cálculos se recogen, a continuación, desde la página 1 hasta la página 35, ambas inclusive.

Zaragoza, 31 de Octubre de 1.997



Fdo: Pedro García Borjabad
Ingeniero de Caminos

PASO INFERIOR "LA CARTUJA"

INTRODUCCION

El siguiente informe recoge el cálculo y armado de la sección tipo del alzado del Paso Inferior de "La Cartuja " . La sección tipo consiste en un cajón de 14 m x 6,3m.

El informe se estructura de la siguiente forma:

I. Cálculos:

- Modelización de la sección tipo del alzado.
- Cálculo del cajón para las distintas hipótesis de carga, usando el programa "ARCO"
- Establecimiento de la envolvente de armaduras requeridas y consiguiente armado dispuesto.

El resultado del estudio realizado en este informe es el establecimiento del armado para el alzado del Paso Inferior de La Cartuja.

LINEA DE ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA - LLEIDA. SUTRAMO I

I. CALCULOS

PASO INFERIOR "LA CARTUJA" (14,00 x 6,30 m). MODELIZACION

GALIBO = 5,30 m

DINTEL e = 1,00 m

Definición geométrica utilizada para modelizar la sección tipo del Paso Inferior, usando el programa ARCO para cálculo de cajones

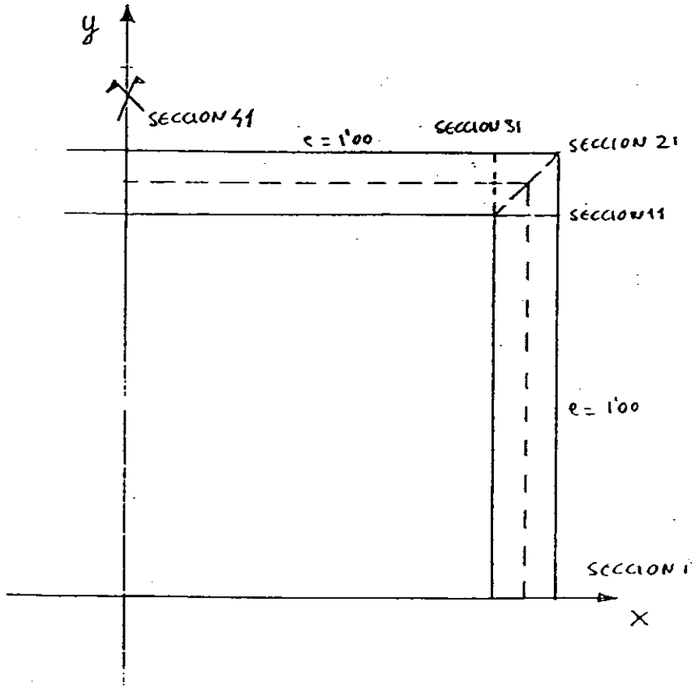


Figura 1. Discretización de la Estructura

Los datos necesarios para el cálculo del paso son recogidos en las siguientes líneas

TIERRAS

-Altura de Tierras:

Sobre dintel ..... 1,00 m
Sobre solera ..... 1,00 m

-Peso Específico de Tierras
Yt = 2,03 t/m3

-Coeficiente de empuje de tierras
K ACTIVO = 0,30
K REPOSO = 0,45

MATERIALES

-Hormigón H-250
Peso Especifico 2,5 t/m3
Yc = 1,50

-Acero AEH-500
Y s = 1,15

CARGAS CONSIDERADAS

Las cargas consideradas en el cálculo del Paso Inferior son las siguientes:

1.- Peso propio de la estructura de hormigón armado

2.- Empuje de tierras

3.- Sobrecarga debido al tren tipo B según Instrucción Española con reducción del coeficiente de impacto según U.I.C.

Coeficiente de Impacto

$$I = 1{,}66 - 0{,}1\ (h\,t - 1) = 1.66$$

Sobrecarga repartida

$$P\,sc = \frac{2 \times 12 \times I}{2\,(3 + h\,t)} = 4{,}98\ (t/m2)$$

COEFICIENTE DE MAYORACION DE ACCIONES

$$Yf = 1{,}5$$

HIPOTESIS DE CARGA

En el cálculo de la estructura se han considerado las siguientes cuatro hipótesis de carga:

I. TIERRAS HASTA DINTEL, SOBRECARGA MINIMA (Psc=0), EMPUJE EN REPOSO

II. SOBRECARGA MINIMA, EMPUJE EN REPOSO

III. SOBRECARGA MAXIMA, EMPUJE ACTIVO

IV. SOBRECARGA MAXIMA, EMPUJE EN REPOSO

Estas cuatro hipótesis han sido calculadas mediante el programa "ARCO" y los esfuerzos debidos a las mismas, así como las armaduras obtenidas.

Con estos datos se establece la envolvente de armaduras (o de capacidades mecánicas, Us) recogidas en las Figuras 3 y 4.

HIPOTESIS I

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

(C) Copyright J.Diaz del Valle, 1988

P R O Y E C T O : L.A.V SUBTRAMO 1

Referencia ..... : LA CARTUJA

Fecha ..... : 15-10-97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON	=	2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck	=	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c	=	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk	=	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s	=	1.15	
RECUBRIMIENTO DE LAS ARMADURAS c	=	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	8.30	m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03	t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.30	
SOBRECARGA q	=	0.00	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.50

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 2.03 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 1.20 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	7.500	0.000	88.658	-13.691	-85.380	1.000
2	7.500	0.630	87.476	-11.363	-78.222	1.000
3	7.500	1.260	85.114	-6.949	-73.844	1.000
4	7.500	1.890	82.751	-2.897	-72.019	1.000
5	7.500	2.520	80.389	0.792	-72.518	1.000
6	7.500	3.150	78.026	4.118	-75.112	1.000
7	7.500	3.780	75.664	7.082	-79.574	1.000
8	7.500	4.410	73.301	9.683	-85.675	1.000
9	7.500	5.040	70.939	11.922	-93.186	1.000
10	7.500	5.670	68.576	13.798	-101.879	1.000
11	7.500	6.300	66.214	15.312	-111.525	1.000
12	7.500	6.350	64.937	15.993	-112.325	1.041
13	7.500	6.400	64.742	16.082	-113.129	1.083
14	7.500	6.450	64.539	16.169	-113.937	1.124
15	7.500	6.500	64.328	16.253	-114.750	1.166
16	7.500	6.550	64.109	16.336	-115.567	1.207
17	7.500	6.600	63.883	16.416	-116.388	1.248
18	7.500	6.650	63.649	16.493	-117.212	1.290
19	7.500	6.700	63.407	16.569	-118.041	1.331
20	7.500	6.750	63.157	16.642	-118.873	1.373
21	7.500	6.800	16.713	-62.900	-119.708	1.414
22	7.450	6.800	16.747	-62.525	-116.582	1.373
23	7.400	6.800	16.747	-62.039	-113.480	1.331
24	7.350	6.800	16.747	-61.561	-110.402	1.290
25	7.300	6.800	16.747	-61.091	-107.348	1.248
26	7.250	6.800	16.747	-60.628	-104.316	1.207
27	7.200	6.800	16.747	-60.174	-101.308	1.166
28	7.150	6.800	16.747	-59.727	-98.321	1.124
29	7.100	6.800	16.747	-59.287	-95.357	1.083
30	7.050	6.800	16.747	-58.856	-92.414	1.041
31	7.000	6.800	16.747	-58.432	-89.493	1.000
32	6.300	6.800	16.747	-55.311	-50.775	1.000
33	5.600	6.800	16.747	-49.489	-16.132	1.000
34	4.900	6.800	16.747	-43.667	14.435	1.000

35	4.200	6.800	16.747	-37.845	40.926	1.000
36	3.500	6.800	16.747	-32.022	63.342	1.000
37	2.800	6.800	16.747	-26.200	81.682	1.000
38	2.100	6.800	16.747	-20.378	95.946	1.000
39	1.400	6.800	16.747	-14.556	106.135	1.000
40	0.700	6.800	16.747	-8.733	112.249	1.000
41	0.000	6.800	16.747	-2.911	114.286	1.000

R = 0.88658E+02 M = -.85380E+02 H = -.13691E+02 V = 0.85780E-02m

LONGITUD DEL SEMIARCO = 14.300 LONGITUD DE TRANSPORTE = 10.124

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
7.500	6.007	-1.064	85.380	88.658	30.036
6.750	5.167	-1.159	26.949	67.684	25.835
6.000	4.290	-1.166	-16.957	49.950	21.451
5.250	3.434	-1.108	-48.793	35.481	17.171
4.500	2.640	-1.003	-70.955	24.116	13.202
3.750	1.938	-0.866	-85.670	15.563	9.691
3.000	1.347	-0.709	-94.908	9.440	6.734
2.250	0.878	-0.539	-100.328	5.308	4.392
1.500	0.540	-0.362	-103.248	2.690	2.701
0.750	0.336	-0.182	-104.617	1.089	1.680
0.000	0.268	-0.000	-105.010	0.000	1.339

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	7.500	0.000	7.500	12.847	0.000
2	7.500	0.630	7.500	11.918	0.000
3	7.500	1.260	7.500	11.127	0.000
4	7.500	1.890	7.500	10.922	0.000
5	7.500	2.520	7.500	11.275	0.000
6	7.500	3.150	7.500	12.087	0.000
7	7.500	3.780	7.500	13.203	0.000
8	7.500	4.410	7.500	14.431	0.000
9	7.500	5.040	7.500	16.260	0.000
10	7.500	5.670	7.500	18.932	0.000
11	7.500	6.300	7.500	21.886	0.000
12	7.500	6.350	7.810	20.882	0.000
13	7.500	6.400	8.121	19.866	0.000
14	7.500	6.450	8.431	18.943	0.000

15	7.500	6.500	8.742	18.101	0.000
16	7.500	6.550	9.052	17.543	0.000
17	7.500	6.600	9.363	17.570	0.000
18	7.500	6.650	9.674	17.374	0.000
19	7.500	6.700	9.984	17.145	0.000
20	7.500	6.750	10.294	16.892	0.000
21	7.500	6.800	10.605	20.353	2.786
22	7.450	6.800	10.294	20.033	3.076
23	7.400	6.800	9.984	19.799	3.358
24	7.350	6.800	9.674	19.929	3.646
25	7.300	6.800	9.363	20.073	3.954
26	7.250	6.800	9.052	20.233	4.285
27	7.200	6.800	8.742	20.411	4.641
28	7.150	6.800	8.431	20.609	5.026
29	7.100	6.800	8.121	20.829	5.442
30	7.050	6.800	7.810	21.075	5.893
31	7.000	6.800	7.500	21.349	6.383
32	6.300	6.800	7.500	12.518	6.012
33	5.600	6.800	7.500	7.500	4.685
34	4.900	6.800	7.500	7.500	3.080
35	4.200	6.800	10.330	7.500	1.319
36	3.500	6.800	14.431	7.500	0.000
37	2.800	6.800	19.248	7.500	0.000
38	2.100	6.800	23.095	7.500	0.000
39	1.400	6.800	25.870	7.500	0.000
40	0.700	6.800	27.546	7.500	0.000
41	0.000	6.800	28.107	7.500	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	7.500	-0.600	18.176	9.000	10.849
2	6.750	-0.600	9.000	9.000	6.486
3	6.000	-0.600	9.000	9.000	2.441
4	5.250	-0.600	9.000	12.510	0.000
5	4.500	-0.600	9.000	16.301	0.000
6	3.750	-0.600	9.000	18.239	0.000
7	3.000	-0.600	9.000	20.248	0.000
8	2.250	-0.600	9.000	21.431	0.000
9	1.500	-0.600	9.000	22.070	0.000
10	0.750	-0.600	9.000	22.369	0.000
11	0.000	-0.600	9.000	22.455	0.000

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V SUBTRAMO 1

Referencia ..... : LA CARTUJA

Fecha ..... : 15-10-97

HIPOTESIS II

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 8.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.50

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 2.03 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 1.20 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	7.500	0.000	88.658	-23.577	-91.096	1.000
2	7.500	0.630	87.476	-20.086	-78.442	1.000
3	7.500	1.260	85.114	-13.464	-69.959	1.000
4	7.500	1.890	82.751	-7.387	-65.306	1.000
5	7.500	2.520	80.389	-1.854	-64.138	1.000
6	7.500	3.150	78.026	3.136	-66.114	1.000
7	7.500	3.780	75.664	7.582	-70.890	1.000
8	7.500	4.410	73.301	11.484	-78.125	1.000
9	7.500	5.040	70.939	14.842	-87.475	1.000
10	7.500	5.670	68.576	17.656	-98.599	1.000
11	7.500	6.300	66.214	19.926	-111.152	1.000
12	7.500	6.350	64.937	20.948	-112.200	1.041
13	7.500	6.400	64.742	21.082	-113.254	1.083
14	7.500	6.450	64.539	21.212	-114.314	1.124
15	7.500	6.500	64.328	21.339	-115.381	1.166
16	7.500	6.550	64.109	21.462	-116.454	1.207
17	7.500	6.600	63.883	21.582	-117.534	1.248
18	7.500	6.650	63.649	21.698	-118.618	1.290
19	7.500	6.700	63.407	21.812	-119.709	1.331
20	7.500	6.750	63.157	21.921	-120.805	1.373
21	7.500	6.800	22.027	-62.900	-121.906	1.414
22	7.450	6.800	22.079	-62.525	-118.780	1.373
23	7.400	6.800	22.079	-62.039	-115.678	1.331
24	7.350	6.800	22.079	-61.561	-112.600	1.290
25	7.300	6.800	22.079	-61.091	-109.546	1.248
26	7.250	6.800	22.079	-60.628	-106.514	1.207
27	7.200	6.800	22.079	-60.174	-103.506	1.166
28	7.150	6.800	22.079	-59.727	-100.519	1.124
29	7.100	6.800	22.079	-59.287	-97.555	1.083
30	7.050	6.800	22.079	-58.856	-94.612	1.041
31	7.000	6.800	22.079	-58.432	-91.690	1.000
32	6.300	6.800	22.079	-55.311	-52.973	1.000
33	5.600	6.800	22.079	-49.489	-18.330	1.000
34	4.900	6.800	22.079	-43.667	12.237	1.000

35	4.200	6.800	22.079	-37.845	38.728	1.000
36	3.500	6.800	22.079	-32.022	61.144	1.000
37	2.800	6.800	22.079	-26.200	79.484	1.000
38	2.100	6.800	22.079	-20.378	93.748	1.000
39	1.400	6.800	22.079	-14.556	103.937	1.000
40	0.700	6.800	22.079	-8.733	110.050	1.000
41	0.000	6.800	22.079	-2.911	112.088	1.000

R = 0.88658E+02 M = -.91096E+02 H = -.23577E+02 V = 0.83314E-02m

LONGITUD DEL SEMIARCO = 14.300 LONGITUD DE TRANSPORTE = 10.124

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
7.500	5.879	-1.003	91.096	88.658	29.396
6.750	5.082	-1.108	32.506	68.082	25.408
6.000	4.240	-1.124	-11.802	50.600	21.201
5.250	3.413	-1.073	-44.181	36.263	17.063
4.500	2.642	-0.976		24.934	13.209
3.750	1.957			16.342	9.785
3.000	1.379			10.123	6.893
2.250				5.853	4.597
				3.068	2.937
				1.283	1.934
				0.000	1.599

R C O

ior 1)	Acortante (cm²/m)
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000
	0.000

15	7.500	6.500	8.742	18.247	0.000
16	7.500	6.550	9.052	17.543	0.000
17	7.500	6.600	9.363	17.719	0.000
18	7.500	6.650	9.674	17.569	0.000
19	7.500	6.700	9.984	17.386	0.000
20	7.500	6.750	10.294	17.179	0.000
21	7.500	6.800	10.605	20.231	2.791
22	7.450	6.800	10.294	20.028	3.076
23	7.400	6.800	9.984	19.617	3.366
24	7.350	6.800	9.674	19.762	3.653
25	7.300	6.800	9.363	19.924	3.960
26	7.250	6.800	9.052	20.102	4.291
27	7.200	6.800	8.742	20.300	4.647
28	7.150	6.800	8.431	20.519	5.030
29	7.100	6.800	8.121	20.763	5.445
30	7.050	6.800	7.810	21.034	5.895
31	7.000	6.800	7.500	21.337	6.384
32	6.300	6.800	7.500	12.481	6.014
33	5.600	6.800	7.500	7.500	4.685
34	4.900	6.800	7.500	7.500	3.080
35	4.200	6.800	9.156	7.500	1.384
36	3.500	6.800	13.981	7.500	0.000
37	2.800	6.800	18.047	7.500	0.000
38	2.100	6.800	21.894	7.500	0.000
39	1.400	6.800	24.670	7.500	0.000
40	0.700	6.800	26.347	7.500	0.000
41	0.000	6.800	26.908	7.500	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	7.500	-0.600	19.418	9.000	10.792
2	6.750	-0.600	9.000	9.000	6.576
3	6.000	-0.600	9.000	9.000	2.589
4	5.250	-0.600	9.000	11.570	0.000
5	4.500	-0.600	9.000	15.706	0.000
6	3.750	-0.600	9.000	17.501	0.000
7	3.000	-0.600	9.000	19.627	0.000
8	2.250	-0.600	9.000	20.909	0.000
9	1.500	-0.600	9.000	21.623	0.000
10	0.750	-0.600	9.000	21.970	0.000
11	0.000	-0.600	9.000	22.071	0.000

HIPOTESIS III

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V SUBTRAMO 1

Referencia ..... : LA CARTUJA

Fecha ..... : 15-10-97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON		=	2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON	fck	=	250 Kp/cm²
COEFICIENTE DE MINORACION DE fck	¥c	=	1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO	fyk	=	5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk	¥s	=	1.15
RECUBRIMIENTO DE LAS ARMADURAS	c	=	4 cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	8.30 m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03 t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.30
SOBRECARGA q	=	4.98 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.50

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 2.03 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 1.20 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPES (m)
1	7.500	0.000	144.682	-3.740	-124.485	1.00
2	7.500	0.630	143.501	-1.412	-123.596	1.00
3	7.500	1.260	141.139	3.003	-125.488	1.00
4	7.500	1.890	138.776	7.054	-129.932	1.00
5	7.500	2.520	136.414	10.743	-136.700	1.00
6	7.500	3.150	134.051	14.069	-145.564	1.00
7	7.500	3.780	131.689	17.033	-156.295	1.00
8	7.500	4.410	129.326	19.635	-168.665	1.00
9	7.500	5.040	126.964	21.873	-182.445	1.00
10	7.500	5.670	124.601	23.749	-197.407	1.00
11	7.500	6.300	122.239	25.263	-213.323	1.00
12	7.500	6.350	120.962	25.944	-214.620	1.04
13	7.500	6.400	120.767	26.033	-215.922	1.08
14	7.500	6.450	120.564	26.120	-217.228	1.12
15	7.500	6.500	120.353	26.205	-218.538	1.16
16	7.500	6.550	120.134	26.287	-219.852	1.20
17	7.500	6.600	119.908	26.367	-221.171	1.24
18	7.500	6.650	119.674	26.444	-222.493	1.29
19	7.500	6.700	119.432	26.520	-223.819	1.33
20	7.500	6.750	119.182	26.593	-225.148	1.37
21	7.500	6.800	26.664	-118.925	-226.482	1.41
22	7.450	6.800	26.698	-118.363	-220.563	1.37
23	7.400	6.800	26.698	-117.504	-214.688	1.33
24	7.350	6.800	26.698	-116.652	-208.856	1.29
25	7.300	6.800	26.698	-115.808	-203.065	1.24
26	7.250	6.800	26.698	-114.972	-197.317	1.20
27	7.200	6.800	26.698	-114.144	-191.609	1.16
28	7.150	6.800	26.698	-113.324	-185.943	1.12
29	7.100	6.800	26.698	-112.511	-180.318	1.08
30	7.050	6.800	26.698	-111.706	-174.732	1.04
31	7.000	6.800	26.698	-110.909	-169.187	1.00
32	6.300	6.800	26.698	-104.987	-95.696	1.00
33	5.600	6.800	26.698	-93.936	-29.941	1.00
34	4.900	6.800	26.698	-82.884	28.078	1.00

35	4.200	6.800	26.698	-71.833	78.361	1.000
36	3.500	6.800	26.698	-60.782	120.908	1.000
37	2.800	6.800	26.698	-49.731	155.720	1.000
38	2.100	6.800	26.698	-38.679	182.795	1.000
39	1.400	6.800	26.698	-27.628	202.135	1.000
40	0.700	6.800	26.698	-16.577	213.739	1.000
41	0.000	6.800	26.698	-5.526	217.607	1.000

R = 0.14468E+03 M = -.12449E+03 H = -.37395E+01 V = 0.16327E-01m

LONGITUD DEL SEMIARCO = 14.300 LONGITUD DE TRANSPORTE = 10.124

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
7.500	10.136	-1.897	124.485	144.683	50.679
6.750	8.654	-2.027	29.544	109.421	43.271
6.000	7.131	-2.014	-41.066	79.826	35.657
5.250	5.660	-1.896	-91.607	55.870	28.299
4.500	4.306	-1.705	-126.202	37.230	21.528
3.750	3.114	-1.465	-148.649	23.373	15.572
3.000	2.115	-1.195	-162.291	13.631	10.576
2.250	1.327	-0.906	-169.935	7.246	6.633
1.500	0.758	-0.608	-173.797	3.406	3.792
0.750	0.416	-0.305	-175.472	1.275	2.081
0.000	0.302	0.000	-175.923	0.000	1.509

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	7.500	0.000	7.500	16.380	0.000
2	7.500	0.630	7.500	17.156	0.000
3	7.500	1.260	7.500	17.955	0.000
4	7.500	1.890	7.500	19.507	0.000
5	7.500	2.520	7.500	21.753	0.000
6	7.500	3.150	7.500	24.636	0.000
7	7.500	3.780	7.500	28.104	0.000
8	7.500	4.410	7.500	32.106	0.000
9	7.500	5.040	7.500	36.591	0.000
10	7.500	5.670	7.500	41.576	0.000
11	7.500	6.300	7.500	46.941	0.000
12	7.500	6.350	7.810	44.163	0.000
13	7.500	6.400	8.121	41.628	0.000
14	7.500	6.450	8.431	39.401	0.000

15	7.500	6.500	8.742	37.392	0.000
16	7.500	6.550	9.052	35.570	0.000
17	7.500	6.600	9.363	33.910	0.000
18	7.500	6.650	9.674	32.390	0.000
19	7.500	6.700	9.984	30.993	0.000
20	7.500	6.750	10.294	29.705	0.000
21	7.500	6.800	10.605	38.505	12.871
22	7.450	6.800	10.294	38.742	13.415
23	7.400	6.800	9.984	39.009	13.932
24	7.350	6.800	9.674	39.305	14.484
25	7.300	6.800	9.363	39.635	15.073
26	7.250	6.800	9.052	40.001	15.705
27	7.200	6.800	8.742	40.408	16.383
28	7.150	6.800	8.431	40.863	17.112
29	7.100	6.800	8.121	41.371	17.898
30	7.050	6.800	7.810	41.941	18.748
31	7.000	6.800	7.500	42.583	19.670
32	6.300	6.800	7.500	21.901	19.182
33	5.600	6.800	7.500	7.500	16.933
34	4.900	6.800	7.500	7.500	13.888
35	4.200	6.800	17.216	7.500	10.305
36	3.500	6.800	28.838	7.500	6.616
37	2.800	6.800	38.683	7.500	3.026
38	2.100	6.800	46.579	7.500	0.000
39	1.400	6.800	52.359	7.500	0.000
40	0.700	6.800	55.887	7.500	0.000
41	0.000	6.800	57.073	7.500	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	7.500	-0.600	26.742	9.000	23.234
2	6.750	-0.600	9.000	9.000	16.004
3	6.000	-0.600	9.000	10.904	9.168
4	5.250	-0.600	9.000	19.529	3.309
5	4.500	-0.600	9.000	27.122	0.000
6	3.750	-0.600	9.000	32.121	0.000
7	3.000	-0.600	9.000	35.191	0.000
8	2.250	-0.600	9.000	36.921	0.000
9	1.500	-0.600	9.000	37.798	0.000
10	0.750	-0.600	9.000	38.179	0.000
11	0.000	-0.600	9.000	38.282	0.000

HIPOTESIS IV

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO 1

Referencia ..... : LA CARTUJA

Fecha ..... : 15-10-97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON		=	2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON	fck	=	250 Kp/cm²
COEFICIENTE DE MINORACION DE fck	¥c	=	1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO	fyk	=	5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk	¥s	=	1.15
RECUBRIMIENTO DE LAS ARMADURAS	c	=	4 cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	8.30 m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03 t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.45
SOBRECARGA q	=	4.98 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.50

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 2.03 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 1.20 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	7.500	0.000	144.682	-13.626	-130.201	1.000
2	7.500	0.630	143.501	-10.134	-123.816	1.000
3	7.500	1.260	141.139	-3.513	-121.603	1.000
4	7.500	1.890	138.776	2.564	-123.219	1.000
5	7.500	2.520	136.414	8.098	-128.320	1.000
6	7.500	3.150	134.051	13.087	-136.565	1.000
7	7.500	3.780	131.689	17.533	-147.611	1.000
8	7.500	4.410	129.326	21.435	-161.115	1.000
9	7.500	5.040	126.964	24.793	-176.734	1.000
10	7.500	5.670	124.601	27.607	-194.127	1.000
11	7.500	6.300	122.239	29.878	-212.950	1.000
12	7.500	6.350	120.962	30.899	-214.495	1.041
13	7.500	6.400	120.767	31.033	-216.046	1.083
14	7.500	6.450	120.564	31.163	-217.605	1.124
15	7.500	6.500	120.353	31.290	-219.169	1.166
16	7.500	6.550	120.134	31.413	-220.740	1.207
17	7.500	6.600	119.908	31.533	-222.316	1.248
18	7.500	6.650	119.674	31.650	-223.899	1.290
19	7.500	6.700	119.432	31.763	-225.487	1.331
20	7.500	6.750	119.182	31.872	-227.081	1.373
21	7.500	6.800	31.978	-118.925	-228.680	1.414
22	7.450	6.800	32.030	-118.363	-222.761	1.373
23	7.400	6.800	32.030	-117.504	-216.886	1.331
24	7.350	6.800	32.030	-116.652	-211.054	1.290
25	7.300	6.800	32.030	-115.808	-205.263	1.248
26	7.250	6.800	32.030	-114.972	-199.515	1.207
27	7.200	6.800	32.030	-114.144	-193.807	1.166
28	7.150	6.800	32.030	-113.324	-188.141	1.124
29	7.100	6.800	32.030	-112.511	-182.516	1.083
30	7.050	6.800	32.030	-111.706	-176.930	1.041
31	7.000	6.800	32.030	-110.909	-171.385	1.000
32	6.300	6.800	32.030	-104.987	-97.894	1.000
33	5.600	6.800	32.030	-93.936	-32.139	1.000
34	4.900	6.800	32.030	-82.884	25.880	1.000

35	4.200	6.800	32.030	-71.833	76.163	1.000
36	3.500	6.800	32.030	-60.782	118.710	1.000
37	2.800	6.800	32.030	-49.731	153.522	1.000
38	2.100	6.800	32.030	-38.679	180.597	1.000
39	1.400	6.800	32.030	-27.628	199.937	1.000
40	0.700	6.800	32.030	-16.577	211.541	1.000
41	0.000	6.800	32.030	-5.526	215.409	1.000

R = 0.14468E+03 M = -.13020E+03 H = -.13626E+02 V = 0.16080E-01m

LONGITUD DEL SEMIARCO = 14.300 LONGITUD DE TRANSPORTE = 10.124

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
7.500	10.008	-1.835	130.201	144.682	50.039
6.750	8.569	-1.975	35.101	109.819	42.844
6.000	7.081	-1.971	-35.911	80.476	35.407
5.250	5.638	-1.862	-86.995	56.652	28.192
4.500	4.307	-1.679	-122.196	38.048	21.535
3.750	3.133	-1.445	-145.245	24.152	15.665
3.000	2.147	-1.180	-159.439	14.314	10.735
2.250	1.368	-0.896	-167.546	7.791	6.839
1.500	0.806	-0.601	-171.755	3.785	4.029
0.750	0.467	-0.302	-173.646	1.468	2.335
0.000	0.354	-0.000	-174.170	0.000	1.769

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	7.500	0.000	7.500	17.979	0.000
2	7.500	0.630	7.500	17.221	0.000
3	7.500	1.260	7.500	16.814	0.000
4	7.500	1.890	7.500	17.532	0.000
5	7.500	2.520	7.500	19.274	0.000
6	7.500	3.150	7.500	21.953	0.000
7	7.500	3.780	7.500	25.487	0.000
8	7.500	4.410	7.500	29.800	0.000
9	7.500	5.040	7.500	34.819	0.000
10	7.500	5.670	7.500	40.524	0.000
11	7.500	6.300	7.500	46.819	0.000
12	7.500	6.350	7.810	44.124	0.000
13	7.500	6.400	8.121	41.663	0.000
14	7.500	6.450	8.431	39.503	0.000

15	7.500	6.500	8.742	37.554	0.000
16	7.500	6.550	9.052	35.786	0.000
17	7.500	6.600	9.363	34.176	0.000
18	7.500	6.650	9.674	32.702	0.000
19	7.500	6.700	9.984	31.349	0.000
20	7.500	6.750	10.294	30.101	0.000
21	7.500	6.800	10.605	38.343	12.878
22	7.450	6.800	10.294	38.595	13.421
23	7.400	6.800	9.984	38.880	13.938
24	7.350	6.800	9.674	39.196	14.488
25	7.300	6.800	9.363	39.547	15.077
26	7.250	6.800	9.052	39.936	15.708
27	7.200	6.800	8.742	40.368	16.385
28	7.150	6.800	8.431	40.851	17.112
29	7.100	6.800	8.121	41.389	17.897
30	7.050	6.800	7.810	41.993	18.745
31	7.000	6.800	7.500	42.673	19.665
32	6.300	6.800	7.500	21.900	19.182
33	5.600	6.800	7.500	7.500	16.933
34	4.900	6.800	7.500	7.500	13.888
35	4.200	6.800	16.015	7.500	10.371
36	3.500	6.800	27.639	7.500	6.683
37	2.800	6.800	37.487	7.500	3.092
38	2.100	6.800	45.385	7.500	0.000
39	1.400	6.800	51.167	7.500	0.000
40	0.700	6.800	54.696	7.500	0.000
41	0.000	6.800	55.882	7.500	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	7.500	-0.600	28.008	9.000	23.176
2	6.750	-0.600	9.565	9.000	16.069
3	6.000	-0.600	9.000	9.752	9.369
4	5.250	-0.600	9.000	18.527	3.534
5	4.500	-0.600	9.000	26.236	0.000
6	3.750	-0.600	9.000	31.359	0.000
7	3.000	-0.600	9.000	34.547	0.000
8	2.250	-0.600	9.000	36.379	0.000
9	1.500	-0.600	9.000	37.334	0.000
10	0.750	-0.600	9.000	37.764	0.000
11	0.000	-0.600	9.000	37.883	0.000

CARACTERISTICAS MECANICAS, REQUERIDAS Y DISPUESTAS

PISO INFERIOR "LA CACIQUE"

2¢3 Ø25/0.125 x Ø20/0.20

ARTESONADA EXTERIOR

124°24

110°04

Ø25/0.25

53°26

Ø25/0.375 x Ø10/0.25

78°11

203°23

39°35

162°27

114°15

Ø25/0.125

74°43

Ø25/0.20

Ø25/0.20 x Ø20/0.20

142°31

Ø25/0.20

35°26

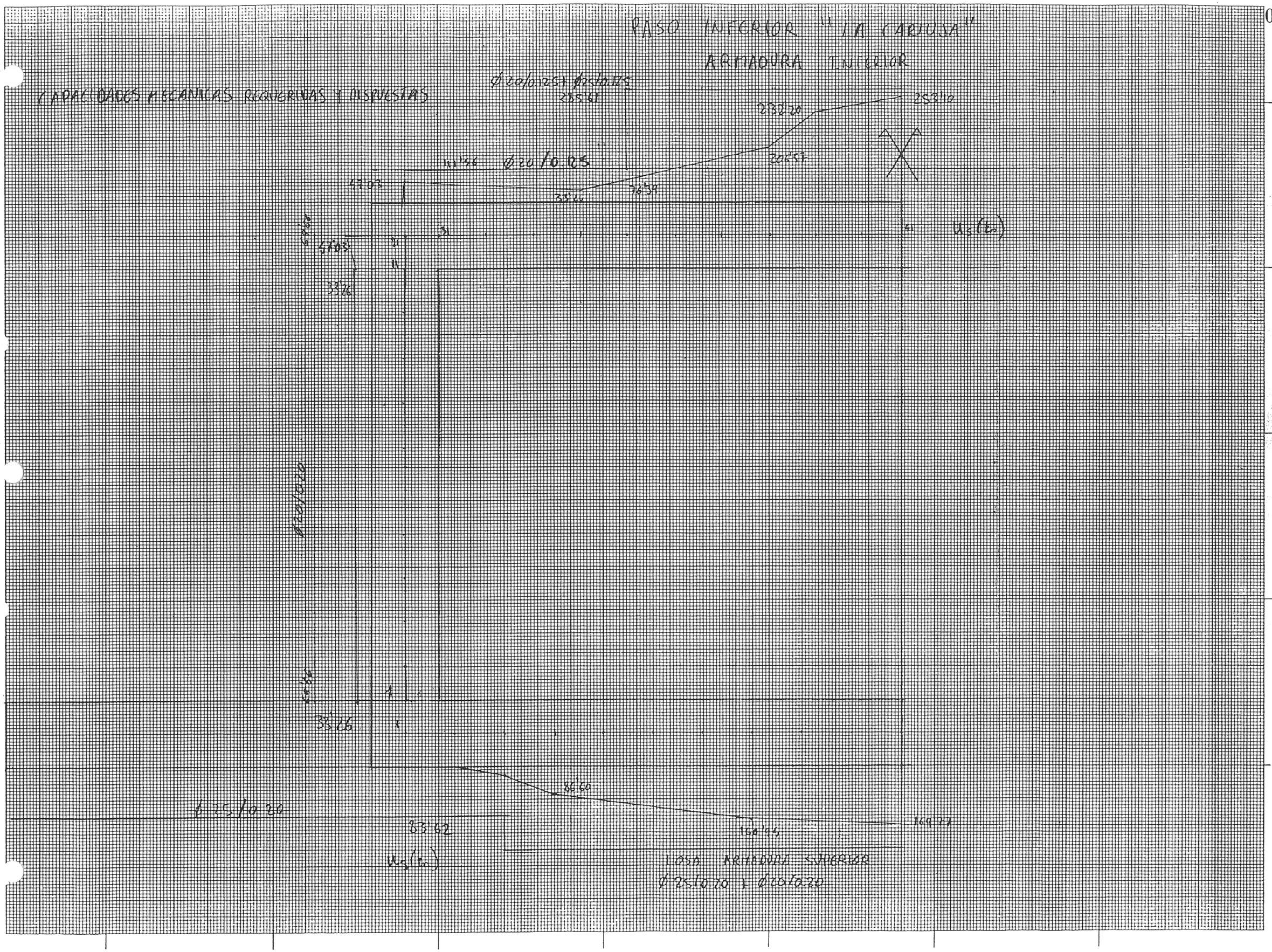
102°56

N° 308 DIN. A. 3 "EXAKTOR" MARCA REGISTRADA

CARACTERÍSTICAS MECÁNICAS REQUERIDAS Y DISPUESTAS

PASO INFERIOR "LA CARTUJA"

ARMADURA INFERIOR



Nº 308 DIN, A. 3 "EXAKTOR" MARCA REGISTRADA

PASOS INFERIORES (P.K. 9+917; P.K. 10+835; P.K. 13+595; y P.K. 13+932)

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    - Cargas consideradas
    - Hipótesis de carga
    - Envolvente de armaduras
- PÓRTICO P.K. 10+835
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  - Generalidades
  - Anejo de cálculo
    - Sección I
    - Sección II
    - Sección III

L.A.V. ZARAGOZA - LLEIDA
SUBTRAMO-I

PASOS INFERIORES P.K. 9+917; P.K. 10+835 P.K. 13+595 Y P.K. 13+932

GENERALIDADES.

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Unión Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción EH- 91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- En Limpieza y nivelación. . . . . $f_{CK} \geq 125$ kp/cm^2
- En Marcos. . . . . $f_{CK} \geq 250$ kp/cm^2
- Coeficiente de seguridad. . . . . $\gamma_c = 1,5$

Armaduras pasivas

- Límite elástico $\geq$ 5100 kp/cm^2
- Coeficiente de seguridad $\gamma_s = 1.15$

Cargas

- Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

Características del terreno

- Tensión admisible de cimentación 2,5 kgr/cm^2
- Densidad de tierras: 1,90 t/m^3
- Empuje de tierras: λ activo = 0,30
  λ reposo = 0,45
- Módulo de deformación: 5000 t/m^3

3.- Criterios generales de cálculo

Para el cálculo de los pórticos se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

En el cálculo se han considerado cuatro hipótesis de carga diferentes:

1.- Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel.
2.- Empuje máximo, sobrecarga mínima.
3.- Empuje mínimo, sobrecarga máxima.
4.- Empuje máximo, sobrecarga máxima.

La obtención de los esfuerzos en la sección transversal del Pórtico, se ha realizado con la ayuda de un programa de cálculo matricial, mediante la discretización de la estructura en barras, basado en el método de la rigidez.

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura dado que los pórticos van a estar cubiertos por las tierras.

El módulo de deformación del terreno adoptado, ha sido de 5000 t/m^3, teniendo en cuenta que el tipo de terreno a colocar bajo la solera del Pórtico se trata de un material granular, tipo zahorra natural procedente de la 2ª terraza del Ebro (préstamo denominado Acampo del Marqués de Ayerbe), que se corresponde con un valor del coeficiente de balasto de tipo medio, análogo a valores utilizados en multitud de cálculos similares al que nos ocupa y sabiendo, además, que una variación razonable de este módulo en ± 1000 t/m^3 va a influir muy poco en la distribución de los esfuerzos en la estructura.

Los posibles desplazamientos originados por las fuerzas horizontales -frenados, fuerza centrífuga- se consideran impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierras bajo la solera para un coeficiente de balasto medio.

No se considera en los cálculos la acción sísmica, ya que según la "Norma de Construcción Sismorresistente N.C.S.E.-94", las obras se encuentran en una zona con aceleración básica inferior a "0,04 g". Teniendo en cuenta dicho valor y un coeficiente de riesgo de 1,30 (construcciones de especial importancia) resulta una aceleración sísmica de cálculo inferior a "0,052 g" < "0,06 g".

4.- Autor de los cálculos

Los cálculos de estos pasos inferiores han sido realizados por IGNACIO GRANELL VICENT.

Estos cálculos se recogen, a continuación, desde la página 1 hasta la página 60 ambas inclusive.

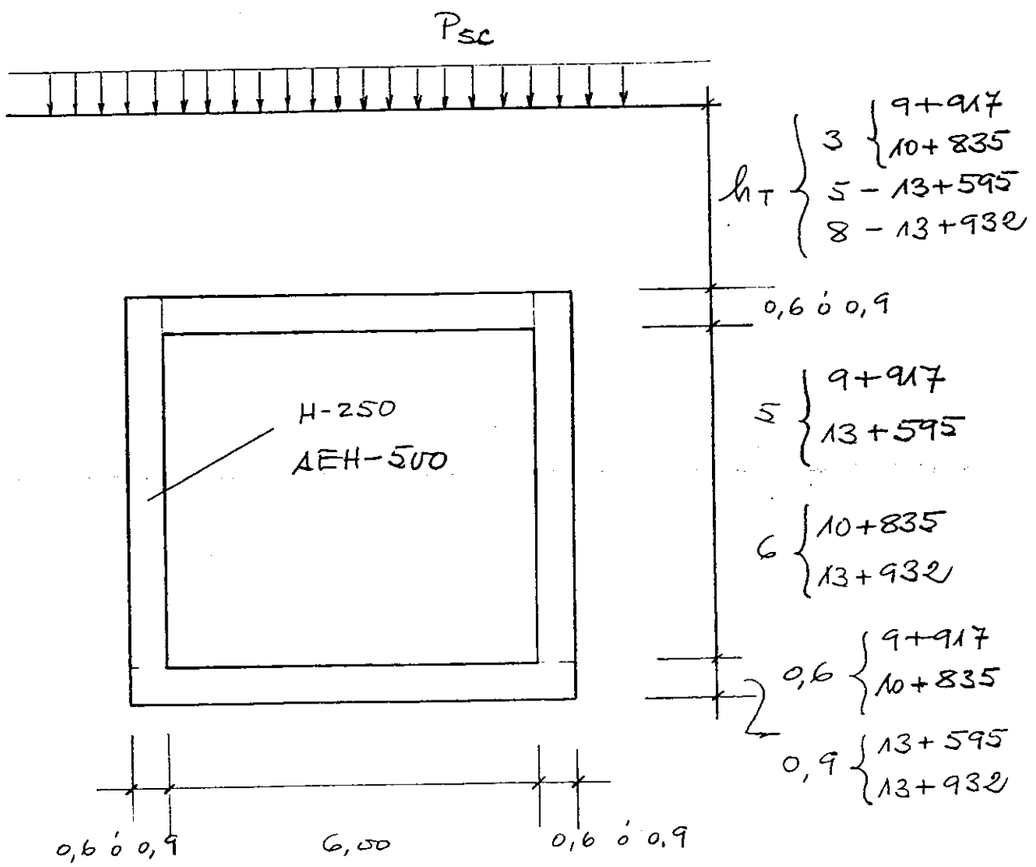
Madrid, 21 de Enero de 1997.

Fdo: IGNACIO GRANELL VICENT

OBJETO FF. CC. HOJA Nº ... DE ...
Zaragoza - Lérida PROYECTO Nº ...
CALCULADO POR ... COMPROBADO POR ... FECHA ...

PASOS INFERIORES

Esquema de Cálculo.-



- Altura de tierras de cálculo h_T
- Módulo de reacción en solera 5000 t/m³
- Tensión admisible cimentación 2,5 kg/cm²
- Densidad de tierras 1,90 t/m³
- Empuje de tierras

  λ activo = 0,30

  λ reposo = 0,45

- Sobrecarga de tráfico Psc (más desfavorable)

Tren tipo "B" Instrucción Española con reducción del coeficiente de impacto según U.I.C

$$I = 1,66 - 0,1(h_T - 1) \geq 1$$

$$Psc = \frac{2 \times 12 \times I}{2(3 + h_T)}$$

- Mayoración de acciones

$$\gamma_f = 1,6$$

PORTICO P.K. 9+917

MEMORIA DE CALCULO

INDICE GENERAL

CAJON CERRADO.

DATOS DE PROCESO
CARGAS CONSIDERADAS
HIPOTESIS DE CARGAS
ENVOLVENTE DE ARMADURAS

DATOS DE PROCESO.

1. DATOS DE ESPECIFICACION DE LAS ACTIVIDADES

DIBUJO	FERRALLA	MEMORIA	MEDICION	CANTO FIJO	SEPAR. FIJA
1	1	1	1	1	1

FACTOR DE DIBUJO	ESCALA DEL DIBUJO
1.00	50.00

2. DATOS DEL HORMIGON

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
250.00	1.50	300000.00

DENSIDAD DEL HORMIGON	RECUBRI. DE ARMADURAS
2.67	4.00

3. DATOS DEL ACERO

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
5100.00	1.15	2100000.00

4. DATOS DE LAS TIERRAS Y DEL PAVIMIENTO

COEF. DE EMPU.ACTIVO	COEF. DE EMPU.REPOSO	MODULO DE BALASTO	DENSIDAD DE LAS TIERRAS	ALTURA DE TIERRAS
0.30	0.45	5000.00	2.03	300.00

DENSIDAD DE PAVIMENTO	ALTURA DEL PAVIMENTO
0.00	10.00

5. GEOMETRIA DEL PORTICO

ANCHO EN CM	ALTO EN	LARGO EN CM
600.00	500.00	1000.00

KDIN	KSOL	KSOP	
0	0	0	1

D0 EN CM	D1 EN CM	D2 EN CM
60.00	0.00	0.00

H0 EN CM	H1 EN CM	H2 EN CM	H3 EN CM	H4 EN CM
60.00	0.00	0.00	0.00	0.00

S0 EN CM	S1 EN CM	S2 EN CM
60.00	0.00	0.00

CANTO EN CM	SEPARACION DE BARRAS
60.00	20.00

6. DATOS DEL TREN DE CARGA

DIST-1	DIST-2	ISOBREC. UNIFI
0.00	0.00	3.12

7. DATOS DE LA ALETA IZQUIERDA

TIPO DE ALETA 0

8. DATOS DE LA ALETA DERECHA

TIPO DE ALETA 0

CARGAS CONSIDERADAS.

CARGAS

1. CARGAS PERMANENTES

   PESO PROPIO -DENSIDAD DEL HORMIGON- 2.67 T/M3

2. SOBRECARGAS

   TREN TIPO DE LA INSTRUCCION FERROCARRILES 3.12 T/M2

3. TERRENO

ALTURA DE TIERRAS	300.00 CM
DENSIDAD DE LAS TIERRAS	2.03 T/M3
COEFICIENTE DE EMPUJE ACTIVO	0.30
COEFICIENTE DE EMPUJE REPOSO	0.45

PARA EL CALCULO DE LOS ESFUERZOS EN EL PORTICO SE HAN CONSIDERADO DESPRECIABLES LOS EFECTOS DE RETRACCION Y TEMPERATURA DEBIDO A ESTAR EL PORTICO CUBIERTO POR LAS TIERRAS.

LOS POSIBLES DESPLAZAMIENTOS ORIGINADOS POR LAS FUERZAS HORIZONTALES -FRENADO,FUERZA CENTRIFUGA- SE CONSIDERAN IMPEDIDOS POR LA REACCION DE LAS TIERRAS, EN CONSECUENCIA EL PORTICO SE CALCULA COMO INTRASLACIONAL TENIENDO EN CUENTA LA DEFORMACION DE LAS TIERRAS BAJO LA SOLERA PARA UN COEFICIENTE DE BALASTO MEDIO.

HIPOTESIS CONSIDERADAS

SE HAN CONSIDERADO CUATRO HIPOTESIS DE CARGA:

1. TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL.
2. EMPUJE MAXIMO, SOBRECARGA MINIMA.
3. EMPUJE MINIMO, SOBRECARGA MAXIMA.
4. EMPUJE MAXIMO, SOBRECARGA MAXIMA.

HIPOTESIS DE CARGAS

PRIMERA HIPOTESIS
TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	4.76	11.48	13.78	0.00	37.33	1	0.00
-0.12	4.82	0.08	-0.87	0.00	0.28	1	0.00
0.24	4.71	8.88	11.19	0.00	32.11	1	0.00
0.60	4.50	5.15	9.53	0.00	18.53	1	0.00
0.96	4.22	2.01	7.95	0.00	7.18	1	0.00
1.32	3.92	-0.59	6.49	2.11	0.00	1	0.00
1.68	3.62	-2.68	5.13	9.61	0.00	1	0.00
2.04	3.36	-4.30	3.88	15.46	0.00	1	0.00
2.40	3.14	-5.49	2.71	19.75	0.00	1	0.00
2.76	2.99	-6.26	1.61	22.57	0.00	1	0.00
3.12	3.00	-6.65	0.55	23.99	0.00	1	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	13.78	-11.48	-12.56	0.00	34.89	1	0.00
0.56	13.36	-2.90	-7.98	0.00	3.35	1	0.00
1.12	12.46	0.80	-5.27	0.00	0.00	1	0.00
1.68	11.57	3.06	-2.86	4.88	0.00	1	0.00
2.24	10.67	4.05	-0.73	8.97	0.00	1	0.00
2.80	9.77	3.93	1.11	9.00	0.00	1	0.00
3.36	8.88	2.86	2.67	5.59	0.00	1	0.00
3.92	7.98	1.00	3.93	0.00	0.00	1	0.00
4.48	7.08	-1.49	4.92	0.00	1.56	1	0.00
5.04	6.18	-4.45	5.61	0.00	12.77	1	0.00
5.60	4.81	-6.06	5.85	0.00	19.37	1	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	5.85	-6.06	-5.29	0.00	21.82	1	0.00
0.66	5.85	-2.92	-4.23	0.00	10.46	1	0.00
1.32	5.85	-0.47	-3.17	0.00	1.69	1	0.00
1.98	5.85	1.27	-2.11	4.55	0.00	1	0.00
2.64	5.85	2.32	-1.06	8.31	0.00	1	0.00
3.30	5.85	2.67	0.00	9.56	0.00	1	0.00

SEGUNDA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MINIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	13.33	24.02	35.70	0.00	66.73	0	17.40
-0.12	13.84	0.23	-2.52	0.00	0.81	1	0.00
0.24	13.11	17.47	28.32	0.00	48.03	0	6.33
0.60	12.16	8.10	23.76	0.00	29.29	1	0.00
0.96	11.11	0.31	19.57	0.00	1.12	1	0.00
1.32	10.05	-6.04	15.77	21.76	0.00	1	0.00
1.68	9.06	-11.09	12.33	37.33	0.00	1	0.00
2.04	8.20	-14.96	9.23	40.98	0.00	0	0.00
2.40	7.52	-17.77	6.41	48.89	0.00	0	0.00
2.76	7.05	-19.61	3.80	54.08	0.00	0	0.00
3.12	7.06	-20.52	1.31	56.70	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	35.70	-24.02	-19.90	0.00	49.07	0	0.00
0.56	35.28	-10.28	-12.93	0.00	19.41	1	0.00
1.12	34.39	-4.25	-8.65	0.00	0.00	1	0.00
1.68	33.49	-0.54	-4.65	0.00	0.00	1	0.00
2.24	32.59	1.01	-0.93	0.00	0.00	1	0.00
2.80	31.70	0.55	2.50	0.00	0.00	1	0.00
3.36	30.80	-1.74	5.64	0.00	0.00	1	0.00
3.92	29.90	-5.71	8.49	0.00	5.01	1	0.00
4.48	29.00	-11.19	11.06	0.00	26.06	1	0.00
5.04	28.11	-18.04	13.34	0.00	37.33	1	0.00
5.60	26.73	-21.92	14.37	0.00	47.34	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	14.37	-21.92	-25.38	0.00	60.69	0	1.93
0.66	14.37	-6.84	-20.31	0.00	24.68	1	0.00
1.32	14.37	4.88	-15.23	17.57	0.00	1	0.00
1.98	14.37	13.26	-10.15	37.33	0.00	1	0.00
2.64	14.37	18.29	-5.08	50.34	0.00	0	0.00
3.30	14.37	19.96	0.00	55.10	0.00	0	0.00

TERCERA HIPOTESIS
EMPUJE MINIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	18.67	24.99	46.92	0.00	69.52	0	34.22
-0.12	19.76	0.33	-3.62	0.00	1.16	1	0.00
0.24	18.26	16.60	36.44	0.00	45.58	0	18.51
0.60	16.56	4.63	30.17	0.00	16.64	1	9.10
0.96	14.79	-5.20	24.52	18.72	0.00	1	0.64
1.32	13.08	-13.12	19.51	37.33	0.00	1	0.00
1.68	11.53	-19.33	15.09	53.30	0.00	0	0.00
2.04	10.21	-24.05	11.19	66.81	0.00	0	0.00
2.40	9.17	-27.44	7.71	76.66	0.00	0	0.00
2.76	8.47	-29.65	4.55	83.11	0.00	0	0.00
3.12	8.48	-30.75	1.58	86.35	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	46.92	-24.99	-12.03	0.00	46.47	0	0.00
0.56	46.50	-16.75	-7.64	0.00	37.33	1	0.00
1.12	45.60	-13.24	-4.95	0.00	25.55	1	0.00
1.68	44.70	-11.17	-2.46	0.00	18.05	1	0.00
2.24	43.81	-10.45	-0.15	0.00	15.74	1	0.00
2.80	42.91	-10.96	1.96	0.00	18.16	1	0.00
3.36	42.01	-12.61	3.89	0.00	24.92	1	0.00
3.92	41.12	-15.28	5.62	0.00	35.70	1	0.00
4.48	40.22	-18.86	7.16	0.00	37.33	1	0.00
5.04	39.32	-23.26	8.51	0.00	45.05	0	0.00
5.60	37.94	-25.73	9.11	0.00	53.02	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	9.11	-25.73	-35.66	0.00	71.67	0	17.35
0.66	9.11	-4.55	-28.53	0.00	16.34	1	6.65
1.32	9.11	11.93	-21.40	37.33	0.00	1	0.00
1.98	9.11	23.70	-14.27	65.80	0.00	0	0.00
2.64	9.11	30.76	-7.13	86.40	0.00	0	0.00
3.30	9.11	33.12	0.00	93.37	0.00	0	0.00

CUARTA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MAXIMA

SOLERA DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	17.73	30.37	46.92	0.00	85.25	0	34.22
-0.12	18.48	0.30	-3.37	0.00	1.08	1	0.00
0.24	17.42	21.80	37.07	0.00	60.35	0	19.46
0.60	16.08	9.56	31.03	0.00	34.61	1	10.40
0.96	14.63	-0.61	25.50	2.18	0.00	1	2.10
1.32	13.18	-8.88	20.50	32.12	0.00	1	0.00
1.68	11.84	-15.44	16.00	42.31	0.00	0	0.00
2.04	10.67	-20.46	11.96	56.51	0.00	0	0.00
2.40	9.76	-24.10	8.29	66.95	0.00	0	0.00
2.76	9.12	-26.47	4.91	73.82	0.00	0	0.00
3.12	9.14	-27.66	1.70	77.28	0.00	0	0.00

HASTIAL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	46.92	-30.37	-23.52	0.00	62.66	0	0.00
0.56	46.50	-14.08	-15.37	0.00	28.39	1	0.00
1.12	45.60	-6.91	-10.30	0.00	1.42	1	0.00
1.68	44.70	-2.49	-5.52	0.00	0.00	1	0.00
2.24	43.81	-0.67	-1.02	0.00	0.00	1	0.00
2.80	42.91	-1.30	3.19	0.00	0.00	1	0.00
3.36	42.01	-4.20	7.12	0.00	0.00	1	0.00
3.92	41.12	-9.22	10.76	0.00	12.43	1	0.00
4.48	40.22	-16.19	14.11	0.00	37.33	1	0.00
5.04	39.32	-24.97	17.18	0.00	50.10	0	0.00
5.60	37.94	-29.98	18.60	0.00	65.74	0	0.00

DINTEL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	18.60	-29.98	-35.66	0.00	84.10	0	17.35
0.66	18.60	-8.80	-28.53	0.00	31.83	1	6.65
1.32	18.60	7.68	-21.40	27.73	0.00	1	0.00
1.98	18.60	19.45	-14.27	53.63	0.00	0	0.00
2.64	18.60	26.51	-7.13	73.93	0.00	0	0.00
3.30	18.60	28.86	0.00	80.81	0.00	0	0.00

ENVOLVENTE DE ARMADURA

CORTANTE	CANTO 60. DISTANCIA	U.INTERIOR	U.EXTERIOR
SOLERA			
34.22	0.00	0.00	85.25
17.20	33.00	0.00	53.92
9.02	66.00	3.12	30.04
1.93	99.00	20.27	6.59
0.00	132.00	37.33	0.00
0.00	165.00	51.97	0.00
0.00	198.00	64.56	0.00
0.00	231.00	74.20	0.00
0.00	264.00	80.96	0.00
0.00	297.00	85.00	0.00
0.00	330.00	87.98	0.00
HASTIAL			
0.00	0.00	0.00	62.66
0.00	56.00	0.00	37.33
0.00	112.00	0.00	25.55
0.00	168.00	4.88	18.05
0.00	224.00	8.97	15.74
0.00	280.00	9.00	18.16
0.00	336.00	5.59	24.92
0.00	392.00	0.00	35.70
0.00	448.00	0.00	37.33
0.00	504.00	0.00	50.10
0.00	560.00	0.00	65.74
DINTEL			
17.35	0.00	0.00	84.10
6.65	66.00	0.00	31.83
0.00	132.00	37.33	1.69
0.00	198.00	65.80	0.00
0.00	264.00	86.40	0.00
0.00	330.00	93.37	0.00

PORTICO P.K. 10+835

018

MEMORIA DE CALCULO

INDICE GENERAL

CAJON CERRADO.

DATOS DE PROCESO
CARGAS CONSIDERADAS
HIPOTESIS DE CARGAS
ENVOLVENTE DE ARMADURAS

DATOS DE PROCESO.

020

1. DATOS DE ESPECIFICACION DE LAS ACTIVIDADES

DIBUJO	FERRALLA	MEMORIA	MEDICION	CANTO FIJO	SEPAR. FIJA
1	1	1	1	1	1

FACTOR DE DIBUJO	ESCALA DEL DIBUJO
1.00	50.00

2. DATOS DEL HORMIGON

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
250.00	1.50	300000.00

DENSIDAD DEL HORMIGON	RECUBRI. DE ARMADURAS
2.67	4.00

3. DATOS DEL ACERO

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
5100.00	1.15	2100000.00

4. DATOS DE LAS TIERRAS Y DEL PAVIMIENTO

COEF. DE EMPU.ACTIVO	COEF. DE EMPU.REPOSO	MODULO DE BALASTO	DENSIDAD DE LAS TIERRAS	ALTURA DE TIERRAS
0.30	0.45	5000.00	2.03	300.00

DENSIDAD DE PAVIMENTO	ALTURA DEL PAVIMENTO
0.00	10.00

5. GEOMETRIA DEL PORTICO

I ANCHO EN CM I	I ALTO EN I	I LARGO EN CM I
I 600.00 I	600.00 I	1000.00 I

I KDIN I	I KSOL I	I KSOP I	
I 0 I	0 I	0 I	1 I

I D0 EN CM I	I D1 EN CM I	I D2 EN CM I
I 60.00 I	0.00 I	0.00 I

I H0 EN CM I	I H1 EN CM I	I H2 EN CM I	I H3 EN CM I	I H4 EN CM I
I 60.00 I	0.00 I	0.00 I	0.00 I	0.00 I

I S0 EN CM I	I S1 EN CM I	I S2 EN CM I
I 60.00 I	0.00 I	0.00 I

I CANTO EN CM I	I SEPARACION DE BARRAS I
I 60.00 I	20.00 I

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6. DATOS DEL TREN DE CARGA

I DIST-1 I	I DIST-2 I	ISOBREC. UNIFI I
I 0.00 I	0.00 I	3.12 I

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7. DATOS DE LA ALETA IZQUIERDA

TIPO DE ALETA 0

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8. DATOS DE LA ALETA DERECHA

TIPO DE ALETA 0

CARGAS CONSIDERADAS.

CARGAS

1. CARGAS PERMANENTES

   PESO PROPIO -DENSIDAD DEL HORMIGON- 2.67 T/M3

2. SOBRECARGAS

   TREN TIPO DE LA INSTRUCCION FERROCARRILES 3.12 T/M2

3. TERRENO

ALTURA DE TIERRAS	300.00 CM
DENSIDAD DE LAS TIERRAS	2.03 T/M3
COEFICIENTE DE EMPUJE ACTIVO	0.30
COEFICIENTE DE EMPUJE REPOSO	0.45

PARA EL CALCULO DE LOS ESFUERZOS EN EL PORTICO SE HAN CONSIDERADO DESPRECIABLES LOS EFECTOS DE RETRACCION Y TEMPERATURA DEBIDO A ESTAR EL PORTICO CUBIERTO POR LAS TIERRAS.

LOS POSIBLES DESPLAZAMIENTOS ORIGINADOS POR LAS FUERZAS HORIZONTALES -FRENADO,FUERZA CENTRIFUGA- SE CONSIDERAN IMPEDIDOS POR LA REACCION DE LAS TIERRAS, EN CONSECUENCIA EL PORTICO SE CALCULA COMO INTRASLACIONAL TENIENDO EN CUENTA LA DEFORMACION DE LAS TIERRAS BAJO LA SOLERA PARA UN COEFICIENTE DE BALASTO MEDIO.

HIPOTESIS CONSIDERADAS

SE HAN CONSIDERADO CUATRO HIPOTESIS DE CARGA:

1. TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL.
2. EMPUJE MAXIMO, SOBRECARGA MINIMA.
3. EMPUJE MINIMO, SOBRECARGA MAXIMA.
4. EMPUJE MAXIMO, SOBRECARGA MAXIMA.

HIPOTESIS DE CARGAS

PRIMERA HIPOTESIS
TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	4.86	15.36	15.38	0.00	42.08	0	0.00
-0.12	4.77	0.08	-0.85	0.00	0.27	1	0.00
0.24	4.86	12.36	12.79	0.00	37.33	1	0.00
0.60	4.80	8.07	11.04	0.00	29.18	1	0.00
0.96	4.64	4.41	9.34	0.00	15.84	1	0.00
1.32	4.42	1.34	7.71	0.00	4.79	1	0.00
1.68	4.18	-1.16	6.16	4.13	0.00	1	0.00
2.04	3.96	-3.11	4.69	11.15	0.00	1	0.00
2.40	3.78	-4.55	3.30	16.34	0.00	1	0.00
2.76	3.65	-5.49	1.97	19.78	0.00	1	0.00
3.12	3.66	-5.97	0.67	21.50	0.00	1	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	15.38	-15.36	-16.77	0.00	37.33	1	0.00
0.66	14.80	-1.92	-10.52	0.00	0.00	1	0.00
1.32	13.75	3.79	-6.86	6.41	0.00	1	0.00
1.98	12.69	7.22	-3.59	19.55	0.00	1	0.00
2.64	11.63	8.62	-0.72	25.30	0.00	1	0.00
3.30	10.57	8.26	1.75	24.50	0.00	1	0.00
3.96	9.52	6.40	3.82	18.17	0.00	1	0.00
4.62	8.46	3.30	5.50	7.39	0.00	1	0.00
5.28	7.40	-0.77	6.78	0.00	0.00	1	0.00
5.94	6.34	-5.56	7.66	0.00	16.74	1	0.00
6.60	4.81	-8.14	7.95	0.00	27.03	1	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	7.95	-8.14	-5.29	0.00	29.41	1	0.00
0.66	7.95	-5.00	-4.23	0.00	17.98	1	0.00
1.32	7.95	-2.55	-3.17	0.00	9.16	1	0.00
1.98	7.95	-0.81	-2.11	0.00	2.90	1	0.00
2.64	7.95	0.24	-1.06	0.85	0.00	1	0.00
3.30	7.95	0.59	0.00	2.09	0.00	1	0.00

SEGUNDA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MINIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	13.24	29.05	37.30	0.00	81.35	0	19.81
-0.12	13.53	0.22	-2.45	0.00	0.79	1	0.00
0.24	13.08	22.06	30.05	0.00	61.10	0	8.93
0.60	12.36	12.08	25.46	0.00	37.33	1	2.05
0.96	11.49	3.69	21.17	0.00	13.26	1	0.00
1.32	10.57	-3.21	17.20	11.50	0.00	1	0.00
1.68	9.69	-8.73	13.55	31.59	0.00	1	0.00
2.04	8.91	-13.00	10.21	37.33	0.00	1	0.00
2.40	8.28	-16.12	7.12	44.23	0.00	0	0.00
2.76	7.85	-18.16	4.23	49.98	0.00	0	0.00
3.12	7.86	-19.18	1.45	52.87	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	37.30	-29.05	-25.66	0.00	63.24	0	2.34
0.66	36.73	-8.20	-16.61	0.00	10.81	1	0.00
1.32	35.67	0.92	-11.08	0.00	0.00	1	0.00
1.98	34.61	6.51	-5.94	5.58	0.00	1	0.00
2.64	33.55	8.85	-1.20	14.88	0.00	1	0.00
3.30	32.50	8.18	3.14	12.93	0.00	1	0.00
3.96	31.44	4.79	7.08	0.82	0.00	1	0.00
4.62	30.38	-1.08	10.63	0.00	0.00	1	0.00
5.28	29.33	-9.15	13.78	0.00	18.19	1	0.00
5.94	28.27	-19.17	16.52	0.00	38.61	0	0.00
6.60	26.73	-24.83	17.75	0.00	55.85	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	17.75	-24.83	-25.38	0.00	69.07	0	1.93
0.66	17.75	-9.75	-20.31	0.00	35.33	1	0.00
1.32	17.75	1.97	-15.23	7.07	0.00	1	0.00
1.98	17.75	10.35	-10.15	37.33	0.00	1	0.00
2.64	17.75	15.38	-5.08	42.14	0.00	0	0.00
3.30	17.75	17.05	0.00	46.85	0.00	0	0.00

TERCERA HIPOTESIS
EMPUJE MINIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	19.02	27.52	48.52	0.00	76.87	0	36.63
-0.12	20.04	0.33	-3.67	0.00	1.18	1	0.00
0.24	18.63	18.79	37.88	0.00	51.76	0	20.67
0.60	16.98	6.32	31.47	0.00	22.77	1	11.05
0.96	15.25	-3.95	25.67	14.20	0.00	1	2.35
1.32	13.56	-12.25	20.48	37.33	0.00	1	0.00
1.68	12.02	-18.78	15.89	51.74	0.00	0	0.00
2.04	10.70	-23.76	11.81	65.96	0.00	0	0.00
2.40	9.67	-27.34	8.16	76.36	0.00	0	0.00
2.76	8.96	-29.67	4.82	83.18	0.00	0	0.00
3.12	8.97	-30.84	1.67	86.62	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	48.52	-27.52	-15.81	0.00	53.26	0	0.00
0.66	47.94	-14.75	-10.08	0.00	30.27	1	0.00
1.32	46.88	-9.26	-6.59	0.00	9.68	1	0.00
1.98	45.83	-5.99	-3.37	0.00	0.00	1	0.00
2.64	44.77	-4.76	-0.41	0.00	0.00	1	0.00
3.30	43.71	-5.39	2.28	0.00	0.00	1	0.00
3.96	42.65	-7.72	4.71	0.00	5.98	1	0.00
4.62	41.60	-11.56	6.87	0.00	21.09	1	0.00
5.28	40.54	-16.73	8.77	0.00	37.33	1	0.00
5.94	39.48	-23.08	10.40	0.00	44.43	0	0.00
6.60	37.94	-26.63	11.12	0.00	55.70	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	11.12	-26.63	-35.66	0.00	74.29	0	17.35
0.66	11.12	-5.45	-28.53	0.00	19.60	1	6.65
1.32	11.12	11.03	-21.40	37.33	0.00	1	0.00
1.98	11.12	22.80	-14.27	63.21	0.00	0	0.00
2.64	11.12	29.86	-7.13	83.74	0.00	0	0.00
3.30	11.12	32.21	0.00	90.70	0.00	0	0.00

CUARTA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	17.54	35.95	48.52	0.00	101.85	0	36.63
-0.12	18.03	0.29	-3.27	0.00	1.05	1	0.00
0.24	17.30	26.93	38.87	0.00	75.17	0	22.16
0.60	16.23	14.04	32.82	0.00	38.39	0	13.09
0.96	14.99	3.24	27.20	0.00	11.64	1	4.65
1.32	13.71	-5.61	22.03	20.19	0.00	1	0.00
1.68	12.50	-12.68	17.32	37.33	0.00	1	0.00
2.04	11.43	-18.13	13.02	49.90	0.00	0	0.00
2.40	10.58	-22.10	9.07	61.21	0.00	0	0.00
2.76	9.99	-24.70	5.38	68.68	0.00	0	0.00
3.12	10.00	-26.00	1.85	72.44	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	48.52	-35.95	-30.05	0.00	79.02	0	8.93
0.66	47.94	-11.44	-19.61	0.00	17.47	1	0.00
1.32	46.88	-0.65	-13.15	0.00	0.00	1	0.00
1.98	45.83	6.01	-7.09	0.00	0.00	1	0.00
2.64	44.77	8.80	-1.43	8.99	0.00	1	0.00
3.30	43.71	7.98	3.84	6.44	0.00	1	0.00
3.96	42.65	3.82	8.71	0.00	0.00	1	0.00
4.62	41.60	-3.42	13.18	0.00	0.00	1	0.00
5.28	40.54	-13.48	17.25	0.00	29.03	1	0.00
5.94	39.48	-26.10	20.92	0.00	53.39	0	0.00
6.60	37.94	-33.29	22.61	0.00	75.76	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	22.61	-33.29	-35.66	0.00	93.89	0	17.35
0.66	22.61	-12.10	-28.53	0.00	37.33	1	6.65
1.32	22.61	4.37	-21.40	15.71	0.00	1	0.00
1.98	22.61	16.14	-14.27	44.29	0.00	0	0.00
2.64	22.61	23.20	-7.13	64.37	0.00	0	0.00
3.30	22.61	25.56	0.00	71.17	0.00	0	0.00

ENVOLVENTE DE ARMADURA

CANTO 60.

CORTANTE	DISTANCIA	U.INTERIOR	U.EXTERIOR
SOLERA			
36.63	0.00	0.00	101.85
19.89	33.00	0.00	65.97
11.68	66.00	2.37	34.63
4.26	99.00	16.12	14.92
0.00	132.00	37.33	4.79
0.00	165.00	50.54	0.40
0.00	198.00	63.59	0.00
0.00	231.00	73.76	0.00
0.00	264.00	80.91	0.00
0.00	297.00	85.18	0.00
0.00	330.00	88.33	0.00
HASTIAL			
8.93	0.00	0.00	79.02
0.00	66.00	0.00	30.27
0.00	132.00	6.41	9.68
0.00	198.00	19.55	0.00
0.00	264.00	25.30	0.00
0.00	330.00	24.50	0.00
0.00	396.00	18.17	5.98
0.00	462.00	7.39	21.09
0.00	528.00	0.00	37.33
0.00	594.00	0.00	53.39
0.00	660.00	0.00	75.76
DINTEL			
17.35	0.00	0.00	93.89
6.65	66.00	0.00	37.33
0.00	132.00	37.33	9.16
0.00	198.00	63.21	2.90
0.00	264.00	83.74	0.00
0.00	330.00	90.70	0.00

PORTICO P.K. 13+595

MEMORIA DE CALCULO

INDICE GENERAL

CAJON CERRADO.

DATOS DE PROCESO
CARGAS CONSIDERADAS
HIPOTESIS DE CARGAS
ENVOLVENTE DE ARMADURAS

DATOS DE PROCESO.

1. DATOS DE ESPECIFICACION DE LAS ACTIVIDADES

DIBUJO	FERRALLA	MEMORIA	MEDICION	CANTO FIJO	SEPAR. FIJA
1	1	1	1	1	1

FACTOR DE DIBUJO	ESCALA DEL DIBUJO
1.00	100.00

2. DATOS DEL HORMIGON

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
250.00	1.50	300000.00

DENSIDAD DEL HORMIGON	RECUBRI. DE ARMADURAS
2.67	4.00

3. DATOS DEL ACERO

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
5100.00	1.15	2100000.00

4. DATOS DE LAS TIERRAS Y DEL PAVIMIENTO

COEF. DE EMPU.ACTIVO	COEF. DE EMPU.REPOSO	MODULO DE BALASTO	DENSIDAD DE LAS TIERRAS	ALTURA DE TIERRAS
0.30	0.45	5000.00	2.03	495.00

DENSIDAD DE PAVIMENTO	ALTURA DEL PAVIMENTO
0.00	10.00

5. GEOMETRIA DEL PORTICO

I ANCHO EN CM I	I ALTO EN I	I LARGO EN CM I
I 600.00 I	500.00 I	1000.00 I

I KDIN I	I KSOL I	I KSOP I	I
I 0 I	0 I	0 I	1 I

I D0 EN CM I	I D1 EN CM I	I D2 EN CM I
I 90.00 I	0.00 I	0.00 I

I H0 EN CM I	I H1 EN CM I	I H2 EN CM I	I H3 EN CM I	I H4 EN CM I
I 90.00 I	0.00 I	0.00 I	0.00 I	0.00 I

I S0 EN CM I	I S1 EN CM I	I S2 EN CM I
I 90.00 I	0.00 I	0.00 I

I CANTO EN CM I	I SEPARACION DE BARRAS I
I 90.00 I	20.00 I

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6. DATOS DEL TREN DE CARGA

I DIST-1 I	I DIST-2 I	ISOBREC. UNIFI I
I 0.00 I	0.00 I	2.02 I

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7. DATOS DE LA ALETA IZQUIERDA

TIPO DE ALETA 0

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8. DATOS DE LA ALETA DERECHA

TIPO DE ALETA 0

CARGAS CONSIDERADAS.

CARGAS

1. CARGAS PERMANENTES

   PESO PROPIO -DENSIDAD DEL HORMIGON- 2.67 T/M3

2. SOBRECARGAS

   TREN TIPO DE LA INSTRUCCION FERROCARRILES 2.02 T/M2

3. TERRENO

ALTURA DE TIERRAS	495.00	CM
DENSIDAD DE LAS TIERRAS	2.03	T/M3
COEFICIENTE DE EMPUJE ACTIVO	0.30	
COEFICIENTE DE EMPUJE REPOSO	0.45	

PARA EL CALCULO DE LOS ESFUERZOS EN EL PORTICO SE HAN CONSIDERADO DESPRECIABLES LOS EFECTOS DE RETRACCION Y TEMPERATURA DEBIDO A ESTAR EL PORTICO CUBIERTO POR LAS TIERRAS.

LOS POSIBLES DESPLAZAMIENTOS ORIGINADOS POR LAS FUERZAS HORIZONTALES -FRENADO,FUERZA CENTRIFUGA- SE CONSIDERAN IMPEDIDOS POR LA REACCION DE LAS TIERRAS, EN CONSECUENCIA EL PORTICO SE CALCULA COMO INTRASLACIONAL TENIENDO EN CUENTA LA DEFORMACION DE LAS TIERRAS BAJO LA SOLERA PARA UN COEFICIENTE DE BALASTO MEDIO.

HIPOTESIS CONSIDERADAS

SE HAN CONSIDERADO CUATRO HIPOTESIS DE CARGA:

1. TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL.
2. EMPUJE MAXIMO, SOBRECARGA MINIMA.
3. EMPUJE MINIMO, SOBRECARGA MAXIMA.
4. EMPUJE MAXIMO, SOBRECARGA MAXIMA.

HIPOTESIS DE CARGAS

PRIMERA HIPOTESIS
TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	6.15	16.76	21.39	0.00	39.39	1	0.00
-0.26	6.23	0.12	-1.22	0.00	0.28	1	0.00
0.13	6.11	14.94	17.76	0.00	35.07	1	0.00
0.52	5.95	8.48	15.40	0.00	19.81	1	0.00
0.91	5.75	2.91	13.12	0.00	6.79	1	0.00
1.30	5.54	-1.77	10.92	4.13	0.00	1	0.00
1.70	5.33	-5.62	8.80	13.11	0.00	1	0.00
2.09	5.15	-8.65	6.76	20.23	0.00	1	0.00
2.47	5.00	-10.90	4.79	25.52	0.00	1	0.00
2.87	4.89	-12.39	2.86	29.04	0.00	1	0.00
3.26	4.90	-13.14	0.96	30.80	0.00	1	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	21.39	-16.76	-14.58	0.00	28.67	1	0.00
0.59	21.05	-6.20	-9.40	0.00	3.62	1	0.00
1.18	19.63	-1.57	-6.35	0.00	0.00	1	0.00
1.77	18.21	1.35	-3.61	0.00	0.00	1	0.00
2.36	16.80	2.75	-1.19	0.00	0.00	1	0.00
2.95	15.38	2.81	0.91	0.00	0.00	1	0.00
3.54	13.96	1.73	2.70	0.00	0.00	1	0.00
4.13	12.54	-0.31	4.16	0.00	0.00	1	0.00
4.72	11.13	-3.12	5.31	0.00	1.49	1	0.00
5.31	9.71	-6.52	6.14	0.00	10.21	1	0.00
5.90	7.21	-8.37	6.44	0.00	15.89	1	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	6.44	-8.37	-8.29	0.00	19.57	1	0.00
0.69	6.44	-3.23	-6.63	0.00	7.52	1	0.00
1.38	6.44	0.78	-4.97	1.81	0.00	1	0.00
2.07	6.44	3.64	-3.32	8.48	0.00	1	0.00
2.76	6.44	5.36	-1.66	12.49	0.00	1	0.00
3.45	6.44	5.93	0.00	13.83	0.00	1	0.00

ENVOLVENTE DE ARMADURA

SEGUNDA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MINIMA

SOLERA DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	17.89	41.18	60.58	0.00	73.73	0	35.35
-0.26	18.26	0.35	-3.58	0.00	0.81	1	0.00
0.13	17.74	36.13	49.96	0.00	64.46	0	19.43
0.52	17.10	17.97	43.17	0.00	42.27	1	9.23
0.91	16.37	2.42	36.64	0.00	5.63	1	0.00
1.30	15.64	-10.65	30.40	24.92	0.00	1	0.00
1.70	14.95	-21.33	24.43	50.27	0.00	1	0.00
2.09	14.34	-29.74	18.73	57.33	0.00	1	0.00
2.47	13.86	-35.97	13.24	64.18	0.00	0	0.00
2.87	13.53	-40.09	7.90	71.72	0.00	0	0.00
3.26	13.54	-42.15	2.67	75.51	0.00	0	0.00

HASTIAL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	60.58	-41.18	-27.54	0.00	57.33	1	0.00
0.59	60.24	-20.96	-18.28	0.00	19.44	1	0.00
1.18	58.82	-11.90	-12.50	0.00	0.00	1	0.00
1.77	57.40	-6.15	-7.04	0.00	0.00	1	0.00
2.36	55.99	-3.52	-1.90	0.00	0.00	1	0.00
2.95	54.57	-3.84	2.92	0.00	0.00	1	0.00
3.54	53.15	-6.91	7.43	0.00	0.00	1	0.00
4.13	51.73	-12.55	11.62	0.00	3.16	1	0.00
4.72	50.32	-20.56	15.49	0.00	23.37	1	0.00
5.31	48.90	-30.76	19.04	0.00	49.31	1	0.00
5.90	46.40	-36.62	20.70	0.00	57.33	1	0.00

DINTEL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	20.70	-36.62	-42.96	0.00	65.36	0	8.92
0.69	20.70	-9.94	-34.37	0.00	23.27	1	0.00
1.38	20.70	10.80	-25.77	25.29	0.00	1	0.00
2.07	20.70	25.62	-17.18	57.33	0.00	1	0.00
2.76	20.70	34.52	-8.59	61.52	0.00	0	0.00
3.45	20.70	37.48	0.00	66.94	0.00	0	0.00

TERCERA HIPOTESIS
EMPUJE MINIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	20.69	40.29	68.45	0.00	72.09	0	47.17
-0.26	21.26	0.41	-4.18	0.00	0.95	1	0.00
0.13	20.48	34.69	56.13	0.00	61.83	0	28.68
0.52	19.56	14.33	48.31	0.00	33.62	1	16.96
0.91	18.59	-3.05	40.87	7.11	0.00	1	5.80
1.30	17.63	-17.61	33.81	41.40	0.00	1	0.00
1.70	16.74	-29.48	27.11	57.33	0.00	1	0.00
2.09	15.98	-38.80	20.74	69.36	0.00	0	0.00
2.47	15.37	-45.70	14.64	82.05	0.00	0	0.00
2.87	14.95	-50.25	8.73	90.50	0.00	0	0.00
3.26	14.96	-52.53	2.95	94.75	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	68.45	-40.29	-17.47	0.00	57.33	1	0.00
0.59	68.12	-27.48	-11.57	0.00	31.74	1	0.00
1.18	66.70	-21.75	-7.89	0.00	18.19	1	0.00
1.77	65.28	-18.12	-4.43	0.00	9.96	1	0.00
2.36	63.86	-16.47	-1.19	0.00	6.63	1	0.00
2.95	62.45	-16.68	1.85	0.00	7.84	1	0.00
3.54	61.03	-18.61	4.67	0.00	13.28	1	0.00
4.13	59.61	-22.15	7.29	0.00	22.69	1	0.00
4.72	58.19	-27.17	9.69	0.00	35.82	1	0.00
5.31	56.78	-33.54	11.87	0.00	52.46	1	0.00
5.90	54.28	-37.20	12.89	0.00	57.33	1	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	12.89	-37.20	-49.93	0.00	66.41	0	19.38
0.69	12.89	-6.19	-39.94	0.00	14.45	1	4.40
1.38	12.89	17.92	-29.96	42.15	0.00	1	0.00
2.07	12.89	35.15	-19.97	62.68	0.00	0	0.00
2.76	12.89	45.48	-9.99	81.66	0.00	0	0.00
3.45	12.89	48.93	0.00	88.04	0.00	0	0.00

CUARTA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	20.25	46.06	68.45	0.00	82.73	0	47.17
-0.26	20.68	0.40	-4.06	0.00	0.92	1	0.00
0.13	20.08	40.36	56.44	0.00	72.21	0	29.14
0.52	19.34	19.86	48.74	0.00	46.75	1	17.60
0.91	18.51	2.29	41.36	0.00	5.34	1	6.53
1.30	17.67	-12.45	34.31	29.18	0.00	1	0.00
1.70	16.88	-24.51	27.57	57.33	0.00	1	0.00
2.09	16.19	-34.00	21.13	60.59	0.00	0	0.00
2.47	15.64	-41.03	14.93	73.45	0.00	0	0.00
2.87	15.26	-45.68	8.92	82.02	0.00	0	0.00
3.26	15.27	-48.00	3.01	86.33	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	68.45	-46.06	-30.09	0.00	57.33	1	0.00
0.59	68.12	-23.94	-20.03	0.00	22.92	1	0.00
1.18	66.70	-14.00	-13.71	0.00	0.00	1	0.00
1.77	65.28	-7.70	-7.72	0.00	0.00	1	0.00
2.36	63.86	-4.84	-2.04	0.00	0.00	1	0.00
2.95	62.45	-5.23	3.32	0.00	0.00	1	0.00
3.54	61.03	-8.70	8.37	0.00	0.00	1	0.00
4.13	59.61	-15.04	13.09	0.00	5.25	1	0.00
4.72	58.19	-24.08	17.50	0.00	28.15	1	0.00
5.31	56.78	-35.62	21.58	0.00	57.33	1	0.00
5.90	54.28	-42.28	23.51	0.00	57.33	1	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	23.51	-42.28	-49.93	0.00	75.74	0	19.38
0.69	23.51	-11.27	-39.94	0.00	26.39	1	4.40
1.38	23.51	12.84	-29.96	30.11	0.00	1	0.00
2.07	23.51	30.07	-19.97	57.33	0.00	1	0.00
2.76	23.51	40.40	-9.99	72.29	0.00	0	0.00
3.45	23.51	43.85	0.00	78.64	0.00	0	0.00

CANTO 90.

CORTANTE	DISTANCIA	U.INTERIOR	U.EXTERIOR
SOLERA			
47.17	0.00	0.00	82.73
22.93	34.50	0.00	58.50
12.92	69.00	3.01	29.84
4.52	103.50	17.66	4.70
0.00	138.00	44.46	0.00
0.00	172.50	58.26	0.00
0.00	207.00	68.90	0.00
0.00	241.50	80.10	0.00
0.00	276.00	88.23	0.00
0.00	310.50	93.12	0.00
0.00	345.00	96.87	0.00
HASTIAL			
0.00	0.00	0.00	57.33
0.00	59.00	0.00	31.74
0.00	118.00	0.00	18.19
0.00	177.00	0.00	9.96
0.00	236.00	0.00	6.63
0.00	295.00	0.00	7.84
0.00	354.00	0.00	13.28
0.00	413.00	0.00	22.69
0.00	472.00	0.00	35.82
0.00	531.00	0.00	57.33
0.00	590.00	0.00	57.33
DINTEL			
19.38	0.00	0.00	75.74
4.40	69.00	0.00	26.39
0.00	138.00	42.15	0.00
0.00	207.00	62.68	0.00
0.00	276.00	81.66	0.00
0.00	345.00	88.04	0.00

PORTICO P.K. 13+932

MEMORIA DE CALCULO

INDICE GENERAL

CAJON CERRADO.

DATOS DE PROCESO
CARGAS CONSIDERADAS
HIPOTESIS DE CARGAS
ENVOLVENTE DE ARMADURAS

DATOS DE PROCESO.

1. DATOS DE ESPECIFICACION DE LAS ACTIVIDADES

DIBUJO	FERRALLA	MEMORIA	MEDICION	CANTO FIJO	SEPAR. FIJA
1	1	1	1	1	1

FACTOR DE DIBUJO	ESCALA DEL DIBUJO
1.00	50.00

2. DATOS DEL HORMIGON

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
250.00	1.50	300000.00

DENSIDAD DEL HORMIGON	RECUBRI. DE ARMADURAS
2.67	4.00

3. DATOS DEL ACERO

RESISTENCIA CARACTERIST.	COEF. DE MINORACION	MODULO DE DEFORMACION
5100.00	1.15	2100000.00

4. DATOS DE LAS TIERRAS Y DEL PAVIMIENTO

COEF. DE EMPU.ACTIVO	COEF. DE EMPU.REPOSO	MODULO DE BALASTO	DENSIDAD DE LAS TIERRAS	ALTURA DE TIERRAS
0.30	0.45	5000.00	2.03	800.00

DENSIDAD DE PAVIMENTO	ALTURA DEL PAVIMENTO
0.00	10.00

5. GEOMETRIA DEL PORTICO

I ANCHO EN CM I	ALTO EN I	LARGO EN CM I
I 600.00 I	600.00 I	1000.00 I

I KDIN I	KSOL I	KSOP I	I
I 0 I	0 I	0 I	1 I

I DO EN CM I	D1 EN CM I	D2 EN CM I
I 90.00 I	0.00 I	0.00 I

I HO EN CM I	H1 EN CM I	H2 EN CM I	H3 EN CM I	H4 EN CM I
I 90.00 I	0.00 I	0.00 I	0.00 I	0.00 I

I SO EN CM I	S1 EN CM I	S2 EN CM I
I 90.00 I	0.00 I	0.00 I

I CANTO EN CM I	SEPARACION DE BARRAS I
I 90.00 I	20.00 I

6. DATOS DEL TREN DE CARGA

I DIST-1 I	DIST-2 I	ISOBREC. UNIFI
I 0.00 I	0.00 I	1.16 I

7. DATOS DE LA ALETA IZQUIERDA

TIPO DE ALETA 0

8. DATOS DE LA ALETA DERECHA

TIPO DE ALETA 0

CARGAS CONSIDERADAS.

CARGAS

1. CARGAS PERMANENTES

   PESO PROPIO -DENSIDAD DEL HORMIGON- 2.67 T/M3

2. SOBRECARGAS

   TREN TIPO DE LA INSTRUCCION FERROCARRILES 1.16 T/M2

3. TERRENO

ALTURA DE TIERRAS	800.00 CM
DENSIDAD DE LAS TIERRAS	2.03 T/M3
COEFICIENTE DE EMPUJE ACTIVO	0.30
COEFICIENTE DE EMPUJE REPOSO	0.45

PARA EL CALCULO DE LOS ESFUERZOS EN EL PORTICO SE HAN CONSIDERADO DESPRECIABLES LOS EFECTOS DE RETRACCION Y TEMPERATURA DEBIDO A ESTAR EL PORTICO CUBIERTO POR LAS TIERRAS.

LOS POSIBLES DESPLAZAMIENTOS ORIGINADOS POR LAS FUERZAS HORIZONTALES -FRENADO,FUERZA CENTRIFUGA- SE CONSIDERAN IMPEDIDOS POR LA REACCION DE LAS TIERRAS, EN CONSECUENCIA EL PORTICO SE CALCULA COMO INTRASLACIONAL TENIENDO EN CUENTA LA DEFORMACION DE LAS TIERRAS BAJO LA SOLERA PARA UN COEFICIENTE DE BALASTO MEDIO.

HIPOTESIS CONSIDERADAS

SE HAN CONSIDERADO CUATRO HIPOTESIS DE CARGA:

1. TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL.
2. EMPUJE MAXIMO, SOBRECARGA MINIMA.
3. EMPUJE MINIMO, SOBRECARGA MAXIMA.
4. EMPUJE MAXIMO, SOBRECARGA MAXIMA.

HIPOTESIS DE CARGAS

PRIMERA HIPOTESIS
TIERRAS HASTA DINTEL, EMPUJE EN REPOSO SIN SOBRECARGA EN DINTEL

SOLERA DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	6.66	21.07	23.79	0.00	49.63	1	0.00
-0.26	6.68	0.13	-1.30	0.00	0.30	1	0.00
0.13	6.64	19.00	19.89	0.00	44.70	1	0.00
0.52	6.52	11.74	17.32	0.00	27.51	1	0.00
0.91	6.36	5.48	14.80	0.00	12.79	1	0.00
1.30	6.17	0.19	12.36	0.00	0.44	1	0.00
1.70	5.98	-4.17	9.99	9.71	0.00	1	0.00
2.09	5.81	-7.61	7.69	17.78	0.00	1	0.00
2.47	5.67	-10.17	5.45	23.80	0.00	1	0.00
2.87	5.57	-11.87	3.26	27.80	0.00	1	0.00
3.26	5.58	-12.72	1.10	29.81	0.00	1	0.00

HASTIAL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	23.79	-21.07	-19.01	0.00	37.87	1	0.00
0.69	23.21	-5.06	-12.08	0.00	0.00	1	0.00
1.38	21.55	1.84	-8.00	0.00	0.00	1	0.00
2.07	19.90	6.08	-4.36	3.93	0.00	1	0.00
2.76	18.24	7.96	-1.15	9.22	0.00	1	0.00
3.45	16.58	7.77	1.62	9.63	0.00	1	0.00
4.14	14.92	5.81	3.96	5.86	0.00	1	0.00
4.83	13.26	2.40	5.87	0.00	0.00	1	0.00
5.52	11.61	-2.18	7.33	0.00	0.00	1	0.00
6.21	9.95	-7.62	8.37	0.00	12.70	1	0.00
6.90	7.21	-10.58	8.72	0.00	21.10	1	0.00

DINTEL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	8.72	-10.58	-8.29	0.00	24.75	1	0.00
0.69	8.72	-5.43	-6.63	0.00	12.66	1	0.00
1.38	8.72	-1.42	-4.97	0.00	3.31	1	0.00
2.07	8.72	1.44	-3.32	3.35	0.00	1	0.00
2.76	8.72	3.15	-1.66	7.35	0.00	1	0.00
3.45	8.72	3.73	0.00	8.68	0.00	1	0.00

SEGUNDA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MINIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	25.44	63.16	87.13	0.00	114.75	0	75.18
-0.26	25.87	0.49	-5.07	0.00	1.15	1	0.00
0.13	25.26	55.82	72.07	0.00	100.91	0	52.60
0.52	24.44	29.61	62.38	0.00	57.33	1	38.05
0.91	23.49	7.12	53.03	0.00	16.62	1	24.03
1.30	22.52	-11.80	44.05	27.65	0.00	1	10.57
1.70	21.59	-27.30	35.46	57.33	0.00	1	0.00
2.09	20.77	-39.51	27.20	70.66	0.00	0	0.00
2.47	20.12	-48.56	19.24	87.36	0.00	0	0.00
2.87	19.67	-54.55	11.49	98.53	0.00	0	0.00
3.26	19.68	-57.55	3.88	104.16	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	87.13	-63.16	-43.70	0.00	73.58	0	10.04
0.69	86.55	-25.56	-29.11	0.00	17.96	1	0.00
1.38	84.89	-8.67	-19.93	0.00	0.00	1	0.00
2.07	83.23	2.04	-11.18	0.00	0.00	1	0.00
2.76	81.57	6.86	-2.87	0.00	0.00	1	0.00
3.45	79.92	6.10	5.01	0.00	0.00	1	0.00
4.14	78.26	0.05	12.46	0.00	0.00	1	0.00
4.83	76.60	-10.99	19.47	0.00	0.00	1	0.00
5.52	74.94	-26.71	26.04	0.00	26.50	1	0.00
6.21	73.28	-46.82	32.18	0.00	57.33	1	0.00
6.90	70.54	-58.43	35.09	0.00	72.10	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	35.09	-58.43	-64.32	0.00	105.82	0	40.96
0.69	35.09	-18.49	-51.45	0.00	43.49	1	21.67
1.38	35.09	12.58	-38.59	29.48	0.00	1	2.37
2.07	35.09	34.77	-25.73	61.98	0.00	0	0.00
2.76	35.09	48.08	-12.86	86.47	0.00	0	0.00
3.45	35.09	52.52	0.00	94.73	0.00	0	0.00

TERCERA HIPOTESIS
EMPUJE MINIMO Y SOBRECARGA MAXIMA

SOLERA

DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	27.54	56.11	91.65	0.00	101.46	0	81.96
-0.26	28.25	0.54	-5.55	0.00	1.26	1	0.00
0.13	27.27	48.57	75.26	0.00	87.37	0	57.38
0.52	26.11	21.26	64.85	0.00	50.09	1	41.76
0.91	24.86	-2.08	54.91	4.85	0.00	1	26.85
1.30	23.62	-21.64	45.45	51.01	0.00	1	12.67
1.70	22.47	-37.61	36.47	67.17	0.00	0	0.00
2.09	21.47	-50.15	27.92	90.32	0.00	0	0.00
2.47	20.68	-59.43	19.71	107.71	0.00	0	0.00
2.87	20.13	-65.56	11.76	119.32	0.00	0	0.00
3.26	20.15	-68.63	3.98	125.17	0.00	0	0.00

HASTIAL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	91.65	-56.11	-28.08	0.00	57.69	0	0.00
0.69	91.07	-31.97	-18.67	0.00	31.98	1	0.00
1.38	89.41	-21.15	-12.76	0.00	5.54	1	0.00
2.07	87.76	-14.30	-7.14	0.00	0.00	1	0.00
2.76	86.10	-11.23	-1.80	0.00	0.00	1	0.00
3.45	84.44	-11.75	3.24	0.00	0.00	1	0.00
4.14	82.78	-15.64	7.99	0.00	0.00	1	0.00
4.83	81.12	-22.71	12.45	0.00	13.48	1	0.00
5.52	79.47	-32.76	16.63	0.00	39.54	1	0.00
6.21	77.81	-45.59	20.51	0.00	57.33	1	0.00
6.90	75.07	-52.98	22.34	0.00	59.44	0	0.00

DINTEL

M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	22.34	-52.98	-68.32	0.00	95.60	0	46.97
0.69	22.34	-10.56	-54.66	0.00	24.71	1	26.47
1.38	22.34	22.44	-40.99	52.93	0.00	1	5.98
2.07	22.34	46.01	-27.33	82.64	0.00	0	0.00
2.76	22.34	60.16	-13.66	109.07	0.00	0	0.00
3.45	22.34	64.87	0.00	118.00	0.00	0	0.00

CUARTA HIPOTESIS
EMPUJE MAXIMO Y SOBRECARGA MAXIMA

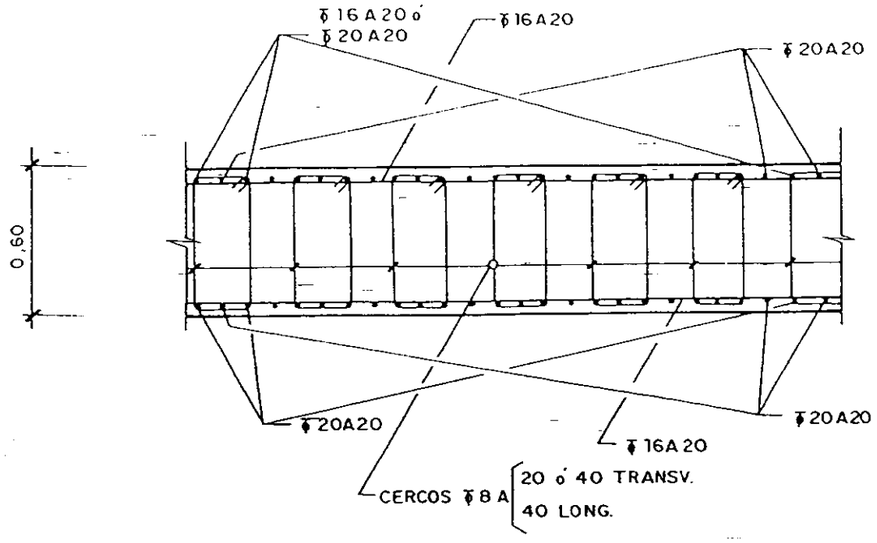
SOLERA DIST M	REACCION T/M2	FLECTOR MT	CORTANTE T	ARM INT T	ARM EXT T	K	TA T
0.00	26.78	66.15	91.65	0.00	120.44	0	81.96
-0.26	27.25	0.52	-5.34	0.00	1.21	1	0.00
0.13	26.59	58.44	75.80	0.00	105.83	0	58.19
0.52	25.72	30.87	65.59	0.00	57.33	1	42.88
0.91	24.72	7.22	55.75	0.00	16.87	1	28.12
1.30	23.68	-12.67	46.32	29.70	0.00	1	13.96
1.70	22.70	-28.96	37.28	57.33	0.00	1	0.40
2.09	21.84	-41.80	28.60	74.87	0.00	0	0.00
2.47	21.15	-51.32	20.22	92.49	0.00	0	0.00
2.87	20.67	-57.61	12.08	104.28	0.00	0	0.00
3.26	20.68	-60.76	4.08	110.21	0.00	0	0.00

HASTIAL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	91.65	-66.15	-45.45	0.00	77.39	0	12.66
0.69	91.07	-27.03	-30.31	0.00	19.47	1	0.00
1.38	89.41	-9.43	-20.77	0.00	0.00	1	0.00
2.07	87.76	1.73	-11.66	0.00	0.00	1	0.00
2.76	86.10	6.76	-2.99	0.00	0.00	1	0.00
3.45	84.44	5.96	5.25	0.00	0.00	1	0.00
4.14	82.78	-0.39	13.06	0.00	0.00	1	0.00
4.83	81.12	-11.96	20.43	0.00	0.00	1	0.00
5.52	79.47	-28.47	27.36	0.00	28.72	1	0.00
6.21	77.81	-49.62	33.86	0.00	57.33	1	0.00
6.90	75.07	-61.84	36.95	0.00	76.60	0	0.00

DINTEL M	T	MT	T	T	T		T
DIST	AXIL	FLECTOR	CORTANTE	ARM INT	ARM EXT	K	TA
0.00	36.95	-61.84	-68.32	0.00	112.25	0	46.97
0.69	36.95	-19.41	-54.66	0.00	45.68	1	26.47
1.38	36.95	13.59	-40.99	31.87	0.00	1	5.98
2.07	36.95	37.16	-27.33	66.35	0.00	0	0.00
2.76	36.95	51.30	-13.66	92.46	0.00	0	0.00
3.45	36.95	56.02	0.00	101.28	0.00	0	0.00

ENVOLVENTE DE ARMADURA

	CANTO 90.		
CORTANTE	DISTANCIA	U.INTERIOR	U.EXTERIOR
SOLERA			
81.96	0.00	0.00	120.44
49.94	34.50	0.00	79.72
36.63	69.00	2.05	40.21
23.76	103.50	19.05	11.81
11.35	138.00	54.12	0.35
0.37	172.50	68.95	0.00
0.02	207.00	89.43	0.00
0.00	241.50	105.03	0.00
0.00	276.00	116.20	0.00
0.00	310.50	122.92	0.00
0.00	345.00	128.09	0.00
HASTIAL			
12.66	0.00	0.00	77.39
0.00	69.00	0.00	31.98
0.00	138.00	0.00	5.54
0.00	207.00	3.93	0.00
0.00	276.00	9.22	0.00
0.00	345.00	9.63	0.00
0.00	414.00	5.86	0.00
0.00	483.00	0.00	13.48
0.00	552.00	0.00	39.54
0.00	621.00	0.00	57.33
0.00	690.00	0.00	76.60
DINTEL			
46.97	0.00	0.00	112.25
26.47	69.00	0.00	45.68
5.98	138.00	52.93	3.31
0.00	207.00	82.64	0.00
0.00	276.00	109.07	0.00
0.00	345.00	118.00	0.00



SECCION A-A

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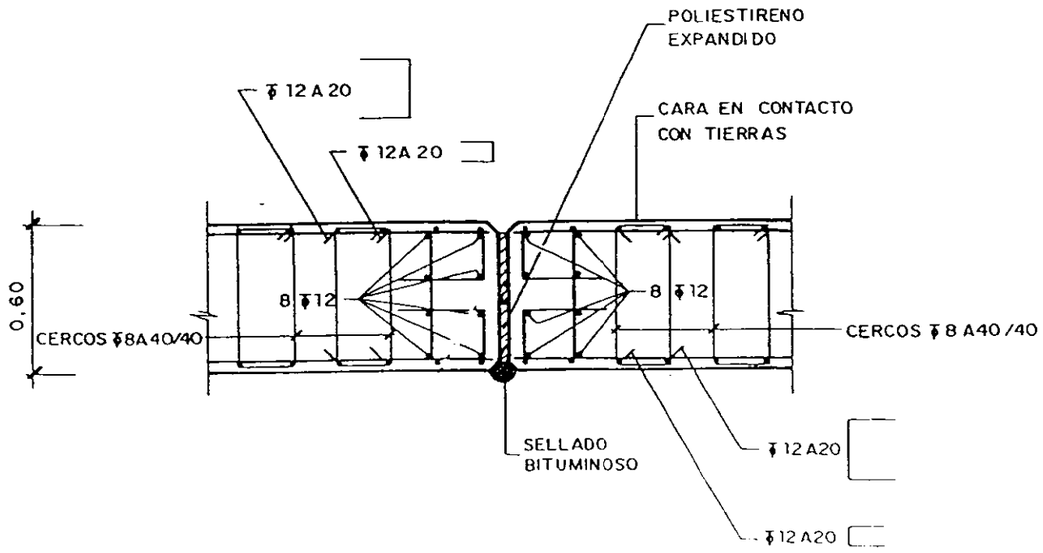


SECCION B-B

NOTAS:

— SE HA CONSIDERADO UÑA TENSION ADMISIBLE DEL TERRENO DE CIMENTACION DE 2,5 KG/CM.^{2}

— SE IMPERMEABILIZARAN TODOS LOS PARAMENTOS EN CONTACTO CON TIERRAS EXCEPTO SOLERAS

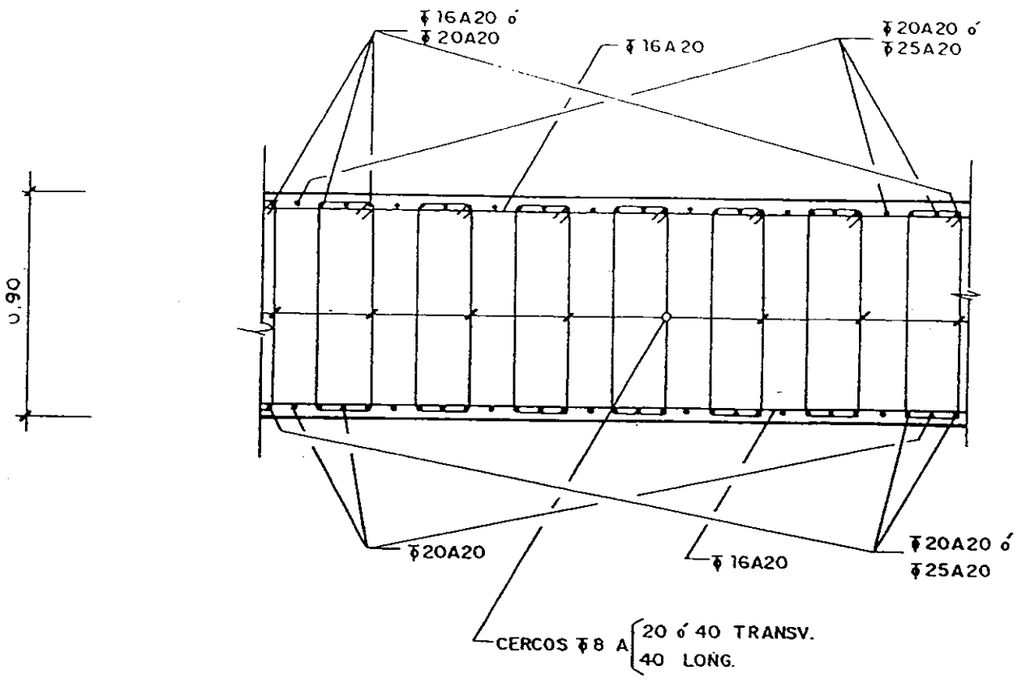
— RESISTENCIA DEL HORMIGON Fck = 250 KG/CM.^{2}

— ACERO DE ALTA ADHERENCIA Fyk = 5.100 KG/CM.^{2} (AEH-500)

— RECUBRIMIENTO DE ARMADURAS 4,0 CM.

— PARA ANCLAJES Y SOLAPOS SE SEGUIRAN LAS PRESCRIPCIONES CONTENIDAS EN LA INSTRUCCION EH-91.

PORTICOS PK. 9+917 Y 10+835
SECCION TRANSVERSAL TIPO. ARMADURAS



SECCION A - A

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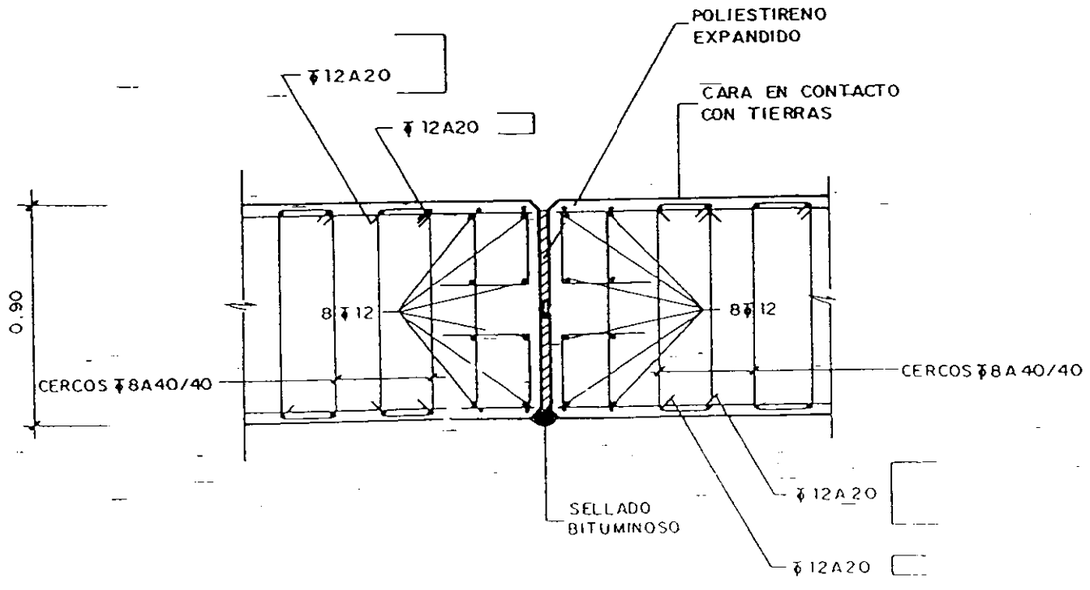


SECCION B-B

NOTAS:

— SE HA CONSIDERADO UNA TENSION ADMISIBLE DEL TERRENO DE CIMENTACION DE 2,5 KG/CM.^{2}

— SE IMPERMEABILIZARAN TODOS LOS PARAMENTOS EN CONTACTO CON TIERRAS EXCEPTO SOLERAS.

— RESISTENCIA DEL HORMIGON Fck = 250 KG/CM.^{2}

— ACERO DE ALTA ADHERENCIA Fyk = 5.100 KG/CM.^{2} (AEH-500)

— RECUBRIMIENTO DE ARMADURAS -4,0 CM.

— PARA ANCLAJES Y SOLAPOS SE SEGUIRAN LAS PRESCRIPCIONES CONTENIDAS EN LA INSTRUCCION EH-91.

PORTICOS PK. 13+595 Y 13+932

SECCION TRANSVERSAL TIPO. ARMADURAS

Aletas Pasos Inferiores

L.A.V. ZARAGOZA - LLEIDA
SUBTRAMO-I

ALETAS DE LOS PASOS INFERIORES P.K. 9+917; P.K. 10+835; P.K. 13+595 y P.K. 13+932

GENERALIDADES.

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".

- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- En Limpieza y nivelación. . . . . $f_{ck} \geq 125$ kp/cm^2
- En Zapatas. . . . . $f_{ck} \geq 250$ kp/cm^2
- En Alzados. . . . . $f_{ck} \geq 250$ kp/cm^2
- Coeficiente de seguridad. . . . . $\gamma_c = 1,5$

Armaduras pasivas

- Límite elástico ≥ 5100 kp/cm^2
- Coeficiente de seguridad $\gamma_s = 1.15$

Cargas

- Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

Características del terreno

- Tensión admisible de cimentación 2,5 kgr/cm^2
- Densidad de tierras: 1,90 t/m^3

3.- Criterios generales de cálculo

El cálculo de estas aletas se ha realizado según la Teoría de Coulomb para suelos granulares, recogida por J. Calavera en su libro "Muros de Contención y Muros de Sótano".

El cálculo se ha realizado para tres secciones diferentes de 8, 6 y 4 m de altura (denominadas respectivamente como Sección I, Sección II y Sección III).

No se ha considerado la acción sísmica, ya que según la "Norma de Construcción Sismoresistente N.C.S.E.-94", las obras se encuentran en un zona con aceleración básica inferior a "0,04 g". Teniendo en cuenta dicho valor y un coeficiente de riesgo de 1,30 (construcciones de especial importancia) resulta una aceleración sísmica de cálculo inferior a "0.052g" <"0,06g".

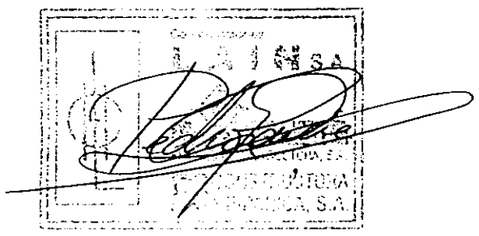
La definición final del armado resultante para cada sección estudiada, se ha realizado con mayor cuantía de la estricta teórica con objeto de homogeneizar y facilitar la colocación en obra de la ferralla correspondiente a cada una de las secciones calculadas.

4.- Equipo redactor

Los cálculos de estos aletas (P.K. 9+917; P.K. 10+835P; P.K. 13+595 y P.K. 13+932) han sido realizados por la Oficina Técnica de LAHISCO AVE, U.T.E. (Construcciones Lain, S.A.; Corsan Empresa Constructora, S.A. y Constructora Hispánica, S.A., en Agrupación Temporal de Empresas) adjudicatario de la obra: Proyecto de "Línea de Alta Velocidad Madrid-Barcelona-frontera francesa. Tramo: Zaragoza-Lleida. Subtramo-I".

Estos cálculos se recogen, a continuación, desde la página 1 hasta la página 27, ambas inclusive.

Zaragoza, 11 de Marzo de 1.997



Fdo: Pedro García Borjabad
Ingeniero de Caminos

PROYECTO LINEA DE ALTA VELOCIDAD
MADRID - BARCELONA - FRONTERA FRANCESA
TRAMO ZARAGOZA - LLEIDA
SUBTRAMO I.

.ALETAS PARA MARCOS.

.ANEJO DE CÁLCULO.

001

El cálculo de éstos muros se ha realizado según la Teoría de Coulomb para suelos granulares recogida por J. Calavera en su libro " MUROS DE CONTENCIÓN Y MUROS DE SÓTANO".

Las características del relleno y el listado de resultados aparece en las páginas siguientes.

Al igual que en el caso de los marcos, no se ha considerado en el cálculo el nivel freático.

Se realiza el cálculo para tres secciones diferentes de 8 , 6 y 4 metros de altura, cuyas definiciones geométricas se indican en las páginas siguientes, siendo denominas respectivamente Sección I, Sección II y Sección III.

ALETAS PARA MARCOS.
ANEJO DE CÁLCULO.

CARACTERÍSTICAS DEL RELLENO.

PESO ESPECÍFICO (Tn / m3) :	1,90
ÁNGULO DE ROZAMIENTO ϕ :	33,00
ÁNGULO DE ROZAMIENTO TERRENO-MURO $\phi = \delta$: (Hipótesis de Coulomb)	33,00
ÁNGULO DE TALUD DEL TERRENO β	26,56
PENDIENTE DE INCLINACIÓN DEL TRASDÓS α :	86,19
SOBRECARGA (Tn / m3)	0,00

CARACTERÍSTICAS DE LOS MATERIALES:

RESISTENCIA CARACTERÍSTICA DEL HORMIGÓN:	=	250	Kg / cm2
LÍMITE ELÁSTICO DEL ACERO:	=	5.100	Kg / cm2
RECUBRIMIENTO DE LAS ARMADURAS	=	0,05	m

ALETAS PARA MARCOS.
ANEJO DE CÁLCULO.

Las aletas serán composición de las tres secciones calculadas en función de la altura del marco. Colocadas de forma que para cada altura se tenga suficiente armado.
Siguiendo este criterio, la distribución de las secciones nos queda de la siguiente manera para las diferentes obras de fábrica:

P.O.D. 14 CAJÓN EN P.K. 9+917

Sección I en 0,00 ml.
Sección II en 5,84 ml. Varía de 6,60 a 4,00 m de altura.
Sección III en 6,28 ml. Varía de 4,00 a 1,20 m de altura.

P.O.D. 16 CAJÓN EN P.K. 10+835

Sección I en 3,59 ml. Varía de 7,60 a 6,00 m de altura.
Sección II en 4,49 ml. Varía de 6,00 a 4,00 m de altura.
Sección III en 6,28 ml. Varía de 4,00 a 1,20 m de altura.

P.O.D. 20 CAJÓN EN P.K. 13+595

Sección I en 2,02 ml. Varía de 6,90 a 6,00 m de altura.
Sección II en 4,49 ml. Varía de 6,00 a 4,00 m de altura.
Sección III en 6,28 ml. Varía de 4,00 a 1,20 m de altura.

P.O.D. 22 CAJÓN EN P.K. 13+932

Sección I en 4,27 ml. Varía de 7,90 a 6,00 m de altura.
Sección II en 4,49 ml. Varía de 6,00 a 4,00 m de altura.
Sección III en 6,28 ml. Varía de 4,00 a 1,20 m de altura.

- Se adjuntan los cálculos de las tres secciones , en los que se incluyen:

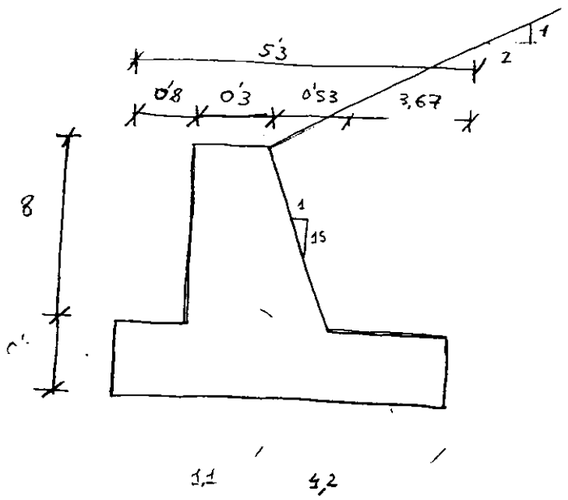
*.- Definición geométrica de la sección.
*.- Estudio de tensiones admisibles por el terreno.
*.- Coeficientes de seguridad al vuelco y al deslizamiento.
*.- Armado de las distintas secciones.
*.- Definición del armado resultante. (Como se observará, el armado final se hace con mayor cuantía que el estricto teórico con objeto de homogeneizar el armado de las distintas secciones).

SECCIÓN I

ALETAS

CÁLCULOS

SECCIÓN I



$\varphi = \delta = 33°$ $\quad \gamma_s = 1,9\ t/m^2$

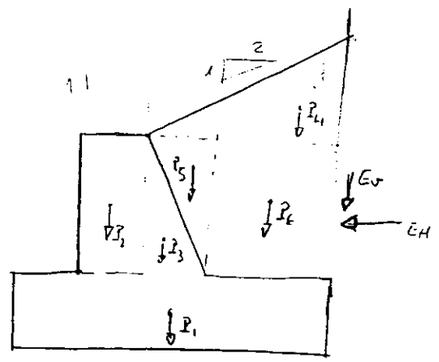
$\alpha = 81,86$

$\beta = 26,56$ $\quad \gamma_c = 2,4\ t/m^2$

$$\begin{cases} \lambda_h = \dfrac{0,873^2}{0,99558\left[1+\sqrt{\dfrac{0,91355 \cdot 0,11216}{0'8006 \cdot 0'92223}}\right]^2} = 0'4064 \\ \lambda_v = 0,30418 \end{cases}$$

$E_H = \frac{1}{2}\ 10,7^2\ 1'9\ \ 0,5064 = 44,20\ t$

$E_V = 33,08\ t$



Empuje

$E_H = 44,20\ t$

$E_V = 33,08\ t$

$P_1 = 7,632\ t$

$P_2 = 5,76\ t$

$P_3 = 5,088\ t$

$P_4 = 8,37\ t$

$P_5 = 4,028\ t$

$P_T = 55,248$

Distancia

$a = 3,587\ m$

$a = 5,3\ m$

$a = 2,65\ m$

$a = 0,95\ m$

$a = 1,2767\ m$

$a = 3,9\ m$

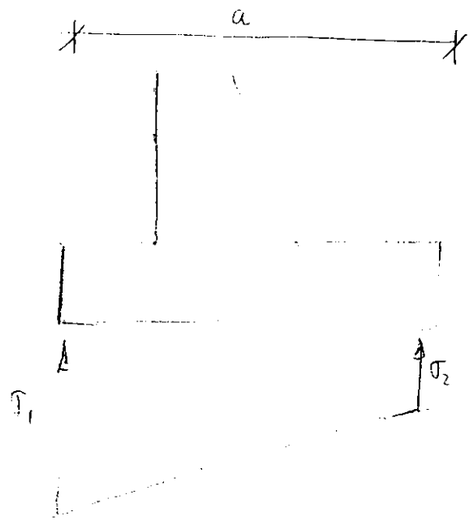
$a = 1,553\ m$

$a = 3,565\ m$

$$\begin{cases} M_{E_A} = 339,3\ t \\ M_{D_L} = 157,66\ t \end{cases} \qquad M_A = 281,64\ t$$

$\Sigma F_V = 119,752\ t$

$\Sigma F_H = 44,20\ t$



$\Sigma F_V = \frac{1}{2}(\sigma_1 + \sigma_2)\cdot a \longrightarrow \sigma_1 + \sigma_2 = 2/a\ \Sigma F_V$

$M_A = \sigma_2 \cdot a^2/2 + \frac{1}{2}(\sigma_1 - \sigma_2)\cdot a^2/3 \quad ; \quad \frac{6M_A}{a^2} = 3\sigma_2 + \sigma_1$

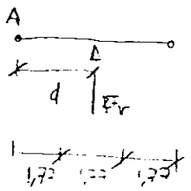
$\frac{6M_A}{a^2} = \sigma_1 + 2\sigma_2$

$$\begin{cases} \sigma_2 = \dfrac{6M_A}{a^2} - \dfrac{2\,\Sigma F_V}{a} \\ \sigma_1 = 2/a\ \Sigma F_V - \sigma_2 \end{cases}$$

$\sigma_2 = 14,97\ t/m^2$

$\sigma_1 = 30,21\ t/m^2$

$\sigma_c = 0'75\,\sigma_1 = 0'75 \cdot 30,21 = 22,65\ t/m^2 \leq \sigma_{ad} = 25\ t/m^2$ (Válido)



$d = \frac{M_A}{\Sigma F_V} = 2,35$

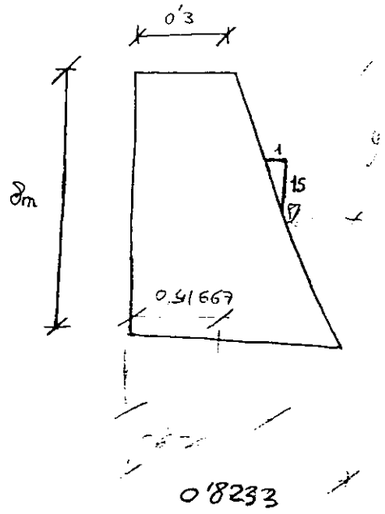
No aparecen tracciones

COEFICIENTES DE SEGURIDAD

$C_{SV} = 2,77$ VUELCO

$C_{SD} = 1,76$ DESLIZAMIENTO

ARMADO . SECCIÓN I



$tg\ \alpha = 15 \qquad \alpha = 86,186°$

$\delta = 22°$

$\varphi = 33°$

$\beta = 26,56°$

$$\begin{cases} \lambda_h = \dfrac{0,873^2}{0,9956\left[1+\sqrt{\dfrac{0,82\cdot 0,112}{0,9\ 0'9223}}\right]^2} = 0,53104 \\ \lambda_v = 0,2085 \end{cases}$$

$E_h = 1,9 \cdot 32 \cdot 0,53104 = 26,207$

$E_v = 1,5 \cdot 32 \cdot 0'2085 = 12,67$

$M_d = 111,831$ m Mp.

Armado:

$x_{eu} = 0,468$ m

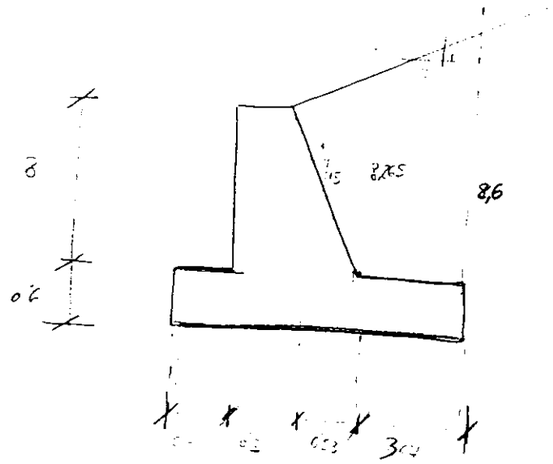
$M_{eu} = 298,52$ m Mp. $\quad M_d < M_{eu}$. $\quad d = 5$ cm

$0,2567 + x^2 - 1,875x = 0$

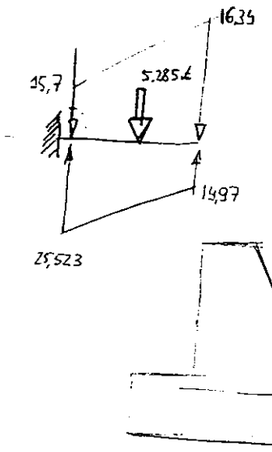
$x = \dfrac{1,875 - 1,59}{2} = 0,1424$

$U_s = 161,37$ t ⟶ 8 ϕ 25 por metro

ARMADO



Sección A



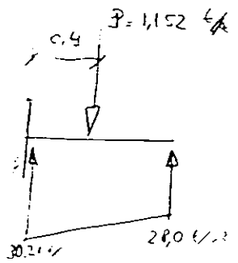
$M_d = 1,6\left[-105,731 + 23,69 - 9,692 - 3,152\right]$

$M_d = 9,5$ m t/m.

- $x_{eu} = 0,341 \qquad M_{eu} = 159,57$ m
- $x^2 - 1,32x + 0,021 = 0 \qquad x = 0,01575$

$U_s = 17,51$ t/m

Sección B



$M_d = 1,6\left[-0,461 + 8,9 + 0,225\right] = 13,97$ t/m

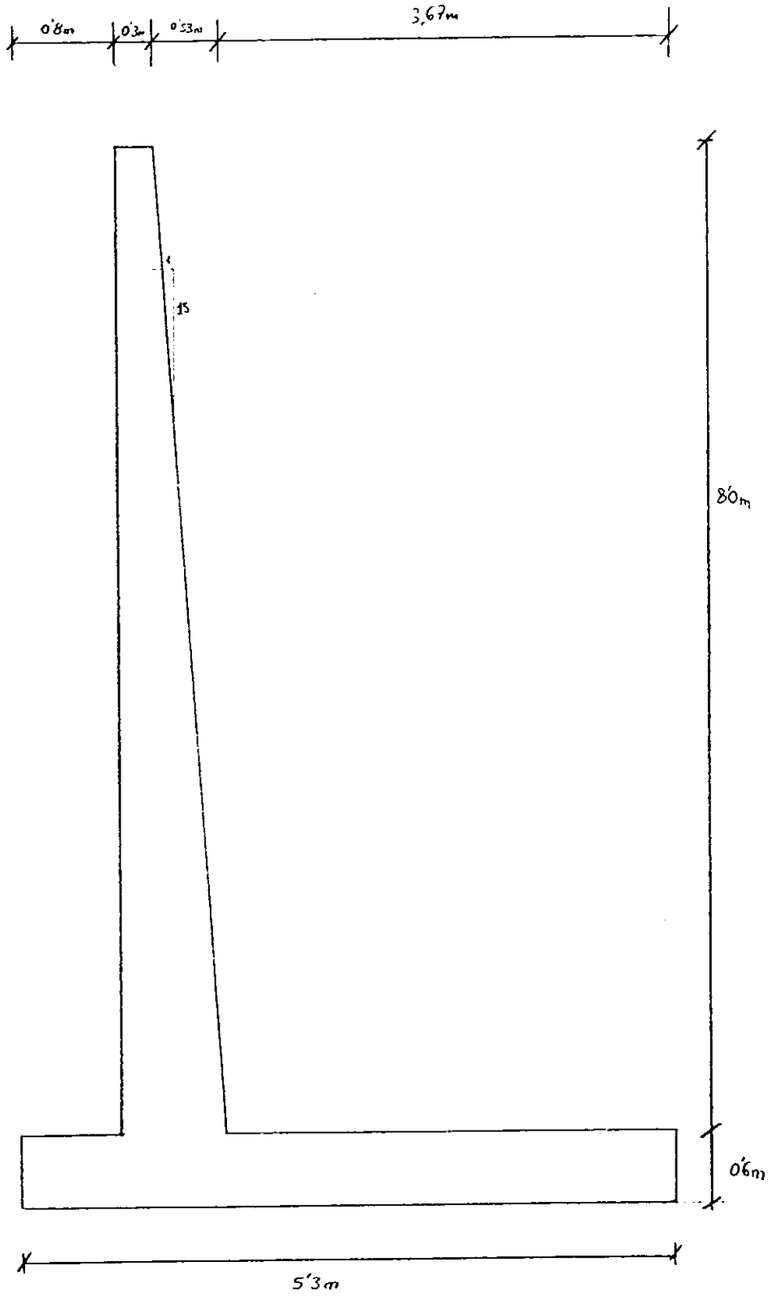
$M_d < M_{eu}$

$x^2 - 1,32x + 0,0209 = 0 \qquad x = 0,02$

$U_s = 25,9$ t/m ⟶ 8 ϕ 10 por metro

SECCIÓN I

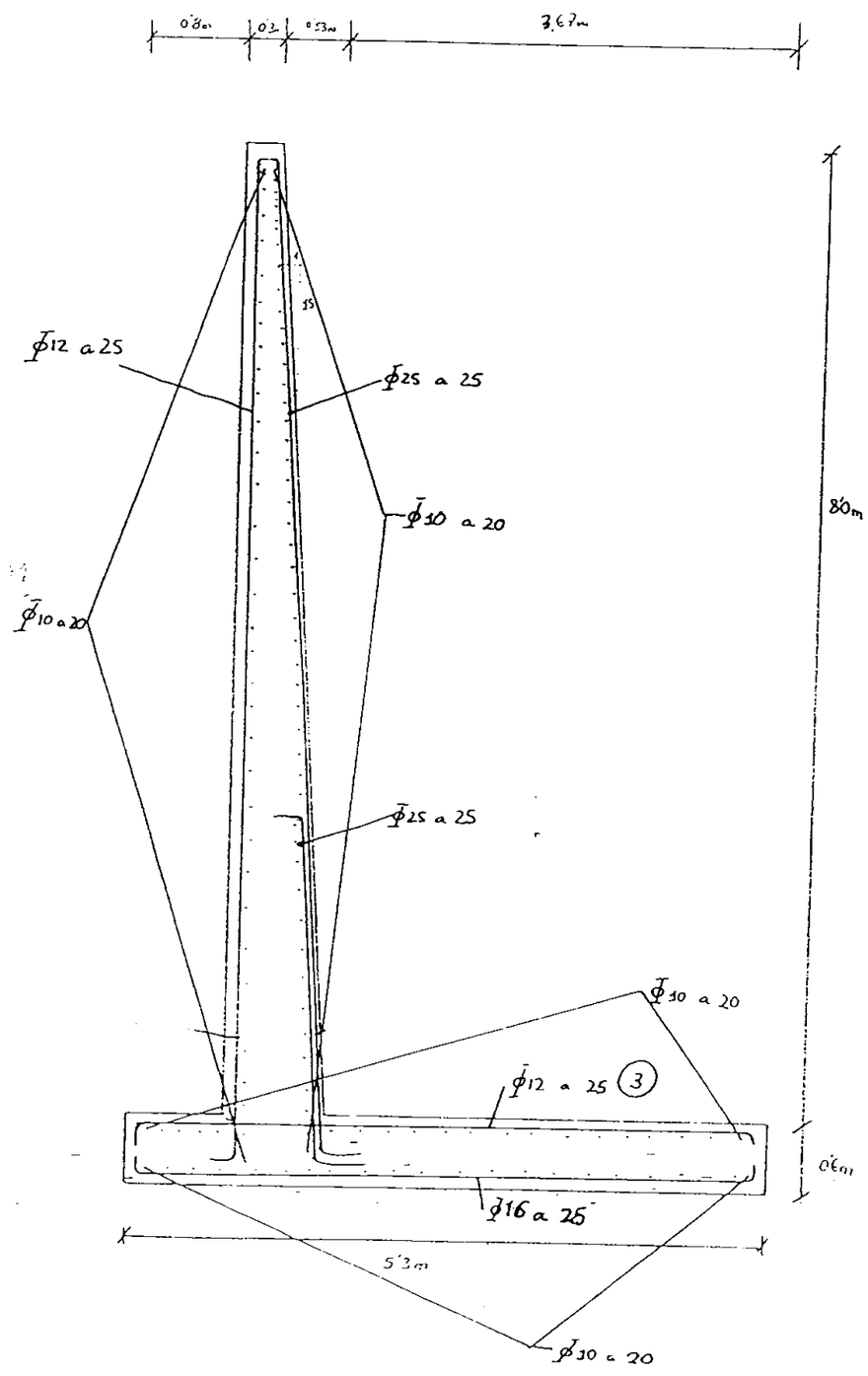
DEFINICIÓN GEOMÉTRICA



ALETA CAJON

SECCIÓN I

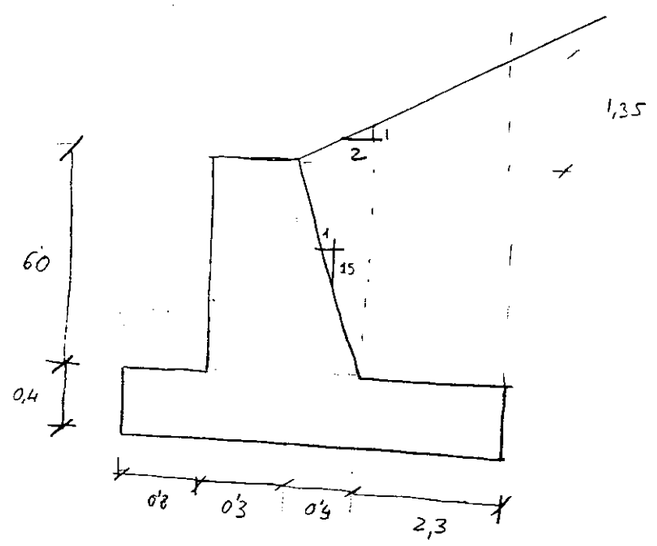
ARMADO



SECCIÓN II

012

SECCION II



H = 7'5 m

Empujes:

		Distancia
E_H =	23,19 t	
E_V =	17,35 t	a = 2,58 m
P_1 =	3,658 t	a = 3,8 m
P_2 =	5,32 t	a = 1,9 m
P_3 =	2,88 t	a = 0,95m
P_4 =	3,563 t	a = 1,233m
P_5 =	2,28 t	a = 2,9 m
P_6 =	26,22 t	a = 1,3667m
		a = 2,65 m

$\Sigma F_V = 60,161$ t

$\Sigma F_H = 23,19$ t

$M_{EA} = 162,6$ mt

$M_{VA} = 59,83$ mt $\quad M_A = 102,77$ mt

$\sigma_1 = 52,702 - 31,66 = 11,05$ t/m²

$\tau_1 = 20,62$ t/m²

$d = \frac{M_A}{\Sigma F_V} = 1,709$m

$\sigma_c = 0'75\ 20'62 = 15,564$ t/m² ≤ $\sigma_{ad} = 25$ t/m² (cumple)

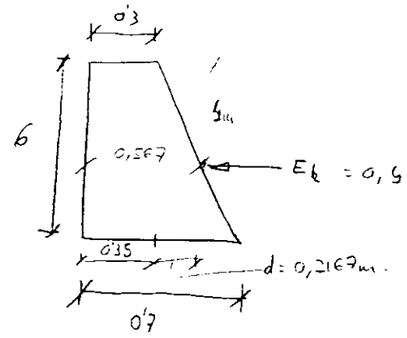
Ac lab 013 Formato

COEF. SEGUR

$C_{SV} = 2,71$

$C_{SD} = 1,67$

ARMADO. SECCIÓN II



$E_k = 0,53105 \cdot \frac{36}{2} \cdot 1,9 = 14,74$ t

$M_d = 14,74$ t . 2 . 1'6 = 47,17 mt

Armado:

$X_{cu} = 0,5$ m

$M_{cu} = 221,13$ m t

d = 5cm.

$M_d < M_{cu}$ no necesita armadura a compresión.

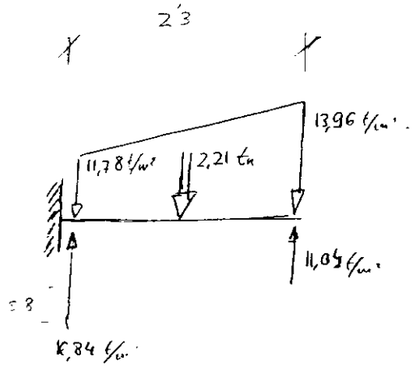
$x^2 - 1,625\ x + 0,10405 = 0$

$x = \frac{1,625 \pm 1,4915}{2} = 0,06677$ m

$U_s = 75,7$ t → 4 ϕ 25 por metro

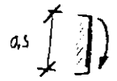
014

ARMADO SECCION II



$M_d = 1'6\left[-31,16 - 3,84 - 2,54 + 29,2 + 5,113\right]$

$M_d = -5,16 \text{ m t}_m$



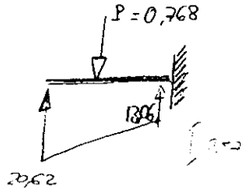
$x_{lim} = 0,218 \qquad U_{lim} = 65,9 \text{ m t}$

$x^2 - 0,85x + 0,0038 = 0$

$x = 0,0132$

$U_s = 15,96 \text{ t}_m$

$5\phi 12$

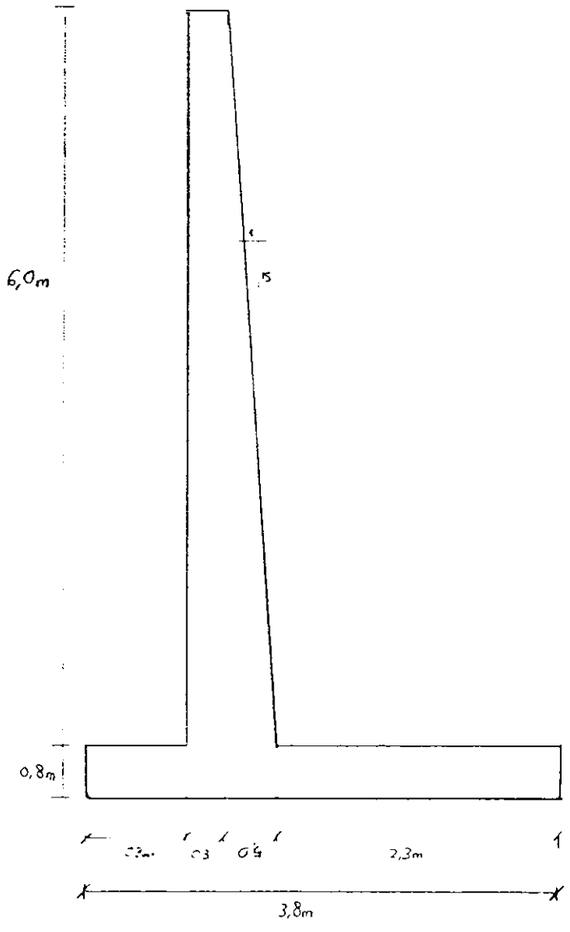


$M_d = 1'6\left[-5,78 + 1,615 + 0,768.0'2\right] = -11,6 \text{ t}_m$

$x^2 - 0,835x + 0,0256 = 0 \qquad x = 0,03031 \text{ m}$

$U_s = 35,34 \text{ t}_m$

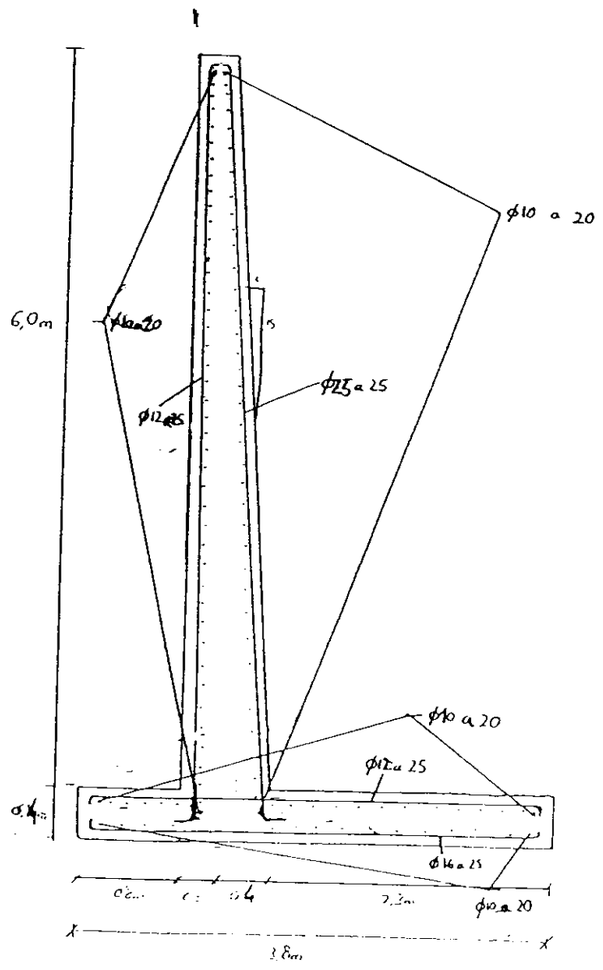
$4\phi 16$



ALETA CAJON

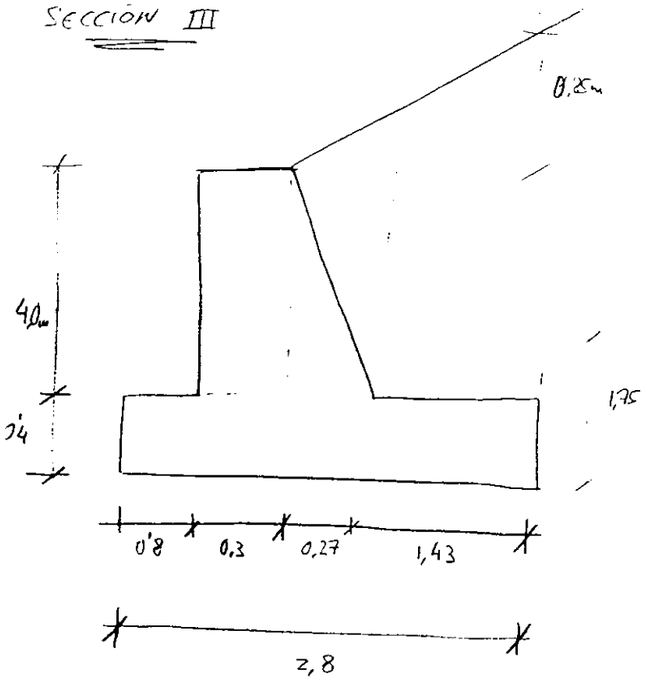
SECCIÓN II

ARMADO



SECCIÓN III

SECCIÓN III



EMPUJES

$E_H = 10,64\ t$
$E_V = 7,965\ t$
$P_1 = 2,688\ t$
$P_2 = 2,88\ t$
$P_3 = 1,296\ t$
$P_4 = 1,373\ t$
$P_5 = 1,026\ t$
$P_6 = 10,87\ t$

DISTANCIAS

$a = 1,75m$
$a = 2,8$ "
$a = 1,9m$
$a = 0,95m$
$a = 1,19m$
$a = 2,233m$
$a = 1,28m$
$a = 2,085m$

$\Sigma F_V = 28,1\ t$
$\Sigma F_H = 10,64\ t$

$M_{E\Delta} = 58,73\ mt$
$M_{P\Delta} = 18,62\ mt$
$\Big\} \quad M_\Delta = 40,11\ mt$

$\sigma_2 = \frac{28,17}{30,6352} - 20,16 = 10,56\ t/m^2$

$\sigma_1 = 9,5\ t/m^2$.

$\sigma_c = 0'75 \cdot 10,56 = 7,92 \leq \sigma_{adm} = 25\ t/m^2$ (cumple)

0,93 0'91 0'85

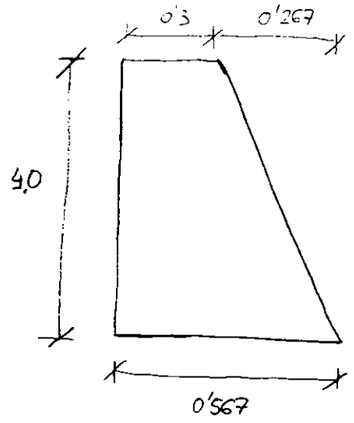
$d = 1,52$ No aprovechan fracciones.

COEFICIENTES DE SEGURIDAD

$C_{SV} = 3,15$

$C_{SD} = 1,715$

ARMADO SECCIÓN III



$E_h = 0'43104 \cdot \frac{16}{2} \cdot 19 = 6,552\ t_n$

$M_d = 1,6 \cdot 6,552 \cdot 1,33 = 13,98\ m\ t_n$

$x_{eu} = 0,312\ m$
$M_{eu} = 132,7\ m\ t_n$
$\Big\}$ $M_d < M_{eu}$ No necesitamos armadura de compresión.

$x^2 - 1,25x + 0,031 = 0$

$x = \frac{1,25 \pm 1,2}{2} = 0,025\ m$

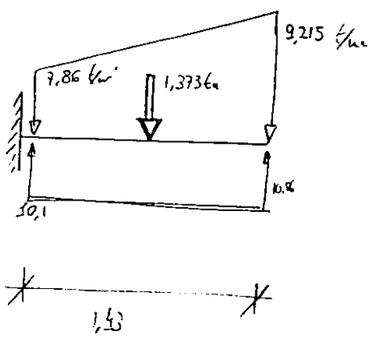
$U = 28,33\ t$

2 ϕ 25 por m

? ϕ 10

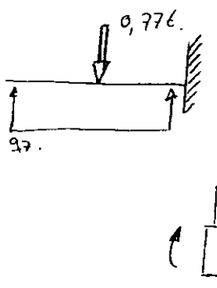
4 ϕ 16

ANCLAJE Sección III



$M_d = 1'6 \left[-8'04 - 0,9475 - 0,982 + 10,58 \right] =$

$M_d = + 0,817 \text{ m tn}$



$M_d = 1,5 \left[0,31 - 3,1 \right] = - 5,57 \text{ m tn}$

$x + 0'825 x + \ldots = 0 \qquad x = 0.00453$

$U_s = 5,135 \text{ tn}$

5 ⌀ 8

Comprobación a esfuerzo cortante y vaxante

Sección I

$V_d = 1,6 \; E_h = 41,94 \text{ tn} \leq 5'2 \sqrt{\frac{250}{15}} \cdot 0'75 = 50,35 \text{ tn}$ Comple

Sección II

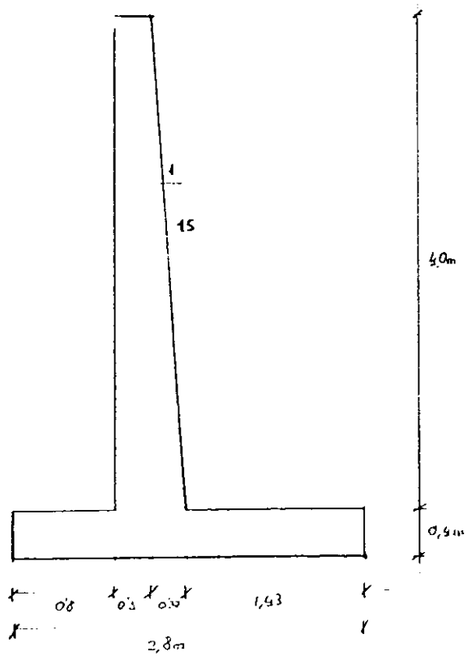
$V_d = 1,6 \, 14,74 = 23,586 \text{ tn} \leq 5'2 \cdot \sqrt{\frac{250}{15}} \cdot 0'65 = 33,63$ Comple

Sección III

$V_d = 1,6 \cdot 13,98 = 22,37 \text{ tn} \leq 5'2 \sqrt{\frac{250}{15}} \cdot 0'5 = 33,6$ Comp 6

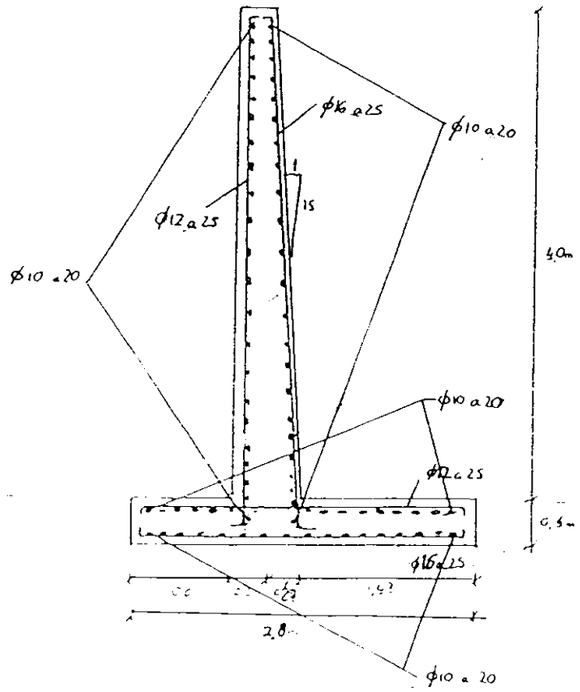
SECCION III

DEFINICIÓN GEOMÉTRICA

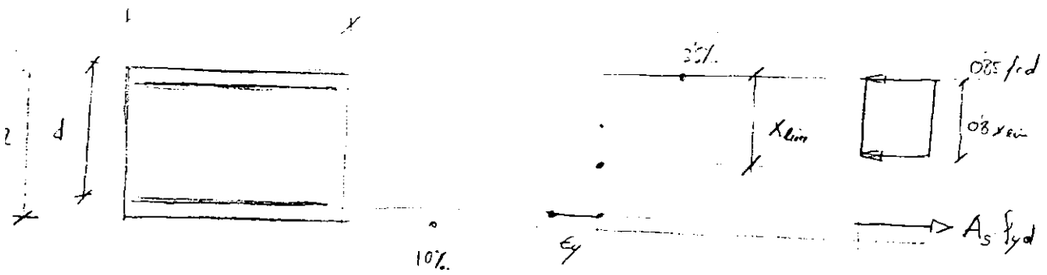


ALETA CAJÓN

SECCION III



ARMADO

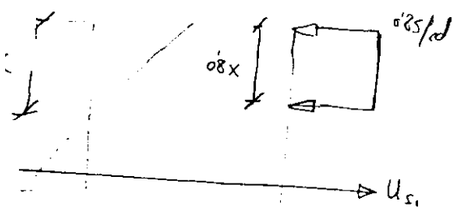


$$\frac{x_{lim}}{3'5} = \frac{d - x_{lim}}{\varepsilon_y} \longrightarrow x_{lim} = \frac{3'5 \cdot 10^{-3}}{\varepsilon_y} \cdot [d - x_{lim}] \longrightarrow$$

$$x_{lim} = \frac{\frac{3'5 \cdot 10^{-3}}{\varepsilon_y} d}{1 + \frac{3'5 \cdot 10^{-3}}{\varepsilon_y}} = \frac{3'5 \cdot 10^{-3} \cdot d}{\varepsilon_y + 3'5 \cdot 10^{-3}} \qquad x_{lim} = \frac{3'5 \cdot 10^{-3}}{\varepsilon_y + 3'5 \cdot 10^{-3}} \cdot d$$

$$M_{lim} = 0'85 \cdot 0'8\, x_{lim} f_{cd} (d - 0'4 x_{lim}) \cdot b = 0'68\, x_{lim} (d - 0'4 x_{lim}) \cdot f_{cd} \cdot b$$

Si $M_d \leq M_{lim}$ Solo armadura de tracción

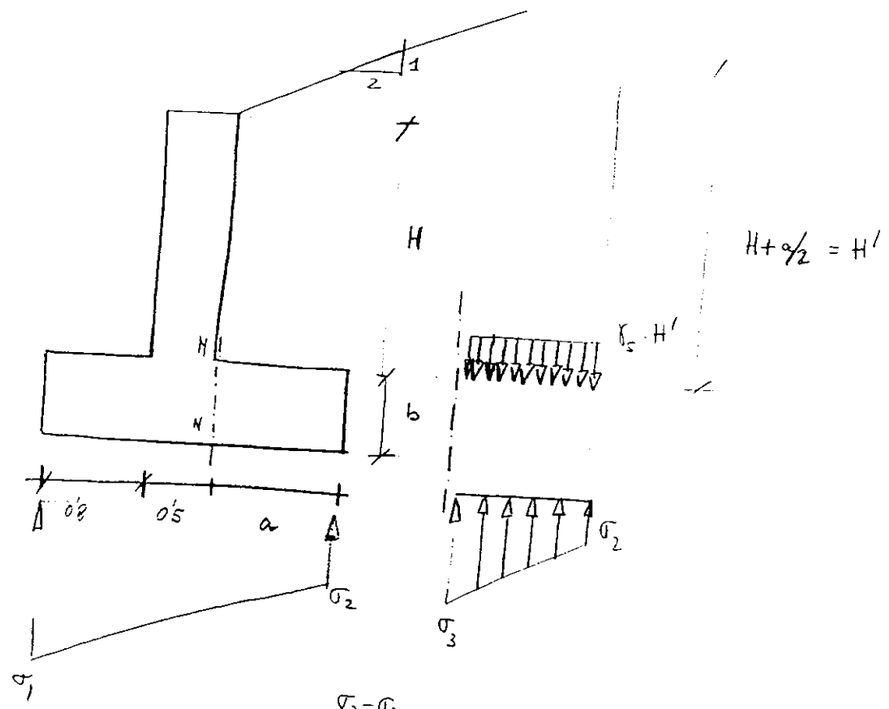


$$U_{s1} = 0'68\, x \cdot f_{cd}\, b$$

$$M_d = 0'68 \times f_{cd} [d - 0'4\, x] \cdot b$$

$$\frac{M_d}{0'68 f_{cd} b} = x \cdot d - 0'4 x^2 \quad \ldots > x$$

$$U_{s1} = 0'68\, x \cdot f_{cd}\, b$$

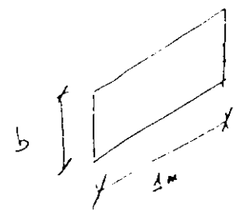


$$\frac{\sigma_3 - \sigma_2}{a} = \frac{\sigma_1 - \sigma_2}{1{,}3 + a} \longrightarrow \sigma_3 = \frac{a}{1{,}3 + a} \cdot (\sigma_1 - \sigma_2) + \sigma_2$$

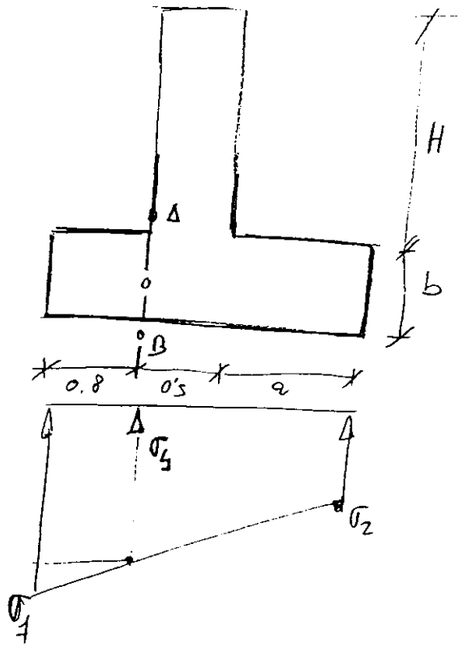
Momento en la sección MN por metro lineal

$$M_{MN} = \left[\sigma_2 \frac{a^2}{2} + \frac{1}{6} (\sigma_3 - \sigma_2) \cdot a^2 - \gamma_s H' \frac{a^2}{2} \right] \gamma$$

Sección a dimensionar



Lunedì (21



$$M_{AB} = \gamma \left[\sigma_3 \frac{a^2}{2} + (\sigma_2 - \sigma_1) \frac{a^2}{3} \right]$$

Pasos Inferiores (P.K. 3+350 y 4+500)

L.A.V. ZARAGOZA - LLEIDA
SUBTRAMO-I

PASOS INFERIORES P.K. 3+350 Y P.K. 4+500

GENERALIDADES.

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Unión Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción EH- 91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- En Limpieza y nivelación. . . . . $f_{ck} \geq 125$ kp/cm^2
- En Marcos. . . . . $f_{ck} \geq 250$ kp/cm^2
- Coeficiente de seguridad. . . . . $\gamma_c = 1,5$

Armaduras pasivas

- Límite elástico $\geq$ 5100 kp/cm^2
- Coeficiente de seguridad $\gamma_s = 1.15$

Cargas

- Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

Características del terreno

- Tensión admisible de cimentación 2,5 kgr/cm^2
- Densidad de tierras: 1,90 t/m^3
- Empuje de tierras: λ activo = 0,30
  λ reposo = 0,45
- Módulo de deformación: 5000 t/m^3

3.- Criterios generales de cálculo

Para el cálculo de los pórticos se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

En el cálculo se han considerado cuatro hipótesis de carga diferentes:

1.- Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel.
2.- Empuje máximo, sobrecarga mínima.
3.- Empuje mínimo, sobrecarga máxima.
4.- Empuje máximo, sobrecarga máxima.

La obtención de los esfuerzos en la sección transversal de los marcos, se ha realizado con la ayuda del programa de cálculo comercializado con el título "PROGRAMA ARCO" para Cálculo de Arcos, Pasos Inferiores y Galerías Enterradas © Copyright J. Díaz del Valle, 1.998.

Este programa obtiene los esfuerzos en la sección de cálculo, mediante la discretización de la estructura en barras (en este caso, se han tomado 40 elementos) y utilizando un cálculo matricial, basado en el método de la rigidez, obtiene los esfuerzos en cada punto para cada una de las hipótesis estudiadas.

El marco se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. La armadura longitudinal se dispone según EH-91.

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura dado que los pórticos van a estar cubiertos por las tierras.

El módulo de deformación del terreno adoptado, ha sido de 5000 t/m^3, teniendo en cuenta que el tipo de terreno a colocar bajo la solera del Pórtico se trata de un material granular, tipo zahorra natural procedente de la 2ª terraza del Ebro (préstamo denominado Acampo del Marqués de Ayerbe), que se corresponde con un valor del coeficiente de balasto de tipo medio, análogo a valores utilizados en multitud de cálculos similares al que nos ocupa y sabiendo, además, que una variación razonable de este módulo en ± 1000 t/m^3 va a influir muy poco en la distribución de los esfuerzos en la estructura.

Los posibles desplazamientos originados por las fuerzas horizontales -frenados, fuerza centrífuga- se consideran impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierras bajo la solera para un coeficiente de balasto medio.

No se considera en los cálculos la acción sísmica, ya que según la "Norma de Construcción Sismorresistente N.C.S.E.-94", las obras se encuentran en una zona con aceleración básica inferior a "0,04 g". Teniendo en cuenta dicho valor y un coeficiente de riesgo de 1,30 (construcciones de especial importancia) resulta una aceleración sísmica de cálculo inferior a "0,052 g" < "0,06 g".

4.- Equipo redactor

Los cálculos de estos pasos inferiores (P.K. 3+350 y P.K. 4+500) han sido realizados por la Oficina Técnica de LAHISCO AVE, U.T.E. (Construcciones Lain, S.A.; Corsan Empresa Constructora, S.A. y Constructora Hispánica, S.A., en Agrupación Temporal de Empresas) adjudicatario de la obra: Proyecto de "Línea de Alta Velocidad Madrid-Barcelona-frontera francesa. Tramo: Zaragoza-Lleida. Subtramo-I".

Estos cálculos se recogen, a continuación, desde la página 1 hasta la página 77, ambas inclusive.

Zaragoza, 7 de Octubre de 1.997

Fdo: Pedro García Borjabad
Ingeniero de Caminos

LINEA DE ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO-I.

MARCO 2 X 2

P.K. 3+350

001

MARCO DE 2X2 (P.K. 3+350)

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1. CÁLCULOS
   - 1.1 DATOS DEL PROCESO
   - 1.2 ESQUEMA DE CÁLCULO
   - 1.3 CARGAS CONSIDERADAS
   - 1.4 HIPÓTESIS DE CARGA
   - 1.5 ENVOLVENTE DE CAPACIDADES MECÁNICAS
2. PLANOS

1 . CALCULOS

MARCO 2X2 en P.K. 3+350

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de un marco de 2x2 m en el P.K. 3+350. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante el envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1- Datos de proceso
2- Esquema estructural
3- Cargas consideradas
4- Hipótesis de carga
5- Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

1.1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

1.2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

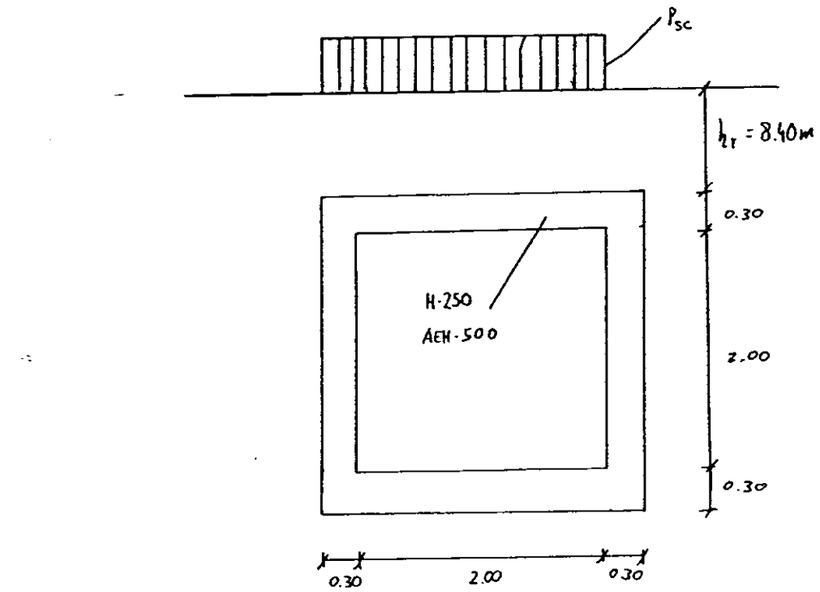

Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 8.40 m

  -sobre cimentación H_T = 10.70 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

1.3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\,(h_T - 1) \geq 1 \quad ,$$

$$I = 1$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\,(3 + h_T)} = 0.876 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 8.4$ m

  $H_T = 10.7$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

1.4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.


```
IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

(C) Copyright J.Diaz del Valle, 1988

P R O Y E C T O  :  L.A.V. SUBTRAMO I

Referencia .....  :  MARCO 2x2

Fecha ..........  :  5/9/97

HIPOTESIS I
```

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	4.595	-2.013	-1.253	0.300
2	1.150	0.200	4.475	-1.796	-0.894	0.300
3	1.150	0.400	4.235	-1.386	-0.617	0.300
4	1.150	0.600	3.995	-1.016	-0.414	0.300
5	1.150	0.800	3.755	-0.685	-0.277	0.300
6	1.150	1.000	3.515	-0.393	-0.198	0.300
7	1.150	1.200	3.275	-0.139	-0.170	0.300
8	1.150	1.400	3.035	0.075	-0.185	0.300
9	1.150	1.600	2.795	0.251	-0.235	0.300
10	1.150	1.800	2.555	0.387	-0.313	0.300
11	1.150	2.000	2.315	0.484	-0.410	0.300
12	1.150	2.015	2.185	0.522	-0.417	0.312
13	1.150	2.030	2.167	0.526	-0.425	0.325
14	1.150	2.045	2.147	0.530	-0.433	0.337
15	1.150	2.060	2.127	0.534	-0.441	0.350
16	1.150	2.075	2.106	0.538	-0.449	0.362
17	1.150	2.090	2.084	0.541	-0.458	0.374
18	1.150	2.105	2.062	0.544	-0.466	0.387
19	1.150	2.120	2.039	0.547	-0.474	0.399
20	1.150	2.135	2.015	0.549	-0.482	0.412
21	1.150	2.150	0.552	-1.990	-0.490	0.424
22	1.135	2.150	0.553	-1.961	-0.461	0.412
23	1.120	2.150	0.553	-1.929	-0.432	0.399
24	1.105	2.150	0.553	-1.898	-0.404	0.387
25	1.090	2.150	0.553	-1.868	-0.376	0.374
26	1.075	2.150	0.553	-1.838	-0.348	0.362
27	1.060	2.150	0.553	-1.809	-0.321	0.350
28	1.045	2.150	0.553	-1.780	-0.294	0.337
29	1.030	2.150	0.553	-1.753	-0.268	0.325
30	1.015	2.150	0.553	-1.726	-0.242	0.312
31	1.000	2.150	0.553	-1.700	-0.216	0.300
32	0.900	2.150	0.553	-1.603	-0.056	0.300
33	0.800	2.150	0.553	-1.434	0.087	0.300
34	0.700	2.150	0.553	-1.265	0.214	0.300
35	0.600	2.150	0.553	-1.097	0.323	0.300
36	0.500	2.150	0.553	-0.928	0.416	0.300
37	0.400	2.150	0.553	-0.759	0.492	0.300
38	0.300	2.150	0.553	-0.591	0.551	0.300
39	0.200	2.150	0.553	-0.422	0.593	0.300
40	0.100	2.150	0.553	-0.253	0.619	0.300
41	0.000	2.150	0.553	-0.084	0.627	0.300

R = 0.45947E+01 M = -.12533E+01 H = -.20134E+01 V = 0.51422E-04m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X	W	GIRO	FLECTOR	CORTANTE	REACCION

(m)	(mm)	(1000xrad)	(txm/m)	(t/m)	(t/m)
1.150	0.853	-0.082	1.253	4.595	4.264
1.035	0.842	-0.099	0.753	4.107	4.212
0.920	0.830	-0.108	0.308	3.626	4.152
0.805	0.818	-0.109	-0.081	3.152	4.089
0.690	0.805	-0.105	-0.417	2.686	4.027
0.575	0.794	-0.096	-0.699	2.226	3.970
0.460	0.784	-0.082	-0.929	1.772	3.918
0.345	0.775	-0.064	-1.107	1.324	3.876
0.230	0.769	-0.044	-1.234	0.880	3.845
0.115	0.765	-0.023	-1.310	0.439	3.826
0.000	0.764	0.000	-1.335	0.000	3.819

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	2.250	0.000
2	1.150	0.200	2.250	2.250	0.000
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	2.250	0.000
12	1.150	2.015	2.343	2.343	0.000
13	1.150	2.030	2.436	2.436	0.000
14	1.150	2.045	2.529	2.529	0.000
15	1.150	2.060	2.622	2.622	0.000
16	1.150	2.075	2.715	2.715	0.000
17	1.150	2.090	2.808	2.808	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	3.180	0.000
22	1.135	2.150	3.087	3.087	0.000
23	1.120	2.150	2.994	2.994	0.000
24	1.105	2.150	2.901	2.901	0.000
25	1.090	2.150	2.808	2.808	0.000
26	1.075	2.150	2.715	2.715	0.000
27	1.060	2.150	2.622	2.622	0.000
28	1.045	2.150	2.529	2.529	0.000
29	1.030	2.150	2.436	2.436	0.000
30	1.015	2.150	2.343	2.343	0.000
31	1.000	2.150	2.250	2.250	0.000
32	0.900	2.150	2.250	2.250	0.000
33	0.800	2.150	2.250	2.250	0.000
34	0.700	2.150	2.250	2.250	0.000
35	0.600	2.150	2.250	2.250	0.000
36	0.500	2.150	2.250	2.250	0.000
37	0.400	2.150	2.250	2.250	0.000
38	0.300	2.150	2.250	2.250	0.000
39	0.200	2.150	2.250	2.250	0.000
40	0.100	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	2.250	2.250	0.000
2	1.035	-0.150	2.250	2.250	0.000
3	0.920	-0.150	2.250	2.250	0.000
4	0.805	-0.150	2.250	2.250	0.000
5	0.690	-0.150	2.250	2.250	0.000
6	0.575	-0.150	2.250	2.250	0.000
7	0.460	-0.150	2.250	2.250	0.000
8	0.345	-0.150	2.250	2.250	0.000
9	0.230	-0.150	2.250	2.250	0.000
10	0.115	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.60 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	35.597	-15.587	-9.579	0.300
2	1.150	0.200	35.477	-14.047	-6.770	0.300
3	1.150	0.400	35.237	-11.007	-4.568	0.300
4	1.150	0.600	34.997	-8.026	-2.963	0.300
5	1.150	0.800	34.757	-5.102	-1.943	0.300
6	1.150	1.000	34.517	-2.238	-1.495	0.300
7	1.150	1.200	34.277	0.569	-1.609	0.300
8	1.150	1.400	34.037	3.316	-2.272	0.300
9	1.150	1.600	33.797	6.006	-3.473	0.300
10	1.150	1.800	33.557	8.637	-5.200	0.300
11	1.150	2.000	33.317	11.209	-7.442	0.300
12	1.150	2.015	33.188	12.570	-7.631	0.312
13	1.150	2.030	33.169	12.758	-7.822	0.325
14	1.150	2.045	33.149	12.946	-8.016	0.337
15	1.150	2.060	33.129	13.134	-8.213	0.350
16	1.150	2.075	33.108	13.321	-8.413	0.362
17	1.150	2.090	33.086	13.508	-8.616	0.374
18	1.150	2.105	33.064	13.694	-8.821	0.387
19	1.150	2.120	33.041	13.881	-9.029	0.399
20	1.150	2.135	33.017	14.067	-9.240	0.412
21	1.150	2.150	14.252	-32.992	-9.454	0.424
22	1.135	2.150	14.345	-32.761	-8.963	0.412
23	1.120	2.150	14.345	-32.325	-8.478	0.399
24	1.105	2.150	14.345	-31.889	-8.000	0.387
25	1.090	2.150	14.345	-31.454	-7.528	0.374
26	1.075	2.150	14.345	-31.020	-7.062	0.362
27	1.060	2.150	14.345	-30.587	-6.604	0.350
28	1.045	2.150	14.345	-30.154	-6.151	0.337
29	1.030	2.150	14.345	-29.722	-5.706	0.325
30	1.015	2.150	14.345	-29.291	-5.266	0.312
31	1.000	2.150	14.345	-28.861	-4.833	0.300
32	0.900	2.150	14.345	-27.213	-2.112	0.300
33	0.800	2.150	14.345	-24.349	0.323	0.300
34	0.700	2.150	14.345	-21.484	2.471	0.300
35	0.600	2.150	14.345	-18.620	4.333	0.300
36	0.500	2.150	14.345	-15.755	5.909	0.300
37	0.400	2.150	14.345	-12.891	7.198	0.300
38	0.300	2.150	14.345	-10.026	8.201	0.300
39	0.200	2.150	14.345	-7.161	8.917	0.300
40	0.100	2.150	14.345	-4.297	9.346	0.300
41	0.000	2.150	14.345	-1.432	9.490	0.300

R = 0.35597E+02 M = -.95791E+01 H = -.15587E+02 V = 0.70027E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	6.615	-0.654	9.579	35.597	33.077
1.035	6.532	-0.784	5.703	31.816	32.660
0.920	6.438	-0.851	2.259	28.087	32.188
0.805	6.338	-0.863	-0.759	24.414	31.692
0.690	6.241	-0.827	-3.358	20.798	31.204
0.575	6.150	-0.751	-5.544	17.236	30.749
0.460	6.069	-0.641	-7.324	13.723	30.347
0.345	6.003	-0.504	-8.702	10.253	30.016
0.230	5.954	-0.347	-9.684	6.816	29.771
0.115	5.924	-0.177	-10.271	3.402	29.620
0.000	5.914	0.000	-10.467	0.000	29.569

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	4.714	3.128
2	1.150	0.200	2.250	2.575	2.147
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	3.490	0.000
12	1.150	2.015	2.343	3.398	0.000
13	1.150	2.030	2.436	3.298	0.000
14	1.150	2.045	2.529	3.201	0.000
15	1.150	2.060	2.622	3.109	0.000
16	1.150	2.075	2.715	3.023	0.000
17	1.150	2.090	2.808	2.943	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	5.003	11.506
22	1.135	2.150	3.087	4.846	11.984
23	1.120	2.150	2.994	4.694	12.352
24	1.105	2.150	2.901	4.539	12.755
25	1.090	2.150	2.808	4.378	13.198
26	1.075	2.150	2.715	4.213	13.686
27	1.060	2.150	2.622	4.041	14.224
28	1.045	2.150	2.529	3.863	14.819
29	1.030	2.150	2.436	3.676	15.478
30	1.015	2.150	2.343	3.480	16.211
31	1.000	2.150	2.250	3.272	17.029

32	0.900	2.150	2.250	2.250	15.632
33	0.800	2.150	2.250	2.250	12.718
34	0.700	2.150	2.250	2.250	9.803
35	0.600	2.150	2.805	2.250	6.737
36	0.500	2.150	3.908	2.250	3.520
37	0.400	2.150	5.102	2.250	0.278
38	0.300	2.150	6.126	2.250	0.000
39	0.200	2.150	6.865	2.250	0.000
40	0.100	2.150	7.311	2.250	0.000
41	0.000	2.150	7.461	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	9.336	2.250	22.223
2	1.035	-0.150	5.452	2.250	19.440
3	0.920	-0.150	2.688	2.250	16.402
4	0.805	-0.150	2.250	2.250	12.784
5	0.690	-0.150	2.250	3.646	8.722
6	0.575	-0.150	2.250	5.296	4.646
7	0.460	-0.150	2.250	7.056	0.591
8	0.345	-0.150	2.250	8.443	0.000
9	0.230	-0.150	2.250	9.444	0.000
10	0.115	-0.150	2.250	10.049	0.000
11	0.000	-0.150	2.250	10.251	0.000

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A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.70 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.88 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	37.582	-10.495	-9.091	0.300
2	1.150	0.200	37.462	-9.459	-7.199	0.300
3	1.150	0.400	37.222	-7.413	-5.717	0.300
4	1.150	0.600	36.982	-5.406	-4.636	0.300
5	1.150	0.800	36.742	-3.437	-3.948	0.300
6	1.150	1.000	36.502	-1.508	-3.647	0.300
7	1.150	1.200	36.262	0.382	-3.723	0.300
8	1.150	1.400	36.022	2.234	-4.170	0.300
9	1.150	1.600	35.782	4.046	-4.979	0.300
10	1.150	1.800	35.542	5.820	-6.143	0.300
11	1.150	2.000	35.302	7.554	-7.654	0.300
12	1.150	2.015	35.173	8.472	-7.781	0.312
13	1.150	2.030	35.154	8.599	-7.910	0.325
14	1.150	2.045	35.135	8.725	-8.041	0.337
15	1.150	2.060	35.115	8.852	-8.174	0.350
16	1.150	2.075	35.094	8.978	-8.308	0.362
17	1.150	2.090	35.072	9.104	-8.445	0.374
18	1.150	2.105	35.049	9.230	-8.583	0.387
19	1.150	2.120	35.026	9.356	-8.724	0.399
20	1.150	2.135	35.002	9.481	-8.866	0.412
21	1.150	2.150	9.606	-34.978	-9.010	0.424
22	1.135	2.150	9.669	-34.734	-8.489	0.412
23	1.120	2.150	9.669	-34.271	-7.975	0.399
24	1.105	2.150	9.669	-33.810	-7.468	0.387
25	1.090	2.150	9.669	-33.349	-6.968	0.374
26	1.075	2.150	9.669	-32.889	-6.474	0.362
27	1.060	2.150	9.669	-32.430	-5.988	0.350
28	1.045	2.150	9.669	-31.971	-5.508	0.337
29	1.030	2.150	9.669	-31.513	-5.035	0.325
30	1.015	2.150	9.669	-31.056	-4.570	0.312
31	1.000	2.150	9.669	-30.600	-4.111	0.300
32	0.900	2.150	9.669	-28.853	-1.225	0.300
33	0.800	2.150	9.669	-25.816	1.356	0.300
34	0.700	2.150	9.669	-22.779	3.634	0.300
35	0.600	2.150	9.669	-19.742	5.608	0.300
36	0.500	2.150	9.669	-16.705	7.279	0.300
37	0.400	2.150	9.669	-13.667	8.646	0.300
38	0.300	2.150	9.669	-10.630	9.709	0.300
39	0.200	2.150	9.669	-7.593	10.468	0.300
40	0.100	2.150	9.669	-4.556	10.923	0.300
41	0.000	2.150	9.669	-1.519	11.075	0.300

R = 0.37582E+02 M = -.90912E+01 H = -.10495E+02 V = 0.84093E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	7.049	-0.860	9.091	37.582	35.243
1.035	6.942	-0.979	5.001	33.559	34.711
0.920	6.826	-1.033	1.370	29.601	34.130
0.805	6.707	-1.028	-1.810	25.710	33.535
0.690	6.591	-0.974	-4.546	21.887	32.957
0.575	6.485	-0.876	-6.846	18.128	32.423
0.460	6.391	-0.743	-8.717	14.427	31.956
0.345	6.315	-0.582	-10.166	10.775	31.574
0.230	6.258	-0.400	-11.197	7.161	31.291
0.115	6.223	-0.203	-11.814	3.574	31.117
0.000	6.212	0.000	-12.020	0.000	31.058

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	3.991	0.000
2	1.150	0.200	2.250	2.785	0.000
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	3.471	0.000
12	1.150	2.015	2.343	3.312	0.000
13	1.150	2.030	2.436	3.142	0.000
14	1.150	2.045	2.529	2.975	0.000
15	1.150	2.060	2.622	2.815	0.000
16	1.150	2.075	2.715	2.715	0.000
17	1.150	2.090	2.808	2.808	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	5.231	12.835
22	1.135	2.150	3.087	5.055	13.352
23	1.120	2.150	2.994	4.880	13.751
24	1.105	2.150	2.901	4.699	14.189
25	1.090	2.150	2.808	4.512	14.670
26	1.075	2.150	2.715	4.317	15.199
27	1.060	2.150	2.622	4.114	15.782
28	1.045	2.150	2.529	3.901	16.427
29	1.030	2.150	2.436	3.676	17.142
30	1.015	2.150	2.343	3.437	17.936
31	1.000	2.150	2.250	3.180	18.824
32	0.900	2.150	2.250	2.250	17.301

33	0.800	2.150	2.250	2.250	14.211
34	0.700	2.150	2.731	2.250	10.989
35	0.600	2.150	4.105	2.250	7.522
36	0.500	2.150	5.776	2.250	3.975
37	0.400	2.150	7.168	2.250	0.503
38	0.300	2.150	8.266	2.250	0.000
39	0.200	2.150	9.060	2.250	0.000
40	0.100	2.150	9.540	2.250	0.000
41	0.000	2.150	9.701	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	8.838	2.250	24.380
2	1.035	-0.150	4.765	2.250	21.401
3	0.920	-0.150	2.250	2.250	18.061
4	0.805	-0.150	2.250	2.250	14.103
5	0.690	-0.150	2.250	4.322	9.646
6	0.575	-0.150	2.250	6.580	5.203
7	0.460	-0.150	2.250	8.458	0.923
8	0.345	-0.150	2.250	9.940	0.000
9	0.230	-0.150	2.250	11.012	0.000
10	0.115	-0.150	2.250	11.660	0.000
11	0.000	-0.150	2.250	11.877	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.70 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.88 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	37.582	-15.725	-9.985	0.300
2	1.150	0.200	37.462	-14.171	-7.151	0.300
3	1.150	0.400	37.222	-11.102	-4.931	0.300
4	1.150	0.600	36.982	-8.091	-3.313	0.300
5	1.150	0.800	36.742	-5.139	-2.285	0.300
6	1.150	1.000	36.502	-2.245	-1.836	0.300
7	1.150	1.200	36.262	0.591	-1.954	0.300
8	1.150	1.400	36.022	3.368	-2.628	0.300
9	1.150	1.600	35.782	6.086	-3.845	0.300
10	1.150	1.800	35.542	8.747	-5.594	0.300
11	1.150	2.000	35.302	11.348	-7.864	0.300
12	1.150	2.015	35.173	12.725	-8.055	0.312
13	1.150	2.030	35.154	12.915	-8.248	0.325
14	1.150	2.045	35.135	13.105	-8.445	0.337
15	1.150	2.060	35.115	13.295	-8.644	0.350
16	1.150	2.075	35.094	13.485	-8.847	0.362
17	1.150	2.090	35.072	13.674	-9.052	0.374
18	1.150	2.105	35.049	13.862	-9.260	0.387
19	1.150	2.120	35.026	14.051	-9.471	0.399
20	1.150	2.135	35.002	14.239	-9.684	0.412
21	1.150	2.150	14.427	-34.978	-9.901	0.424
22	1.135	2.150	14.520	-34.734	-9.379	0.412
23	1.120	2.150	14.520	-34.271	-8.865	0.399
24	1.105	2.150	14.520	-33.810	-8.358	0.387
25	1.090	2.150	14.520	-33.349	-7.858	0.374
26	1.075	2.150	14.520	-32.889	-7.365	0.362
27	1.060	2.150	14.520	-32.430	-6.878	0.350
28	1.045	2.150	14.520	-31.971	-6.399	0.337
29	1.030	2.150	14.520	-31.513	-5.926	0.325
30	1.015	2.150	14.520	-31.056	-5.460	0.312
31	1.000	2.150	14.520	-30.600	-5.001	0.300
32	0.900	2.150	14.520	-28.853	-2.116	0.300
33	0.800	2.150	14.520	-25.816	0.466	0.300
34	0.700	2.150	14.520	-22.779	2.744	0.300
35	0.600	2.150	14.520	-19.742	4.718	0.300
36	0.500	2.150	14.520	-16.705	6.388	0.300
37	0.400	2.150	14.520	-13.667	7.755	0.300
38	0.300	2.150	14.520	-10.630	8.818	0.300
39	0.200	2.150	14.520	-7.593	9.577	0.300
40	0.100	2.150	14.520	-4.556	10.033	0.300
41	0.000	2.150	14.521	-1.519	10.185	0.300

R = 0.37582E+02 M = -.99854E+01 H = -.15725E+02 V = 0.75425E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	6.992	-0.712	9.985	37.582	34.962
1.035	6.902	-0.847	5.894	33.587	34.511
0.920	6.800	-0.915	2.258	29.647	34.001
0.805	6.694	-0.926	-0.927	25.767	33.469
0.690	6.589	-0.886	-3.671	21.949	32.946
0.575	6.492	-0.803	-5.978	18.188	32.458
0.460	6.406	-0.685	-7.856	14.481	32.029
0.345	6.335	-0.539	-9.310	10.819	31.676
0.230	6.283	-0.371	-10.346	7.192	31.414
0.115	6.250	-0.189	-10.965	3.590	31.252
0.000	6.240	0.000	-11.172	0.000	31.198

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	4.908	3.216
2	1.150	0.200	2.250	2.733	2.230
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	3.652	0.000
11	1.150	2.000	2.250	3.554	0.103
12	1.150	2.015	2.343	3.445	0.000
13	1.150	2.030	2.436	3.339	0.000
14	1.150	2.045	2.529	3.238	0.000
15	1.150	2.060	2.622	3.142	0.000
16	1.150	2.075	2.715	3.051	0.000
17	1.150	2.090	2.808	2.967	0.000
18	1.150	2.105	2.901	2.994	0.000
19	1.150	2.120	2.994	3.087	0.000
20	1.150	2.135	3.087	5.223	12.836
21	1.150	2.150	3.180	5.058	13.351
22	1.135	2.150	3.087	4.899	13.748
23	1.120	2.150	2.994	4.735	14.182
24	1.105	2.150	2.901	4.566	14.659
25	1.090	2.150	2.808	4.391	15.184
26	1.075	2.150	2.715		

27	1.060	2.150	2.622	4.210	15.761
28	1.045	2.150	2.529	4.022	16.399
29	1.030	2.150	2.436	3.825	17.105
30	1.015	2.150	2.343	3.618	17.890
31	1.000	2.150	2.250	3.398	18.764
32	0.900	2.150	2.250	2.250	17.301
33	0.800	2.150	2.250	2.250	14.211
34	0.700	2.150	2.250	2.250	11.120
35	0.600	2.150	3.148	2.250	7.784
36	0.500	2.150	4.262	2.250	4.389
37	0.400	2.150	5.647	2.250	0.920
38	0.300	2.150	6.741	2.250	0.000
39	0.200	2.150	7.531	2.250	0.000
40	0.100	2.150	8.009	2.250	0.000
41	0.000	2.150	8.169	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	9.754	2.250	24.129
2	1.035	-0.150	5.639	2.250	21.190
3	0.920	-0.150	2.687	2.250	17.989
4	0.805	-0.150	2.250	2.250	14.161
5	0.690	-0.150	2.250	3.875	9.831
6	0.575	-0.150	2.250	5.722	5.499
7	0.460	-0.150	2.250	7.589	1.216
8	0.345	-0.150	2.250	9.061	0.000
9	0.230	-0.150	2.250	10.126	0.000
10	0.115	-0.150	2.250	10.770	0.000
11	0.000	-0.150	2.250	10.985	0.000

1.5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_S (Ton)	DISPUESTO ARMADURA	U_S (Ton)
HASTIAL	Interior	10.0	ϕ 10 A 0.20	17.4
	Exterior	21.8	ϕ 16 A 0.20	44.6
DINTEL	Interior	43.02	ϕ 16 A 0.20	44.6
	Exterior	15.1	ϕ 10 A 0.20	17.4
SOLERA	Inferior	43.2	ϕ 16 A 0.20	44.6
	Superior	52.7	ϕ 20 A 0.20	69.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- **HASTIAL**

  * Elemento: Muro vertical

    Acero: AEH-500 _ Cuantía mínima = 0,90 %

  * $A_C = 2 \times 0,3 = 0,6\ m^2$

  * $A_S = 10.8 \times 10^{-4}\ m^2 \Rightarrow 5,4 \times 10^{-4}\ m^2$ por cara

    Φ 10 A 0,20 en 2 m $\Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara _ **Válido**

- **DINTEL**

  * Elemento: Muro horizontal

    Acero: AEH-500 _ Cuantía mínima = 1,6 %

  * $A_C = 2.6 \times 0,3 = 0,78\ m^2$

  * $A_S = 12,48 \times 10^{-4}\ m^2 \Rightarrow 6,24 \times 10^{-4}\ m^2$ por cara

    Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

- **SOLERA**

  * Elemento: Losa

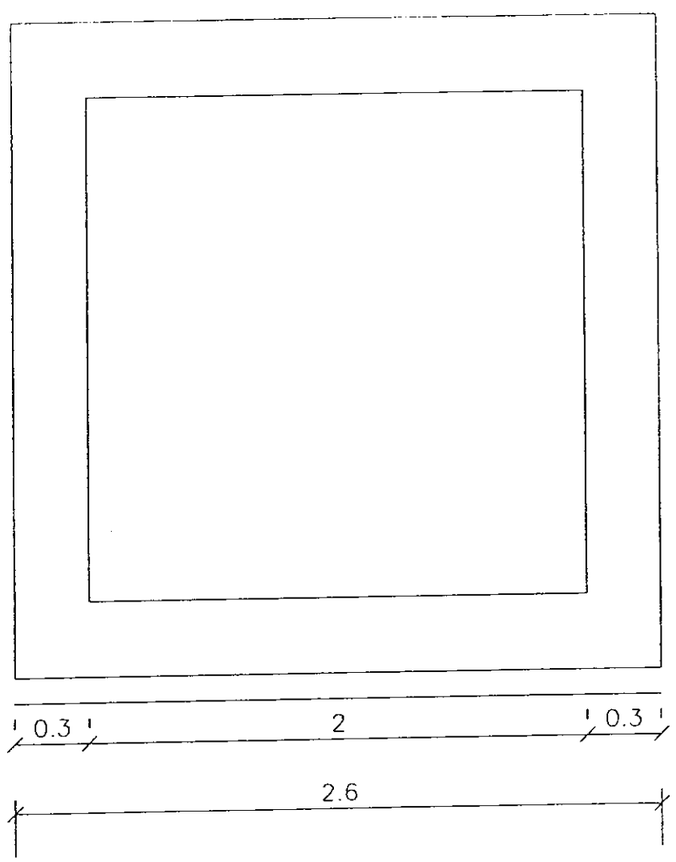
    Acero: AEH-500 _ Cuantia mínima = 1,5 %

  * $A_C = 2,6 \times 0,3 = 0,78\ m^2$

  * $A_S = 12,48 \times 10^{-4}\ m^2 \Rightarrow 6,24 \times 10^{-4}\ m^2$ por cara

    Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara **Válido**

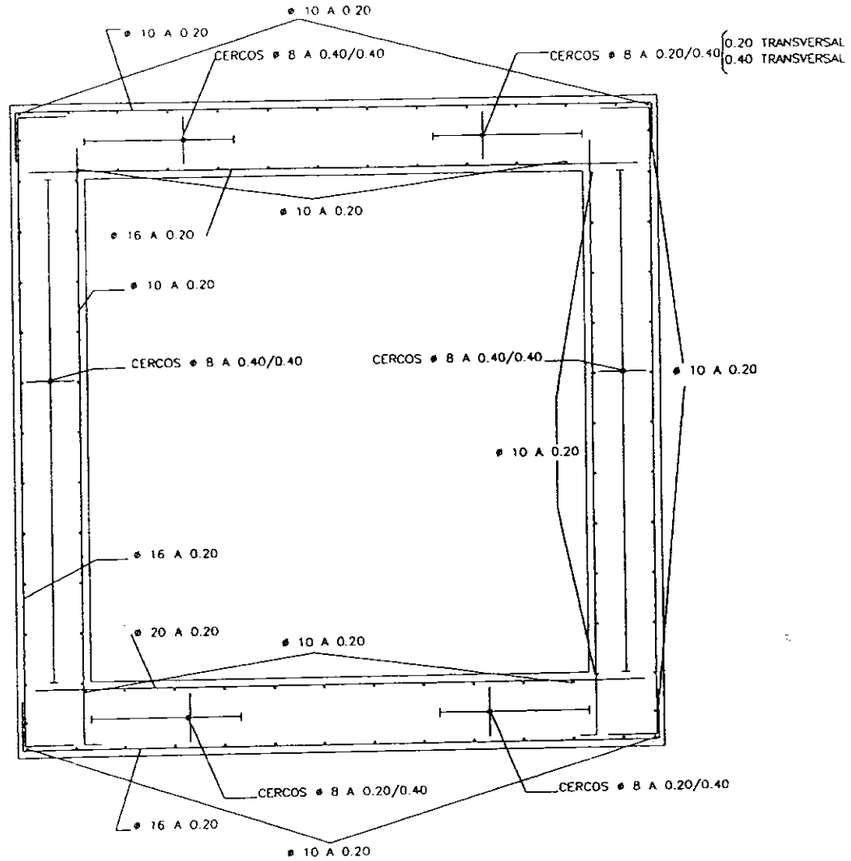
2 .PLANOS



SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 25



SECCION TRANSVERSAL

ARMADURAS

ESCALA 1 : 25

LINEA DE ALTA VELOCIDAD.
MADRID - BARCELONA - FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

MARCO 2X2

P.K. 4 + 500

040

MARCO DE 2X2 (P.K. 4+500)

ÍNDICE

1. CÁLCULOS
   - 1.1 DATOS DEL PROCESO
   - 1.2 ESQUEMA DE CÁLCULO
   - 1.3 CARGAS CONSIDERADAS
   - 1.4 HIPÓTESIS DE CARGA
   - 1.5 ENVOLVENTE DE CAPACIDADES MECÁNICAS
2. PLANOS

1 . CALCULOS

MARCO 2x2 en P.K. 4+500

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de un marco de 2x2 m en el P.K. 4+500. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso

2 - Esquema estructural

3 - Cargas consideradas

4 - Hipótesis de carga

5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

1.1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- Hormigón

H-250 $\gamma_C = 1,5$

$\gamma_{HORMIGON} = 2,5\ t/m^3$

- Acero

AEH-500 $\gamma_S = 1,15$

Recubrimiento = 4 cm

- Tierras

Densidad de tierras $\gamma_{TIERRAS} = 2,03\ t/m^3$

Coeficientes de empuje

ACTIVO, $K_{ACTIVO} = 0,30$

EN REPOSO, $K_{REPOSO} = 0,45$

- Módulo de Balasto 5.000 t/m^3

- Tensión admisible en cimentación 2.5 Kg/m^3

044

1.2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

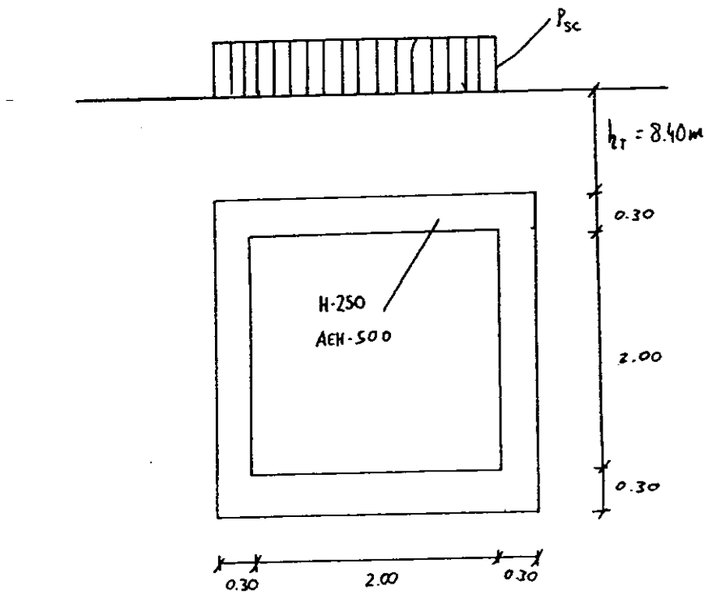


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 8.40 m

  -sobre cimentación H_T = 10.70 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

1.3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\,(h_T - 1) \geq 1 \quad ,$$

$$I = 1$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\,(3 + h_T)} = 0.876 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 8.4$ m

  $H_T = 10.7$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

1.4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. **Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel**
2. **Empuje máximo, sobrecarga mínima**
3. **Empuje mínimo, sobrecarga máxima**
4. **Empuje máximo, sobrecarga máxima**

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON	=	2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck	=	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c	=	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk	=	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s	=	1.15	
RECUBRIMIENTO DE LAS ARMADURAS c	=	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	2.30	m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03	t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.30	
SOBRECARGA q	=	0.00	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q	=	0.00	t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t	=	0.30	m
COEFICIENTE DE BALASTO DEL TERRENO ..... K	=	5000	t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	4.595	-2.013	-1.253	0.300
2	1.150	0.200	4.475	-1.796	-0.894	0.300
3	1.150	0.400	4.235	-1.386	-0.617	0.300
4	1.150	0.600	3.995	-1.016	-0.414	0.300
5	1.150	0.800	3.755	-0.685	-0.277	0.300
6	1.150	1.000	3.515	-0.393	-0.198	0.300
7	1.150	1.200	3.275	-0.139	-0.170	0.300
8	1.150	1.400	3.035	0.075	-0.185	0.300
9	1.150	1.600	2.795	0.251	-0.235	0.300
10	1.150	1.800	2.555	0.387	-0.313	0.300
11	1.150	2.000	2.315	0.484	-0.410	0.300
12	1.150	2.015	2.185	0.522	-0.417	0.312
13	1.150	2.030	2.167	0.526	-0.425	0.325
14	1.150	2.045	2.147	0.530	-0.433	0.337
15	1.150	2.060	2.127	0.534	-0.441	0.350
16	1.150	2.075	2.106	0.538	-0.449	0.362
17	1.150	2.090	2.084	0.541	-0.458	0.374
18	1.150	2.105	2.062	0.544	-0.466	0.387
19	1.150	2.120	2.039	0.547	-0.474	0.399
20	1.150	2.135	2.015	0.549	-0.482	0.412
21	1.150	2.150	0.552	-1.990	-0.490	0.424
22	1.135	2.150	0.553	-1.961	-0.461	0.412
23	1.120	2.150	0.553	-1.929	-0.432	0.399
24	1.105	2.150	0.553	-1.898	-0.404	0.387
25	1.090	2.150	0.553	-1.868	-0.376	0.374
26	1.075	2.150	0.553	-1.838	-0.348	0.362
27	1.060	2.150	0.553	-1.809	-0.321	0.350
28	1.045	2.150	0.553	-1.780	-0.294	0.337
29	1.030	2.150	0.553	-1.753	-0.268	0.325
30	1.015	2.150	0.553	-1.726	-0.242	0.312
31	1.000	2.150	0.553	-1.700	-0.216	0.300
32	0.900	2.150	0.553	-1.603	-0.056	0.300
33	0.800	2.150	0.553	-1.434	0.087	0.300
34	0.700	2.150	0.553	-1.265	0.214	0.300
35	0.600	2.150	0.553	-1.097	0.323	0.300
36	0.500	2.150	0.553	-0.928	0.416	0.300
37	0.400	2.150	0.553	-0.759	0.492	0.300
38	0.300	2.150	0.553	-0.591	0.551	0.300
39	0.200	2.150	0.553	-0.422	0.593	0.300
40	0.100	2.150	0.553	-0.253	0.619	0.300
41	0.000	2.150	0.553	-0.084	0.627	0.300

R = 0.45947E+01 M = -.12533E+01 H = -.20134E+01 V = 0.51422E-04m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	0.853	-0.082	1.253	4.595	4.264
1.035	0.842	-0.099	0.753	4.107	4.212
0.920	0.830	-0.108	0.308	3.626	4.152
0.805	0.818	-0.109	-0.081	3.152	4.089
0.690	0.805	-0.105	-0.417	2.686	4.027
0.575	0.794	-0.096	-0.699	2.226	3.970
0.460	0.784	-0.082	-0.929	1.772	3.918
0.345	0.775	-0.064	-1.107	1.324	3.876
0.230	0.769	-0.044	-1.234	0.880	3.845
0.115	0.765	-0.023	-1.310	0.439	3.826
0.000	0.764	0.000	-1.335	0.000	3.819

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	2.250	0.000
2	1.150	0.200	2.250	2.250	0.000
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	2.250	0.000
12	1.150	2.015	2.343	2.343	0.000
13	1.150	2.030	2.436	2.436	0.000
14	1.150	2.045	2.529	2.529	0.000
15	1.150	2.060	2.622	2.622	0.000
16	1.150	2.075	2.715	2.715	0.000
17	1.150	2.090	2.808	2.808	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	3.180	0.000
22	1.135	2.150	3.087	3.087	0.000
23	1.120	2.150	2.994	2.994	0.000
24	1.105	2.150	2.901	2.901	0.000
25	1.090	2.150	2.808	2.808	0.000
26	1.075	2.150	2.715	2.715	0.000
27	1.060	2.150	2.622	2.622	0.000
28	1.045	2.150	2.529	2.529	0.000
29	1.030	2.150	2.436	2.436	0.000
30	1.015	2.150	2.343	2.343	0.000
31	1.000	2.150	2.250	2.250	0.000
32	0.900	2.150	2.250	2.250	0.000
33	0.800	2.150	2.250	2.250	0.000
34	0.700	2.150	2.250	2.250	0.000

35	0.600	2.150	2.250	2.250	0.000
36	0.500	2.150	2.250	2.250	0.000
37	0.400	2.150	2.250	2.250	0.000
38	0.300	2.150	2.250	2.250	0.000
39	0.200	2.150	2.250	2.250	0.000
40	0.100	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	2.250	2.250	0.000
2	1.035	-0.150	2.250	2.250	0.000
3	0.920	-0.150	2.250	2.250	0.000
4	0.805	-0.150	2.250	2.250	0.000
5	0.690	-0.150	2.250	2.250	0.000
6	0.575	-0.150	2.250	2.250	0.000
7	0.460	-0.150	2.250	2.250	0.000
8	0.345	-0.150	2.250	2.250	0.000
9	0.230	-0.150	2.250	2.250	0.000
10	0.115	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2_x2

Fecha ..... : 5/9/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.60 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	35.597	-15.587	-9.579	0.300
2	1.150	0.200	35.477	-14.047	-6.770	0.300
3	1.150	0.400	35.237	-11.007	-4.568	0.300
4	1.150	0.600	34.997	-8.026	-2.963	0.300
5	1.150	0.800	34.757	-5.102	-1.943	0.300
6	1.150	1.000	34.517	-2.238	-1.495	0.300
7	1.150	1.200	34.277	0.569	-1.609	0.300
8	1.150	1.400	34.037	3.316	-2.272	0.300
9	1.150	1.600	33.797	6.006	-3.473	0.300
10	1.150	1.800	33.557	8.637	-5.200	0.300
11	1.150	2.000	33.317	11.209	-7.442	0.300
12	1.150	2.015	33.188	12.570	-7.631	0.312
13	1.150	2.030	33.169	12.758	-7.822	0.325
14	1.150	2.045	33.149	12.946	-8.016	0.337
15	1.150	2.060	33.129	13.134	-8.213	0.350
16	1.150	2.075	33.108	13.321	-8.413	0.362
17	1.150	2.090	33.086	13.508	-8.616	0.374
18	1.150	2.105	33.064	13.694	-8.821	0.387
19	1.150	2.120	33.041	13.881	-9.029	0.399
20	1.150	2.135	33.017	14.067	-9.240	0.412
21	1.150	2.150	14.252	-32.992	-9.454	0.424
22	1.135	2.150	14.345	-32.761	-8.963	0.412
23	1.120	2.150	14.345	-32.325	-8.478	0.399
24	1.105	2.150	14.345	-31.889	-8.000	0.387
25	1.090	2.150	14.345	-31.454	-7.528	0.374
26	1.075	2.150	14.345	-31.020	-7.062	0.362
27	1.060	2.150	14.345	-30.587	-6.604	0.350
28	1.045	2.150	14.345	-30.154	-6.151	0.337
29	1.030	2.150	14.345	-29.722	-5.706	0.325
30	1.015	2.150	14.345	-29.291	-5.266	0.312
31	1.000	2.150	14.345	-28.861	-4.833	0.300
32	0.900	2.150	14.345	-27.213	-2.112	0.300
33	0.800	2.150	14.345	-24.349	0.323	0.300
34	0.700	2.150	14.345	-21.484	2.471	0.300
35	0.600	2.150	14.345	-18.620	4.333	0.300
36	0.500	2.150	14.345	-15.755	5.909	0.300
37	0.400	2.150	14.345	-12.891	7.198	0.300
38	0.300	2.150	14.345	-10.026	8.201	0.300
39	0.200	2.150	14.345	-7.161	8.917	0.300
40	0.100	2.150	14.345	-4.297	9.346	0.300
41	0.000	2.150	14.345	-1.432	9.490	0.300

R = 0.35597E+02 M = -.95791E+01 H = -.15587E+02 V = 0.70027E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	6.615	-0.654	9.579	35.597	33.077
1.035	6.532	-0.784	5.703	31.816	32.660
0.920	6.438	-0.851	2.259	28.087	32.188
0.805	6.338	-0.863	-0.759	24.414	31.692
0.690	6.241	-0.827	-3.358	20.798	31.204
0.575	6.150	-0.751	-5.544	17.236	30.749
0.460	6.069	-0.641	-7.324	13.723	30.347
0.345	6.003	-0.504	-8.702	10.253	30.016
0.230	5.954	-0.347	-9.684	6.816	29.771
0.115	5.924	-0.177	-10.271	3.402	29.620
0.000	5.914	0.000	-10.467	0.000	29.569

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	4.714	3.128
2	1.150	0.200	2.250	2.575	2.147
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	3.490	0.000
12	1.150	2.015	2.343	3.398	0.000
13	1.150	2.030	2.436	3.298	0.000
14	1.150	2.045	2.529	3.201	0.000
15	1.150	2.060	2.622	3.109	0.000
16	1.150	2.075	2.715	3.023	0.000
17	1.150	2.090	2.808	2.943	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	5.003	11.506
22	1.135	2.150	3.087	4.846	11.984
23	1.120	2.150	2.994	4.694	12.352
24	1.105	2.150	2.901	4.539	12.755
25	1.090	2.150	2.808	4.378	13.198
26	1.075	2.150	2.715	4.213	13.686
27	1.060	2.150	2.622	4.041	14.224
28	1.045	2.150	2.529	3.863	14.819
29	1.030	2.150	2.436	3.676	15.478
30	1.015	2.150	2.343	3.480	16.211
31	1.000	2.150	2.250	3.272	17.029
32	0.900	2.150	2.250	2.250	15.632
33	0.800	2.150	2.250	2.250	12.718
34	0.700	2.150	2.250	2.250	9.803
35	0.600	2.150	2.805	2.250	6.737
36	0.500	2.150	3.908	2.250	3.520
37	0.400	2.150	5.102	2.250	0.278
38	0.300	2.150	6.126	2.250	0.000
39	0.200	2.150	6.865	2.250	0.000
40	0.100	2.150	7.311	2.250	0.000
41	0.000	2.150	7.461	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	9.336	2.250	22.223
2	1.035	-0.150	5.452	2.250	19.440
3	0.920	-0.150	2.688	2.250	16.402
4	0.805	-0.150	2.250	2.250	12.784
5	0.690	-0.150	2.250	3.646	8.722
6	0.575	-0.150	2.250	5.296	4.646
7	0.460	-0.150	2.250	7.056	0.591
8	0.345	-0.150	2.250	8.443	0.000
9	0.230	-0.150	2.250	9.444	0.000
10	0.115	-0.150	2.250	10.049	0.000
11	0.000	-0.150	2.250	10.251	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.70 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.88 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	37.582	-10.495	-9.091	0.300
2	1.150	0.200	37.462	-9.459	-7.199	0.300
3	1.150	0.400	37.222	-7.413	-5.717	0.300
4	1.150	0.600	36.982	-5.406	-4.636	0.300
5	1.150	0.800	36.742	-3.437	-3.948	0.300
6	1.150	1.000	36.502	-1.508	-3.647	0.300
7	1.150	1.200	36.262	0.382	-3.723	0.300
8	1.150	1.400	36.022	2.234	-4.170	0.300
9	1.150	1.600	35.782	4.046	-4.979	0.300
10	1.150	1.800	35.542	5.820	-6.143	0.300
11	1.150	2.000	35.302	7.554	-7.654	0.300
12	1.150	2.015	35.173	8.472	-7.781	0.312
13	1.150	2.030	35.154	8.599	-7.910	0.325
14	1.150	2.045	35.135	8.725	-8.041	0.337
15	1.150	2.060	35.115	8.852	-8.174	0.350
16	1.150	2.075	35.094	8.978	-8.308	0.362
17	1.150	2.090	35.072	9.104	-8.445	0.374
18	1.150	2.105	35.049	9.230	-8.583	0.387
19	1.150	2.120	35.026	9.356	-8.724	0.399
20	1.150	2.135	35.002	9.481	-8.866	0.412
21	1.150	2.150	9.606	-34.978	-9.010	0.424
22	1.135	2.150	9.669	-34.734	-8.489	0.412
23	1.120	2.150	9.669	-34.271	-7.975	0.399
24	1.105	2.150	9.669	-33.810	-7.468	0.387
25	1.090	2.150	9.669	-33.349	-6.968	0.374
26	1.075	2.150	9.669	-32.889	-6.474	0.362
27	1.060	2.150	9.669	-32.430	-5.988	0.350
28	1.045	2.150	9.669	-31.971	-5.508	0.337
29	1.030	2.150	9.669	-31.513	-5.035	0.325
30	1.015	2.150	9.669	-31.056	-4.570	0.312
31	1.000	2.150	9.669	-30.600	-4.111	0.300
32	0.900	2.150	9.669	-28.853	-1.225	0.300
33	0.800	2.150	9.669	-25.816	1.356	0.300
34	0.700	2.150	9.669	-22.779	3.634	0.300
35	0.600	2.150	9.669	-19.742	5.608	0.300
36	0.500	2.150	9.669	-16.705	7.279	0.300
37	0.400	2.150	9.669	-13.667	8.646	0.300
38	0.300	2.150	9.669	-10.630	9.709	0.300
39	0.200	2.150	9.669	-7.593	10.468	0.300
40	0.100	2.150	9.669	-4.556	10.923	0.300
41	0.000	2.150	9.669	-1.519	11.075	0.300

R = 0.37582E+02 M = -.90912E+01 H = -.10495E+02 V = 0.84093E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	7.049	-0.860	9.091	37.582	35.243
1.035	6.942	-0.979	5.001	33.559	34.711
0.920	6.826	-1.033	1.370	29.601	34.130
0.805	6.707	-1.028	-1.810	25.710	33.535
0.690	6.591	-0.974	-4.546	21.887	32.957
0.575	6.485	-0.876	-6.846	18.128	32.423
0.460	6.391	-0.743	-8.717	14.427	31.956
0.345	6.315	-0.582	-10.166	10.775	31.574
0.230	6.258	-0.400	-11.197	7.161	31.291
0.115	6.223	-0.203	-11.814	3.574	31.117
0.000	6.212	0.000	-12.020	0.000	31.058

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	3.991	0.000
2	1.150	0.200	2.250	2.785	0.000
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	2.250	0.000
11	1.150	2.000	2.250	3.471	0.000
12	1.150	2.015	2.343	3.312	0.000
13	1.150	2.030	2.436	3.142	0.000
14	1.150	2.045	2.529	2.975	0.000
15	1.150	2.060	2.622	2.815	0.000
16	1.150	2.075	2.715	2.715	0.000
17	1.150	2.090	2.808	2.808	0.000
18	1.150	2.105	2.901	2.901	0.000
19	1.150	2.120	2.994	2.994	0.000
20	1.150	2.135	3.087	3.087	0.000
21	1.150	2.150	3.180	5.231	12.835
22	1.135	2.150	3.087	5.055	13.352
23	1.120	2.150	2.994	4.880	13.751
24	1.105	2.150	2.901	4.699	14.189
25	1.090	2.150	2.808	4.512	14.670
26	1.075	2.150	2.715	4.317	15.199
27	1.060	2.150	2.622	4.114	15.782
28	1.045	2.150	2.529	3.901	16.427
29	1.030	2.150	2.436	3.676	17.142
30	1.015	2.150	2.343	3.437	17.936
31	1.000	2.150	2.250	3.180	18.824
32	0.900	2.150	2.250	2.250	17.301

33	0.800	2.150	2.250	2.250	14.211
34	0.700	2.150	2.731	2.250	10.989
35	0.600	2.150	4.105	2.250	7.522
36	0.500	2.150	5.776	2.250	3.975
37	0.400	2.150	7.168	2.250	0.503
38	0.300	2.150	8.266	2.250	0.000
39	0.200	2.150	9.060	2.250	0.000
40	0.100	2.150	9.540	2.250	0.000
41	0.000	2.150	9.701	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	8.838	2.250	24.380
2	1.035	-0.150	4.765	2.250	21.401
3	0.920	-0.150	2.250	2.250	18.061
4	0.805	-0.150	2.250	2.250	14.103
5	0.690	-0.150	2.250	4.322	9.646
6	0.575	-0.150	2.250	6.580	5.203
7	0.460	-0.150	2.250	8.458	0.923
8	0.345	-0.150	2.250	9.940	0.000
9	0.230	-0.150	2.250	11.012	0.000
10	0.115	-0.150	2.250	11.660	0.000
11	0.000	-0.150	2.250	11.877	0.000

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : MARCO 2x2

Fecha ..... : 5/9/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... =
SALTO ..... =

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300
PESO ESPECIFICO DEL HORMIGON ..... = 2.50
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.70
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.88

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.150	0.000	37.582	-15.725	-9.985	0.300
2	1.150	0.200	37.462	-14.171	-7.151	0.300
3	1.150	0.400	37.222	-11.102	-4.931	0.300
4	1.150	0.600	36.982	-8.091	-3.313	0.300
5	1.150	0.800	36.742	-5.139	-2.285	0.300
6	1.150	1.000	36.502	-2.245	-1.836	0.300
7	1.150	1.200	36.262	0.591	-1.954	0.300
8	1.150	1.400	36.022	3.368	-2.628	0.300
9	1.150	1.600	35.782	6.086	-3.845	0.300
10	1.150	1.800	35.542	8.747	-5.594	0.300
11	1.150	2.000	35.302	11.348	-7.864	0.300
12	1.150	2.015	35.173	12.725	-8.055	0.312
13	1.150	2.030	35.154	12.915	-8.248	0.325
14	1.150	2.045	35.135	13.105	-8.445	0.337
15	1.150	2.060	35.115	13.295	-8.644	0.350
16	1.150	2.075	35.094	13.485	-8.847	0.362
17	1.150	2.090	35.072	13.674	-9.052	0.374
18	1.150	2.105	35.049	13.862	-9.260	0.387
19	1.150	2.120	35.026	14.051	-9.471	0.399
20	1.150	2.135	35.002	14.239	-9.684	0.412
21	1.150	2.150	14.427	-34.978	-9.901	0.424
22	1.135	2.150	14.520	-34.734	-9.379	0.412
23	1.120	2.150	14.520	-34.271	-8.865	0.399
24	1.105	2.150	14.520	-33.810	-8.358	0.387
25	1.090	2.150	14.520	-33.349	-7.858	0.374
26	1.075	2.150	14.520	-32.889	-7.365	0.362
27	1.060	2.150	14.520	-32.430	-6.878	0.350
28	1.045	2.150	14.520	-31.971	-6.399	0.337
29	1.030	2.150	14.520	-31.513	-5.926	0.325
30	1.015	2.150	14.520	-31.056	-5.460	0.312
31	1.000	2.150	14.520	-30.600	-5.001	0.300
32	0.900	2.150	14.520	-28.853	-2.116	0.300
33	0.800	2.150	14.520	-25.816	0.466	0.300
34	0.700	2.150	14.520	-22.779	2.744	0.300
35	0.600	2.150	14.520	-19.742	4.718	0.300
36	0.500	2.150	14.520	-16.705	6.388	0.300
37	0.400	2.150	14.520	-13.667	7.755	0.300
38	0.300	2.150	14.520	-10.630	8.818	0.300
39	0.200	2.150	14.520	-7.593	9.577	0.300
40	0.100	2.150	14.520	-4.556	10.033	0.300
41	0.000	2.150	14.521	-1.519	10.185	0.300

R = 0.37582E+02 M = -.99854E+01 H = -.15725E+02 V = 0.75425E-03m

LONGITUD DEL SEMIARCO = 3.300 LONGITUD DE TRANSPORTE = 2.438

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.150	6.992	-0.712	9.985	37.582	34.962
1.035	6.902	-0.847	5.894	33.587	34.511
0.920	6.800	-0.915	2.258	29.647	34.001
0.805	6.694	-0.926	-0.927	25.767	33.469
0.690	6.589	-0.886	-3.671	21.949	32.946
0.575	6.492	-0.803	-5.978	18.188	32.458
0.460	6.406	-0.685	-7.856	14.481	32.029
0.345	6.335	-0.539	-9.310	10.819	31.676
0.230	6.283	-0.371	-10.346	7.192	31.414
0.115	6.250	-0.189	-10.965	3.590	31.252
0.000	6.240	0.000	-11.172	0.000	31.198

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.150	0.000	2.250	4.908	3.216
2	1.150	0.200	2.250	2.733	2.230
3	1.150	0.400	2.250	2.250	0.000
4	1.150	0.600	2.250	2.250	0.000
5	1.150	0.800	2.250	2.250	0.000
6	1.150	1.000	2.250	2.250	0.000
7	1.150	1.200	2.250	2.250	0.000
8	1.150	1.400	2.250	2.250	0.000
9	1.150	1.600	2.250	2.250	0.000
10	1.150	1.800	2.250	3.652	0.000
11	1.150	2.000	2.250	3.554	0.103
12	1.150	2.015	2.343	3.445	0.000
13	1.150	2.030	2.436	3.339	0.000
14	1.150	2.045	2.529	3.238	0.000
15	1.150	2.060	2.622	3.142	0.000
16	1.150	2.075	2.715	3.051	0.000
17	1.150	2.090	2.808	2.967	0.000
18	1.150	2.105	2.901	2.994	0.000
19	1.150	2.120	2.994	3.087	0.000
20	1.150	2.135	3.087	5.223	12.836
21	1.150	2.150	3.180	5.058	13.351
22	1.135	2.150	3.087	4.899	13.748
23	1.120	2.150	2.994	4.735	14.182
24	1.105	2.150	2.901	4.566	14.659
25	1.090	2.150	2.808	4.391	15.184
26	1.075	2.150	2.715		
27	1.060	2.150	2.622	4.210	15.761
28	1.045	2.150	2.529	4.022	16.399
29	1.030	2.150	2.436	3.825	17.105
30	1.015	2.150	2.343	3.618	17.890
31	1.000	2.150	2.250	3.398	18.764
32	0.900	2.150	2.250	2.250	17.301
33	0.800	2.150	2.250	2.250	14.211
34	0.700	2.150	2.250	2.250	11.120
35	0.600	2.150	3.148	2.250	7.784
36	0.500	2.150	4.262	2.250	4.389
37	0.400	2.150	5.647	2.250	0.920
38	0.300	2.150	6.741	2.250	0.000
39	0.200	2.150	7.531	2.250	0.000
40	0.100	2.150	8.009	2.250	0.000
41	0.000	2.150	8.169	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.150	-0.150	9.754	2.250	24.129
2	1.035	-0.150	5.639	2.250	21.190
3	0.920	-0.150	2.687	2.250	17.989
4	0.805	-0.150	2.250	2.250	14.161
5	0.690	-0.150	2.250	3.875	9.831
6	0.575	-0.150	2.250	5.722	5.499
7	0.460	-0.150	2.250	7.589	1.216
8	0.345	-0.150	2.250	9.061	0.000
9	0.230	-0.150	2.250	10.126	0.000
10	0.115	-0.150	2.250	10.770	0.000
11	0.000	-0.150	2.250	10.985	0.000

1.5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_S (Ton)	DISPUESTO ARMADURA	U_S (Ton)
HASTIAL	Interior	10.0	ϕ 10 A 0.20	17.4
	Exterior	21.8	ϕ 16 A 0.20	44.6
DINTEL	Interior	43.02	ϕ 16 A 0.20	44.6
	Exterior	15.1	ϕ 10 A 0.20	17.4
SOLERA	Inferior	43.2	ϕ 16 A 0.20	44.6
	Superior	52.7	ϕ 20 A 0.20	69.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

* Elemento: Muro vertical

Acero: AEH-500 _ Cuantía mínima = 0,90 %

* $A_C = 2 \times 0,3 = 0,6\ m^2$

* $A_S = 10.8 \times 10^{-4}\ m^2 \Rightarrow$ $5,4 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 2 m $\Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara _ **Válido**

- DINTEL

* Elemento: Muro horizontal

Acero: AEH-500 _ Cuantía mínima = 1,6 %

* $A_C = 2.6 \times 0,3 = 0,78\ m^2$

* $A_S = 12,48 \times 10^{-4}\ m^2 \Rightarrow$ $6,24 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

- SOLERA

* Elemento: Losa

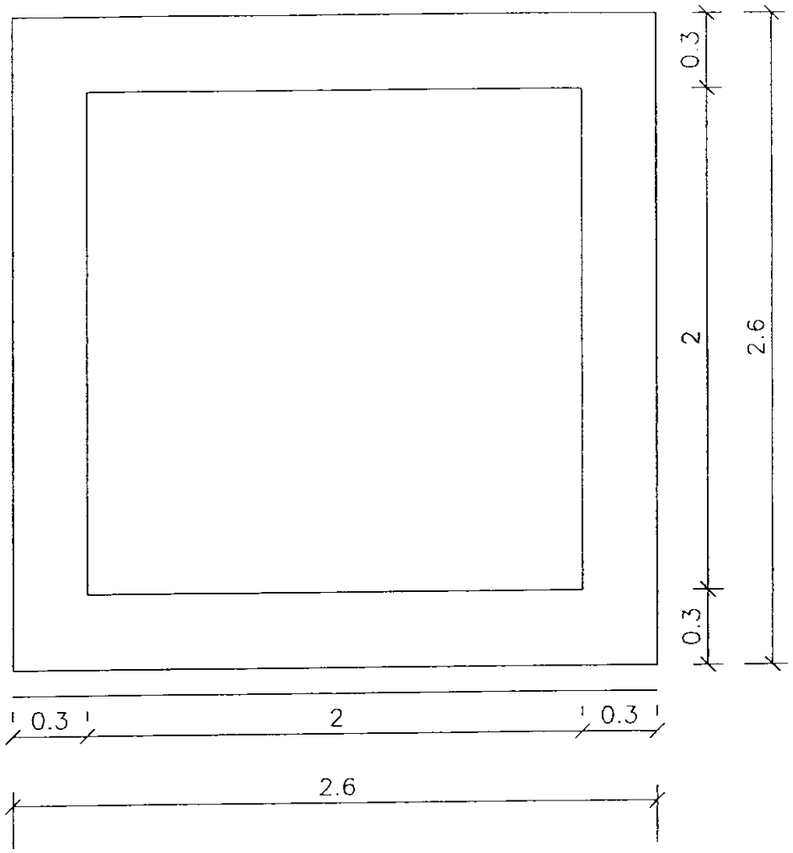
Acero: AEH-500 _ Cuantía mínima = 1,5 %

* $A_C = 2,6 \times 0,3 = 0,78\ m^2$

* $A_S = 12,48 \times 10^{-4}\ m^2 \Rightarrow$ $6,24 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

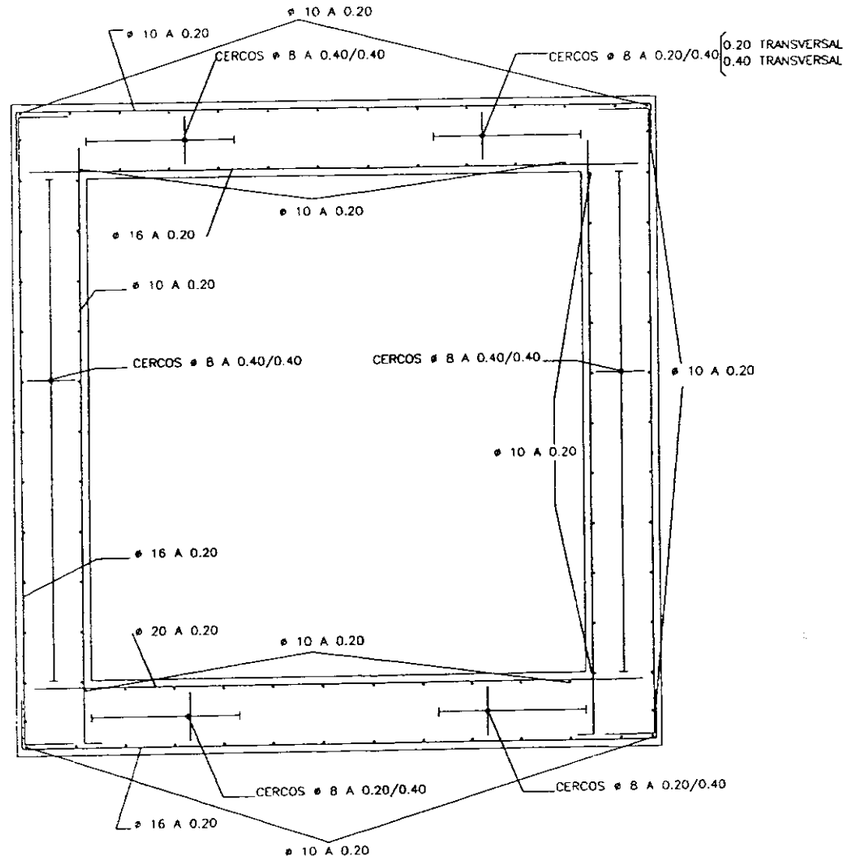
2 .PLANOS



SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 25



SECCION TRANSVERSAL

ARMADURAS

ESCALA 1 : 25

300

MARCOS DE OBRAS DE RIEGO

GENERALIDADES.

1.- Normativa empleada

Las normas aplicadas en el cálculo y comprobación de los distintos elementos son las siguientes:

- Normativa de la "Unión Internationale des Chemins de Fer" (U.I.C.).
- "Instrucción EH-91, para el proyecto y ejecución de obras de hormigón en masa y armado".
- "Norma de Construcción Sismorresistente N.C.S.E.-94".

2.- Materiales y coeficientes de seguridad adoptados

Hormigones "in situ" (Resistencia a 28 días)

- En Limpieza y nivelación. . . . . $f_{ck} \geq 125$ kp/cm^2
- En Marcos. . . . . $f_{ck} \geq 250$ kp/cm^2
- En Zapatas. . . . . $f_{ck} \geq 250$ kp/cm^2
- En Alzados. . . . . $f_{ck} \geq 250$ kp/cm^2
- Coeficiente de seguridad. . . . . $\gamma_c = 1,5$

Armaduras pasivas

- Límite elástico ≥ 5100 kp/cm^2
- Coeficiente de seguridad $\gamma_s = 1.15$

Cargas

- Para las cargas se ha tomado un coeficiente de seguridad básico de 1,6.

Características del terreno

- Tensión admisible de cimentación 2,5 kgr/cm^2
- Densidad de tierras: 1,90 t/m^3
- Empuje de tierras: λ activo = 0,30
  λ reposo = 0,45
- Módulo de deformación: 5000 t/m^3

3.- Criterios generales de cálculo

Para el cálculo de los pórticos se han adoptado las hipótesis básicas de la Elasticidad y de la Resistencia de Materiales.

En el cálculo se han considerado cuatro hipótesis de carga diferentes:

1.- Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel.
2.- Empuje máximo, sobrecarga mínima.
3.- Empuje mínimo, sobrecarga máxima.
4.- Empuje máximo, sobrecarga máxima.

La obtención de los esfuerzos en la sección transversal de los marcos, se ha realizado con la ayuda del programa de cálculo comercializado con el título "PROGRAMA ARCO" para Cálculo de Arcos, Pasos Inferiores y Galerías Enterradas © Copyright J. Díaz del Valle, 1.998.

Este programa obtiene los esfuerzos en la sección de cálculo, mediante la discretización de la estructura en barras (en este caso, se han tomado 40 elementos) y utilizando un cálculo matricial, basado en el método de la rigidez, obtiene los esfuerzos en cada punto para cada una de las hipótesis estudiadas.

El marco se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. La armadura longitudinal se dispone según EH-91.

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura dado que los pórticos van a estar cubiertos por las tierras.

El módulo de deformación del terreno adoptado, ha sido de 5000 t/m^3, teniendo en cuenta que el tipo de terreno a colocar bajo la solera del Pórtico se trata de un material granular, tipo zahorra natural procedente de la 2ª terraza del Ebro (préstamo denominado Acampo del Marqués de Ayerbe), que se corresponde con un valor del coeficiente de balasto de tipo medio, análogo a valores utilizados en multitud de cálculos similares al que nos ocupa y sabiendo, además, que una variación razonable de este módulo en ± 1000 t/m^3 va a influir muy poco en la distribución de los esfuerzos en la estructura.

Los posibles desplazamientos originados por las fuerzas horizontales -frenados, fuerza centrífuga- se consideran impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierras bajo la solera para un coeficiente de balasto medio.

No se considera en los cálculos la acción sísmica, ya que según la "Norma de Construcción Sismorresistente N.C.S.E.-94", las obras se encuentran en una zona con aceleración básica inferior a "0,04 g". Teniendo en cuenta dicho valor y un coeficiente de riesgo de 1,30 (construcciones de especial importancia) resulta una aceleración sísmica de cálculo inferior a "0,052 g" < "0,06 g".

El cálculo de las aletas se ha realizado según la Teoría de Coulomb para suelos granulares, recogida por J. Calavera en su libro "Muros de Contención y Muros de Sótano"

Estos cálculos se recogen, a continuación, desde la página 1 hasta la página 285, ambas inclusive.

Zaragoza, 7 de Octubre de 1.997

edro García Borjabad
geniero de Caminos

4.- Equipo redactor

Los cálculos de estos marcos de obras de riego (O.R. 2+640 marco 3,00 x 2,00; O.R. 3+020 marco 2,50 x 2,00; O.R. 3+260 marco 2,50 x 2,00; O.R. 3+480 marco 3,00 x 2,00; O.R. 3+780 marco 2,50 x 2,00; O.R. 4+220 marco 2,50 x 2,00; O.R. 4+495 marco 2,50 x 2,00 y aletas respectivas), han sido realizados por la Oficina Técnica de LAHISCO AVE, U.T.E. (Construcciones Lain, S.A.; Corsan Empresa Constructora, S.A. y Constructora Hispánica, S.A., en Agrupación Temporal de Empresas) adjudicatario de la obra: Proyecto de "Línea de Alta Velocidad Madrid-Barcelona-frontera francesa. Tramo: Zaragoza-Lleida. Subtramo-I".

LINEA DE ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA.SUBTRAMO-I.

CONTENIDO.

El presente documento consta de los siguientes apartados:

-O.R. **2+640** Marco 3,00x2,00

-O.R. **3+020** Marco 2,50x2,00

-O.R. **3+260** Marco 2,50x2,00

-O.R. **3+480** Marco 3,00x2,00

-O.R. **3+780** Marco 2,50x2,00

-O.R. **4+220** Marco 2,50x2,00

-O.R. **4+495** Marco 2,50x2,00

-**ALETAS.**

O.R. 2 + 640

1 . CALCULOS

O.R. 2 + 640

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 2 + 640. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso

2 - Esquema estructural

3 - Cargas consideradas

4 - Hipótesis de carga

5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

1.1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- Hormigón

H-250 $\gamma_C = 1,5$

$\gamma_{HORMIGON} = 2,5$ t/m^3

- Acero

AEH-500 $\gamma_S = 1,15$

Recubrimiento = 4 cm

- Tierras

Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

Coeficientes de empuje

ACTIVO, $K_{ACTIVO} = 0,30$

EN REPOSO, $K_{REPOSO} = 0,45$

- Módulo de Balasto 5.000 t/m^3

- Tensión admisible en cimentación 2.5 Kg/m^3

1.2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

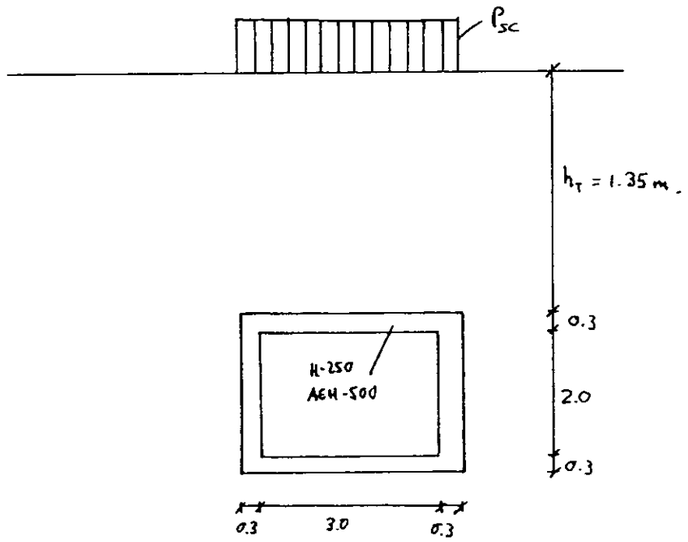


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 1.35 m

  -sobre cimentación H_T = 3.65 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

1.3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$I = 1{,}66 - 0{,}1\,(h_T - 1) = 1.625$

$$P_{SC} = \frac{2 \times 12 \times I}{2\,(3 + h_T)} = 4.483 \ t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 1.35$ m

  $H_T = 3.65$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

1.4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

(C) Copyright J.Diaz del Valle, 1988

P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 2+640

Fecha ..... : 5/9/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	5.438	-2.135	-2.023	0.300
2	1.650	0.200	5.318	-1.917	-1.640	0.300
3	1.650	0.400	5.078	-1.508	-1.338	0.300
4	1.650	0.600	4.838	-1.138	-1.111	0.300
5	1.650	0.800	4.598	-0.806	-0.950	0.300
6	1.650	1.000	4.358	-0.514	-0.847	0.300
7	1.650	1.200	4.118	-0.261	-0.795	0.300
8	1.650	1.400	3.878	-0.046	-0.785	0.300
9	1.650	1.600	3.638	0.129	-0.811	0.300
10	1.650	1.800	3.398	0.265	-0.864	0.300
11	1.650	2.000	3.158	0.363	-0.937	0.300
12	1.650	2.015	3.029	0.401	-0.943	0.312
13	1.650	2.030	3.010	0.405	-0.949	0.325
14	1.650	2.045	2.991	0.409	-0.955	0.337
15	1.650	2.060	2.971	0.413	-0.961	0.350
16	1.650	2.075	2.950	0.416	-0.967	0.362
17	1.650	2.090	2.928	0.419	-0.974	0.374
18	1.650	2.105	2.905	0.422	-0.980	0.387
19	1.650	2.120	2.882	0.425	-0.986	0.399
20	1.650	2.135	2.858	0.428	-0.993	0.412
21	1.650	2.150	0.430	-2.834	-0.999	0.424
22	1.635	2.150	0.431	-2.805	-0.957	0.412
23	1.620	2.150	0.431	-2.773	-0.916	0.399
24	1.605	2.150	0.431	-2.742	-0.874	0.387
25	1.590	2.150	0.431	-2.711	-0.834	0.374
26	1.575	2.150	0.431	-2.681	-0.793	0.362
27	1.560	2.150	0.431	-2.652	-0.754	0.350
28	1.545	2.150	0.431	-2.624	-0.714	0.337
29	1.530	2.150	0.431	-2.596	-0.675	0.325
30	1.515	2.150	0.431	-2.570	-0.637	0.312
31	1.500	2.150	0.431	-2.544	-0.599	0.300
32	1.350	2.150	0.431	-2.404	-0.238	0.300
33	1.200	2.150	0.431	-2.151	0.085	0.300
34	1.050	2.150	0.431	-1.898	0.369	0.300
35	0.900	2.150	0.431	-1.645	0.616	0.300
36	0.750	2.150	0.431	-1.392	0.825	0.300
37	0.600	2.150	0.431	-1.139	0.996	0.300
38	0.450	2.150	0.431	-0.886	1.129	0.300
39	0.300	2.150	0.431	-0.633	1.223	0.300
40	0.150	2.150	0.431	-0.380	1.280	0.300
41	0.000	2.150	0.431	-0.127	1.299	0.300

R = 0.54383E+01 M = -.20235E+01 H = -.21349E+01 V = 0.19414E-03m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	0.837	-0.190	2.023	5.438	4.183
1.485	0.802	-0.229	1.182	4.762	4.009
1.320	0.762	-0.249	0.450	4.117	3.811
1.155	0.721	-0.252	-0.178	3.505	3.603
0.990	0.680	-0.241	-0.708	2.927	3.399
0.825	0.642	-0.218	-1.146	2.383	3.209
0.660	0.608	-0.186	-1.496	1.867	3.042
0.495	0.581	-0.146	-1.763	1.377	2.905
0.330	0.561	-0.100	-1.952	0.907	2.803
0.165	0.548	-0.051	-2.063	0.450	2.741
0.000	0.544	0.000	-2.100	-0.000	2.720

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	2.250	0.000
2	1.650	0.200	2.250	2.250	0.000
3	1.650	0.400	2.250	2.250	0.000
4	1.650	0.600	2.250	2.250	0.000
5	1.650	0.800	2.250	2.250	0.000
6	1.650	1.000	2.250	2.250	0.000
7	1.650	1.200	2.250	2.250	0.000
8	1.650	1.400	2.250	2.250	0.000
9	1.650	1.600	2.250	2.250	0.000
10	1.650	1.800	2.250	2.250	0.000
11	1.650	2.000	2.250	2.250	0.000
12	1.650	2.015	2.343	2.343	0.000
13	1.650	2.030	2.436	2.436	0.000
14	1.650	2.045	2.529	2.529	0.000
15	1.650	2.060	2.622	2.622	0.000
16	1.650	2.075	2.715	2.715	0.000
17	1.650	2.090	2.808	2.808	0.000
18	1.650	2.105	2.901	2.901	0.000
19	1.650	2.120	2.994	2.994	0.000
20	1.650	2.135	3.087	3.087	0.000
21	1.650	2.150	3.180	3.180	0.000
22	1.635	2.150	3.087	3.087	0.000
23	1.620	2.150	2.994	2.994	0.000
24	1.605	2.150	2.901	2.901	0.000
25	1.590	2.150	2.808	2.808	0.000
26	1.575	2.150	2.715	2.715	0.000
27	1.560	2.150	2.622	2.622	0.000
28	1.545	2.150	2.529	2.529	0.000
29	1.530	2.150	2.436	2.436	0.000
30	1.515	2.150	2.343	2.343	0.000
31	1.500	2.150	2.250	2.250	0.000
32	1.350	2.150	2.250	2.250	0.000
33	1.200	2.150	2.250	2.250	0.000
34	1.050	2.150	2.250	2.250	0.000
35	0.900	2.150	2.250	2.250	0.000
36	0.750	2.150	2.250	2.250	0.000
37	0.600	2.150	2.250	2.250	0.000
38	0.450	2.150	2.250	2.250	0.000
39	0.300	2.150	2.250	2.250	0.000
40	0.150	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	2.452	2.250	0.000
2	1.485	-0.150	2.250	2.250	0.000
3	1.320	-0.150	2.250	2.250	0.000
4	1.155	-0.150	2.250	2.250	0.000
5	0.990	-0.150	2.250	2.250	0.000
6	0.825	-0.150	2.250	2.250	0.000
7	0.660	-0.150	2.250	2.250	0.000
8	0.495	-0.150	2.250	2.250	0.000
9	0.330	-0.150	2.250	2.378	0.000
10	0.165	-0.150	2.250	2.493	0.000
11	0.000	-0.150	2.250	2.530	0.000

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

(C) Copyright J.Diaz del Valle, 1988

P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 2+640

Fecha ..... : 5/9/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.65 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	12.673	-4.931	-4.631	0.300
2	1.650	0.200	12.553	-4.407	-3.750	0.300
3	1.650	0.400	12.313	-3.398	-3.070	0.300
4	1.650	0.600	12.073	-2.448	-2.581	0.300
5	1.650	0.800	11.833	-1.557	-2.269	0.300
6	1.650	1.000	11.593	-0.724	-2.124	0.300
7	1.650	1.200	11.353	0.051	-2.135	0.300
8	1.650	1.400	11.113	0.767	-2.288	0.300
9	1.650	1.600	10.873	1.425	-2.573	0.300
10	1.650	1.800	10.633	2.024	-2.978	0.300
11	1.650	2.000	10.393	2.565	-3.491	0.300
12	1.650	2.015	10.264	2.834	-3.533	0.312
13	1.650	2.030	10.245	2.870	-3.576	0.325
14	1.650	2.045	10.226	2.905	-3.620	0.337
15	1.650	2.060	10.206	2.940	-3.664	0.350
16	1.650	2.075	10.185	2.975	-3.709	0.362
17	1.650	2.090	10.163	3.010	-3.754	0.374
18	1.650	2.105	10.140	3.044	-3.800	0.387
19	1.650	2.120	10.117	3.078	-3.846	0.399
20	1.650	2.135	10.093	3.111	-3.892	0.412
21	1.650	2.150	3.145	-10.069	-3.940	0.424
22	1.635	2.150	3.161	-10.007	-3.789	0.412
23	1.620	2.150	3.161	-9.909	-3.641	0.399
24	1.605	2.150	3.161	-9.812	-3.494	0.387
25	1.590	2.150	3.161	-9.716	-3.348	0.374
26	1.575	2.150	3.161	-9.620	-3.204	0.362
27	1.560	2.150	3.161	-9.525	-3.061	0.350
28	1.545	2.150	3.161	-9.431	-2.919	0.337
29	1.530	2.150	3.161	-9.338	-2.779	0.325
30	1.515	2.150	3.161	-9.246	-2.640	0.312
31	1.500	2.150	3.161	-9.154	-2.503	0.300
32	1.350	2.150	3.161	-8.653	-1.205	0.300
33	1.200	2.150	3.161	-7.742	-0.044	0.300
34	1.050	2.150	3.161	-6.831	0.981	0.300
35	0.900	2.150	3.161	-5.920	1.869	0.300
36	0.750	2.150	3.161	-5.009	2.620	0.300
37	0.600	2.150	3.161	-4.099	3.235	0.300
38	0.450	2.150	3.161	-3.188	3.713	0.300
39	0.300	2.150	3.161	-2.277	4.055	0.300
40	0.150	2.150	3.161	-1.366	4.260	0.300
41	0.000	2.150	3.161	-0.455	4.328	0.300

R = 0.12673E+02 M = -.46313E+01 H = -.49307E+01 V = 0.61891E-03m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	1.959	-0.461	4.631	12.673	9.797
1.485	1.875	-0.550	2.672	11.090	9.377
1.320	1.780	-0.594	0.967	9.582	8.902
1.155	1.681	-0.599	-0.495	8.154	8.407
0.990	1.584	-0.572	-1.728	6.807	7.922
0.825	1.494	-0.517	-2.745	5.537	7.472
0.660	1.415	-0.439	-3.559	4.338	7.076
0.495	1.350	-0.344	-4.180	3.198	6.752
0.330	1.302	-0.237	-4.617	2.105	6.511
0.165	1.273	-0.120	-4.877	1.045	6.364
0.000	1.263	0.000	-4.963	-0.000	6.314

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	3.156	0.000
2	1.650	0.200	2.250	2.453	0.000
3	1.650	0.400	2.250	2.250	0.000
4	1.650	0.600	2.250	2.250	0.000
5	1.650	0.800	2.250	2.250	0.000
6	1.650	1.000	2.250	2.250	0.000
7	1.650	1.200	2.250	2.250	0.000
8	1.650	1.400	2.250	2.250	0.000
9	1.650	1.600	2.250	2.250	0.000
10	1.650	1.800	2.250	2.250	0.000
11	1.650	2.000	2.250	2.486	0.000
12	1.650	2.015	2.343	2.401	0.000
13	1.650	2.030	2.436	2.436	0.000
14	1.650	2.045	2.529	2.529	0.000
15	1.650	2.060	2.622	2.622	0.000
16	1.650	2.075	2.715	2.715	0.000
17	1.650	2.090	2.808	2.808	0.000
18	1.650	2.105	2.901	2.901	0.000
19	1.650	2.120	2.994	2.994	0.000
20	1.650	2.135	3.087	3.087	0.000
21	1.650	2.150	3.180	3.180	0.000
22	1.635	2.150	3.087	3.087	0.000
23	1.620	2.150	2.994	2.994	0.000
24	1.605	2.150	2.901	2.901	0.000
25	1.590	2.150	2.808	2.808	0.000
26	1.575	2.150	2.715	2.715	0.000
27	1.560	2.150	2.622	2.626	0.000
28	1.545	2.150	2.529	2.593	0.000
29	1.530	2.150	2.436	2.560	0.000
30	1.515	2.150	2.343	2.526	0.000
31	1.500	2.150	2.250	2.490	0.000

32	1.350	2.150	2.250	2.250	0.000
33	1.200	2.150	2.250	2.250	0.000
34	1.050	2.150	2.250	2.250	0.000
35	0.900	2.150	2.250	2.250	0.000
36	0.750	2.150	2.609	2.250	0.000
37	0.600	2.150	3.187	2.250	0.000
38	0.450	2.150	3.585	2.250	0.000
39	0.300	2.150	3.841	2.250	0.000
40	0.150	2.150	3.908	2.250	0.000
41	0.000	2.150	3.908	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	4.406	2.250	0.248
2	1.485	-0.150	3.075	2.250	0.000
3	1.320	-0.150	2.250	2.250	0.000
4	1.155	-0.150	2.250	2.250	0.000
5	0.990	-0.150	2.250	2.250	0.000
6	0.825	-0.150	2.250	3.141	0.000
7	0.660	-0.150	2.250	3.795	0.000
8	0.495	-0.150	2.250	3.968	0.000
9	0.330	-0.150	2.250	4.392	0.000
10	0.165	-0.150	2.250	4.644	0.000
11	0.000	-0.150	2.250	4.728	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 2+640

Fecha ..... : 5/9/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.65 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 4.48 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	24.500	-3.092	-7.976	0.300
2	1.650	0.200	24.380	-2.743	-7.427	0.300
3	1.650	0.400	24.140	-2.071	-7.013	0.300
4	1.650	0.600	23.900	-1.437	-6.725	0.300
5	1.650	0.800	23.660	-0.843	-6.557	0.300
6	1.650	1.000	23.420	-0.288	-6.499	0.300
7	1.650	1.200	23.180	0.229	-6.545	0.300
8	1.650	1.400	22.940	0.706	-6.686	0.300
9	1.650	1.600	22.700	1.145	-6.915	0.300
10	1.650	1.800	22.460	1.544	-7.224	0.300
11	1.650	2.000	22.220	1.905	-7.605	0.300
12	1.650	2.015	22.091	2.084	-7.636	0.312
13	1.650	2.030	22.072	2.108	-7.668	0.325
14	1.650	2.045	22.053	2.132	-7.700	0.337
15	1.650	2.060	22.033	2.155	-7.732	0.350
16	1.650	2.075	22.012	2.178	-7.765	0.362
17	1.650	2.090	21.990	2.201	-7.798	0.374
18	1.650	2.105	21.968	2.224	-7.831	0.387
19	1.650	2.120	21.944	2.247	-7.865	0.399
20	1.650	2.135	21.920	2.269	-7.899	0.412
21	1.650	2.150	2.291	-21.896	-7.933	0.424
22	1.635	2.150	2.302	-21.780	-7.607	0.412
23	1.620	2.150	2.302	-21.575	-7.283	0.399
24	1.605	2.150	2.302	-21.371	-6.963	0.387
25	1.590	2.150	2.302	-21.167	-6.645	0.374
26	1.575	2.150	2.302	-20.964	-6.331	0.362
27	1.560	2.150	2.302	-20.761	-6.019	0.350
28	1.545	2.150	2.302	-20.560	-5.711	0.337
29	1.530	2.150	2.302	-20.359	-5.405	0.325
30	1.515	2.150	2.302	-20.159	-5.103	0.312
31	1.500	2.150	2.302	-19.959	-4.804	0.300
32	1.350	2.150	2.302	-18.867	-1.974	0.300
33	1.200	2.150	2.302	-16.881	0.559	0.300
34	1.050	2.150	2.302	-14.895	2.793	0.300
35	0.900	2.150	2.302	-12.909	4.729	0.300
36	0.750	2.150	2.302	-10.923	6.368	0.300
37	0.600	2.150	2.302	-8.937	7.708	0.300
38	0.450	2.150	2.302	-6.951	8.751	0.300
39	0.300	2.150	2.302	-4.965	9.496	0.300
40	0.150	2.150	2.302	-2.979	9.942	0.300
41	0.000	2.150	2.302	-0.993	10.091	0.300

R = 0.24500E+02 M = -.79755E+01 H = -.30922E+01 V = 0.14766E-02m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	3.902	-1.106	7.976	24.500	19.509
1.485	3.706	-1.253	4.194	21.360	18.530
1.320	3.493	-1.315	0.917	18.390	17.465
1.155	3.276	-1.302	-1.884	15.598	16.381
0.990	3.067	-1.226	-4.240	12.983	15.334

0.825	2.874	-1.098	-6.178	10.533	14.372
0.660	2.707	-0.928	-7.724	8.233	13.533
0.495	2.570	-0.724	-8.902	6.059	12.850
0.330	2.469	-0.496	-9.729	3.983	12.345
0.165	2.407	-0.252	-10.220	1.974	12.035
0.000	2.386	-0.000	-10.382	-0.000	11.931

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	4.384	0.000
2	1.650	0.200	2.250	4.076	0.000
3	1.650	0.400	2.250	3.908	0.000
4	1.650	0.600	2.250	3.830	0.000
5	1.650	0.800	2.250	3.723	0.000
6	1.650	1.000	2.250	3.701	0.000
7	1.650	1.200	2.250	3.760	0.000
8	1.650	1.400	2.250	3.890	0.000
9	1.650	1.600	2.250	3.908	0.000
10	1.650	1.800	2.250	4.107	0.000
11	1.650	2.000	2.250	4.529	0.000
12	1.650	2.015	2.343	4.218	0.000
13	1.650	2.030	2.436	4.281	0.000
14	1.650	2.045	2.529	4.170	0.000
15	1.650	2.060	2.622	4.019	0.000
16	1.650	2.075	2.715	3.863	0.000
17	1.650	2.090	2.808	3.704	0.000
18	1.650	2.105	2.901	3.546	0.000
19	1.650	2.120	2.994	3.390	0.000
20	1.650	2.135	3.087	3.237	0.000
21	1.650	2.150	3.180	5.392	3.795
22	1.635	2.150	3.087	5.303	4.087
23	1.620	2.150	2.994	5.213	4.339
24	1.605	2.150	2.901	5.121	4.619
25	1.590	2.150	2.808	5.025	4.929
26	1.575	2.150	2.715	4.841	5.291
27	1.560	2.150	2.622	4.654	5.692
28	1.545	2.150	2.529	4.468	6.137
29	1.530	2.150	2.436	4.393	6.604
30	1.515	2.150	2.343	4.334	7.121
31	1.500	2.150	2.250	4.272	7.698
32	1.350	2.150	2.250	2.250	7.140
33	1.200	2.150	2.250	2.250	5.119
34	1.050	2.150	2.892	2.250	2.923
35	0.900	2.150	4.199	2.250	0.544
36	0.750	2.150	5.809	2.250	0.000
37	0.600	2.150	7.146	2.250	0.000
38	0.450	2.150	8.201	2.250	0.000
39	0.300	2.150	8.962	2.250	0.000
40	0.150	2.150	9.423	2.250	0.000
41	0.000	2.150	9.577	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	7.709	2.250	11.378
2	1.485	-0.150	3.982	2.250	9.203
3	1.320	-0.150	2.250	2.250	6.655
4	1.155	-0.150	2.250	2.308	3.798
5	0.990	-0.150	2.250	4.026	0.666
6	0.825	-0.150	2.250	5.919	0.000
7	0.660	-0.150	2.250	7.456	0.000
8	0.495	-0.150	2.250	8.645	0.000
9	0.330	-0.150	2.250	9.490	0.000
10	0.165	-0.150	2.250	9.996	0.000
11	0.000	-0.150	2.250	10.164	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 2+640

Fecha ..... : 5/9/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.65 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 4.48 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.65 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 4.48 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	24.500	-4.642	-8.190	0.300
2	1.650	0.200	24.380	-4.119	-7.366	0.300
3	1.650	0.400	24.140	-3.110	-6.744	0.300
4	1.650	0.600	23.900	-2.160	-6.312	0.300
5	1.650	0.800	23.660	-1.268	-6.058	0.300
6	1.650	1.000	23.420	-0.435	-5.971	0.300
7	1.650	1.200	23.180	0.339	-6.039	0.300
8	1.650	1.400	22.940	1.056	-6.250	0.300
9	1.650	1.600	22.700	1.713	-6.593	0.300
10	1.650	1.800	22.460	2.312	-7.055	0.300
11	1.650	2.000	22.220	2.853	-7.626	0.300
12	1.650	2.015	22.091	3.122	-7.673	0.312
13	1.650	2.030	22.072	3.158	-7.720	0.325
14	1.650	2.045	22.053	3.194	-7.768	0.337
15	1.650	2.060	22.033	3.229	-7.816	0.350
16	1.650	2.075	22.012	3.264	-7.865	0.362
17	1.650	2.090	21.990	3.298	-7.915	0.374
18	1.650	2.105	21.968	3.332	-7.965	0.387
19	1.650	2.120	21.944	3.366	-8.015	0.399
20	1.650	2.135	21.920	3.400	-8.066	0.412
21	1.650	2.150	3.433	-21.896	-8.118	0.424
22	1.635	2.150	3.449	-21.780	-7.791	0.412
23	1.620	2.150	3.449	-21.575	-7.467	0.399
24	1.605	2.150	3.449	-21.371	-7.147	0.387
25	1.590	2.150	3.449	-21.167	-6.829	0.374
26	1.575	2.150	3.449	-20.964	-6.515	0.362
27	1.560	2.150	3.449	-20.761	-6.203	0.350
28	1.545	2.150	3.449	-20.560	-5.895	0.337
29	1.530	2.150	3.449	-20.359	-5.590	0.325
30	1.515	2.150	3.449	-20.159	-5.287	0.312
31	1.500	2.150	3.449	-19.959	-4.988	0.300
32	1.350	2.150	3.449	-18.867	-2.158	0.300
33	1.200	2.150	3.449	-16.881	0.374	0.300
34	1.050	2.150	3.449	-14.895	2.609	0.300
35	0.900	2.150	3.449	-12.909	4.545	0.300
36	0.750	2.150	3.449	-10.923	6.183	0.300
37	0.600	2.150	3.449	-8.937	7.524	0.300
38	0.450	2.150	3.449	-6.951	8.567	0.300
39	0.300	2.150	3.449	-4.965	9.311	0.300
40	0.150	2.150	3.449	-2.979	9.758	0.300
41	0.000	2.150	3.449	-0.993	9.907	0.300

R = 0.24500E+02 M = -.81895E+01 H = -.46423E+01 V = 0.14396E-02m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	3.877	-1.059	8.190	24.500	19.385
1.485	3.688	-1.212	4.407	21.378	18.442
1.320	3.482	-1.278	1.126	18.420	17.409
1.155	3.271	-1.271	-1.681	15.634	16.353
0.990	3.066	-1.200	-4.043	13.021	15.330
0.825	2.878	-1.077	-5.987	10.571	14.388
0.660	2.713	-0.911	-7.539	8.267	13.565
0.495	2.579	-0.712	-8.722	6.086	12.894
0.330	2.480	-0.488	-9.553	4.002	12.398
0.165	2.419	-0.248	-10.046	1.984	12.094
0.000	2.398	0.000	-10.210	0.000	11.991

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	4.595	0.000
2	1.650	0.200	2.250	4.013	0.000
3	1.650	0.400	2.250	3.822	0.000
4	1.650	0.600	2.250	3.497	0.000
5	1.650	0.800	2.250	3.302	0.000
6	1.650	1.000	2.250	3.250	0.000
7	1.650	1.200	2.250	3.338	0.000
8	1.650	1.400	2.250	3.546	0.000
9	1.650	1.600	2.250	3.842	0.000
10	1.650	1.800	2.250	3.934	0.000
11	1.650	2.000	2.250	4.551	0.000
12	1.650	2.015	2.343	4.253	0.000
13	1.650	2.030	2.436	4.281	0.000
14	1.650	2.045	2.529	4.217	0.000
15	1.650	2.060	2.622	4.079	0.000
16	1.650	2.075	2.715	3.936	0.000
17	1.650	2.090	2.808	3.790	0.000
18	1.650	2.105	2.901	3.645	0.000
19	1.650	2.120	2.994	3.502	0.000
20	1.650	2.135	3.087	3.362	0.000
21	1.650	2.150	3.180	5.374	3.798
22	1.635	2.150	3.087	5.288	4.089
23	1.620	2.150	2.994	5.201	4.342
24	1.605	2.150	2.901	5.112	4.621
25	1.590	2.150	2.808	5.021	4.930
26	1.575	2.150	2.715	4.841	5.291
27	1.560	2.150	2.622	4.654	5.692
28	1.545	2.150	2.529	4.468	6.137
29	1.530	2.150	2.436	4.409	6.601
30	1.515	2.150	2.343	4.356	7.115
31	1.500	2.150	2.250	4.302	7.690
32	1.350	2.150	2.250	2.250	7.140
33	1.200	2.150	2.250	2.250	5.119
34	1.050	2.150	2.557	2.250	3.015
35	0.900	2.150	3.908	2.250	0.624
36	0.750	2.150	5.478	2.250	0.000
37	0.600	2.150	6.815	2.250	0.000
38	0.450	2.150	7.869	2.250	0.000
39	0.300	2.150	8.630	2.250	0.000
40	0.150	2.150	9.090	2.250	0.000
41	0.000	2.150	9.243	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	7.924	2.250	11.319
2	1.485	-0.150	4.188	2.250	9.165
3	1.320	-0.150	2.250	2.250	6.685
4	1.155	-0.150	2.250	2.250	3.851
5	0.990	-0.150	2.250	3.908	0.738
6	0.825	-0.150	2.250	5.731	0.000
7	0.660	-0.150	2.250	7.271	0.000
8	0.495	-0.150	2.250	8.463	0.000
9	0.330	-0.150	2.250	9.310	0.000
10	0.165	-0.150	2.250	9.817	0.000
11	0.000	-0.150	2.250	9.985	0.000

1.5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_S (Ton)	DISPUESTO ARMADURA	U_S (Ton)
HASTIAL	Interior	10	ϕ 10 A 0.20	17.4
	Exterior	20.4	ϕ 16 A 0.20	44.6
DINTEL	Interior	42.5	ϕ 20 A 0.20	69.6
	Exterior	19.1	ϕ 16 A 0.20	44.6
SOLERA	Inferior	35.1	ϕ 16 A 0.20	44.6
	Superior	45.1	ϕ 20 A 0.20	69.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

* Elemento: Muro vertical

Acero: AEH-500 _ Cuantía mínima = 0,90 %

* $A_C = 2 \times 0,3 = 0,6\ m^2$

* $A_S = 10.8 \times 10^{-4}\ m^2 \Rightarrow$ $5,4 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 2 m $\Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara _ **Válido**

- DINTEL

* Elemento: Muro horizontal

Acero: AEH-500 _ Cuantía mínima = 1,6 %

* $A_C = 3,6 \times 0,3 = 1,08\ m^2$

* $A_S = 17,28 \times 10^{-4}\ m^2 \Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

- SOLERA

* Elemento: Losa

Acero: AEH-500 _ Cuantía mínima = 1,5 %

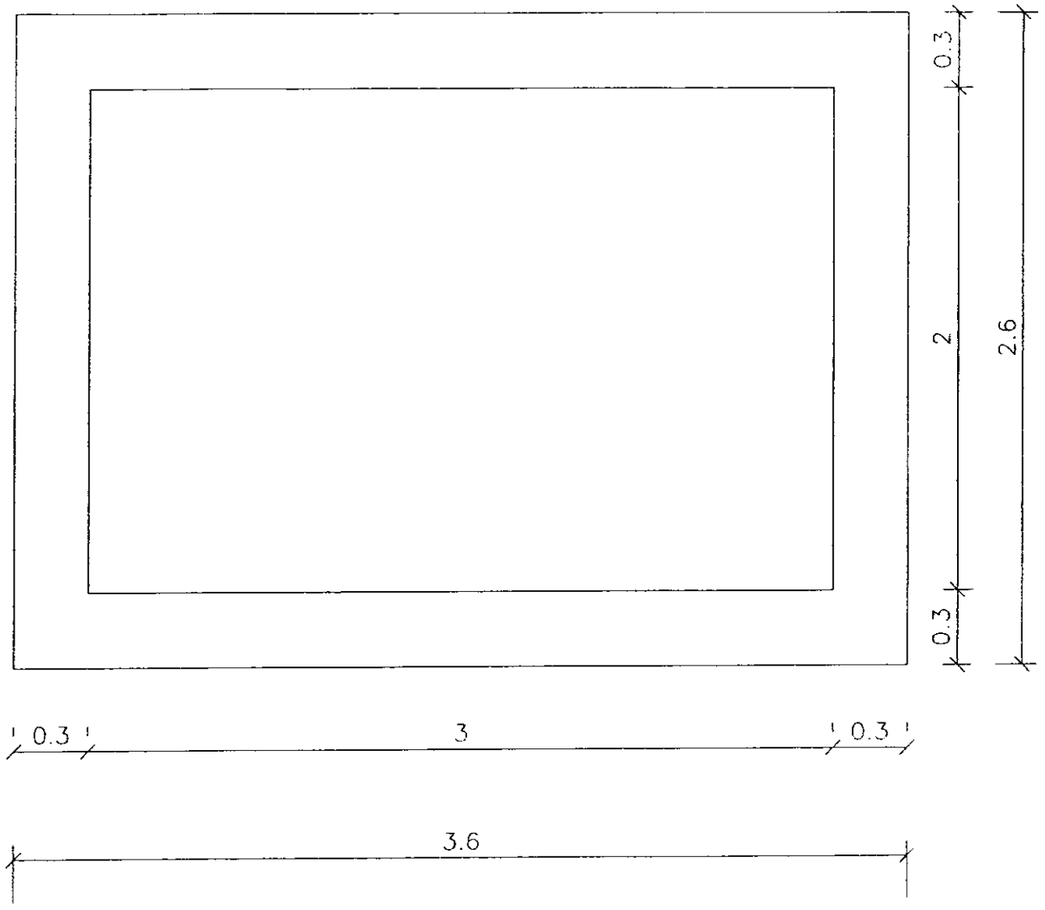
* $A_C = 3,6 \times 0,3 = 1,08\ m^2$

* $A_S = 16,20 \times 10^{-4}\ m^2 \Rightarrow$ $8,1 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

2 .PLANOS

039

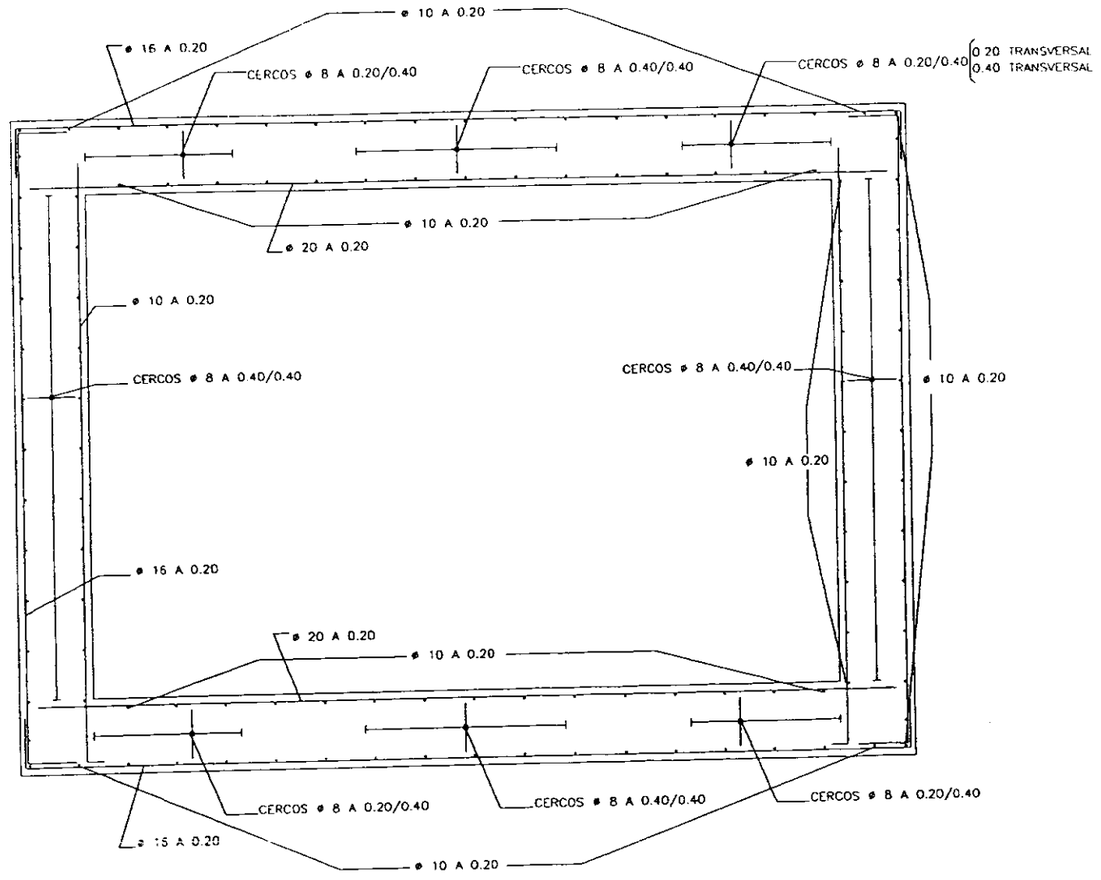


SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 25

040



SECCION TRANSVERSAL

ARMADURAS O.R. 2+640

ESCALA 1 : 25

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

O.R. 3 + 020

I. CALCULOS

O.R. 3 + 020

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 3 + 020. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso
2 - Esquema estructural
3 - Cargas consideradas
4 - Hipótesis de carga
5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

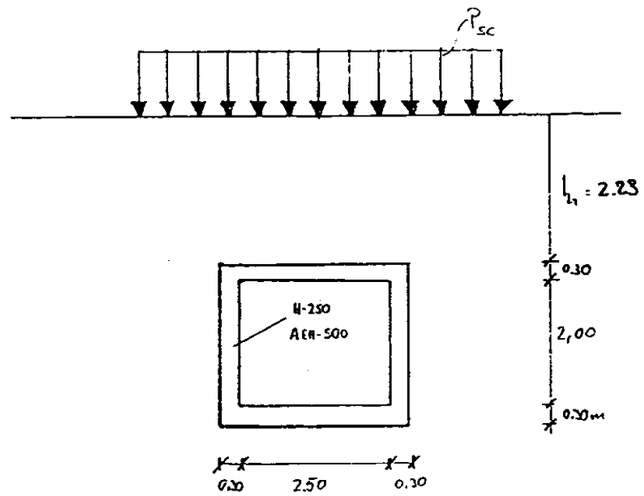


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 2.23 m

  -sobre cimentación H_T = 4.53 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\ (h_T - 1) = 1.537$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\ (3 + h_T)} = 3.526 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 2.23$ m

  $H_T = 4.53$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+020

Fecha ..... : 29/7/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.0 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	5.016	-2.085	-1.623	0.300
2	1.400	0.200	4.896	-1.867	-1.249	0.300
3	1.400	0.400	4.656	-1.458	-0.958	0.300
4	1.400	0.600	4.416	-1.088	-0.740	0.300
5	1.400	0.800	4.176	-0.757	-0.589	0.300
6	1.400	1.000	3.936	-0.464	-0.496	0.300
7	1.400	1.200	3.696	-0.211	-0.454	0.300
8	1.400	1.400	3.456	0.003	-0.454	0.300
9	1.400	1.600	3.216	0.179	-0.490	0.300
10	1.400	1.800	2.976	0.315	-0.553	0.300
11	1.400	2.000	2.736	0.413	-0.636	0.300
12	1.400	2.015	2.607	0.451	-0.642	0.312
13	1.400	2.030	2.589	0.455	-0.649	0.325
14	1.400	2.045	2.569	0.459	-0.656	0.337
15	1.400	2.060	2.549	0.462	-0.663	0.350
16	1.400	2.075	2.528	0.466	-0.670	0.362
17	1.400	2.090	2.506	0.469	-0.677	0.374
18	1.400	2.105	2.484	0.472	-0.684	0.387
19	1.400	2.120	2.460	0.475	-0.691	0.399
20	1.400	2.135	2.437	0.478	-0.699	0.412
21	1.400	2.150	0.480	-2.412	-0.706	0.424
22	1.385	2.150	0.481	-2.383	-0.670	0.412
23	1.370	2.150	0.481	-2.351	-0.635	0.399
24	1.355	2.150	0.481	-2.320	-0.600	0.387
25	1.340	2.150	0.481	-2.289	-0.566	0.374
26	1.325	2.150	0.481	-2.260	-0.532	0.362
27	1.310	2.150	0.481	-2.231	-0.498	0.350
28	1.295	2.150	0.481	-2.202	-0.465	0.337
29	1.280	2.150	0.481	-2.175	-0.433	0.325
30	1.265	2.150	0.481	-2.148	-0.400	0.312
31	1.250	2.150	0.481	-2.122	-0.369	0.300
32	1.125	2.150	0.481	-2.004	-0.118	0.300
33	1.000	2.150	0.481	-1.793	0.106	0.300
34	0.875	2.150	0.481	-1.582	0.304	0.300
35	0.750	2.150	0.481	-1.371	0.475	0.300
36	0.625	2.150	0.481	-1.160	0.620	0.300
37	0.500	2.150	0.481	-0.949	0.739	0.300
38	0.375	2.150	0.481	-0.738	0.831	0.300
39	0.250	2.150	0.481	-0.527	0.897	0.300
40	0.125	2.150	0.481	-0.316	0.936	0.300
41	0.000	2.150	0.481	-0.105	0.950	0.300

R = 0.50165E+01 M = -.16227E+01 H = -.20850E+01 V = 0.10674E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	1.157	-0.132	1.623	5.016	5.786

1.260	1.137	-0.159	0.960	4.449	5.684
1.120	1.113	-0.172	0.376	3.896	5.560
0.980	1.089	-0.175	-0.131	3.360	5.445
0.840	1.065	-0.168	-0.565	2.842	5.325
0.700	1.042	-0.152	-0.928	2.339	5.212
0.560	1.023	-0.130	-1.221	1.852	5.113
0.420	1.006	-0.102	-1.447	1.377	5.032
0.280	0.994	-0.070	-1.607	0.912	4.972
0.140	0.987	-0.036	-1.703	0.454	4.935
0.000	0.984	0.000	-1.735	0.000	4.922

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.250	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.250	2.250	0.000
38	0.375	2.150	2.250	2.250	0.000
39	0.250	2.150	2.250	2.250	0.000
40	0.125	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	2.250	2.250	0.000
2	1.260	-0.150	2.250	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.250	0.000
7	0.560	-0.150	2.250	2.250	0.000
8	0.420	-0.150	2.250	2.250	0.000
9	0.280	-0.150	2.250	2.250	0.000
10	0.140	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V SUBTRAMO I

Referencia ..... : O.R. 3+020

Fecha ..... : 29/7/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 4.53 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

060

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	15.157	-6.282	-4.818	0.300
2	1.400	0.200	15.037	-5.629	-3.692	0.300
3	1.400	0.400	14.797	-4.364	-2.819	0.300
4	1.400	0.600	14.557	-3.156	-2.188	0.300
5	1.400	0.800	14.317	-2.008	-1.786	0.300
6	1.400	1.000	14.077	-0.917	-1.603	0.300
7	1.400	1.200	13.837	0.115	-1.626	0.300
8	1.400	1.400	13.597	1.088	-1.843	0.300
9	1.400	1.600	13.357	2.003	-2.244	0.300
10	1.400	1.800	13.117	2.860	-2.816	0.300
11	1.400	2.000	12.877	3.658	-3.547	0.300
12	1.400	2.015	12.748	4.065	-3.608	0.312
13	1.400	2.030	12.729	4.120	-3.670	0.325
14	1.400	2.045	12.709	4.175	-3.733	0.337
15	1.400	2.060	12.689	4.229	-3.796	0.350
16	1.400	2.075	12.668	4.283	-3.861	0.362
17	1.400	2.090	12.646	4.337	-3.926	0.374
18	1.400	2.105	12.624	4.391	-3.991	0.387
19	1.400	2.120	12.601	4.444	-4.058	0.399
20	1.400	2.135	12.577	4.497	-4.126	0.412
21	1.400	2.150	4.549	-12.552	-4.194	0.424
22	1.385	2.150	4.575	-12.469	-4.007	0.412
23	1.370	2.150	4.575	-12.328	-3.822	0.399
24	1.355	2.150	4.575	-12.188	-3.639	0.387
25	1.340	2.150	4.575	-12.049	-3.458	0.374
26	1.325	2.150	4.575	-11.911	-3.280	0.362
27	1.310	2.150	4.575	-11.773	-3.103	0.350
28	1.295	2.150	4.575	-11.636	-2.929	0.337
29	1.280	2.150	4.575	-11.500	-2.756	0.325
30	1.265	2.150	4.575	-11.365	-2.586	0.312
31	1.250	2.150	4.575	-11.230	-2.417	0.300
32	1.125	2.150	4.575	-10.605	-1.092	0.300
33	1.000	2.150	4.575	-9.488	0.095	0.300
34	0.875	2.150	4.575	-8.372	1.141	0.300
35	0.750	2.150	4.575	-7.256	2.048	0.300
36	0.625	2.150	4.575	-6.140	2.815	0.300
37	0.500	2.150	4.575	-5.023	3.443	0.300
38	0.375	2.150	4.575	-3.907	3.932	0.300
39	0.250	2.150	4.575	-2.791	4.281	0.300
40	0.125	2.150	4.575	-1.674	4.490	0.300
41	0.000	2.150	4.575	-0.558	4.560	0.300

R = 0.15157E+02 M = -.48177E+01 H = -.62818E+01 V = 0.48141E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	2.729	-0.416	4.818	15.157	13.645
1.260	2.665	-0.495	2.817	13.436	13.324
1.120	2.592	-0.534	1.053	11.764	12.968
0.980	2.517	-0.540	-0.480	10.144	12.584
0.840	2.443	-0.516	-1.789	8.576	12.213
0.700	2.374	-0.467	-2.883	7.059	11.868
0.560	2.313	-0.398	-3.768	5.587	11.564
0.420	2.263	-0.312	-4.449	4.154	11.315
0.280	2.226	-0.215	-4.932	2.752	11.129
0.140	2.203	-0.109	-5.221	1.371	11.016
0.000	2.195	0.000	-5.317	0.000	10.977

061

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.033	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.608	2.250	0.000
37	0.500	2.150	3.200	2.250	0.000
38	0.375	2.150	3.605	2.250	0.000
39	0.250	2.150	3.866	2.250	0.000
40	0.125	2.150	3.908	2.250	0.000
41	0.000	2.150	3.908	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	4.587	2.250	0.000
2	1.260	-0.150	3.203	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	3.261	0.000
7	0.560	-0.150	2.250	3.908	0.000
8	0.420	-0.150	2.250	4.229	0.000
9	0.280	-0.150	2.250	4.698	0.000
10	0.140	-0.150	2.250	4.980	0.000
11	0.000	-0.150	2.250	5.073	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+020

Fecha ..... : 29/7/97

HIPOTESIS III

DATOS DE LA ESTRUCTURA

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 4.53 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 3.53 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

ESFUERZOS EN EL ARCO

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	23.064	-4.156	-6.477	0.300
2	1.400	0.200	22.944	-3.721	-5.733	0.300
3	1.400	0.400	22.704	-2.877	-5.158	0.300
4	1.400	0.600	22.464	-2.072	-4.743	0.300
5	1.400	0.800	22.224	-1.306	-4.482	0.300
6	1.400	1.000	21.984	-0.579	-4.366	0.300
7	1.400	1.200	21.744	0.109	-4.388	0.300
8	1.400	1.400	21.504	0.758	-4.539	0.300
9	1.400	1.600	21.264	1.367	-4.813	0.300
10	1.400	1.800	21.024	1.938	-5.200	0.300
11	1.400	2.000	20.784	2.471	-5.695	0.300
12	1.400	2.015	20.655	2.742	-5.736	0.312
13	1.400	2.030	20.636	2.779	-5.777	0.325
14	1.400	2.045	20.617	2.815	-5.820	0.337
15	1.400	2.060	20.596	2.852	-5.862	0.350
16	1.400	2.075	20.575	2.888	-5.906	0.362
17	1.400	2.090	20.554	2.924	-5.950	0.374
18	1.400	2.105	20.531	2.959	-5.994	0.387
19	1.400	2.120	20.508	2.995	-6.039	0.399
20	1.400	2.135	20.484	3.030	-6.084	0.412
21	1.400	2.150	3.065	-20.459	-6.130	0.424
22	1.385	2.150	3.082	-20.334	-5.825	0.412
23	1.370	2.150	3.082	-20.109	-5.524	0.399
24	1.355	2.150	3.082	-19.884	-5.225	0.387
25	1.340	2.150	3.082	-19.660	-4.931	0.374
26	1.325	2.150	3.082	-19.437	-4.639	0.362
27	1.310	2.150	3.082	-19.214	-4.351	0.350
28	1.295	2.150	3.082	-18.993	-4.066	0.337
29	1.280	2.150	3.082	-18.772	-3.784	0.325
30	1.265	2.150	3.082	-18.552	-3.506	0.312
31	1.250	2.150	3.082	-18.332	-3.231	0.300
32	1.125	2.150	3.082	-17.312	-1.067	0.300
33	1.000	2.150	3.082	-15.489	0.869	0.300
34	0.875	2.150	3.082	-13.667	2.578	0.300
35	0.750	2.150	3.082	-11.845	4.058	0.300
36	0.625	2.150	3.082	-10.023	5.311	0.300
37	0.500	2.150	3.082	-8.200	6.336	0.300
38	0.375	2.150	3.082	-6.378	7.133	0.300
39	0.250	2.150	3.082	-4.556	7.703	0.300
40	0.125	2.150	3.082	-2.733	8.044	0.300
41	0.000	2.150	3.082	-0.911	8.158	0.300

R = 0.23064E+02 M = -.64772E+01 H = -.41557E+01 V = 0.88679E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	4.104	-0.799	6.477	23.064	20.520

1.260	3.984	-0.901	3.436	20.400	19.921
1.120	3.854	-0.944	0.761	17.824	19.026
0.980	3.722	-0.935	-1.560	15.341	18.611
0.840	3.594	-0.882	-3.539	12.948	17.972
0.700	3.477	-0.791	-5.189	10.642	17.385
0.560	3.374	-0.669	-6.522	8.413	16.872
0.420	3.291	-0.523	-7.548	6.249	16.453
0.280	3.229	-0.359	-8.274	4.137	16.144
0.140	3.191	-0.182	-8.708	2.060	15.954
0.000	3.178	0.000	-8.852	0.000	15.890

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.581	0.000
2	1.400	0.200	2.250	3.085	0.000
3	1.400	0.400	2.250	2.537	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.364	0.000
10	1.400	1.800	2.250	2.803	0.000
11	1.400	2.000	2.250	3.300	0.000
12	1.400	2.015	2.343	3.149	0.000
13	1.400	2.030	2.436	2.985	0.000
14	1.400	2.045	2.529	2.824	0.000
15	1.400	2.060	2.622	2.668	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	4.316	0.000
22	1.385	2.150	3.087	4.217	0.000
23	1.370	2.150	2.994	4.119	0.000
24	1.355	2.150	2.901	4.017	0.000
25	1.340	2.150	2.808	3.912	0.000
26	1.325	2.150	2.715	3.804	0.000
27	1.310	2.150	2.622	3.692	0.000
28	1.295	2.150	2.529	3.575	0.000
29	1.280	2.150	2.436	3.454	0.361
30	1.265	2.150	2.343	3.326	0.940
31	1.250	2.150	2.250	3.193	1.577
32	1.125	2.150	2.250	2.250	0.538
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.577	2.250	0.000
35	0.750	2.150	3.851	2.250	0.000
36	0.625	2.150	4.666	2.250	0.000
37	0.500	2.150	5.677	2.250	0.000
38	0.375	2.150	6.470	2.250	0.000
39	0.250	2.150	7.041	2.250	0.000
40	0.125	2.150	7.386	2.250	0.000
41	0.000	2.150	7.501	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	6.214	2.250	6.391
2	1.260	-0.150	3.704	2.250	3.681
3	1.120	-0.150	2.250	2.250	1.060
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.781	0.000
6	0.700	-0.150	2.250	4.949	0.000
7	0.560	-0.150	2.250	6.259	0.000
8	0.420	-0.150	2.250	7.280	0.000
9	0.280	-0.150	2.250	8.010	0.000
10	0.140	-0.150	2.250	8.448	0.000
11	0.000	-0.150	2.250	8.594	0.000

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+020

Fecha ..... : 29/7/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO		= 0.300	m
PESO ESPECIFICO DEL HORMIGON		= 2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON	fck =	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck	¥c =	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO	fyk =	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk	¥s =	1.15	
RECUBRIMIENTO DE LAS ARMADURAS	c =	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE		= 4.53	m
PESO ESPECIFICO DE LAS TIERRAS		= 2.03	t/m3
COEFICIENTE EMPUJE TIERRAS		= 0.45	
SOBRECARGA q		= 3.53	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE Llosa DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION	Q =	0.00	t/m;
CANTO DE LA LOSA DE CIMENTACION	t =	0.30	m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	23.064	-6.164	-6.779	0.300
2	1.400	0.200	22.944	-5.511	-5.676	0.300
3	1.400	0.400	22.704	-4.245	-4.827	0.300
4	1.400	0.600	22.464	-3.038	-4.220	0.300
5	1.400	0.800	22.224	-1.889	-3.842	0.300
6	1.400	1.000	21.984	-0.799	-3.682	0.300
7	1.400	1.200	21.744	0.233	-3.728	0.300
8	1.400	1.400	21.504	1.206	-3.970	0.300
9	1.400	1.600	21.264	2.121	-4.394	0.300
10	1.400	1.800	21.024	2.978	-4.989	0.300
11	1.400	2.000	20.784	3.776	-5.745	0.300
12	1.400	2.015	20.655	4.183	-5.807	0.312
13	1.400	2.030	20.636	4.238	-5.871	0.325
14	1.400	2.045	20.617	4.293	-5.935	0.337
15	1.400	2.060	20.596	4.347	-6.001	0.350
16	1.400	2.075	20.575	4.402	-6.067	0.362
17	1.400	2.090	20.554	4.455	-6.133	0.374
18	1.400	2.105	20.531	4.509	-6.201	0.387
19	1.400	2.120	20.508	4.562	-6.269	0.399
20	1.400	2.135	20.484	4.615	-6.339	0.412
21	1.400	2.150	4.667	-20.459	-6.409	0.424
22	1.385	2.150	4.694	-20.334	-6.104	0.412
23	1.370	2.150	4.694	-20.109	-5.802	0.399
24	1.355	2.150	4.694	-19.884	-5.504	0.387
25	1.340	2.150	4.694	-19.660	-5.209	0.374
26	1.325	2.150	4.694	-19.437	-4.917	0.362
27	1.310	2.150	4.694	-19.214	-4.629	0.350
28	1.295	2.150	4.694	-18.993	-4.344	0.337
29	1.280	2.150	4.694	-18.772	-4.063	0.325
30	1.265	2.150	4.694	-18.552	-3.784	0.312
31	1.250	2.150	4.694	-18.332	-3.509	0.300
32	1.125	2.150	4.694	-17.312	-1.345	0.300
33	1.000	2.150	4.694	-15.489	0.591	0.300
34	0.875	2.150	4.694	-13.667	2.299	0.300
35	0.750	2.150	4.694	-11.845	3.780	0.300
36	0.625	2.150	4.694	-10.023	5.033	0.300
37	0.500	2.150	4.694	-8.200	6.058	0.300
38	0.375	2.150	4.694	-6.378	6.855	0.300
39	0.250	2.150	4.694	-4.556	7.424	0.300
40	0.125	2.150	4.694	-2.733	7.766	0.300
41	0.000	2.150	4.694	-0.911	7.880	0.300

R = 0.23064E+02 M = -.67785E+01 H = -.61636E+01 V = 0.84656E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	4.077	-0.741	6.779	23.064	20.385
1.260	3.965	-0.849	3.736	20.416	19.825
1.120	3.842	-0.898	1.058	17.851	19.210
0.980	3.716	-0.895	-1.267	15.374	18.580
0.840	3.594	-0.848	-3.251	12.984	17.968
0.700	3.480	-0.763	-4.906	10.677	17.402
0.560	3.381	-0.647	-6.244	8.444	16.907
0.420	3.300	-0.506	-7.274	6.275	16.502
0.280	3.240	-0.348	-8.003	4.155	16.202
0.140	3.204	-0.177	-8.438	2.069	16.018
0.000	3.191	0.000	-8.583	0.000	15.956

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.808	0.000
2	1.400	0.200	2.250	3.031	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.586	0.000
11	1.400	2.000	2.250	3.345	0.000
12	1.400	2.015	2.343	3.213	0.000
13	1.400	2.030	2.436	3.070	0.000
14	1.400	2.045	2.529	2.930	0.000
15	1.400	2.060	2.622	2.794	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	4.295	0.000
22	1.385	2.150	3.087	4.201	0.000
23	1.370	2.150	2.994	4.108	0.000
24	1.355	2.150	2.901	4.012	0.000
25	1.340	2.150	2.808	3.914	0.000
26	1.325	2.150	2.715	3.812	0.000
27	1.310	2.150	2.622	3.707	0.000
28	1.295	2.150	2.529	3.598	0.000
29	1.280	2.150	2.436	3.485	0.361
30	1.265	2.150	2.343	3.367	0.940
31	1.250	2.150	2.250	3.243	1.577
32	1.125	2.150	2.250	2.250	0.538
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	3.471	2.250	0.000
36	0.625	2.150	4.183	2.250	0.000
37	0.500	2.150	5.193	2.250	0.000
38	0.375	2.150	5.985	2.250	0.000
39	0.250	2.150	6.556	2.250	0.000
40	0.125	2.150	6.900	2.250	0.000
41	0.000	2.150	7.015	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	6.513	2.250	6.391
2	1.260	-0.150	3.908	2.250	3.697
3	1.120	-0.150	2.250	2.250	1.087
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.563	0.000
6	0.700	-0.150	2.250	4.673	0.000
7	0.560	-0.150	2.250	5.984	0.000
8	0.420	-0.150	2.250	7.006	0.000
9	0.280	-0.150	2.250	7.736	0.000
10	0.140	-0.150	2.250	8.175	0.000
11	0.000	-0.150	2.250	8.322	0.000

5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_s (Ton)	DISPUESTO ARMADURA	U_s (Ton)
HASTIAL	Interior	10.0	ϕ 10 A 0.20	17.4
	Exterior	17	ϕ 12 A 0.20	25.1
DINTEL	Interior	33.3	ϕ 16 A 0.20	44.6
	Exterior	14.4	ϕ 12 A 0.20	25.1
SOLERA	Inferior	17.3	ϕ 12 A 0.20	25.1
	Superior	38.1	ϕ 16 A 0.20	44.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

  * Elemento: Muro vertical
    Acero: AEH-500 } Cuantía mínima = 0,90 ‰
  * $A_C = 2 \times 0,3 = 0,6\ m^2$
  * $A_S = 10.8 \times 10^{-4}\ m^2$ ⇒ $5,4 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 2 m ⇒ $8,64 \times 10^{-4}\ m^2$ por cara } Válido

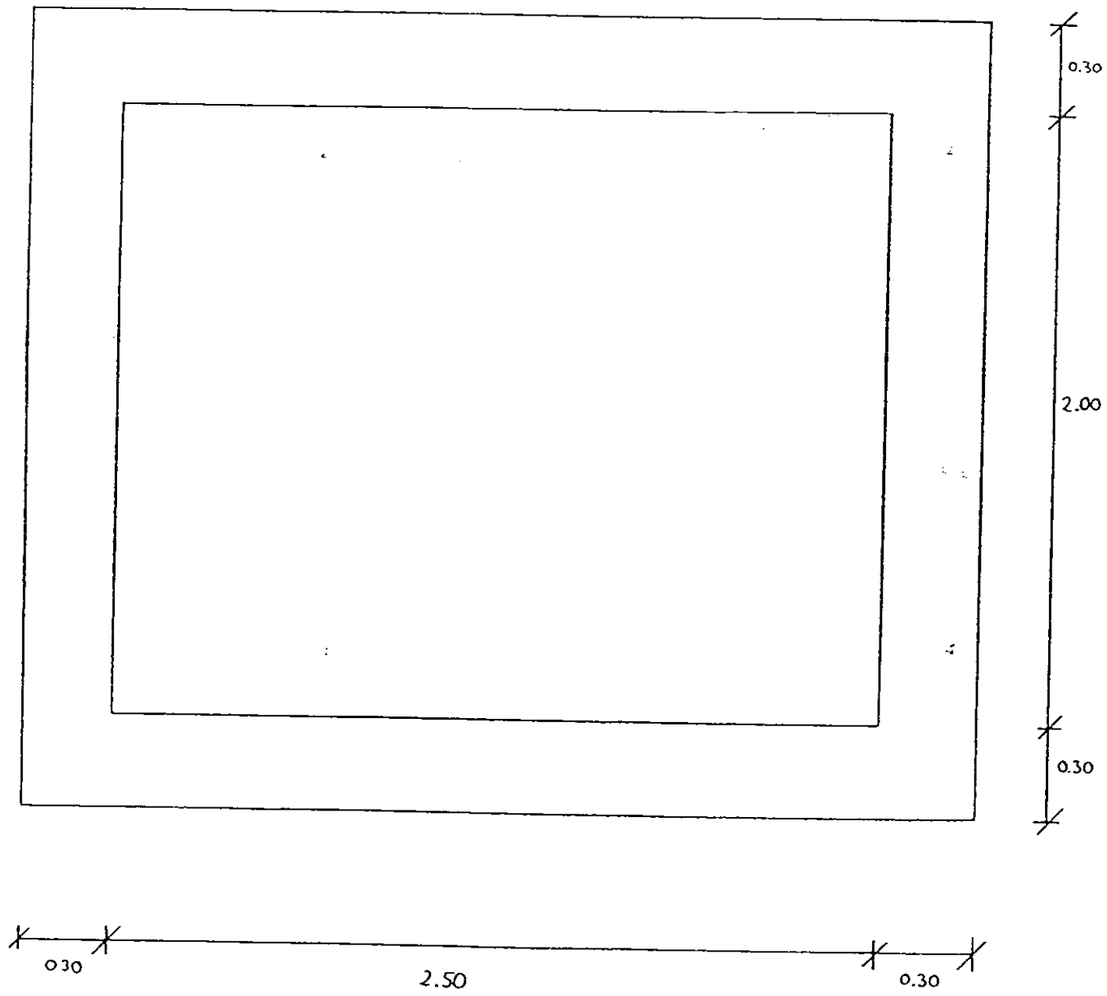
- DINTEL

  * Elemento: Muro horizontal
    Acero: AEH-500 } Cuantía mínima = 1,6 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,88 \times 10^{-4}\ m^2$ ⇒ $7,44 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

- SOLERA

  * Elemento: Losa
    Acero: AEH-500 } Cuantía mínima = 1,5 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,0 \times 10^{-4}\ m^2$ ⇒ $7,0 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

II. PLANOS



SECCION TRANSVERSAL

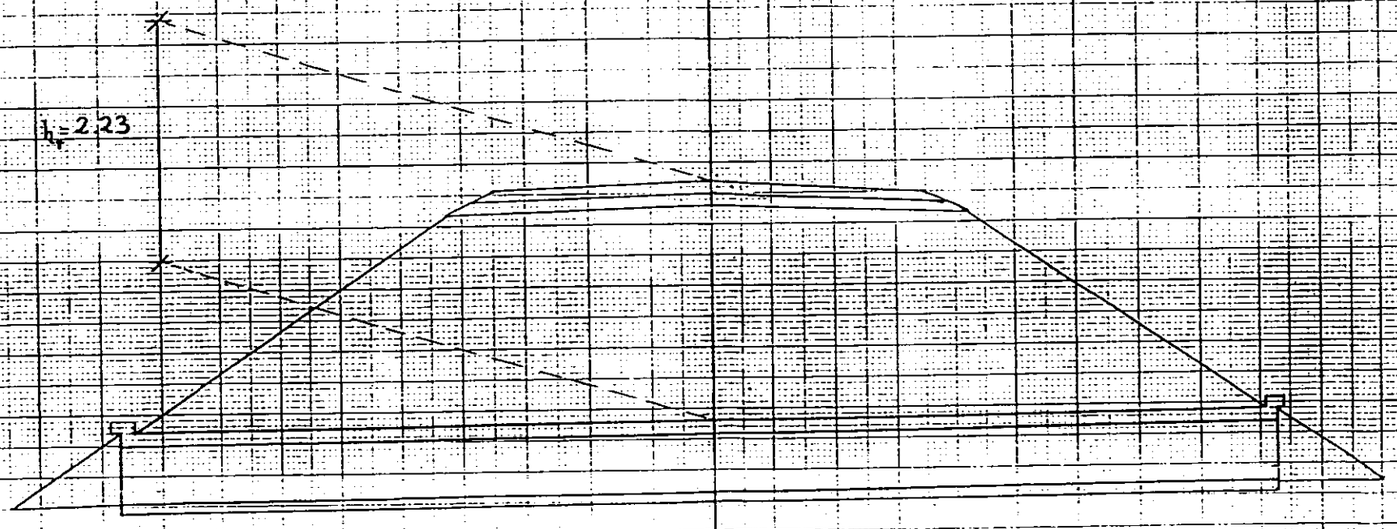
DEFINICION GEOMETRICA

ESCALA 1 : 20

078

O. R. 3+020

SECCION LONGITUDINAL



OBRAS DE RIEGO

SECCIÓN LONGITUDINAL

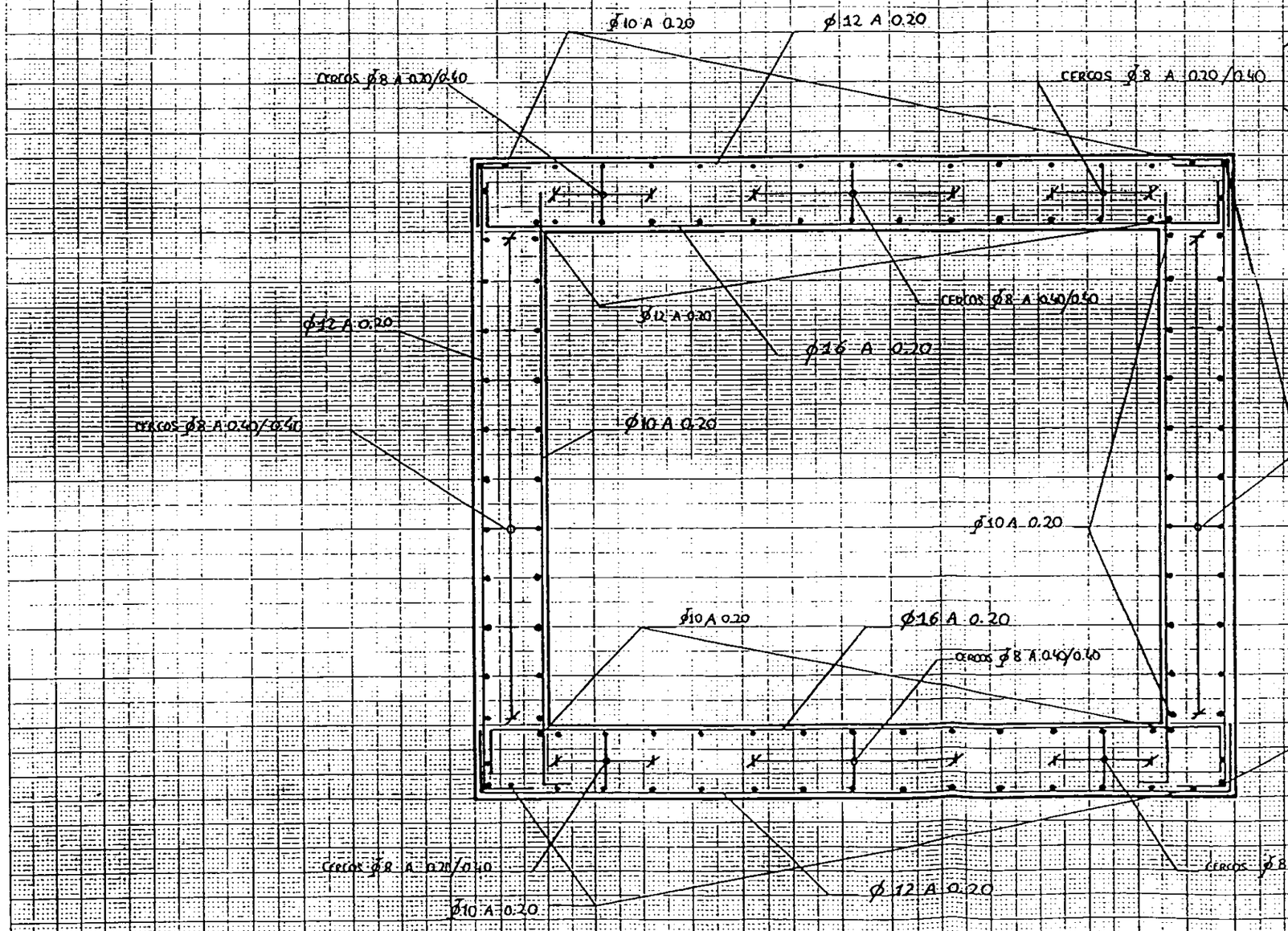
ESCALA 1:200

079

O. R. 3+020

SECCION TRANSVERSAL

ARMADURAS



CARACTERISTICAS	
HORMIGON	H-250 $\gamma_c = 1.5$
ACERO	AEH-500 $\gamma_s = 1.15$
COEF. MAYORACION DE ACCIONES	$\gamma_f = 1.6$
RECUBRIMIENTO	4cm
ESCALA	1:20

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

O.R. 3 + 260

I. CALCULOS

O.R. 3 + 260

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 3 + 260. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso
2 - Esquema estructural
3 - Cargas consideradas
4 - Hipótesis de carga
5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

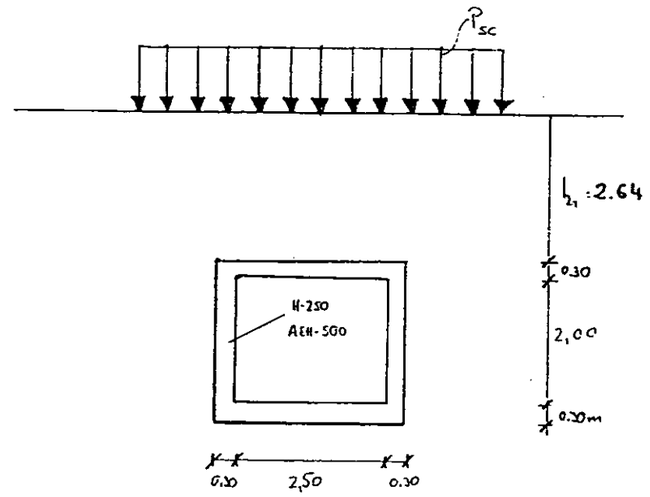


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 2.64 m

  -sobre cimentación H_T = 4.94 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\ (h_T - 1) = 1.496$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\ (3 + h_T)} = 3.183 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: h_T = 2.64 m

  H_T = 4.94 m

- Densidad de Tierras

  $\gamma_{TIERRAS}$ = 2,03 t/m3

- Coeficiente de empuje

  K_{ACTIVO} = 0,30

  K_{REPOSO} = 0,45

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

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P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+260

Fecha ..... : 29/7/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.0 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m³

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	5.016	-2.085	-1.623	0.300
2	1.400	0.200	4.896	-1.867	-1.249	0.300
3	1.400	0.400	4.656	-1.458	-0.958	0.300
4	1.400	0.600	4.416	-1.088	-0.740	0.300
5	1.400	0.800	4.176	-0.757	-0.589	0.300
6	1.400	1.000	3.936	-0.464	-0.496	0.300
7	1.400	1.200	3.696	-0.211	-0.454	0.300
8	1.400	1.400	3.456	0.003	-0.454	0.300
9	1.400	1.600	3.216	0.179	-0.490	0.300
10	1.400	1.800	2.976	0.315	-0.553	0.300
11	1.400	2.000	2.736	0.413	-0.636	0.300
12	1.400	2.015	2.607	0.451	-0.642	0.312
13	1.400	2.030	2.589	0.455	-0.649	0.325
14	1.400	2.045	2.569	0.459	-0.656	0.337
15	1.400	2.060	2.549	0.462	-0.663	0.350
16	1.400	2.075	2.528	0.466	-0.670	0.362
17	1.400	2.090	2.506	0.469	-0.677	0.374
18	1.400	2.105	2.484	0.472	-0.684	0.387
19	1.400	2.120	2.460	0.475	-0.691	0.399
20	1.400	2.135	2.437	0.478	-0.699	0.412
21	1.400	2.150	0.480	-2.412	-0.706	0.424
22	1.385	2.150	0.481	-2.383	-0.670	0.412
23	1.370	2.150	0.481	-2.351	-0.635	0.399
24	1.355	2.150	0.481	-2.320	-0.600	0.387
25	1.340	2.150	0.481	-2.289	-0.566	0.374
26	1.325	2.150	0.481	-2.260	-0.532	0.362
27	1.310	2.150	0.481	-2.231	-0.498	0.350
28	1.295	2.150	0.481	-2.202	-0.465	0.337
29	1.280	2.150	0.481	-2.175	-0.433	0.325
30	1.265	2.150	0.481	-2.148	-0.400	0.312
31	1.250	2.150	0.481	-2.122	-0.369	0.300
32	1.125	2.150	0.481	-2.004	-0.118	0.300
33	1.000	2.150	0.481	-1.793	0.106	0.300
34	0.875	2.150	0.481	-1.582	0.304	0.300
35	0.750	2.150	0.481	-1.371	0.475	0.300
36	0.625	2.150	0.481	-1.160	0.620	0.300
37	0.500	2.150	0.481	-0.949	0.739	0.300
38	0.375	2.150	0.481	-0.738	0.831	0.300
39	0.250	2.150	0.481	-0.527	0.897	0.300
40	0.125	2.150	0.481	-0.316	0.936	0.300
41	0.000	2.150	0.481	-0.105	0.950	0.300

R = 0.50165E+01 M = -.16227E+01 H = -.20850E+01 V = 0.10674E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	1.157	-0.132	1.623	5.016	5.786

1.260	1.137	-0.159	0.960	4.449	5.644
1.120	1.113	-0.172	0.376	3.896	5.567
0.980	1.089	-0.175	-0.131	3.360	5.445
0.840	1.065	-0.168	-0.565	2.842	5.325
0.700	1.042	-0.152	-0.928	2.339	5.212
0.560	1.023	-0.130	-1.221	1.852	5.113
0.420	1.006	-0.102	-1.447	1.377	5.032
0.280	0.994	-0.070	-1.607	0.912	4.972
0.140	0.987	-0.036	-1.703	0.454	4.935
0.000	0.984	0.000	-1.735	0.000	4.922

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.250	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.250	2.250	0.000
38	0.375	2.150	2.250	2.250	0.000
39	0.250	2.150	2.250	2.250	0.000
40	0.125	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	2.250	2.250	0.000
2	1.260	-0.150	2.250	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.250	0.000
7	0.560	-0.150	2.250	2.250	0.000
8	0.420	-0.150	2.250	2.250	0.000
9	0.280	-0.150	2.250	2.250	0.000
10	0.140	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+260

Fecha ..... : 29/7/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO	=	0.300	m
PESO ESPECIFICO DEL HORMIGON	=	2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck	=	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c	=	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk	=	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s	=	1.15	
RECUBRIMIENTO DE LAS ARMADURAS c	=	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	4.94	m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03	t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.45	
SOBRECARGA q	=	0.00	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q	=	0.00	t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t	=	0.30	m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

099

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	17.021	-6.899	-5.385	0.300
2	1.400	0.200	16.901	-6.187	-4.147	0.300
3	1.400	0.400	16.661	-4.801	-3.187	0.300
4	1.400	0.600	16.421	-3.474	-2.492	0.300
5	1.400	0.800	16.181	-2.206	-2.051	0.300
6	1.400	1.000	15.941	-0.995	-1.852	0.300
7	1.400	1.200	15.701	0.156	-1.883	0.300
8	1.400	1.400	15.461	1.250	-2.133	0.300
9	1.400	1.600	15.221	2.284	-2.590	0.300
10	1.400	1.800	14.981	3.261	-3.242	0.300
11	1.400	2.000	14.741	4.179	-4.078	0.300
12	1.400	2.015	14.612	4.650	-4.147	0.312
13	1.400	2.030	14.593	4.714	-4.218	0.325
14	1.400	2.045	14.574	4.778	-4.290	0.337
15	1.400	2.060	14.553	4.842	-4.362	0.350
16	1.400	2.075	14.532	4.905	-4.436	0.362
17	1.400	2.090	14.511	4.968	-4.511	0.374
18	1.400	2.105	14.488	5.030	-4.586	0.387
19	1.400	2.120	14.465	5.092	-4.662	0.399
20	1.400	2.135	14.441	5.154	-4.740	0.412
21	1.400	2.150	5.216	-14.416	-4.818	0.424
22	1.385	2.150	5.246	-14.323	-4.603	0.412
23	1.370	2.150	5.246	-14.163	-4.391	0.399
24	1.355	2.150	5.246	-14.003	-4.181	0.387
25	1.340	2.150	5.246	-13.844	-3.973	0.374
26	1.325	2.150	5.246	-13.685	-3.768	0.362
27	1.310	2.150	5.246	-13.528	-3.565	0.350
28	1.295	2.150	5.246	-13.371	-3.364	0.337
29	1.280	2.150	5.246	-13.215	-3.166	0.325
30	1.265	2.150	5.246	-13.059	-2.970	0.312
31	1.250	2.150	5.246	-12.905	-2.776	0.300
32	1.125	2.150	5.246	-12.186	-1.253	0.300
33	1.000	2.150	5.246	-10.903	0.110	0.300
34	0.875	2.150	5.246	-9.621	1.312	0.300
35	0.750	2.150	5.246	-8.338	2.354	0.300
36	0.625	2.150	5.246	-7.055	3.236	0.300
37	0.500	2.150	5.246	-5.772	3.958	0.300
38	0.375	2.150	5.246	-4.490	4.519	0.300
39	0.250	2.150	5.246	-3.207	4.920	0.300
40	0.125	2.150	5.246	-1.924	5.160	0.300
41	0.000	2.150	5.246	-0.641	5.241	0.300

R = 0.17021E+02 M = -.53846E+01 H = -.68994E+01 V = 0.55279E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	3.038	-0.472	5.385	17.021	15.188
1.260	2.965	-0.560	3.138	15.088	14.824
1.120	2.883	-0.604	1.158	13.209	14.414
0.980	2.797	-0.610	-0.564	11.388	13.987
0.840	2.714	-0.582	-2.034	9.628	13.568
0.700	2.636	-0.527	-3.262	7.924	13.179
0.560	2.567	-0.449	-4.255	6.272	12.836
0.420	2.511	-0.352	-5.020	4.663	12.555
0.280	2.469	-0.242	-5.562	3.089	12.346
0.140	2.443	-0.123	-5.886	1.538	12.217
0.000	2.435	0.000	-5.994	0.000	12.174

100

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.314	0.000
2	1.400	0.200	2.250	2.258	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.491	0.000
12	1.400	2.015	2.343	2.405	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.092	0.000
23	1.370	2.150	2.994	3.032	0.000
24	1.355	2.150	2.901	2.970	0.000
25	1.340	2.150	2.808	2.906	0.000
26	1.325	2.150	2.715	2.841	0.000
27	1.310	2.150	2.622	2.773	0.000
28	1.295	2.150	2.529	2.703	0.000
29	1.280	2.150	2.436	2.630	0.000
30	1.265	2.150	2.343	2.554	0.000
31	1.250	2.150	2.250	2.474	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.928	2.250	0.000
37	0.500	2.150	3.554	2.250	0.000
38	0.375	2.150	3.908	2.250	0.000
39	0.250	2.150	4.001	2.250	0.000
40	0.125	2.150	4.237	2.250	0.000
41	0.000	2.150	4.315	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	5.140	2.250	0.242
2	1.260	-0.150	3.473	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.463	0.000
6	0.700	-0.150	2.250	3.572	0.000
7	0.560	-0.150	2.250	4.041	0.000
8	0.420	-0.150	2.250	4.784	0.000
9	0.280	-0.150	2.250	5.314	0.000
10	0.140	-0.150	2.250	5.632	0.000
11	0.000	-0.150	2.250	5.737	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+260

Fecha ..... : 29/7/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 4.90 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 3.18 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m³

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	23.969	-4.531	-6.765	0.300
2	1.400	0.200	23.849	-4.060	-5.953	0.300
3	1.400	0.400	23.609	-3.144	-5.324	0.300
4	1.400	0.600	23.369	-2.267	-4.871	0.300
5	1.400	0.800	23.129	-1.429	-4.585	0.300
6	1.400	1.000	22.889	-0.630	-4.459	0.300
7	1.400	1.200	22.649	0.130	-4.485	0.300
8	1.400	1.400	22.409	0.851	-4.655	0.300
9	1.400	1.600	22.169	1.533	-4.962	0.300
10	1.400	1.800	21.929	2.177	-5.397	0.300
11	1.400	2.000	21.689	2.781	-5.953	0.300
12	1.400	2.015	21.560	3.091	-6.000	0.312
13	1.400	2.030	21.541	3.133	-6.047	0.325
14	1.400	2.045	21.522	3.175	-6.094	0.337
15	1.400	2.060	21.501	3.217	-6.143	0.350
16	1.400	2.075	21.480	3.258	-6.192	0.362
17	1.400	2.090	21.459	3.300	-6.241	0.374
18	1.400	2.105	21.436	3.341	-6.291	0.387
19	1.400	2.120	21.413	3.382	-6.342	0.399
20	1.400	2.135	21.389	3.422	-6.393	0.412
21	1.400	2.150	3.463	-21.364	-6.445	0.424
22	1.385	2.150	3.483	-21.234	-6.127	0.412
23	1.370	2.150	3.483	-20.999	-5.812	0.399
24	1.355	2.150	3.483	-20.765	-5.500	0.387
25	1.340	2.150	3.483	-20.531	-5.192	0.374
26	1.325	2.150	3.483	-20.298	-4.888	0.362
27	1.310	2.150	3.483	-20.066	-4.587	0.350
28	1.295	2.150	3.483	-19.835	-4.289	0.337
29	1.280	2.150	3.483	-19.604	-3.995	0.325
30	1.265	2.150	3.483	-19.374	-3.705	0.312
31	1.250	2.150	3.483	-19.145	-3.417	0.300
32	1.125	2.150	3.483	-18.079	-1.157	0.300
33	1.000	2.150	3.483	-16.176	0.865	0.300
34	0.875	2.150	3.483	-14.273	2.649	0.300
35	0.750	2.150	3.483	-12.370	4.195	0.300
36	0.625	2.150	3.483	-10.467	5.503	0.300
37	0.500	2.150	3.483	-8.564	6.574	0.300
38	0.375	2.150	3.483	-6.661	7.407	0.300
39	0.250	2.150	3.483	-4.758	8.001	0.300
40	0.125	2.150	3.483	-2.855	8.358	0.300
41	0.000	2.150	3.483	-0.952	8.477	0.300

R = 0.23969E+02 M = -.67645E+01 H = -.45305E+01 V = 0.91974E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	4.253	-0.824	6.765	23.969	21.263

1.260	4.129	-0.931	3.604	21.203	20.645
1.120	3.995	-0.976	0.824	18.527	19.974
0.980	3.858	-0.968	-1.588	15.946	19.291
0.840	3.726	-0.913	-3.646	13.460	18.630
0.700	3.604	-0.819	-5.362	11.064	18.022
0.560	3.498	-0.693	-6.747	8.747	17.491
0.420	3.411	-0.542	-7.814	6.498	17.057
0.280	3.347	-0.372	-8.569	4.301	16.737
0.140	3.308	-0.189	-9.020	2.141	16.540
0.000	3.295	0.000	-9.170	0.000	16.474

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.715	0.000
2	1.400	0.200	2.250	3.184	0.000
3	1.400	0.400	2.250	2.591	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.400	0.000
10	1.400	1.800	2.250	2.884	0.000
11	1.400	2.000	2.250	3.427	0.000
12	1.400	2.015	2.343	3.278	0.000
13	1.400	2.030	2.436	3.115	0.000
14	1.400	2.045	2.529	2.954	0.000
15	1.400	2.060	2.622	2.798	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	4.459	0.000
22	1.385	2.150	3.087	4.358	0.000
23	1.370	2.150	2.994	4.257	0.000
24	1.355	2.150	2.901	4.152	0.000
25	1.340	2.150	2.808	4.044	0.000
26	1.325	2.150	2.715	3.933	0.000
27	1.310	2.150	2.622	3.817	0.070
28	1.295	2.150	2.529	3.698	0.579
29	1.280	2.150	2.436	3.573	1.134
30	1.265	2.150	2.343	3.443	1.740
31	1.250	2.150	2.250	3.307	2.404
32	1.125	2.150	2.250	2.250	1.319
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.593	2.250	0.000
35	0.750	2.150	3.908	2.250	0.000
36	0.625	2.150	4.803	2.250	0.000
37	0.500	2.150	5.861	2.250	0.000
38	0.375	2.150	6.693	2.250	0.000
39	0.250	2.150	7.292	2.250	0.000
40	0.125	2.150	7.653	2.250	0.000
41	0.000	2.150	7.774	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	6.499	2.250	7.312
2	1.260	-0.150	3.827	2.250	4.497
3	1.120	-0.150	2.250	2.250	1.775
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.858	0.000
6	0.700	-0.150	2.250	5.117	0.000
7	0.560	-0.150	2.250	6.482	0.000
8	0.420	-0.150	2.250	7.546	0.000
9	0.280	-0.150	2.250	8.308	0.000
10	0.140	-0.150	2.250	8.765	0.000
11	0.000	-0.150	2.250	8.918	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+260

Fecha ..... : 29/7/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO	=	0.300	m
PESO ESPECIFICO DEL HORMIGON	=	2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck	=	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c	=	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk	=	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s	=	1.15	
RECUBRIMIENTO DE LAS ARMADURAS c	=	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	4.94	m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03	t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.45	
SOBRECARGA q	=	3.18	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q	=	0.00	t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t	=	0.30	m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	24.151	-6.793	-7.153	0.300
2	1.400	0.200	24.031	-6.081	-5.937	0.300
3	1.400	0.400	23.791	-4.695	-4.998	0.300
4	1.400	0.600	23.551	-3.368	-4.324	0.300
5	1.400	0.800	23.311	-2.099	-3.904	0.300
6	1.400	1.000	23.071	-0.889	-3.726	0.300
7	1.400	1.200	22.831	0.263	-3.779	0.300
8	1.400	1.400	22.591	1.356	-4.050	0.300
9	1.400	1.600	22.351	2.391	-4.528	0.300
10	1.400	1.800	22.111	3.367	-5.202	0.300
11	1.400	2.000	21.871	4.285	-6.059	0.300
12	1.400	2.015	21.742	4.757	-6.130	0.312
13	1.400	2.030	21.723	4.821	-6.203	0.325
14	1.400	2.045	21.704	4.885	-6.276	0.337
15	1.400	2.060	21.683	4.948	-6.350	0.350
16	1.400	2.075	21.662	5.011	-6.425	0.362
17	1.400	2.090	21.641	5.074	-6.501	0.374
18	1.400	2.105	21.618	5.137	-6.578	0.387
19	1.400	2.120	21.595	5.199	-6.656	0.399
20	1.400	2.135	21.571	5.261	-6.735	0.412
21	1.400	2.150	5.322	-21.546	-6.815	0.424
22	1.385	2.150	5.353	-21.415	-6.494	0.412
23	1.370	2.150	5.353	-21.178	-6.176	0.399
24	1.355	2.150	5.353	-20.942	-5.862	0.387
25	1.340	2.150	5.353	-20.706	-5.551	0.374
26	1.325	2.150	5.353	-20.472	-5.244	0.362
27	1.310	2.150	5.353	-20.237	-4.941	0.350
28	1.295	2.150	5.353	-20.004	-4.641	0.337
29	1.280	2.150	5.353	-19.772	-4.344	0.325
30	1.265	2.150	5.353	-19.540	-4.051	0.312
31	1.250	2.150	5.353	-19.309	-3.761	0.300
32	1.125	2.150	5.353	-18.234	-1.482	0.300
33	1.000	2.150	5.353	-16.314	0.557	0.300
34	0.875	2.150	5.353	-14.395	2.356	0.300
35	0.750	2.150	5.353	-12.476	3.916	0.300
36	0.625	2.150	5.353	-10.556	5.235	0.300
37	0.500	2.150	5.353	-8.637	6.315	0.300
38	0.375	2.150	5.353	-6.718	7.155	0.300
39	0.250	2.150	5.353	-4.798	7.755	0.300
40	0.125	2.150	5.353	-2.879	8.114	0.300
41	0.000	2.150	5.353	-0.960	8.234	0.300

R = 0.24151E+02 M = -.71526E+01 H = -.67928E+01 V = 0.88204E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	4.253	-0.765	7.153	24.151	21.265
1.260	4.137	-0.879	3.966	21.382	20.686
1.120	4.010	-0.932	1.162	18.698	20.048
0.980	3.879	-0.930	-1.273	16.105	19.394
0.840	3.751	-0.882	-3.352	13.603	18.757
0.700	3.634	-0.794	-5.086	11.187	18.169
0.560	3.531	-0.673	-6.488	8.848	17.654
0.420	3.446	-0.527	-7.567	6.575	17.232
0.280	3.384	-0.362	-8.331	4.354	16.920
0.140	3.346	-0.184	-8.787	2.168	16.728
0.000	3.333	0.000	-8.939	0.000	16.664

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.908	0.000
2	1.400	0.200	2.250	3.148	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.663	0.000
11	1.400	2.000	2.250	3.498	0.000
12	1.400	2.015	2.343	3.371	0.000
13	1.400	2.030	2.436	3.231	0.000
14	1.400	2.045	2.529	3.093	0.000
15	1.400	2.060	2.622	2.958	0.000
16	1.400	2.075	2.715	2.829	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	4.465	0.000
22	1.385	2.150	3.087	4.367	0.000
23	1.370	2.150	2.994	4.271	0.000
24	1.355	2.150	2.901	4.172	0.000
25	1.340	2.150	2.808	4.071	0.000
26	1.325	2.150	2.715	3.966	0.000
27	1.310	2.150	2.622	3.858	0.216
28	1.295	2.150	2.529	3.746	0.730
29	1.280	2.150	2.436	3.629	1.289
30	1.265	2.150	2.343	3.508	1.900
31	1.250	2.150	2.250	3.382	2.570
32	1.125	2.150	2.250	2.250	1.476
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	3.509	2.250	0.000
36	0.625	2.150	4.296	2.250	0.000
37	0.500	2.150	5.363	2.250	0.000
38	0.375	2.150	6.201	2.250	0.000
39	0.250	2.150	6.805	2.250	0.000
40	0.125	2.150	7.169	2.250	0.000
41	0.000	2.150	7.291	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	6.885	2.250	7.497
2	1.260	-0.150	3.908	2.250	4.679
3	1.120	-0.150	2.250	2.250	1.948
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.641	0.000
6	0.700	-0.150	2.250	4.848	0.000
7	0.560	-0.150	2.250	6.225	0.000
8	0.420	-0.150	2.250	7.298	0.000
9	0.280	-0.150	2.250	8.067	0.000
10	0.140	-0.150	2.250	8.529	0.000
11	0.000	-0.150	2.250	8.683	0.000

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_s (Ton)	DISPUESTO ARMADURA	U_s (Ton)
HASTIAL	Interior	10.0	ϕ 10 A 0.20	17.4
	Exterior	17.3	ϕ 12 A 0.20	25.1
DINTEL	Interior	34.5	ϕ 16 A 0.20	44.6
	Exterior	17	ϕ 12 A 0.20	25.1
SOLERA	Inferior	17.33	ϕ 12 A 0.20	25.1
	Superior	40	ϕ 16 A 0.20	44.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

  * Elemento: Muro vertical
    Acero: AEH-500 } Cuantía mínima = 0,90 ‰
  * $A_C = 2 \times 0,3 = 0,6\ m^2$
  * $A_S = 10.8 \times 10^{-4}\ m^2 \Rightarrow 5,4 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 2 m $\Rightarrow 8,64 \times 10^{-4}\ m^2$ por cara } Válido

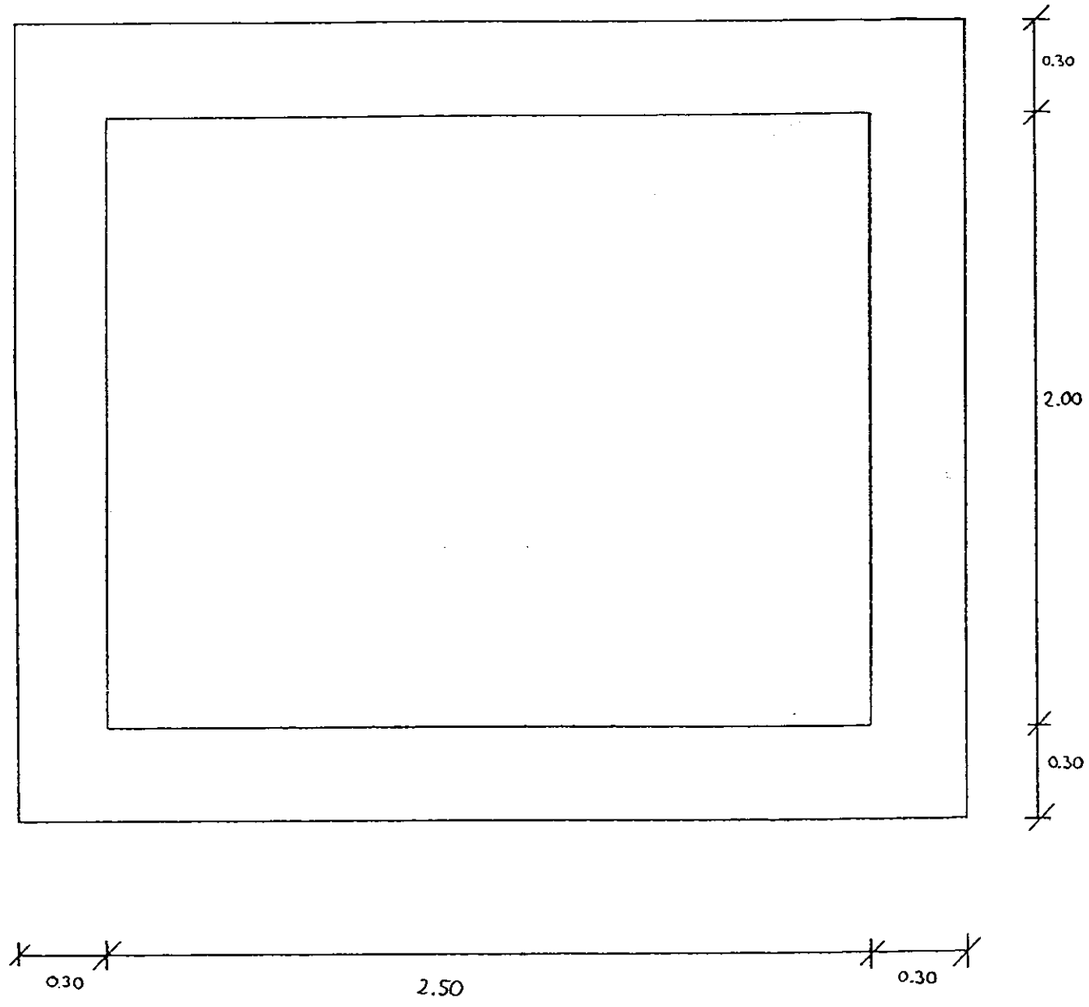
- DINTEL

  * Elemento: Muro horizontal
    Acero: AEH-500 } Cuantía mínima = 1,6 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,88 \times 10^{-4}\ m^2 \Rightarrow 7,44 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m $\Rightarrow 10,21 \times 10^{-4}\ m^2$ por cara } Válido

- SOLERA

  * Elemento: Losa
    Acero: AEH-500 } Cuantía mínima = 1,5 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,0 \times 10^{-4}\ m^2 \Rightarrow 7,0 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m $\Rightarrow 10,21 \times 10^{-4}\ m^2$ por cara } Válido

II. PLANOS



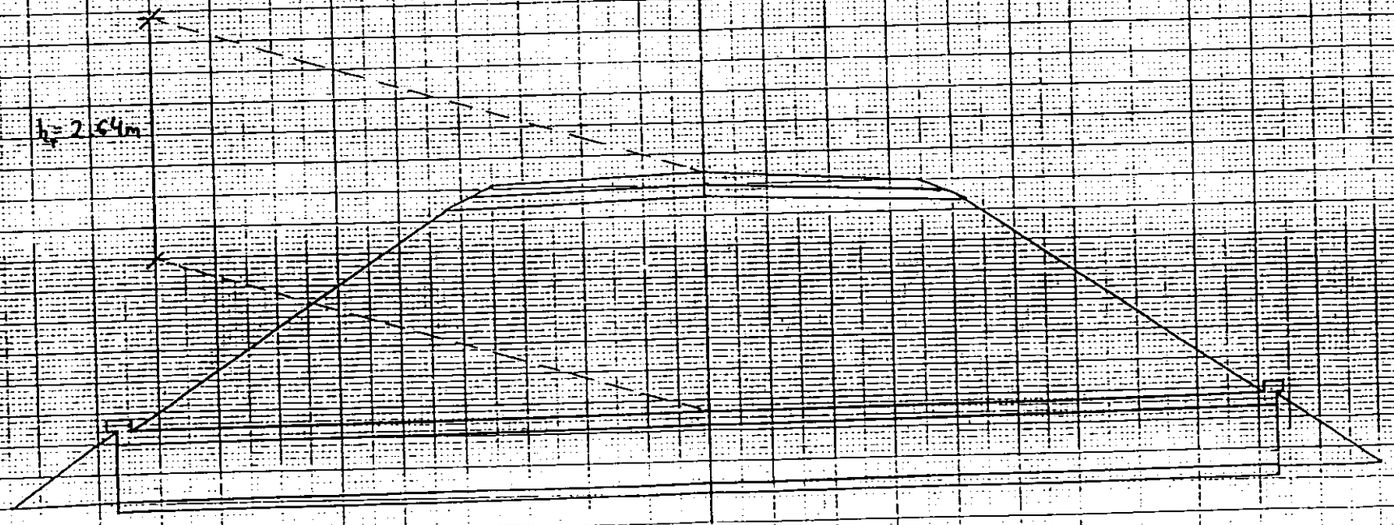
SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 20

O. R. 3+260

SECCION LONGITUDINAL



OBRAS DE RIEGO

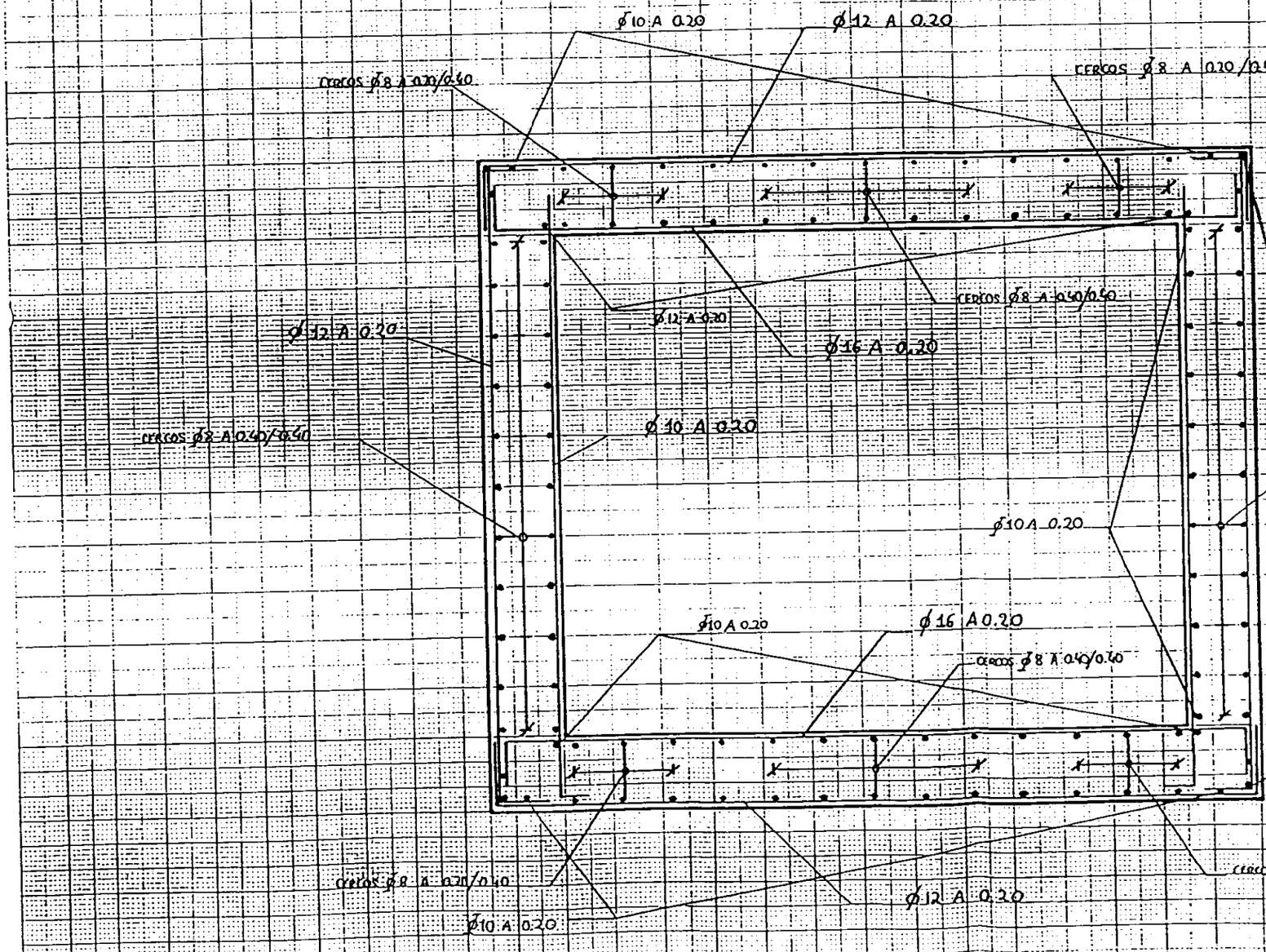
SECCIÓN LONGITUDINAL

ESCALA 1:200

O. R. 3+260

SECCION TRANSVERSAL

ARMADURAS



CARACTERISTICAS		
HORMIGON	H-250	$\gamma_c = 1.5$
ACERO	AEH-500	$\gamma_s = 1.15$
COEF. MAYORACION DE ACCIONES		$\gamma_f = 1.6$
RECUBRIMIENTO	4cm	

ESCALA 1:20

O.R. 3 + 480

1 . CALCULOS

O.R. 3 + 480

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 3 + 480. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso

2 - Esquema estructural

3 - Cargas consideradas

4 - Hipótesis de carga

5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

1.1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

1.2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

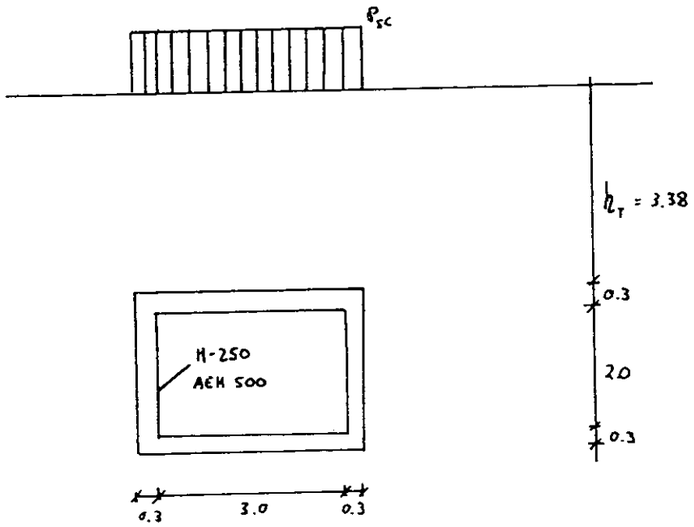


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 3.38 m

  -sobre cimentación H_T = 5.68 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

1.3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\,(h_T - 1) = 1.422$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\,(3 + h_T)} = 2.68 \ \ t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 3.38$ m

  $H_T = 5.68$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

1.4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel
2. Empuje máximo, sobrecarga mínima
3. Empuje mínimo, sobrecarga máxima
4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O  :  L.A.V. SUBTRAMO I

Referencia .....  :  O.R. 3+480

Fecha ..........  :  5/9/97

HIPOTESIS I
```

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	5.438	-2.135	-2.023	0.300
2	1.650	0.200	5.318	-1.917	-1.640	0.300
3	1.650	0.400	5.078	-1.508	-1.338	0.300
4	1.650	0.600	4.838	-1.138	-1.111	0.300
5	1.650	0.800	4.598	-0.806	-0.950	0.300
6	1.650	1.000	4.358	-0.514	-0.847	0.300
7	1.650	1.200	4.118	-0.261	-0.795	0.300
8	1.650	1.400	3.878	-0.046	-0.785	0.300
9	1.650	1.600	3.638	0.129	-0.811	0.300
10	1.650	1.800	3.398	0.265	-0.864	0.300
11	1.650	2.000	3.158	0.363	-0.937	0.300
12	1.650	2.015	3.029	0.401	-0.943	0.312
13	1.650	2.030	3.010	0.405	-0.949	0.325
14	1.650	2.045	2.991	0.409	-0.955	0.337
15	1.650	2.060	2.971	0.413	-0.961	0.350
16	1.650	2.075	2.950	0.416	-0.967	0.362
17	1.650	2.090	2.928	0.419	-0.974	0.374
18	1.650	2.105	2.905	0.422	-0.980	0.387
19	1.650	2.120	2.882	0.425	-0.986	0.399
20	1.650	2.135	2.858	0.428	-0.993	0.412
21	1.650	2.150	0.430	-2.834	-0.999	0.424
22	1.635	2.150	0.431	-2.805	-0.957	0.412
23	1.620	2.150	0.431	-2.773	-0.916	0.399
24	1.605	2.150	0.431	-2.742	-0.874	0.387
25	1.590	2.150	0.431	-2.711	-0.834	0.374
26	1.575	2.150	0.431	-2.681	-0.793	0.362
27	1.560	2.150	0.431	-2.652	-0.754	0.350
28	1.545	2.150	0.431	-2.624	-0.714	0.337
29	1.530	2.150	0.431	-2.596	-0.675	0.325
30	1.515	2.150	0.431	-2.570	-0.637	0.312
31	1.500	2.150	0.431	-2.544	-0.599	0.300
32	1.350	2.150	0.431	-2.404	-0.238	0.300
33	1.200	2.150	0.431	-2.151	0.085	0.300
34	1.050	2.150	0.431	-1.898	0.369	0.300
35	0.900	2.150	0.431	-1.645	0.616	0.300
36	0.750	2.150	0.431	-1.392	0.825	0.300
37	0.600	2.150	0.431	-1.139	0.996	0.300
38	0.450	2.150	0.431	-0.886	1.129	0.300
39	0.300	2.150	0.431	-0.633	1.223	0.300
40	0.150	2.150	0.431	-0.380	1.280	0.300
41	0.000	2.150	0.431	-0.127	1.299	0.300

R = 0.54383E+01 M = -.20235E+01 H = -.21349E+01 V = 0.19414E-03m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	0.837	-0.190	2.023	5.438	4.183
1.485	0.802	-0.229	1.182	4.762	4.009
1.320	0.762	-0.249	0.450	4.117	3.811
1.155	0.721	-0.252	-0.178	3.505	3.603
0.990	0.680	-0.241	-0.708	2.927	3.399
0.825	0.642	-0.218	-1.146	2.383	3.209
0.660	0.608	-0.186	-1.496	1.867	3.042
0.495	0.581	-0.146	-1.763	1.377	2.905
0.330	0.561	-0.100	-1.952	0.907	2.803
0.165	0.548	-0.051	-2.063	0.450	2.741
0.000	0.544	0.000	-2.100	-0.000	2.720

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	2.250	0.000
2	1.650	0.200	2.250	2.250	0.000
3	1.650	0.400	2.250	2.250	0.000
4	1.650	0.600	2.250	2.250	0.000
5	1.650	0.800	2.250	2.250	0.000
6	1.650	1.000	2.250	2.250	0.000
7	1.650	1.200	2.250	2.250	0.000
8	1.650	1.400	2.250	2.250	0.000
9	1.650	1.600	2.250	2.250	0.000
10	1.650	1.800	2.250	2.250	0.000
11	1.650	2.000	2.250	2.250	0.000
12	1.650	2.015	2.343	2.343	0.000
13	1.650	2.030	2.436	2.436	0.000
14	1.650	2.045	2.529	2.529	0.000
15	1.650	2.060	2.622	2.622	0.000
16	1.650	2.075	2.715	2.715	0.000
17	1.650	2.090	2.808	2.808	0.000
18	1.650	2.105	2.901	2.901	0.000
19	1.650	2.120	2.994	2.994	0.000
20	1.650	2.135	3.087	3.087	0.000
21	1.650	2.150	3.180	3.180	0.000
22	1.635	2.150	3.087	3.087	0.000
23	1.620	2.150	2.994	2.994	0.000
24	1.605	2.150	2.901	2.901	0.000
25	1.590	2.150	2.808	2.808	0.000
26	1.575	2.150	2.715	2.715	0.000
27	1.560	2.150	2.622	2.622	0.000
28	1.545	2.150	2.529	2.529	0.000
29	1.530	2.150	2.436	2.436	0.000
30	1.515	2.150	2.343	2.343	0.000
31	1.500	2.150	2.250	2.250	0.000
32	1.350	2.150	2.250	2.250	0.000
33	1.200	2.150	2.250	2.250	0.000
34	1.050	2.150	2.250	2.250	0.000
35	0.900	2.150	2.250	2.250	0.000
36	0.750	2.150	2.250	2.250	0.000
37	0.600	2.150	2.250	2.250	0.000
38	0.450	2.150	2.250	2.250	0.000
39	0.300	2.150	2.250	2.250	0.000
40	0.150	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	2.452	2.250	0.000
2	1.485	-0.150	2.250	2.250	0.000
3	1.320	-0.150	2.250	2.250	0.000
4	1.155	-0.150	2.250	2.250	0.000
5	0.990	-0.150	2.250	2.250	0.000
6	0.825	-0.150	2.250	2.250	0.000
7	0.660	-0.150	2.250	2.250	0.000
8	0.495	-0.150	2.250	2.250	0.000
9	0.330	-0.150	2.250	2.378	0.000
10	0.165	-0.150	2.250	2.493	0.000
11	0.000	-0.150	2.250	2.530	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+480

Fecha ..... : 5/9/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO	=	0.300	m
PESO ESPECIFICO DEL HORMIGON	=	2.50	t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck	=	250	Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c	=	1.50	
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk	=	5100	Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s	=	1.15	
RECUBRIMIENTO DE LAS ARMADURAS c	=	4	cm

SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE	=	5.68	m
PESO ESPECIFICO DE LAS TIERRAS	=	2.03	t/m3
COEFICIENTE EMPUJE TIERRAS	=	0.45	
SOBRECARGA q	=	0.00	t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q	=	0.00	t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t	=	0.30	m
COEFICIENTE DE BALASTO DEL TERRENO ..... K	=	5000	t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	23.552	-7.873	-8.394	0.300
2	1.650	0.200	23.432	-7.052	-6.984	0.300
3	1.650	0.400	23.192	-5.450	-5.894	0.300
4	1.650	0.600	22.952	-3.907	-5.112	0.300
5	1.650	0.800	22.712	-2.422	-4.628	0.300
6	1.650	1.000	22.472	-0.996	-4.429	0.300
7	1.650	1.200	22.232	0.373	-4.503	0.300
8	1.650	1.400	21.992	1.682	-4.840	0.300
9	1.650	1.600	21.752	2.933	-5.426	0.300
10	1.650	1.800	21.512	4.126	-6.251	0.300
11	1.650	2.000	21.272	5.260	-7.303	0.300
12	1.650	2.015	21.143	5.848	-7.391	0.312
13	1.650	2.030	21.124	5.928	-7.480	0.325
14	1.650	2.045	21.105	6.008	-7.570	0.337
15	1.650	2.060	21.085	6.088	-7.662	0.350
16	1.650	2.075	21.064	6.167	-7.754	0.362
17	1.650	2.090	21.042	6.247	-7.848	0.374
18	1.650	2.105	21.020	6.325	-7.943	0.387
19	1.650	2.120	20.996	6.404	-8.039	0.399
20	1.650	2.135	20.972	6.482	-8.136	0.412
21	1.650	2.150	6.559	-20.948	-8.234	0.424
22	1.635	2.150	6.598	-20.837	-7.922	0.412
23	1.620	2.150	6.598	-20.640	-7.612	0.399
24	1.605	2.150	6.598	-20.444	-7.305	0.387
25	1.590	2.150	6.598	-20.249	-7.002	0.374
26	1.575	2.150	6.598	-20.054	-6.701	0.362
27	1.560	2.150	6.598	-19.861	-6.403	0.350
28	1.545	2.150	6.598	-19.668	-6.108	0.337
29	1.530	2.150	6.598	-19.476	-5.816	0.325
30	1.515	2.150	6.598	-19.284	-5.527	0.312
31	1.500	2.150	6.598	-19.093	-5.240	0.300
32	1.350	2.150	6.598	-18.048	-2.533	0.300
33	1.200	2.150	6.598	-16.148	-0.111	0.300
34	1.050	2.150	6.598	-14.249	2.027	0.300
35	0.900	2.150	6.598	-12.349	3.879	0.300
36	0.750	2.150	6.598	-10.449	5.446	0.300
37	0.600	2.150	6.598	-8.549	6.729	0.300
38	0.450	2.150	6.598	-6.649	7.726	0.300
39	0.300	2.150	6.598	-4.750	8.438	0.300
40	0.150	2.150	6.598	-2.850	8.866	0.300
41	0.000	2.150	6.598	-0.950	9.008	0.300

R = 0.23552E+02 M = -.83941E+01 H = -.78728E+01 V = 0.12831E-02m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	3.666	-0.904	8.394	23.552	18.331
1.485	3.503	-1.064	4.754	20.593	17.514
1.320	3.320	-1.140	1.590	17.778	16.599
1.155	3.130	-1.145	-1.121	15.117	15.652
0.990	2.945	-1.089	-3.407	12.612	14.727
0.825	2.774	-0.982	-5.291	10.254	13.870
0.660	2.624	-0.833	-6.798	8.029	13.119
0.495	2.501	-0.653	-7.947	5.917	12.504
0.330	2.410	-0.448	-8.755	3.894	12.048
0.165	2.354	-0.228	-9.235	1.931	11.768
0.000	2.335	-0.000	-9.394	-0.000	11.674

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	4.908	0.000
2	1.650	0.200	2.250	3.908	0.000
3	1.650	0.400	2.250	3.205	0.000
4	1.650	0.600	2.250	2.454	0.000
5	1.650	0.800	2.250	2.250	0.000
6	1.650	1.000	2.250	2.250	0.000
7	1.650	1.200	2.250	2.250	0.000
8	1.650	1.400	2.250	2.291	0.000
9	1.650	1.600	2.250	2.935	0.000
10	1.650	1.800	2.250	3.692	0.000
11	1.650	2.000	2.250	4.338	0.000
12	1.650	2.015	2.343	4.098	0.000
13	1.650	2.030	2.436	4.272	0.000
14	1.650	2.045	2.529	4.174	0.000
15	1.650	2.060	2.622	4.069	0.000
16	1.650	2.075	2.715	3.961	0.000
17	1.650	2.090	2.808	3.853	0.000
18	1.650	2.105	2.901	3.746	0.000
19	1.650	2.120	2.994	3.641	0.000
20	1.650	2.135	3.087	3.539	0.000
21	1.650	2.150	3.180	5.129	3.186
22	1.635	2.150	3.087	5.054	3.458
23	1.620	2.150	2.994	4.982	3.693
24	1.605	2.150	2.901	4.907	3.954
25	1.590	2.150	2.808	4.830	4.242
26	1.575	2.150	2.715	4.751	4.563
27	1.560	2.150	2.622	4.654	4.923
28	1.545	2.150	2.529	4.468	5.343
29	1.530	2.150	2.436	4.281	5.811
30	1.515	2.150	2.343	4.172	6.313
31	1.500	2.150	2.250	4.139	6.853
32	1.350	2.150	2.250	2.250	6.307

33	1.200	2.150	2.250	2.250	4.374
34	1.050	2.150	2.250	2.250	2.441
35	0.900	2.150	3.338	2.250	0.210
36	0.750	2.150	4.342	2.250	0.000
37	0.600	2.150	5.615	2.250	0.000
38	0.450	2.150	6.618	2.250	0.000
39	0.300	2.150	7.341	2.250	0.000
40	0.150	2.150	7.778	2.250	0.000
41	0.000	2.150	7.925	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	8.131	2.250	10.298
2	1.485	-0.150	4.525	2.250	8.274
3	1.320	-0.150	2.250	2.250	6.032
4	1.155	-0.150	2.250	2.250	3.325
5	0.990	-0.150	2.250	3.683	0.383
6	0.825	-0.150	2.250	5.049	0.000
7	0.660	-0.150	2.250	6.532	0.000
8	0.495	-0.150	2.250	7.680	0.000
9	0.330	-0.150	2.250	8.497	0.000
10	0.165	-0.150	2.250	8.985	0.000
11	0.000	-0.150	2.250	9.147	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+480

Fecha ..... : 5/9/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 5.68 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 2.68 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	30.628	-5.081	-10.145	0.300
2	1.650	0.200	30.508	-4.534	-9.239	0.300
3	1.650	0.400	30.268	-3.466	-8.545	0.300
4	1.650	0.600	30.028	-2.437	-8.058	0.300
5	1.650	0.800	29.788	-1.447	-7.769	0.300
6	1.650	1.000	29.548	-0.496	-7.669	0.300
7	1.650	1.200	29.308	0.416	-7.752	0.300
8	1.650	1.400	29.068	1.289	-8.010	0.300
9	1.650	1.600	28.828	2.123	-8.435	0.300
10	1.650	1.800	28.588	2.918	-9.018	0.300
11	1.650	2.000	28.348	3.674	-9.753	0.300
12	1.650	2.015	28.218	4.066	-9.814	0.312
13	1.650	2.030	28.200	4.120	-9.876	0.325
14	1.650	2.045	28.180	4.173	-9.939	0.337
15	1.650	2.060	28.160	4.226	-10.002	0.350
16	1.650	2.075	28.139	4.279	-10.066	0.362
17	1.650	2.090	28.117	4.332	-10.131	0.374
18	1.650	2.105	28.095	4.384	-10.197	0.387
19	1.650	2.120	28.072	4.437	-10.264	0.399
20	1.650	2.135	28.048	4.489	-10.331	0.412
21	1.650	2.150	4.540	-28.023	-10.399	0.424
22	1.635	2.150	4.566	-27.880	-9.981	0.412
23	1.620	2.150	4.566	-27.619	-9.567	0.399
24	1.605	2.150	4.566	-27.358	-9.156	0.387
25	1.590	2.150	4.566	-27.099	-8.750	0.374
26	1.575	2.150	4.566	-26.840	-8.347	0.362
27	1.560	2.150	4.566	-26.582	-7.948	0.350
28	1.545	2.150	4.566	-26.325	-7.553	0.337
29	1.530	2.150	4.566	-26.068	-7.162	0.325
30	1.515	2.150	4.566	-25.813	-6.775	0.312
31	1.500	2.150	4.566	-25.557	-6.392	0.300
32	1.350	2.150	4.566	-24.159	-2.768	0.300
33	1.200	2.150	4.566	-21.616	0.474	0.300
34	1.050	2.150	4.566	-19.073	3.335	0.300
35	0.900	2.150	4.566	-16.530	5.815	0.300
36	0.750	2.150	4.566	-13.987	7.913	0.300
37	0.600	2.150	4.566	-11.444	9.629	0.300
38	0.450	2.150	4.566	-8.901	10.964	0.300
39	0.300	2.150	4.566	-6.358	11.918	0.300
40	0.150	2.150	4.566	-3.815	12.490	0.300
41	0.000	2.150	4.566	-1.272	12.681	0.300

R = 0.30628E+02 M = -.10145E+02 H = -.50811E+01 V = 0.18412E-02m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	4.857	-1.344	10.145	30.628	24.286
1.485	4.618	-1.533	5.417	26.717	23.092
1.320	4.357	-1.614	1.317	23.013	21.787
1.155	4.091	-1.602	-2.189	19.529	20.455
0.990	3.833	-1.511	-5.139	16.261	19.165
0.825	3.596	-1.355	-7.567	13.198	17.979
0.660	3.389	-1.146	-9.504	10.320	16.944
0.495	3.220	-0.895	-10.981	7.596	16.099
0.330	3.095	-0.613	-12.018	4.995	15.475
0.165	3.019	-0.312	-12.633	2.476	15.093
0.000	2.993	-0.000	-12.837	-0.000	14.964

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	5.855	0.000
2	1.650	0.200	2.250	5.223	0.000
3	1.650	0.400	2.250	4.517	0.000
4	1.650	0.600	2.250	4.034	0.000
5	1.650	0.800	2.250	3.908	0.000
6	1.650	1.000	2.250	3.908	0.000
7	1.650	1.200	2.250	3.908	0.000
8	1.650	1.400	2.250	4.102	0.000
9	1.650	1.600	2.250	4.577	0.000
10	1.650	1.800	2.250	5.222	0.000
11	1.650	2.000	2.250	6.034	0.000
12	1.650	2.015	2.343	5.623	0.000
13	1.650	2.030	2.436	5.245	0.000
14	1.650	2.045	2.529	4.906	0.000
15	1.650	2.060	2.622	4.654	0.000
16	1.650	2.075	2.715	4.765	0.000
17	1.650	2.090	2.808	4.630	0.000
18	1.650	2.105	2.901	4.486	0.000
19	1.650	2.120	2.994	4.337	0.000
20	1.650	2.135	3.087	4.186	0.000
21	1.650	2.150	3.180	6.136	7.891
22	1.635	2.150	3.087	6.080	8.292
23	1.620	2.150	2.994	6.026	8.641
24	1.605	2.150	2.901	5.972	9.024
25	1.590	2.150	2.808	5.915	9.443
26	1.575	2.150	2.715	5.858	9.905
27	1.560	2.150	2.622	5.799	10.413
28	1.545	2.150	2.529	5.738	10.973
29	1.530	2.150	2.436	5.675	11.594
30	1.515	2.150	2.343	5.609	12.282
31	1.500	2.150	2.250	5.541	13.047
32	1.350	2.150	2.250	2.562	12.439
33	1.200	2.150	2.250	2.250	9.937
34	1.050	2.150	3.104	2.250	7.115
35	0.900	2.150	4.969	2.250	4.018
36	0.750	2.150	7.064	2.250	0.857
37	0.600	2.150	8.817	2.250	0.000
38	0.450	2.150	10.207	2.250	0.000
39	0.300	2.150	11.214	2.250	0.000
40	0.150	2.150	11.825	2.250	0.000
41	0.000	2.150	12.030	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	9.919	2.250	17.008
2	1.485	-0.150	5.172	2.250	14.328
3	1.320	-0.150	2.250	2.250	11.359
4	1.155	-0.150	2.250	2.619	7.712
5	0.990	-0.150	2.250	4.900	3.763
6	0.825	-0.150	2.250	7.298	0.000
7	0.660	-0.150	2.250	9.260	0.000
8	0.495	-0.150	2.250	10.786	0.000
9	0.330	-0.150	2.250	11.875	0.000
10	0.165	-0.150	2.250	12.529	0.000
11	0.000	-0.150	2.250	12.747	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+480

Fecha ..... : 5/9/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 5.68 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 2.68 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.650	0.000	30.628	-7.700	-10.523	0.300
2	1.650	0.200	30.508	-6.880	-9.147	0.300
3	1.650	0.400	30.268	-5.278	-8.091	0.300
4	1.650	0.600	30.028	-3.735	-7.344	0.300
5	1.650	0.800	29.788	-2.250	-6.894	0.300
6	1.650	1.000	29.548	-0.823	-6.730	0.300
7	1.650	1.200	29.308	0.545	-6.839	0.300
8	1.650	1.400	29.068	1.855	-7.210	0.300
9	1.650	1.600	28.828	3.106	-7.831	0.300
10	1.650	1.800	28.588	4.298	-8.691	0.300
11	1.650	2.000	28.348	5.433	-9.777	0.300
12	1.650	2.015	28.218	6.021	-9.867	0.312
13	1.650	2.030	28.200	6.101	-9.959	0.325
14	1.650	2.045	28.180	6.181	-10.052	0.337
15	1.650	2.060	28.160	6.261	-10.145	0.350
16	1.650	2.075	28.139	6.340	-10.241	0.362
17	1.650	2.090	28.117	6.419	-10.337	0.374
18	1.650	2.105	28.095	6.498	-10.434	0.387
19	1.650	2.120	28.072	6.576	-10.533	0.399
20	1.650	2.135	28.048	6.654	-10.633	0.412
21	1.650	2.150	6.732	-28.023	-10.734	0.424
22	1.635	2.150	6.771	-27.880	-10.316	0.412
23	1.620	2.150	6.771	-27.619	-9.901	0.399
24	1.605	2.150	6.771	-27.358	-9.491	0.387
25	1.590	2.150	6.771	-27.099	-9.084	0.374
26	1.575	2.150	6.771	-26.840	-8.682	0.362
27	1.560	2.150	6.771	-26.582	-8.283	0.350
28	1.545	2.150	6.771	-26.325	-7.888	0.337
29	1.530	2.150	6.771	-26.068	-7.497	0.325
30	1.515	2.150	6.771	-25.813	-7.110	0.312
31	1.500	2.150	6.771	-25.557	-6.727	0.300
32	1.350	2.150	6.771	-24.159	-3.103	0.300
33	1.200	2.150	6.771	-21.616	0.140	0.300
34	1.050	2.150	6.771	-19.073	3.000	0.300
35	0.900	2.150	6.771	-16.530	5.480	0.300
36	0.750	2.150	6.771	-13.987	7.578	0.300
37	0.600	2.150	6.771	-11.444	9.294	0.300
38	0.450	2.150	6.771	-8.901	10.629	0.300
39	0.300	2.150	6.771	-6.358	11.583	0.300
0	0.150	2.150	6.771	-3.815	12.155	0.300
41	0.000	2.150	6.771	-1.272	12.346	0.300

R = 0.30628E+02 M = -.10523E+02 H = -.77003E+01 V = 0.17740E-02m

LONGITUD DEL SEMIARCO = 3.800 LONGITUD DE TRANSPORTE = 2.710

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.650	4.813	-1.262	10.523	30.628	24.067
1.485	4.587	-1.459	5.792	26.748	22.937
1.320	4.338	-1.549	1.685	23.065	21.689
1.155	4.081	-1.546	-1.831	19.592	20.406
0.990	3.832	-1.465	-4.792	16.329	19.159
0.825	3.601	-1.317	-7.231	13.265	18.007
0.660	3.400	-1.116	-9.179	10.379	17.000
0.495	3.236	-0.872	-10.664	7.644	16.178
0.330	3.114	-0.598	-11.708	5.028	15.569
0.165	3.039	-0.304	-12.328	2.494	15.196
0.000	3.014	0.000	-12.533	-0.000	15.070

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.650	0.000	2.250	6.241	0.000
2	1.650	0.200	2.250	5.125	0.000
3	1.650	0.400	2.250	4.039	0.000
4	1.650	0.600	2.250	3.734	0.000
5	1.650	0.800	2.250	3.377	0.000
6	1.650	1.000	2.250	3.254	0.000
7	1.650	1.200	2.250	3.379	0.000
8	1.650	1.400	2.250	3.718	0.000
9	1.650	1.600	2.250	3.944	0.000
10	1.650	1.800	2.250	4.875	0.000
11	1.650	2.000	2.250	6.059	0.000
12	1.650	2.015	2.343	5.677	0.000
13	1.650	2.030	2.436	5.324	0.000
14	1.650	2.045	2.529	5.008	0.000
15	1.650	2.060	2.622	4.722	0.000
16	1.650	2.075	2.715	4.841	0.000
17	1.650	2.090	2.808	4.754	0.000

18	1.650	2.105	2.901	4.634	0.000
19	1.650	2.120	2.994	4.509	0.000
20	1.650	2.135	3.087	4.382	0.000
21	1.650	2.150	3.180	6.085	7.900
22	1.635	2.150	3.087	6.035	8.300
23	1.620	2.150	2.994	5.989	8.648
24	1.605	2.150	2.901	5.942	9.029
25	1.590	2.150	2.808	5.895	9.448
26	1.575	2.150	2.715	5.846	9.907
27	1.560	2.150	2.622	5.798	10.413
28	1.545	2.150	2.529	5.748	10.971
29	1.530	2.150	2.436	5.697	11.588
30	1.515	2.150	2.343	5.645	12.272
31	1.500	2.150	2.250	5.591	13.033
32	1.350	2.150	2.250	2.594	12.430
33	1.200	2.150	2.250	2.250	9.937
34	1.050	2.150	2.489	2.250	7.284
35	0.900	2.150	4.353	2.250	4.186
36	0.750	2.150	6.446	2.250	1.026
37	0.600	2.150	8.197	2.250	0.000
38	0.450	2.150	9.585	2.250	0.000
39	0.300	2.150	10.591	2.250	0.000
40	0.150	2.150	11.201	2.250	0.000
41	0.000	2.150	11.406	2.250	0.000

150

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.650	-0.150	10.309	2.250	16.901
2	1.485	-0.150	5.539	2.250	14.258
3	1.320	-0.150	2.250	2.250	11.411
4	1.155	-0.150	2.250	2.251	7.878
5	0.990	-0.150	2.250	4.562	3.925
6	0.825	-0.150	2.250	6.963	0.150
7	0.660	-0.150	2.250	8.928	0.000
8	0.495	-0.150	2.250	10.456	0.000
9	0.330	-0.150	2.250	11.548	0.000
10	0.165	-0.150	2.250	12.204	0.000
11	0.000	-0.150	2.250	12.422	0.000

1.5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_S (Ton)	DISPUESTO ARMADURA	U_S (Ton)
HASTIAL	Interior	10.0	ϕ 10 A 0.20	17.4
	Exterior	26.9	ϕ 16 A 0.20	44.6
DINTEL	Interior	53.3	ϕ 20 A 0.20	69.6
	Exterior	24.8	ϕ 16 A 0.20	44.6
SOLERA	Inferior	45.7	ϕ 20 A 0.20	69.6
	Superior	56.53	ϕ 20 A 0.20	69.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página .

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

* Elemento: Muro vertical

Acero: AEH-500 _ Cuantía mínima = 0,90 %

* $A_C = 2 \times 0,3 = 0,6\ m^2$

* $A_S = 10.8 \times 10^{-4}\ m^2 \Rightarrow$ $5,4 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 2 m $\Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara _ **Válido**

- DINTEL

* Elemento: Muro horizontal

Acero: AEH-500 _ Cuantía mínima = 1,6 %

* $A_C = 3,6 \times 0,3 = 1,08\ m^2$

* $A_S = 17,28 \times 10^{-4}\ m^2 \Rightarrow$ $8,64 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

- SOLERA

* Elemento: Losa

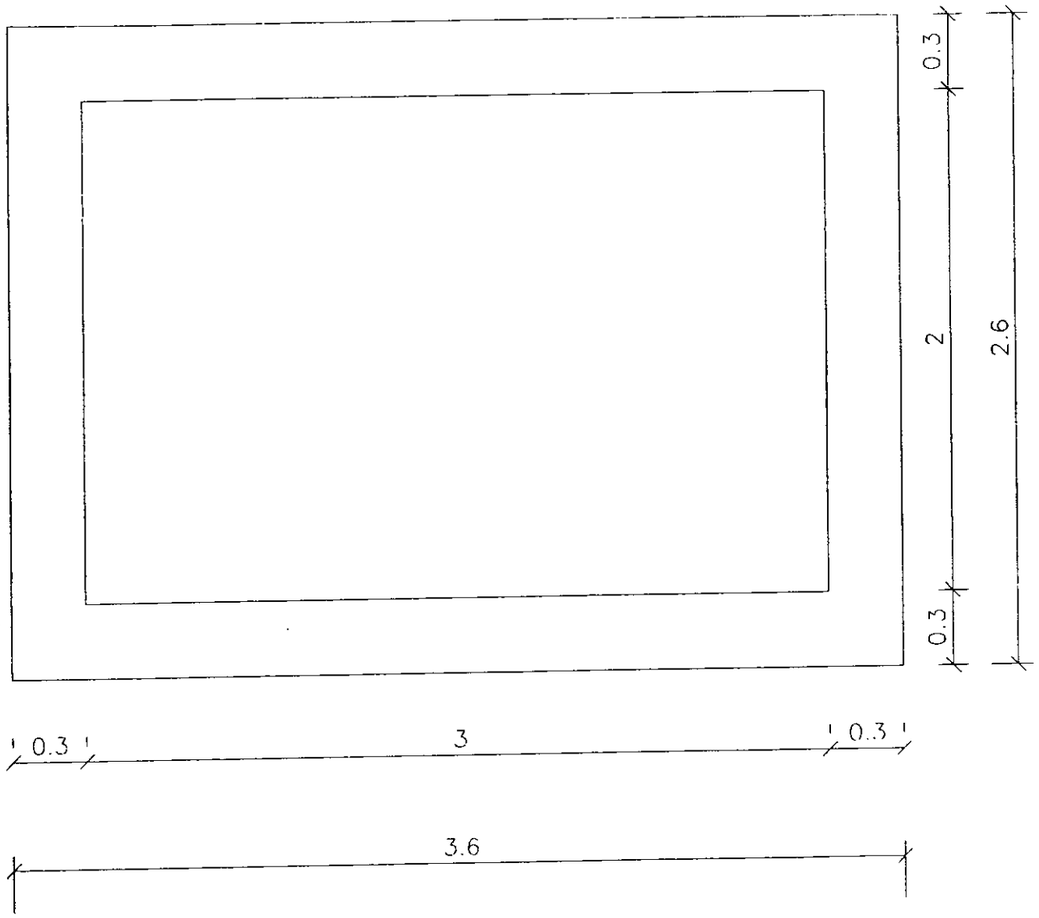
Acero: AEH-500 _ Cuantía mínima = 1,5 %

* $A_C = 3,6 \times 0,3 = 1,08\ m^2$

* $A_S = 16,20 \times 10^{-4}\ m^2 \Rightarrow$ $8,1 \times 10^{-4}\ m^2$ por cara

Φ 10 A 0,20 en 3,1 m $\Rightarrow$ $10,21 \times 10^{-4}\ m^2$ por cara _ **Válido**

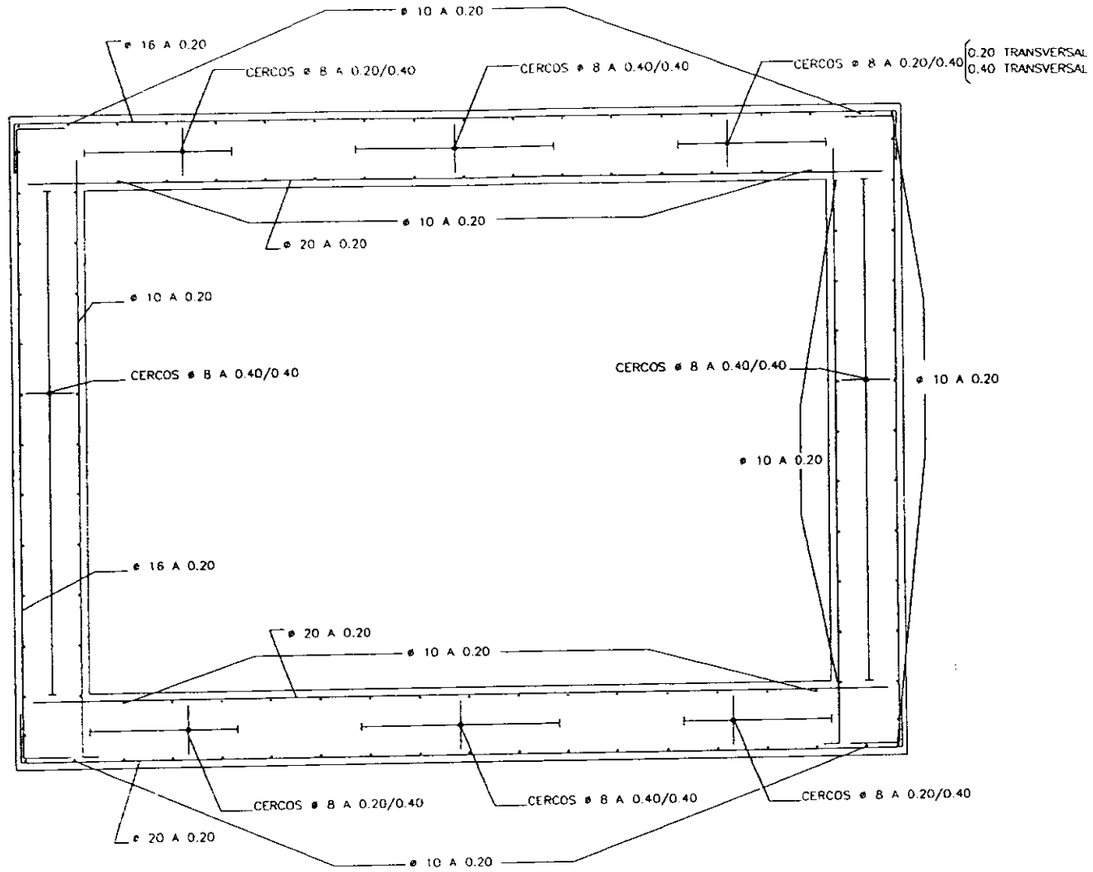
2 .PLANOS



SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 25



SECCION TRANSVERSAL

ARMADURAS O.R. 3+480

ESCALA 1 : 25

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

O.R. 3 + 780

I. CALCULOS

O.R. 3 + 780

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 3 + 780. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso
2 - Esquema estructural
3 - Cargas consideradas
4 - Hipótesis de carga
5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

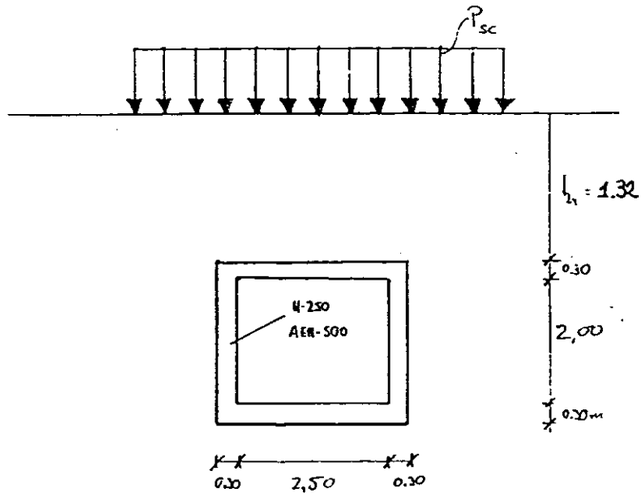


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 1.32 m

  -sobre cimentación H_T = 3.62 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\ (h_T - 1) = 1.628$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\ (3 + h_T)} = 4.52 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 1.32$ m

  $H_T = 3.62$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

(C) Copyright J.Diaz del Valle, 1988

P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+780

Fecha ..... : 29/7/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.0 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	5.016	-2.085	-1.623	0.300
2	1.400	0.200	4.896	-1.867	-1.249	0.300
3	1.400	0.400	4.656	-1.458	-0.958	0.300
4	1.400	0.600	4.416	-1.088	-0.740	0.300
5	1.400	0.800	4.176	-0.757	-0.589	0.300
6	1.400	1.000	3.936	-0.464	-0.496	0.300
7	1.400	1.200	3.696	-0.211	-0.454	0.300
8	1.400	1.400	3.456	0.003	-0.454	0.300
9	1.400	1.600	3.216	0.179	-0.490	0.300
10	1.400	1.800	2.976	0.315	-0.553	0.300
11	1.400	2.000	2.736	0.413	-0.636	0.300
12	1.400	2.015	2.607	0.451	-0.642	0.312
13	1.400	2.030	2.589	0.455	-0.649	0.325
14	1.400	2.045	2.569	0.459	-0.656	0.337
15	1.400	2.060	2.549	0.462	-0.663	0.350
16	1.400	2.075	2.528	0.466	-0.670	0.362
17	1.400	2.090	2.506	0.469	-0.677	0.374
18	1.400	2.105	2.484	0.472	-0.684	0.387
19	1.400	2.120	2.460	0.475	-0.691	0.399
20	1.400	2.135	2.437	0.478	-0.699	0.412
21	1.400	2.150	0.480	-2.412	-0.706	0.424
22	1.385	2.150	0.481	-2.383	-0.670	0.412
23	1.370	2.150	0.481	-2.351	-0.635	0.399
24	1.355	2.150	0.481	-2.320	-0.600	0.387
25	1.340	2.150	0.481	-2.289	-0.566	0.374
26	1.325	2.150	0.481	-2.260	-0.532	0.362
27	1.310	2.150	0.481	-2.231	-0.498	0.350
28	1.295	2.150	0.481	-2.202	-0.465	0.337
29	1.280	2.150	0.481	-2.175	-0.433	0.325
30	1.265	2.150	0.481	-2.148	-0.400	0.312
31	1.250	2.150	0.481	-2.122	-0.369	0.300
32	1.125	2.150	0.481	-2.004	-0.118	0.300
33	1.000	2.150	0.481	-1.793	0.106	0.300
34	0.875	2.150	0.481	-1.582	0.304	0.300
35	0.750	2.150	0.481	-1.371	0.475	0.300
36	0.625	2.150	0.481	-1.160	0.620	0.300
37	0.500	2.150	0.481	-0.949	0.739	0.300
38	0.375	2.150	0.481	-0.738	0.831	0.300
39	0.250	2.150	0.481	-0.527	0.897	0.300
40	0.125	2.150	0.481	-0.316	0.936	0.300
41	0.000	2.150	0.481	-0.105	0.950	0.300

R = 0.50165E+01 M = -.16227E+01 H = -.20850E+01 V = 0.10674E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	1.157	-0.132	1.623	5.016	5.786

1.260	1.137	-0.159	0.960	4.449	5.684
1.120	1.113	-0.172	0.376	3.896	5.567
0.980	1.089	-0.175	-0.131	3.360	5.445
0.840	1.065	-0.168	-0.565	2.842	5.325
0.700	1.042	-0.152	-0.928	2.339	5.212
0.560	1.023	-0.130	-1.221	1.852	5.113
0.420	1.006	-0.102	-1.447	1.377	5.032
0.280	0.994	-0.070	-1.607	0.912	4.972
0.140	0.987	-0.036	-1.703	0.454	4.935
0.000	0.984	0.000	-1.735	0.000	4.922

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.250	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.250	2.250	0.000
38	0.375	2.150	2.250	2.250	0.000
39	0.250	2.150	2.250	2.250	0.000
40	0.125	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	2.250	2.250	0.000
2	1.260	-0.150	2.250	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.250	0.000
7	0.560	-0.150	2.250	2.250	0.000
8	0.420	-0.150	2.250	2.250	0.000
9	0.280	-0.150	2.250	2.250	0.000
10	0.140	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+780

Fecha ..... : 29/7/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.62 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	11.019	-4.911	-3.560	0.300
2	1.400	0.200	10.899	-4.392	-2.681	0.300
3	1.400	0.400	10.659	-3.392	-2.003	0.300
4	1.400	0.600	10.419	-2.451	-1.513	0.300
5	1.400	0.800	10.179	-1.568	-1.199	0.300
6	1.400	1.000	9.939	-0.743	-1.050	0.300
7	1.400	1.200	9.699	0.022	-1.055	0.300
8	1.400	1.400	9.459	0.730	-1.201	0.300
9	1.400	1.600	9.219	1.379	-1.477	0.300
10	1.400	1.800	8.979	1.969	-1.870	0.300
11	1.400	2.000	8.739	2.501	-2.371	0.300
12	1.400	2.015	8.610	2.765	-2.412	0.312
13	1.400	2.030	8.591	2.801	-2.454	0.325
14	1.400	2.045	8.571	2.836	-2.497	0.337
15	1.400	2.060	8.551	2.870	-2.540	0.350
16	1.400	2.075	8.530	2.904	-2.583	0.362
17	1.400	2.090	8.508	2.938	-2.627	0.374
18	1.400	2.105	8.486	2.972	-2.672	0.387
19	1.400	2.120	8.463	3.005	-2.717	0.399
20	1.400	2.135	8.439	3.038	-2.763	0.412
21	1.400	2.150	3.070	-8.414	-2.809	0.424
22	1.385	2.150	3.087	-8.353	-2.683	0.412
23	1.370	2.150	3.087	-8.257	-2.560	0.399
24	1.355	2.150	3.087	-8.161	-2.437	0.387
25	1.340	2.150	3.087	-8.067	-2.316	0.374
26	1.325	2.150	3.087	-7.972	-2.197	0.362
27	1.310	2.150	3.087	-7.879	-2.078	0.350
28	1.295	2.150	3.087	-7.787	-1.962	0.337
29	1.280	2.150	3.087	-7.695	-1.846	0.325
30	1.265	2.150	3.087	-7.604	-1.732	0.312
31	1.250	2.150	3.087	-7.513	-1.619	0.300
32	1.125	2.150	3.087	-7.095	-0.733	0.300
33	1.000	2.150	3.087	-6.348	0.061	0.300
34	0.875	2.150	3.087	-5.601	0.761	0.300
35	0.750	2.150	3.087	-4.854	1.368	0.300
36	0.625	2.150	3.087	-4.108	1.881	0.300
37	0.500	2.150	3.087	-3.361	2.301	0.300
38	0.375	2.150	3.087	-2.614	2.628	0.300
39	0.250	2.150	3.087	-1.867	2.862	0.300
40	0.125	2.150	3.087	-1.120	3.002	0.300
41	0.000	2.150	3.087	-0.373	3.048	0.300

R = 0.11019E+02 M = -.35595E+01 H = -.49110E+01 V = 0.32299E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	2.044	-0.291	3.560	11.019	10.222
1.260	1.999	-0.350	2.105	9.771	9.996
1.120	1.948	-0.380	0.822	8.557	9.739
0.980	1.894	-0.385	-0.293	7.381	9.470
0.840	1.841	-0.369	-1.246	6.241	9.206
0.700	1.792	-0.334	-2.042	5.138	8.959
0.560	1.748	-0.285	-2.686	4.068	8.741
0.420	1.712	-0.224	-3.183	3.025	8.562
0.280	1.686	-0.154	-3.534	2.004	8.430
0.140	1.670	-0.079	-3.744	0.998	8.348
0.000	1.664	0.000	-3.814	0.000	8.320

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.359	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.291	2.250	0.000
38	0.375	2.150	2.627	2.250	0.000
39	0.250	2.150	2.854	2.250	0.000
40	0.125	2.150	2.986	2.250	0.000
41	0.000	2.150	3.028	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	3.796	2.250	0.000
2	1.260	-0.150	2.534	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.471	0.000
7	0.560	-0.150	2.250	3.088	0.000
8	0.420	-0.150	2.250	3.509	0.000
9	0.280	-0.150	2.250	3.778	0.000
10	0.140	-0.150	2.250	3.908	0.000
11	0.000	-0.150	2.250	3.908	0.000

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A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+780

Fecha ..... : 29/7/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.62 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 4.52 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	21.144	-3.229	-5.846	0.300
2	1.400	0.200	21.024	-2.883	-5.270	0.300
3	1.400	0.400	20.784	-2.217	-4.826	0.300
4	1.400	0.600	20.544	-1.589	-4.508	0.300
5	1.400	0.800	20.304	-1.001	-4.308	0.300
6	1.400	1.000	20.064	-0.451	-4.218	0.300
7	1.400	1.200	19.824	0.060	-4.230	0.300
8	1.400	1.400	19.584	0.531	-4.336	0.300
9	1.400	1.600	19.344	0.964	-4.529	0.300
10	1.400	1.800	19.104	1.357	-4.801	0.300
11	1.400	2.000	18.864	1.712	-5.143	0.300
12	1.400	2.015	18.734	1.888	-5.171	0.312
13	1.400	2.030	18.716	1.912	-5.200	0.325
14	1.400	2.045	18.696	1.935	-5.229	0.337
15	1.400	2.060	18.676	1.958	-5.258	0.350
16	1.400	2.075	18.655	1.981	-5.288	0.362
17	1.400	2.090	18.633	2.003	-5.318	0.374
18	1.400	2.105	18.611	2.026	-5.349	0.387
19	1.400	2.120	18.588	2.048	-5.379	0.399
20	1.400	2.135	18.564	2.070	-5.410	0.412
21	1.400	2.150	2.092	-18.539	-5.442	0.424
22	1.385	2.150	2.102	-18.424	-5.165	0.412
23	1.370	2.150	2.102	-18.219	-4.892	0.399
24	1.355	2.150	2.102	-18.015	-4.622	0.387
25	1.340	2.150	2.102	-17.812	-4.355	0.374
26	1.325	2.150	2.102	-17.609	-4.091	0.362
27	1.310	2.150	2.102	-17.407	-3.829	0.350
28	1.295	2.150	2.102	-17.206	-3.571	0.337
29	1.280	2.150	2.102	-17.006	-3.316	0.325
30	1.265	2.150	2.102	-16.806	-3.064	0.312
31	1.250	2.150	2.102	-16.607	-2.815	0.300
32	1.125	2.150	2.102	-15.683	-0.855	0.300
33	1.000	2.150	2.102	-14.032	0.899	0.300
34	0.875	2.150	2.102	-12.381	2.447	0.300
35	0.750	2.150	2.102	-10.730	3.788	0.300
36	0.625	2.150	2.102	-9.080	4.923	0.300
37	0.500	2.150	2.102	-7.429	5.852	0.300
38	0.375	2.150	2.102	-5.778	6.574	0.300
39	0.250	2.150	2.102	-4.127	7.090	0.300
40	0.125	2.150	2.102	-2.476	7.399	0.300
41	0.000	2.150	2.102	-0.825	7.503	0.300

R = 0.21144E+02 M = -.58462E+01 H = -.32294E+01 V = 0.81989E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	3.790	-0.751	5.846	21.144	18.952

1.260	3.678	-0.842	3.058	18.697	18.391
1.120	3.557	-0.880	0.607	16.332	17.786
0.980	3.434	-0.870	-1.519	14.053	17.171
0.840	3.315	-0.819	-3.332	11.859	16.577
0.700	3.206	-0.734	-4.843	9.745	16.032
0.560	3.111	-0.620	-6.064	7.703	15.557
0.420	3.034	-0.485	-7.003	5.721	15.169
0.280	2.976	-0.332	-7.668	3.787	14.882
0.140	2.941	-0.169	-8.065	1.885	14.706
0.000	2.929	0.000	-8.196	0.000	14.647

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.260	0.000
2	1.400	0.200	2.250	2.872	0.000
3	1.400	0.400	2.250	2.446	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.326	0.000
10	1.400	1.800	2.250	2.648	0.000
11	1.400	2.000	2.250	3.018	0.000
12	1.400	2.015	2.343	2.862	0.000
13	1.400	2.030	2.436	2.696	0.000
14	1.400	2.045	2.529	2.535	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	4.002	0.000
22	1.385	2.150	3.087	3.911	0.000
23	1.370	2.150	2.994	3.818	0.000
24	1.355	2.150	2.901	3.722	0.000
25	1.340	2.150	2.808	3.624	0.000
26	1.325	2.150	2.715	3.521	0.000
27	1.310	2.150	2.622	3.415	0.000
28	1.295	2.150	2.529	3.304	0.000
29	1.280	2.150	2.436	3.188	0.000
30	1.265	2.150	2.343	3.067	0.000
31	1.250	2.150	2.250	2.939	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.583	2.250	0.000
35	0.750	2.150	3.752	2.250	0.000
36	0.625	2.150	4.414	2.250	0.000
37	0.500	2.150	5.325	2.250	0.000
38	0.375	2.150	6.039	2.250	0.000
39	0.250	2.150	6.553	2.250	0.000
40	0.125	2.150	6.862	2.250	0.000
41	0.000	2.150	6.966	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	5.592	2.250	4.437
2	1.260	-0.150	3.408	2.250	1.947
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.626	0.000
6	0.700	-0.150	2.250	4.611	0.000
7	0.560	-0.150	2.250	5.806	0.000
8	0.420	-0.150	2.250	6.736	0.000
9	0.280	-0.150	2.250	7.400	0.000
10	0.140	-0.150	2.250	7.798	0.000
11	0.000	-0.150	2.250	7.931	0.000

IBM

Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 3+780

Fecha ..... : 29/7/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 3.62 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 4.52 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	21.144	-4.760	-6.070	0.300
2	1.400	0.200	21.024	-4.240	-5.222	0.300
3	1.400	0.400	20.784	-3.241	-4.574	0.300
4	1.400	0.600	20.544	-2.299	-4.114	0.300
5	1.400	0.800	20.304	-1.417	-3.831	0.300
6	1.400	1.000	20.064	-0.592	-3.712	0.300
7	1.400	1.200	19.824	0.174	-3.747	0.300
8	1.400	1.400	19.584	0.881	-3.923	0.300
9	1.400	1.600	19.344	1.530	-4.229	0.300
10	1.400	1.800	19.104	2.121	-4.654	0.300
11	1.400	2.000	18.864	2.653	-5.184	0.300
12	1.400	2.015	18.734	2.917	-5.228	0.312
13	1.400	2.030	18.716	2.952	-5.272	0.325
14	1.400	2.045	18.696	2.987	-5.317	0.337
15	1.400	2.060	18.676	3.021	-5.362	0.350
16	1.400	2.075	18.655	3.056	-5.408	0.362
17	1.400	2.090	18.633	3.089	-5.454	0.374
18	1.400	2.105	18.611	3.123	-5.501	0.387
19	1.400	2.120	18.588	3.156	-5.549	0.399
20	1.400	2.135	18.564	3.189	-5.596	0.412
21	1.400	2.150	3.222	-18.539	-5.645	0.424
22	1.385	2.150	3.238	-18.424	-5.368	0.412
23	1.370	2.150	3.238	-18.219	-5.095	0.399
24	1.355	2.150	3.238	-18.015	-4.825	0.387
25	1.340	2.150	3.238	-17.812	-4.558	0.374
26	1.325	2.150	3.238	-17.609	-4.294	0.362
27	1.310	2.150	3.238	-17.407	-4.032	0.350
28	1.295	2.150	3.238	-17.206	-3.774	0.337
29	1.280	2.150	3.238	-17.006	-3.519	0.325
30	1.265	2.150	3.238	-16.806	-3.267	0.312
31	1.250	2.150	3.238	-16.607	-3.018	0.300
32	1.125	2.150	3.238	-15.683	-1.058	0.300
33	1.000	2.150	3.238	-14.032	0.696	0.300
34	0.875	2.150	3.238	-12.381	2.244	0.300
35	0.750	2.150	3.238	-10.730	3.585	0.300
36	0.625	2.150	3.238	-9.080	4.720	0.300
37	0.500	2.150	3.238	-7.429	5.649	0.300
38	0.375	2.150	3.238	-5.778	6.371	0.300
39	0.250	2.150	3.238	-4.127	6.887	0.300
40	0.125	2.150	3.238	-2.476	7.196	0.300
41	0.000	2.150	3.238	-0.825	7.300	0.300

R = 0.21144E+02 M = -.60703E+01 H = -.47597E+01 V = 0.79054E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	3.770	-0.707	6.070	21.144	18.852
1.260	3.664	-0.803	3.281	18.709	18.320
1.120	3.548	-0.845	0.828	16.352	17.740
0.980	3.430	-0.840	-1.301	14.078	17.148
0.840	3.315	-0.794	-3.118	11.886	16.574
0.700	3.209	-0.713	-4.633	9.771	16.045
0.560	3.116	-0.604	-5.857	7.726	15.582
0.420	3.041	-0.472	-6.799	5.740	15.205
0.280	2.985	-0.324	-7.466	3.800	14.925
0.140	2.951	-0.165	-7.864	1.892	14.754
0.000	2.939	0.000	-7.997	-0.000	14.696

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	3.447	0.000
2	1.400	0.200	2.250	2.825	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.494	0.000
11	1.400	2.000	2.250	3.057	0.000
12	1.400	2.015	2.343	2.916	0.000
13	1.400	2.030	2.436	2.765	0.000
14	1.400	2.045	2.529	2.619	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.990	0.000
22	1.385	2.150	3.087	3.902	0.000
23	1.370	2.150	2.994	3.814	0.000
24	1.355	2.150	2.901	3.723	0.000
25	1.340	2.150	2.808	3.629	0.000
26	1.325	2.150	2.715	3.531	0.000
27	1.310	2.150	2.622	3.430	0.000
28	1.295	2.150	2.529	3.326	0.000
29	1.280	2.150	2.436	3.216	0.000
30	1.265	2.150	2.343	3.102	0.000
31	1.250	2.150	2.250	2.982	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	3.474	2.250	0.000
36	0.625	2.150	4.068	2.250	0.000
37	0.500	2.150	4.978	2.250	0.000
38	0.375	2.150	5.691	2.250	0.000
39	0.250	2.150	6.204	2.250	0.000
40	0.125	2.150	6.514	2.250	0.000
41	0.000	2.150	6.617	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	5.813	2.250	4.437
2	1.260	-0.150	3.587	2.250	1.960
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	3.456	0.000
6	0.700	-0.150	2.250	4.407	0.000
7	0.560	-0.150	2.250	5.603	0.000
8	0.420	-0.150	2.250	6.533	0.000
9	0.280	-0.150	2.250	7.198	0.000
10	0.140	-0.150	2.250	7.597	0.000
11	0.000	-0.150	2.250	7.730	0.000

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_s (Ton)	DISPUESTO ARMADURA	U_s (Ton)
HASTIAL	Interior	10	ϕ 10 A 0.20	17.4
	Exterior	15.3	ϕ 12 A 0.20	25.1
DINTEL	Interior	31	ϕ 16 A 0.20	44.6
	Exterior	10	ϕ 12 A 0.20	25.1
SOLERA	Inferior	16	ϕ 12 A 0.20	25.1
	Superior	35.2	ϕ 16 A 0.20	44.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

  * Elemento: Muro vertical
    Acero: AEH-500 } Cuantía mínima = 0,90 ‰
  * $A_C = 2 \times 0,3 = 0,6\ m^2$
  * $A_S = 10.8 \times 10^{-4}\ m^2$ ⇒ $5,4 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 2 m ⇒ $8,64 \times 10^{-4}\ m^2$ por cara } Válido

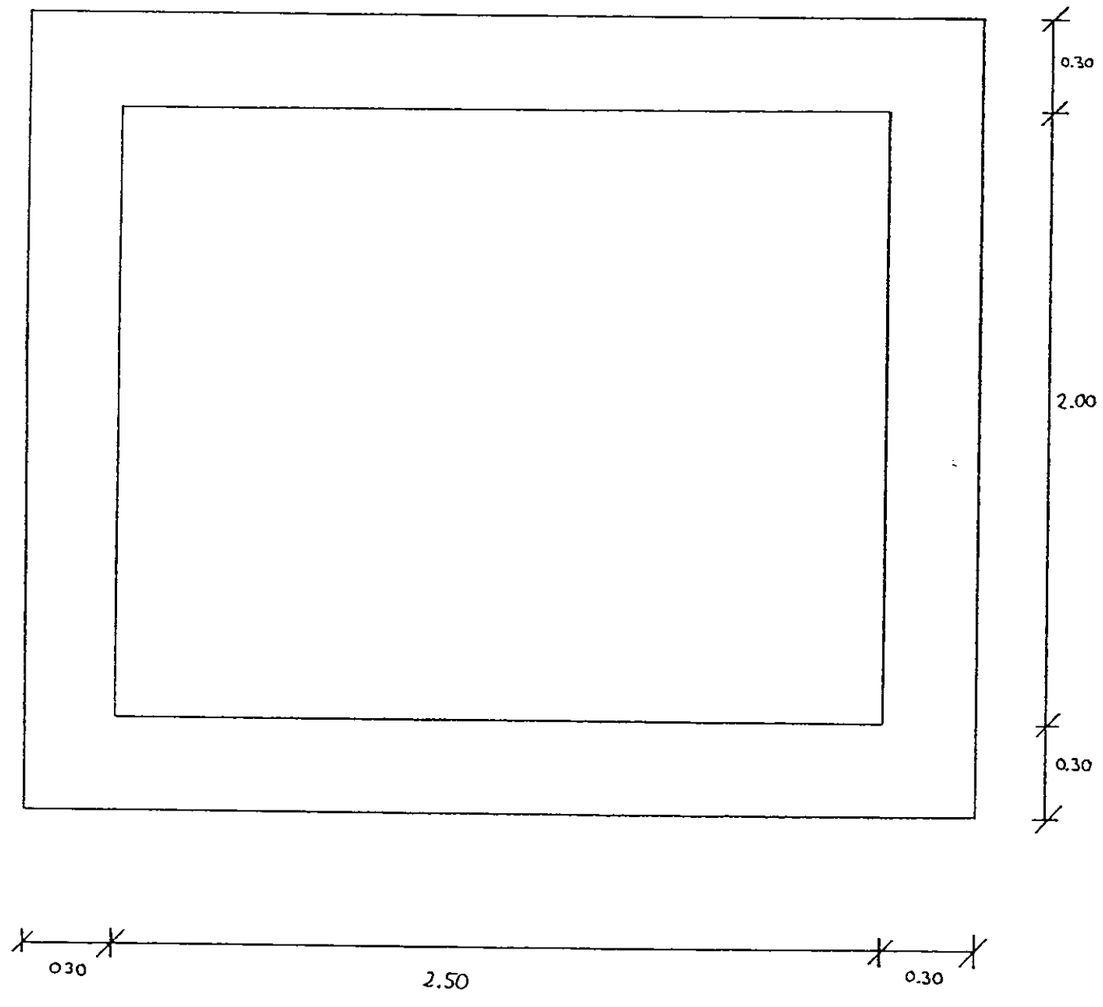
- DINTEL

  * Elemento: Muro horizontal
    Acero: AEH-500 } Cuantía mínima = 1,6 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,88 \times 10^{-4}\ m^2$ ⇒ $7,44 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

- SOLERA

  * Elemento: Losa
    Acero: AEH-500 } Cuantía mínima = 1,5 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,0 \times 10^{-4}\ m^2$ ⇒ $7,0 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

II. PLANOS



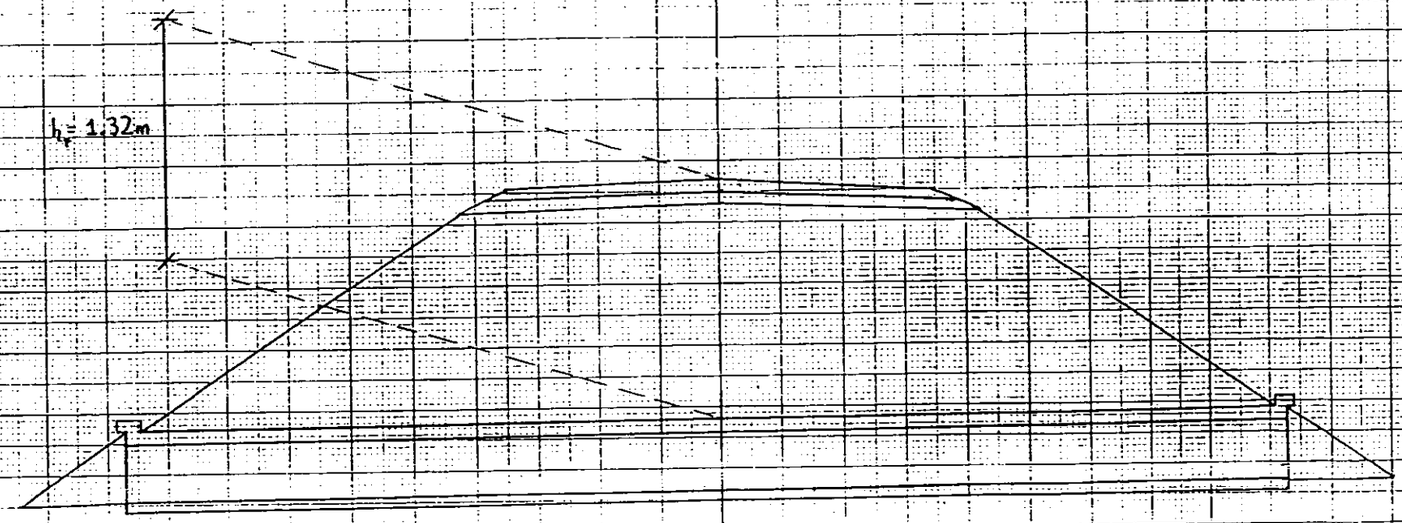
SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 20

O. R. 3+780 194

SECCION LONGITUDINAL



OBRAS DE RIEGO

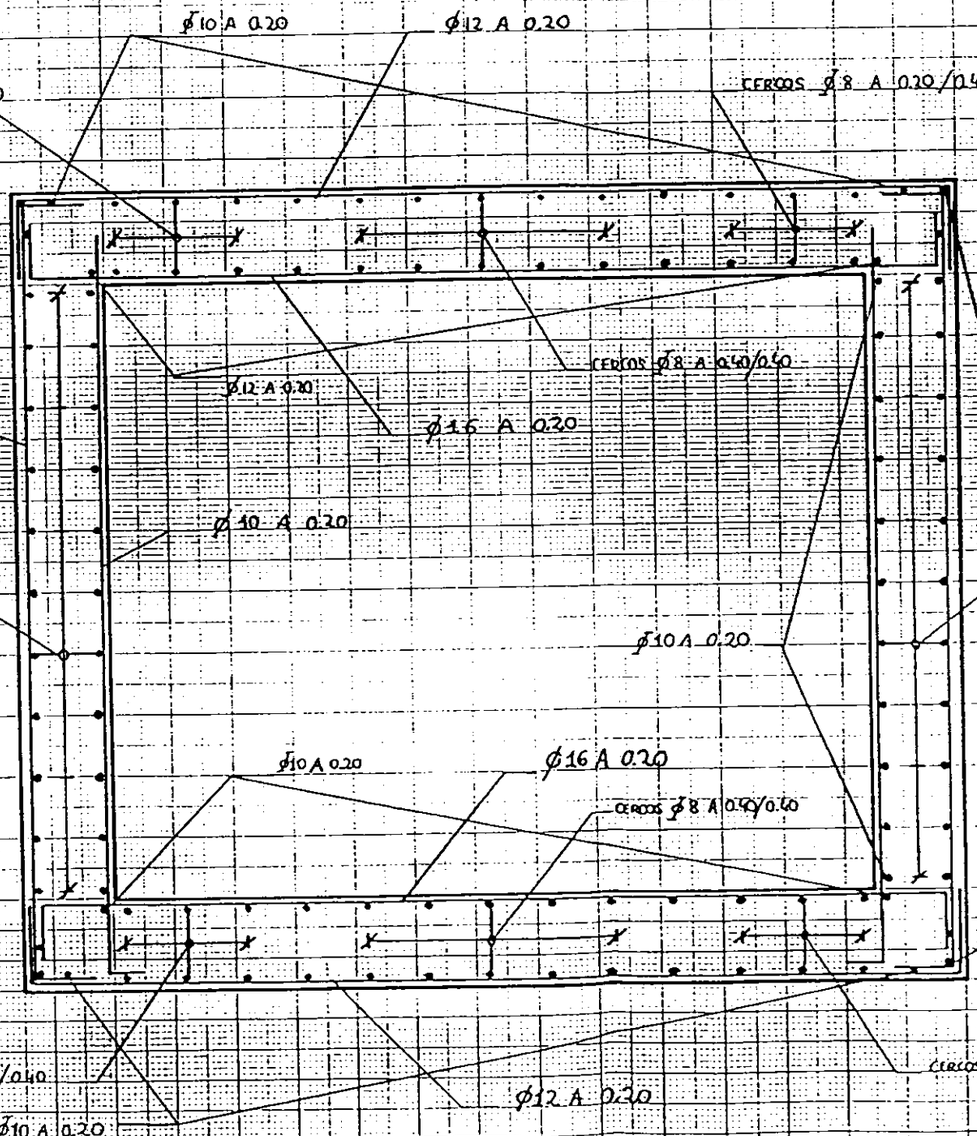
SECCIÓN LONGITUDINAL

ESCALA 1:200

O. R. 3+780

SECCION TRANSVERSAL

ARMADURAS



0.20 TRANSVERSAL
0.40 LONGITUDINAL

CARACTERÍSTICAS	
HORMIGON	H-250 $\gamma_c = 1.5$
ACERO	AEH-500 $\gamma_s = 1.15$
COEF. MAYORACION DE ACCIONES	$\gamma_f = 1.6$
RECUBRIMIENTO	4cm

ESCALA 1:20

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

O.R. 4 + 220

I. CALCULOS

O.R. 4 + 220

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 4 + 220. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso
2 - Esquema estructural
3 - Cargas consideradas
4 - Hipótesis de carga
5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5\ t/m^3$

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03\ t/m^3$

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

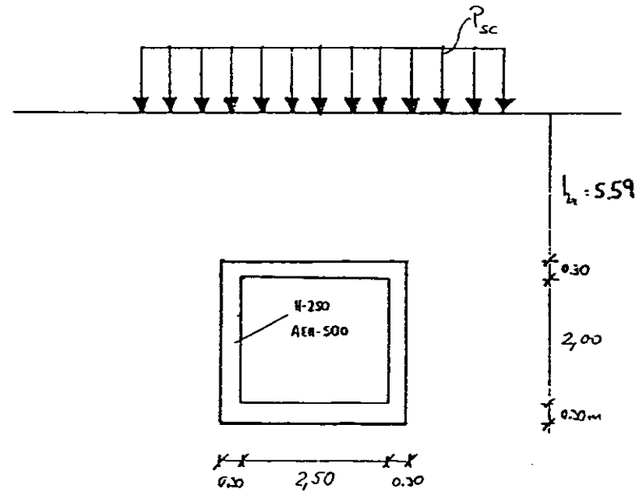


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 5.59 m

  -sobre cimentación H_T = 7.89 m

- Módulo de reacción en solera: 5.000 t/m³

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\ (h_T - 1) = 1.201$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\ (3 + h_T)} = 1.678 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 5.59$ m

  $H_T = 7.89$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

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TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

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P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+220

Fecha ..... : 29/7/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.0 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	5.016	-2.085	-1.623	0.300
2	1.400	0.200	4.896	-1.867	-1.249	0.300
3	1.400	0.400	4.656	-1.458	-0.958	0.300
4	1.400	0.600	4.416	-1.088	-0.740	0.300
5	1.400	0.800	4.176	-0.757	-0.589	0.300
6	1.400	1.000	3.936	-0.464	-0.496	0.300
7	1.400	1.200	3.696	-0.211	-0.454	0.300
8	1.400	1.400	3.456	0.003	-0.454	0.300
9	1.400	1.600	3.216	0.179	-0.490	0.300
10	1.400	1.800	2.976	0.315	-0.553	0.300
11	1.400	2.000	2.736	0.413	-0.636	0.300
12	1.400	2.015	2.607	0.451	-0.642	0.312
13	1.400	2.030	2.589	0.455	-0.649	0.325
14	1.400	2.045	2.569	0.459	-0.656	0.337
15	1.400	2.060	2.549	0.462	-0.663	0.350
16	1.400	2.075	2.528	0.466	-0.670	0.362
17	1.400	2.090	2.506	0.469	-0.677	0.374
18	1.400	2.105	2.484	0.472	-0.684	0.387
19	1.400	2.120	2.460	0.475	-0.691	0.399
20	1.400	2.135	2.437	0.478	-0.699	0.412
21	1.400	2.150	0.480	-2.412	-0.706	0.424
22	1.385	2.150	0.481	-2.383	-0.670	0.412
23	1.370	2.150	0.481	-2.351	-0.635	0.399
24	1.355	2.150	0.481	-2.320	-0.600	0.387
25	1.340	2.150	0.481	-2.289	-0.566	0.374
26	1.325	2.150	0.481	-2.260	-0.532	0.362
27	1.310	2.150	0.481	-2.231	-0.498	0.350
28	1.295	2.150	0.481	-2.202	-0.465	0.337
29	1.280	2.150	0.481	-2.175	-0.433	0.325
30	1.265	2.150	0.481	-2.148	-0.400	0.312
31	1.250	2.150	0.481	-2.122	-0.369	0.300
32	1.125	2.150	0.481	-2.004	-0.118	0.300
33	1.000	2.150	0.481	-1.793	0.106	0.300
34	0.875	2.150	0.481	-1.582	0.304	0.300
35	0.750	2.150	0.481	-1.371	0.475	0.300
36	0.625	2.150	0.481	-1.160	0.620	0.300
37	0.500	2.150	0.481	-0.949	0.739	0.300
38	0.375	2.150	0.481	-0.738	0.831	0.300
39	0.250	2.150	0.481	-0.527	0.897	0.300
40	0.125	2.150	0.481	-0.316	0.936	0.300
41	0.000	2.150	0.481	-0.105	0.950	0.300

R = 0.50165E+01 M = -.16227E+01 H = -.20850E+01 V = 0.10674E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	1.157	-0.132	1.623	5.016	5.786

1.260	1.137	-0.159	0.960	4.449	5.684
1.120	1.113	-0.172	0.376	3.896	5.561
0.980	1.089	-0.175	-0.131	3.360	5.445
0.840	1.065	-0.168	-0.565	2.842	5.325
0.700	1.042	-0.152	-0.928	2.339	5.212
0.560	1.023	-0.130	-1.221	1.852	5.113
0.420	1.006	-0.102	-1.447	1.377	5.032
0.280	0.994	-0.070	-1.607	0.912	4.972
0.140	0.987	-0.036	-1.703	0.454	4.935
0.000	0.984	0.000	-1.735	0.000	4.922

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.250	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.250	2.250	0.000
38	0.375	2.150	2.250	2.250	0.000
39	0.250	2.150	2.250	2.250	0.000
40	0.125	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	2.250	2.250	0.000
2	1.260	-0.150	2.250	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.250	0.000
7	0.560	-0.150	2.250	2.250	0.000
8	0.420	-0.150	2.250	2.250	0.000
9	0.280	-0.150	2.250	2.250	0.000
10	0.140	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R.4+220

Fecha ..... : 29/7/97

HPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 8.89 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	34.983	-12.849	-10.846	0.300
2	1.400	0.200	34.863	-11.560	-8.534	0.300
3	1.400	0.400	34.623	-9.019	-6.730	0.300
4	1.400	0.600	34.383	-6.538	-5.423	0.300
5	1.400	0.800	34.143	-4.114	-4.600	0.300
6	1.400	1.000	33.903	-1.749	-4.250	0.300
7	1.400	1.200	33.663	0.557	-4.361	0.300
8	1.400	1.400	33.423	2.805	-4.922	0.300
9	1.400	1.600	33.183	4.994	-5.921	0.300
10	1.400	1.800	32.943	7.125	-7.346	0.300
11	1.400	2.000	32.703	9.198	-9.186	0.300
12	1.400	2.015	32.573	10.290	-9.340	0.312
13	1.400	2.030	32.555	10.441	-9.497	0.325
14	1.400	2.045	32.535	10.591	-9.655	0.337
15	1.400	2.060	32.515	10.741	-9.817	0.350
16	1.400	2.075	32.494	10.891	-9.980	0.362
17	1.400	2.090	32.472	11.041	-10.146	0.374
18	1.400	2.105	32.450	11.190	-10.313	0.387
19	1.400	2.120	32.426	11.338	-10.483	0.399
20	1.400	2.135	32.403	11.487	-10.656	0.412
21	1.400	2.150	11.635	-32.378	-10.830	0.424
22	1.385	2.150	11.709	-32.189	-10.347	0.412
23	1.370	2.150	11.709	-31.836	-9.870	0.399
24	1.355	2.150	11.709	-31.483	-9.398	0.387
25	1.340	2.150	11.709	-31.132	-8.931	0.374
26	1.325	2.150	11.709	-30.781	-8.469	0.362
27	1.310	2.150	11.709	-30.431	-8.013	0.350
28	1.295	2.150	11.709	-30.081	-7.561	0.337
29	1.280	2.150	11.709	-29.733	-7.115	0.325
30	1.265	2.150	11.709	-29.385	-6.675	0.312
31	1.250	2.150	11.709	-29.038	-6.239	0.300
32	1.125	2.150	11.709	-27.421	-2.811	0.300
33	1.000	2.150	11.709	-24.535	0.255	0.300
34	0.875	2.150	11.709	-21.648	2.962	0.300
35	0.750	2.150	11.709	-18.762	5.307	0.300
36	0.625	2.150	11.709	-15.875	7.291	0.300
37	0.500	2.150	11.709	-12.989	8.915	0.300
38	0.375	2.150	11.709	-10.103	10.178	0.300
39	0.250	2.150	11.709	-7.216	11.080	0.300
40	0.125	2.150	11.709	-4.330	11.621	0.300
41	0.000	2.150	11.709	-1.443	11.801	0.300

R = 0.34983E+02 M = -.10846E+02 H = -.12849E+02 V = 0.12405E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	6.009	-1.013	10.846	34.983	30.047
1.260	5.854	-1.189	6.229	30.997	29.270
1.120	5.681	-1.275	2.161	27.127	28.403
0.980	5.501	-1.282	-1.373	23.382	27.524
0.840	5.325	-1.222	-4.391	19.761	26.624
0.700	5.161	-1.104	-6.911	16.260	25.807
0.560	5.018	-0.939	-8.949	12.867	25.089
0.420	4.900	-0.736	-10.518	9.565	24.501
0.280	4.813	-0.506	-11.631	6.335	24.065
0.140	4.759	-0.258	-12.295	3.155	23.796
0.000	4.741	0.000	-12.515	0.000	23.706

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	6.089	0.000
2	1.400	0.200	2.250	3.946	0.000
3	1.400	0.400	2.250	2.643	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	3.444	0.000
11	1.400	2.000	2.250	4.902	0.000
12	1.400	2.015	2.343	4.619	0.000
13	1.400	2.030	2.436	4.355	0.000
14	1.400	2.045	2.529	4.468	0.000
15	1.400	2.060	2.622	4.409	0.000
16	1.400	2.075	2.715	4.307	0.000
17	1.400	2.090	2.808	4.202	0.000
18	1.400	2.105	2.901	4.096	0.000
19	1.400	2.120	2.994	3.992	0.000
20	1.400	2.135	3.087	3.891	0.000
21	1.400	2.150	3.180	5.773	5.230
22	1.385	2.150	3.087	5.586	5.839
23	1.370	2.150	2.994	5.400	6.370
24	1.355	2.150	2.901	5.257	6.940
25	1.340	2.150	2.808	5.159	7.552
26	1.325	2.150	2.715	5.057	8.212
27	1.310	2.150	2.622	4.951	8.926
28	1.295	2.150	2.529	4.840	9.700
29	1.280	2.150	2.436	4.723	10.542
30	1.265	2.150	2.343	4.601	11.461
31	1.250	2.150	2.250	4.471	12.469
32	1.125	2.150	2.250	2.250	10.824
33	1.000	2.150	2.250	2.250	7.887
34	0.875	2.150	2.250	2.250	4.950

35	0.750	2.150	3.908	2.250	2.014
36	0.625	2.150	5.530	2.250	0.000
37	0.500	2.150	7.190	2.250	0.000
38	0.375	2.150	8.505	2.250	0.000
39	0.250	2.150	9.458	2.250	0.000
40	0.125	2.150	10.035	2.250	0.000
41	0.000	2.150	10.228	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	10.645	2.250	18.518
2	1.260	-0.150	5.969	2.250	14.463
3	1.120	-0.150	2.591	2.250	10.525
4	0.980	-0.150	2.250	2.250	6.714
5	0.840	-0.150	2.250	4.173	3.030
6	0.700	-0.150	2.250	6.645	0.000
7	0.560	-0.150	2.250	8.693	0.000
8	0.420	-0.150	2.250	10.305	0.000
9	0.280	-0.150	2.250	11.467	0.000
10	0.140	-0.150	2.250	12.168	0.000
11	0.000	-0.150	2.250	12.403	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+220

Fecha ..... : 29/7/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 8.89 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 1.68 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	38.741	-8.497	-11.106	0.300
2	1.400	0.200	38.621	-7.638	-9.578	0.300
3	1.400	0.400	38.381	-5.944	-8.390	0.300
4	1.400	0.600	38.141	-4.290	-7.532	0.300
5	1.400	0.800	37.901	-2.674	-6.997	0.300
6	1.400	1.000	37.661	-1.097	-6.777	0.300
7	1.400	1.200	37.421	0.440	-6.865	0.300
8	1.400	1.400	37.181	1.939	-7.253	0.300
9	1.400	1.600	36.941	3.398	-7.933	0.300
10	1.400	1.800	36.701	4.819	-8.897	0.300
11	1.400	2.000	36.461	6.201	-10.137	0.300
12	1.400	2.015	36.332	6.929	-10.241	0.312
13	1.400	2.030	36.313	7.029	-10.346	0.325
14	1.400	2.045	36.294	7.130	-10.453	0.337
15	1.400	2.060	36.274	7.230	-10.562	0.350
16	1.400	2.075	36.253	7.330	-10.672	0.362
17	1.400	2.090	36.231	7.429	-10.783	0.374
18	1.400	2.105	36.208	7.529	-10.896	0.387
19	1.400	2.120	36.185	7.628	-11.010	0.399
20	1.400	2.135	36.161	7.727	-11.126	0.412
21	1.400	2.150	7.825	-36.137	-11.244	0.424
22	1.385	2.150	7.875	-35.927	-10.705	0.412
23	1.370	2.150	7.875	-35.534	-10.172	0.399
24	1.355	2.150	7.875	-35.141	-9.645	0.387
25	1.340	2.150	7.875	-34.749	-9.123	0.374
26	1.325	2.150	7.875	-34.358	-8.608	0.362
27	1.310	2.150	7.875	-33.968	-8.099	0.350
28	1.295	2.150	7.875	-33.578	-7.595	0.337
29	1.280	2.150	7.875	-33.189	-7.097	0.325
30	1.265	2.150	7.875	-32.801	-6.605	0.312
31	1.250	2.150	7.875	-32.414	-6.119	0.300
32	1.125	2.150	7.875	-30.609	-2.293	0.300
33	1.000	2.150	7.875	-27.387	1.131	0.300
34	0.875	2.150	7.875	-24.165	4.151	0.300
35	0.750	2.150	7.875	-20.943	6.769	0.300
36	0.625	2.150	7.875	-17.721	8.985	0.300
37	0.500	2.150	7.875	-14.499	10.797	0.300
38	0.375	2.150	7.875	-11.277	12.207	0.300
39	0.250	2.150	7.875	-8.055	13.213	0.300
40	0.125	2.150	7.875	-4.833	13.818	0.300
41	0.000	2.150	7.875	-1.611	14.019	0.300

R = 0.38741E+02 M = -.11106E+02 H = -.84974E+01 V = 0.15064E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	6.710	-1.299	11.106	38.741	33.551

1.260	6.515	-1.475	5.996	34.279	32.574
1.120	6.302	-1.551	1.501	29.961	31.510
0.980	6.085	-1.541	-2.400	25.793	30.423
0.840	5.874	-1.456	-5.728	21.777	29.370
0.700	5.680	-1.308	-8.504	17.902	28.399
0.560	5.510	-1.107	-10.747	14.155	27.551
0.420	5.372	-0.866	-12.472	10.517	26.858
0.280	5.269	-0.594	-13.695	6.962	26.346
0.140	5.206	-0.302	-14.425	3.466	26.031
0.000	5.185	0.000	-14.667	0.000	25.925

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	5.945	0.000
2	1.400	0.200	2.250	4.617	0.000
3	1.400	0.400	2.250	3.794	0.000
4	1.400	0.600	2.250	3.045	0.000
5	1.400	0.800	2.250	2.509	0.000
6	1.400	1.000	2.250	2.292	0.000
7	1.400	1.200	2.250	2.425	0.000
8	1.400	1.400	2.250	2.875	0.000
9	1.400	1.600	2.250	3.549	0.000
10	1.400	1.800	2.250	4.111	0.000
11	1.400	2.000	2.250	5.480	0.000
12	1.400	2.015	2.343	5.084	0.000
13	1.400	2.030	2.436	4.721	0.000
14	1.400	2.045	2.529	4.468	0.000
15	1.400	2.060	2.622	4.553	0.000
16	1.400	2.075	2.715	4.404	0.000
17	1.400	2.090	2.808	4.247	0.000
18	1.400	2.105	2.901	4.086	0.000
19	1.400	2.120	2.994	3.925	0.000
20	1.400	2.135	3.087	3.766	0.000
21	1.400	2.150	3.180	6.288	7.819
22	1.385	2.150	3.087	6.165	8.501
23	1.370	2.150	2.994	6.044	9.094
24	1.355	2.150	2.901	5.917	9.730
25	1.340	2.150	2.808	5.786	10.414
26	1.325	2.150	2.715	5.649	11.152
27	1.310	2.150	2.622	5.505	11.949
28	1.295	2.150	2.529	5.354	12.813
29	1.280	2.150	2.436	5.194	13.753
30	1.265	2.150	2.343	5.024	14.779
31	1.250	2.150	2.250	4.843	15.905
32	1.125	2.150	2.250	2.250	14.068
33	1.000	2.150	2.250	2.250	10.790
34	0.875	2.150	3.423	2.250	7.512
35	0.750	2.150	5.493	2.250	4.233
36	0.625	2.150	7.740	2.250	0.955
37	0.500	2.150	9.626	2.250	0.000
38	0.375	2.150	11.124	2.250	0.000
39	0.250	2.150	12.212	2.250	0.000
40	0.125	2.150	12.872	2.250	0.000
41	0.000	2.150	13.094	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	10.916	2.250	22.343
2	1.260	-0.150	5.740	2.250	17.802
3	1.120	-0.150	2.250	2.250	13.408
4	0.980	-0.150	2.250	2.824	9.168
5	0.840	-0.150	2.250	5.476	5.081
6	0.700	-0.150	2.250	8.242	1.139
7	0.560	-0.150	2.250	10.542	0.000
8	0.420	-0.150	2.250	12.357	0.000
9	0.280	-0.150	2.250	13.669	0.000
10	0.140	-0.150	2.250	14.463	0.000
11	0.000	-0.150	2.250	14.729	0.000

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+220

Fecha ..... : 29/7/97

HIPOTESIS IV

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	11.622	2.250	22.343
2	1.260	-0.150	6.401	2.250	17.839
3	1.120	-0.150	2.593	2.250	13.470
4	0.980	-0.150	2.250	2.250	9.244
5	0.840	-0.150	2.250	4.848	5.162
6	0.700	-0.150	2.250	7.606	1.218
7	0.560	-0.150	2.250	9.899	0.000
8	0.420	-0.150	2.250	11.709	0.000
9	0.280	-0.150	2.250	13.017	0.000
10	0.140	-0.150	2.250	13.809	0.000
11	0.000	-0.150	2.250	14.074	0.000

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 8.89 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 1.68 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	38.741	-12.793	-11.778	0.300
2	1.400	0.200	38.621	-11.504	-9.477	0.300
3	1.400	0.400	38.381	-8.963	-7.685	0.300
4	1.400	0.600	38.141	-6.482	-6.388	0.300
5	1.400	0.800	37.901	-4.058	-5.577	0.300
6	1.400	1.000	37.661	-1.693	-5.238	0.300
7	1.400	1.200	37.421	0.613	-5.361	0.300
8	1.400	1.400	37.181	2.861	-5.933	0.300
9	1.400	1.600	36.941	5.051	-6.943	0.300
10	1.400	1.800	36.701	7.182	-8.379	0.300
11	1.400	2.000	36.461	9.254	-10.230	0.300
12	1.400	2.015	36.332	10.346	-10.385	0.312
13	1.400	2.030	36.313	10.497	-10.543	0.325
14	1.400	2.045	36.294	10.647	-10.702	0.337
15	1.400	2.060	36.274	10.798	-10.864	0.350
16	1.400	2.075	36.253	10.947	-11.029	0.362
17	1.400	2.090	36.231	11.097	-11.195	0.374
18	1.400	2.105	36.208	11.246	-11.364	0.387
19	1.400	2.120	36.185	11.395	-11.535	0.399
20	1.400	2.135	36.161	11.543	-11.708	0.412
21	1.400	2.150	11.691	-36.137	-11.883	0.424
22	1.385	2.150	11.765	-35.927	-11.344	0.412
23	1.370	2.150	11.765	-35.534	-10.811	0.399
24	1.355	2.150	11.765	-35.141	-10.284	0.387
25	1.340	2.150	11.765	-34.749	-9.763	0.374
26	1.325	2.150	11.765	-34.358	-9.248	0.362
27	1.310	2.150	11.765	-33.968	-8.738	0.350
28	1.295	2.150	11.765	-33.578	-8.234	0.337
29	1.280	2.150	11.765	-33.189	-7.736	0.325
30	1.265	2.150	11.765	-32.801	-7.244	0.312
31	1.250	2.150	11.765	-32.414	-6.758	0.300
32	1.125	2.150	11.765	-30.609	-2.932	0.300
33	1.000	2.150	11.765	-27.387	0.491	0.300
34	0.875	2.150	11.765	-24.165	3.512	0.300
35	0.750	2.150	11.765	-20.943	6.130	0.300
36	0.625	2.150	11.765	-17.721	8.345	0.300
37	0.500	2.150	11.765	-14.499	10.157	0.300
38	0.375	2.150	11.765	-11.277	11.567	0.300
39	0.250	2.150	11.765	-8.055	12.574	0.300
40	0.125	2.150	11.765	-4.833	13.178	0.300
41	0.000	2.150	11.765	-1.611	13.380	0.300

R = 0.38741E+02 M = -.11778E+02 H = -.12793E+02 V = 0.14140E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	6.650	-1.168	11.778	38.741	33.251

1.260	6.472	-1.358	6.666	34.315	32.361
1.120	6.275	-1.448	2.164	30.021	31.373
0.980	6.071	-1.451	-1.747	25.868	30.384
0.840	5.872	-1.380	-5.086	21.857	29.359
0.700	5.687	-1.244	-7.873	17.980	28.437
0.560	5.526	-1.057	-10.126	14.225	27.629
0.420	5.393	-0.829	-11.861	10.573	26.967
0.280	5.295	-0.569	-13.090	7.002	26.476
0.140	5.235	-0.290	-13.824	3.487	26.175
0.000	5.215	0.000	-14.068	0.000	26.073

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	6.655	0.000
2	1.400	0.200	2.250	4.507	0.000
3	1.400	0.400	2.250	3.168	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.574	0.000
10	1.400	1.800	2.250	3.908	0.000
11	1.400	2.000	2.250	5.581	0.000
12	1.400	2.015	2.343	5.232	0.000
13	1.400	2.030	2.436	4.911	0.000
14	1.400	2.045	2.529	4.625	0.000
15	1.400	2.060	2.622	4.654	0.000
16	1.400	2.075	2.715	4.633	0.000
17	1.400	2.090	2.808	4.521	0.000
18	1.400	2.105	2.901	4.404	0.000
19	1.400	2.120	2.994	4.287	0.000
20	1.400	2.135	3.087	4.171	0.000
21	1.400	2.150	3.180	6.238	7.819
22	1.385	2.150	3.087	6.125	8.501
23	1.370	2.150	2.994	6.018	9.094
24	1.355	2.150	2.901	5.908	9.730
25	1.340	2.150	2.808	5.793	10.414
26	1.325	2.150	2.715	5.674	11.152
27	1.310	2.150	2.622	5.550	11.949
28	1.295	2.150	2.529	5.420	12.813
29	1.280	2.150	2.436	5.283	13.753
30	1.265	2.150	2.343	5.138	14.779
31	1.250	2.150	2.250	4.985	15.905
32	1.125	2.150	2.250	2.250	14.068
33	1.000	2.150	2.250	2.250	10.790
34	0.875	2.150	2.312	2.250	7.512
35	0.750	2.150	4.355	2.250	4.233
36	0.625	2.150	6.597	2.250	0.955
37	0.500	2.150	8.477	2.250	0.000
38	0.375	2.150	9.971	2.250	0.000
39	0.250	2.150	11.056	2.250	0.000
40	0.125	2.150	11.714	2.250	0.000
41	0.000	2.150	11.935	2.250	0.000

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_s (Ton)	DISPUESTO ARMADURA	U_s (Ton)
HASTIAL	Interior	10	ϕ 10 A 0.20	17.4
	Exterior	29.5	ϕ 16 A 0.20	44.6
DINTEL	Interior	58.1	ϕ 20 A 0.20	69.6
	Exterior	22.1	ϕ 12 A 0.20	25.1
SOLERA	Inferior	28.4	ϕ 16 A 0.20	44.6
	Superior	65.3	ϕ 20 A 0.20	69.6

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

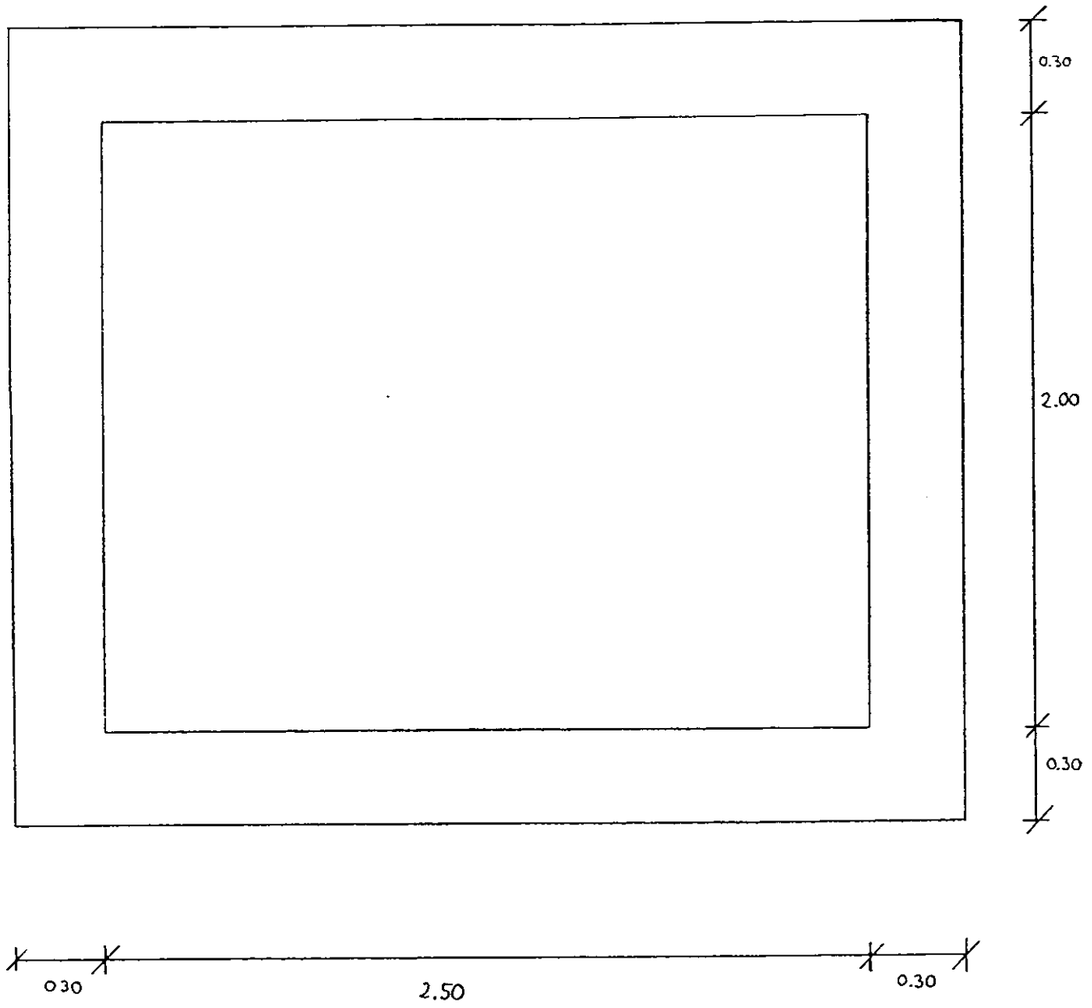
ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL
  - * Elemento: Muro vertical
    Acero: AEH-500 } Cuantía mínima = 0,90 ‰
  - * $A_C = 2 \times 0,3 = 0,6\ m^2$
  - * $A_S = 10.8 \times 10^{-4}\ m^2$ ⇒ $5,4 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 2 m ⇒ $8,64 \times 10^{-4}\ m^2$ por cara } Válido

- DINTEL
  - * Elemento: Muro horizontal
    Acero: AEH-500 } Cuantía mínima = 1,6 ‰
  - * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  - * $A_S = 14,88 \times 10^{-4}\ m^2$ ⇒ $7,44 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

- SOLERA
  - * Elemento: Losa
    Acero: AEH-500 } Cuantía mínima = 1,5 ‰
  - * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  - * $A_S = 14,0 \times 10^{-4}\ m^2$ ⇒ $7,0 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

II. PLANOS



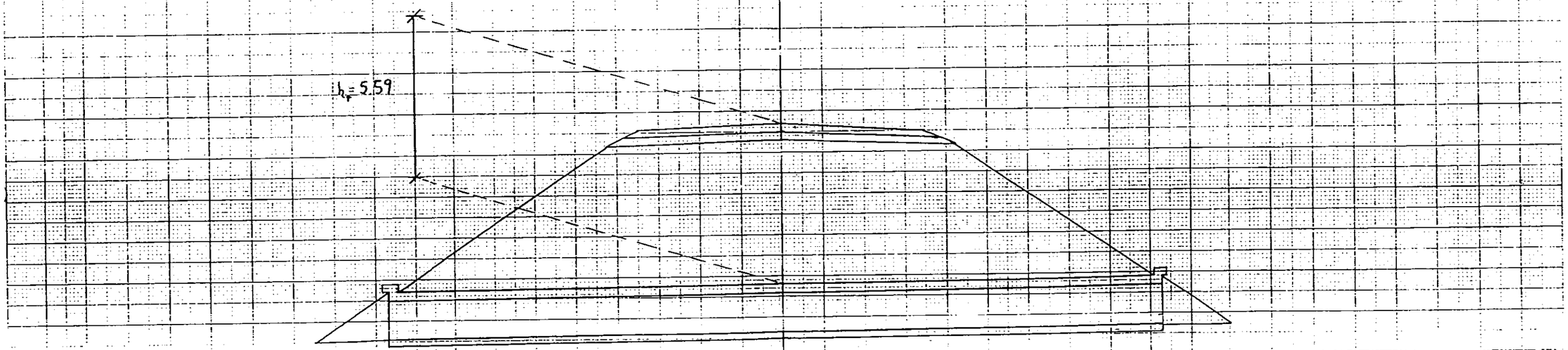
SECCION TRANSVERSAL

DEFINICION GEOMETRICA

ESCALA 1 : 20

O. R. 4+220

SECCION LONGITUDINAL



OBRAS DE RIEGO

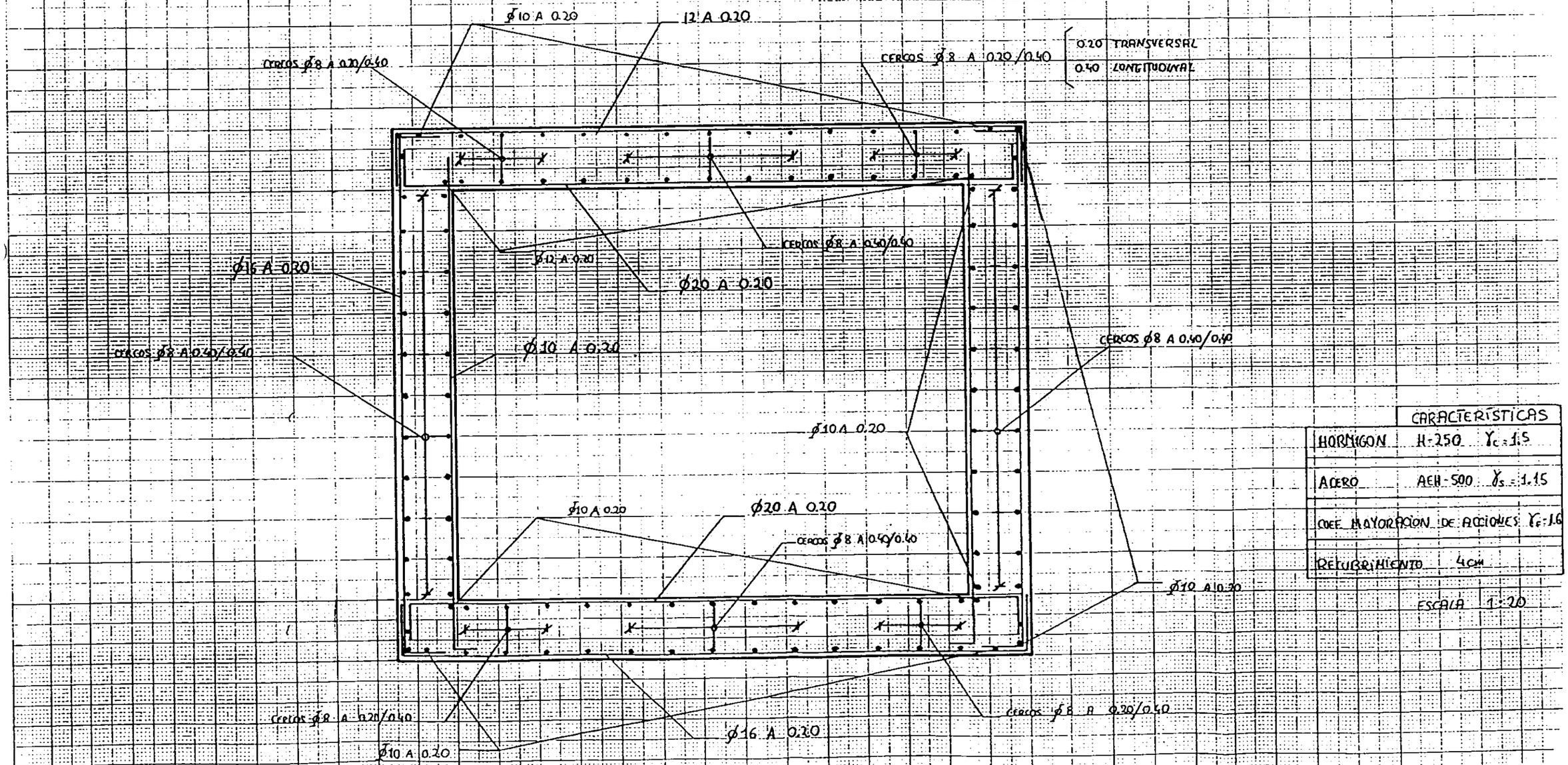
SECCIÓN LONGITUDINAL

ESCALA 1:200

O. R. 4+220

SECCION TRANSVERSAL

ARMADURAS



CARACTERISTICAS		
HORMIGON	H-250	$\gamma_c = 1.5$
ACERO	AEH-500	$\gamma_s = 1.15$
COEF MAYORACION DE ACCIONES		$\gamma_f = 1.6$
RECUBRIMIENTO	4cm	

ESCALA 1:20

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

O.R. 4 + 495

I. CALCULOS

O.R. 4 + 495

SECCION TRANSVERSAL

El presente informe recoge el estudio y dimensionamiento de la sección transversal de la O.R. 4 + 495. Se establecen cuatro hipótesis de cálculo para las que se estudian los esfuerzos y armadura necesarias. Mediante la envolvente de capacidades mecánicas, para las cuatro hipótesis, se llega al dimensionamiento de la sección considerada.

- El informe se esquematiza como sigue:

1 - Datos de proceso
2 - Esquema estructural
3 - Cargas consideradas
4 - Hipótesis de carga
5 - Envolvente de armaduras

- El cálculo de solicitaciones y armaduras necesarias se realiza mediante el programa "ARCO" para cálculo de cajones.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

1. DATOS DE PROCESO

1. DATOS DE PROCESO

Las características de los materiales considerados en el estudio son las siguientes:

- **Hormigón**

  H-250 $\gamma_C = 1,5$

  $\gamma_{HORMIGON} = 2,5$ t/m^3

- **Acero**

  AEH-500 $\gamma_S = 1,15$

  Recubrimiento = 4 cm

- **Tierras**

  Densidad de tierras $\gamma_{TIERRAS} = 2,03$ t/m^3

  Coeficientes de empuje

  ACTIVO, $K_{ACTIVO} = 0,30$

  EN REPOSO, $K_{REPOSO} = 0,45$

- **Módulo de Balasto** 5.000 t/m^3

- **Tensión admisible en cimentación** 2.5 Kg/m^3

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

2. ESQUEMA DE CALCULO

2. ESQUEMA DE CALCULO

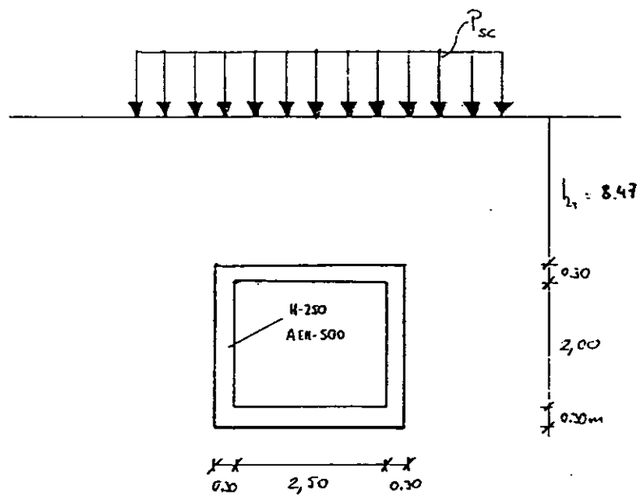


Figura 1. Esquema de Cálculo.

- Altura de Tierras:

  -sobre dintel h_T = 8.47 m

  -sobre cimentación H_T = 10.77 m

- Módulo de reacción en solera: 5.000 t/m^3

La sección mostrada en la Figura 1 ha sido modelizada para el uso del programa "ARCO".

3. CARGAS CONSIDERADAS

3. CARGAS CONSIDERADAS

I. CARGA PERMANENTE

Peso propio del hormigón 2,50 t/m^3.

II. SOBRECARGA

Tren tipo B de la Instrucción Española de Ferrocarriles con reducción del coeficiente de impacto según U.I.C.

$$I = 1{,}66 - 0{,}1\ (h_T - 1) = 1.201$$

$$P_{SC} = \frac{2 \times 12 \times I}{2\ (3 + h_T)} = 1.03 \quad t/m^3$$

III. TERRENO

- Altura de Tierras: $h_T = 8.47$ m

  $H_T = 10.77$ m

- Densidad de Tierras

  $\gamma_{TIERRAS} = 2{,}03$ t/m3

- Coeficiente de empuje

  $K_{ACTIVO} = 0{,}30$

  $K_{REPOSO} = 0{,}45$

Para el cálculo de los esfuerzos en el pórtico se han considerado despreciables los efectos de retracción y temperatura debido a estar el pórtico cubierto por las tierras.

Los posibles desplazamientos originados por las fuerzas horizontales (frenado, fuerza centrífuga) se considera impedidos por la reacción de las tierras, en consecuencia el pórtico se calcula como intraslacional teniendo en cuenta la deformación de las tierra bajo la solera para un coeficiente de balasto medio.

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

4. HIPOTESIS DE CARGA

4. HIPOTESIS CONSIDERADAS

Se han considerado cuatro hipótesis de carga:

1. Tierras hasta dintel, empuje en reposo sin sobrecarga en dintel

2. Empuje máximo, sobrecarga mínima

3. Empuje mínimo, sobrecarga máxima

4. Empuje máximo, sobrecarga máxima

Los cálculos correspondientes a cada una de las hipótesis se acompañan en las páginas siguientes.

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P R O G R A M A

A R C O

CALCULO DE ARCOS, PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+495

Fecha ..... : 29/7/97

HIPOTESIS I

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 2.30 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.0 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	5.016	-2.085	-1.623	0.300
2	1.400	0.200	4.896	-1.867	-1.249	0.300
3	1.400	0.400	4.656	-1.458	-0.958	0.300
4	1.400	0.600	4.416	-1.088	-0.740	0.300
5	1.400	0.800	4.176	-0.757	-0.589	0.300
6	1.400	1.000	3.936	-0.464	-0.496	0.300
7	1.400	1.200	3.696	-0.211	-0.454	0.300
8	1.400	1.400	3.456	0.003	-0.454	0.300
9	1.400	1.600	3.216	0.179	-0.490	0.300
10	1.400	1.800	2.976	0.315	-0.553	0.300
11	1.400	2.000	2.736	0.413	-0.636	0.300
12	1.400	2.015	2.607	0.451	-0.642	0.312
13	1.400	2.030	2.589	0.455	-0.649	0.325
14	1.400	2.045	2.569	0.459	-0.656	0.337
15	1.400	2.060	2.549	0.462	-0.663	0.350
16	1.400	2.075	2.528	0.466	-0.670	0.362
17	1.400	2.090	2.506	0.469	-0.677	0.374
18	1.400	2.105	2.484	0.472	-0.684	0.387
19	1.400	2.120	2.460	0.475	-0.691	0.399
20	1.400	2.135	2.437	0.478	-0.699	0.412
21	1.400	2.150	0.480	-2.412	-0.706	0.424
22	1.385	2.150	0.481	-2.383	-0.670	0.412
23	1.370	2.150	0.481	-2.351	-0.635	0.399
24	1.355	2.150	0.481	-2.320	-0.600	0.387
25	1.340	2.150	0.481	-2.289	-0.566	0.374
26	1.325	2.150	0.481	-2.260	-0.532	0.362
27	1.310	2.150	0.481	-2.231	-0.498	0.350
28	1.295	2.150	0.481	-2.202	-0.465	0.337
29	1.280	2.150	0.481	-2.175	-0.433	0.325
30	1.265	2.150	0.481	-2.148	-0.400	0.312
31	1.250	2.150	0.481	-2.122	-0.369	0.300
32	1.125	2.150	0.481	-2.004	-0.118	0.300
33	1.000	2.150	0.481	-1.793	0.106	0.300
34	0.875	2.150	0.481	-1.582	0.304	0.300
35	0.750	2.150	0.481	-1.371	0.475	0.300
36	0.625	2.150	0.481	-1.160	0.620	0.300
37	0.500	2.150	0.481	-0.949	0.739	0.300
38	0.375	2.150	0.481	-0.738	0.831	0.300
39	0.250	2.150	0.481	-0.527	0.897	0.300
40	0.125	2.150	0.481	-0.316	0.936	0.300
41	0.000	2.150	0.481	-0.105	0.950	0.300

R = 0.50165E+01 M = -.16227E+01 H = -.20850E+01 V = 0.10674E-03m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	1.157	-0.132	1.623	5.016	5.786

1.260	1.137	-0.159	0.960	4.449	5.684
1.120	1.113	-0.172	0.376	3.896	5.567
0.980	1.089	-0.175	-0.131	3.360	5.445
0.840	1.065	-0.168	-0.565	2.842	5.325
0.700	1.042	-0.152	-0.928	2.339	5.212
0.560	1.023	-0.130	-1.221	1.852	5.113
0.420	1.006	-0.102	-1.447	1.377	5.032
0.280	0.994	-0.070	-1.607	0.912	4.972
0.140	0.987	-0.036	-1.703	0.454	4.935
0.000	0.984	0.000	-1.735	0.000	4.922

ARMADURAS EN EL ARCO

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	2.250	0.000
2	1.400	0.200	2.250	2.250	0.000
3	1.400	0.400	2.250	2.250	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.250	0.000
10	1.400	1.800	2.250	2.250	0.000
11	1.400	2.000	2.250	2.250	0.000
12	1.400	2.015	2.343	2.343	0.000
13	1.400	2.030	2.436	2.436	0.000
14	1.400	2.045	2.529	2.529	0.000
15	1.400	2.060	2.622	2.622	0.000
16	1.400	2.075	2.715	2.715	0.000
17	1.400	2.090	2.808	2.808	0.000
18	1.400	2.105	2.901	2.901	0.000
19	1.400	2.120	2.994	2.994	0.000
20	1.400	2.135	3.087	3.087	0.000
21	1.400	2.150	3.180	3.180	0.000
22	1.385	2.150	3.087	3.087	0.000
23	1.370	2.150	2.994	2.994	0.000
24	1.355	2.150	2.901	2.901	0.000
25	1.340	2.150	2.808	2.808	0.000
26	1.325	2.150	2.715	2.715	0.000
27	1.310	2.150	2.622	2.622	0.000
28	1.295	2.150	2.529	2.529	0.000
29	1.280	2.150	2.436	2.436	0.000
30	1.265	2.150	2.343	2.343	0.000
31	1.250	2.150	2.250	2.250	0.000
32	1.125	2.150	2.250	2.250	0.000
33	1.000	2.150	2.250	2.250	0.000
34	0.875	2.150	2.250	2.250	0.000
35	0.750	2.150	2.250	2.250	0.000
36	0.625	2.150	2.250	2.250	0.000
37	0.500	2.150	2.250	2.250	0.000
38	0.375	2.150	2.250	2.250	0.000
39	0.250	2.150	2.250	2.250	0.000
40	0.125	2.150	2.250	2.250	0.000
41	0.000	2.150	2.250	2.250	0.000

ARMADURAS EN LA LOSA

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	2.250	2.250	0.000
2	1.260	-0.150	2.250	2.250	0.000
3	1.120	-0.150	2.250	2.250	0.000
4	0.980	-0.150	2.250	2.250	0.000
5	0.840	-0.150	2.250	2.250	0.000
6	0.700	-0.150	2.250	2.250	0.000
7	0.560	-0.150	2.250	2.250	0.000
8	0.420	-0.150	2.250	2.250	0.000
9	0.280	-0.150	2.250	2.250	0.000
10	0.140	-0.150	2.250	2.250	0.000
11	0.000	-0.150	2.250	2.250	0.000

IBM

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+495

Fecha ..... : 29/7/97

HIPOTESIS II

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.77 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 0.00 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m³

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E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	43.531	-15.681	-13.445	0.300
2	1.400	0.200	43.411	-14.117	-10.622	0.300
3	1.400	0.400	43.171	-11.027	-8.416	0.300
4	1.400	0.600	42.931	-7.996	-6.817	0.300
5	1.400	0.800	42.691	-5.023	-5.813	0.300
6	1.400	1.000	42.451	-2.108	-5.391	0.300
7	1.400	1.200	42.211	0.748	-5.541	0.300
8	1.400	1.400	41.971	3.545	-6.250	0.300
9	1.400	1.600	41.731	6.284	-7.506	0.300
10	1.400	1.800	41.491	8.965	-9.299	0.300
11	1.400	2.000	41.251	11.587	-11.617	0.300
12	1.400	2.015	41.122	12.974	-11.811	0.312
13	1.400	2.030	41.103	13.166	-12.009	0.325
14	1.400	2.045	41.084	13.358	-12.209	0.337
15	1.400	2.060	41.064	13.549	-12.412	0.350
16	1.400	2.075	41.043	13.740	-12.619	0.362
17	1.400	2.090	41.021	13.931	-12.828	0.374
18	1.400	2.105	40.998	14.121	-13.039	0.387
19	1.400	2.120	40.975	14.311	-13.254	0.399
20	1.400	2.135	40.951	14.501	-13.472	0.412
21	1.400	2.150	14.690	-40.927	-13.692	0.424
22	1.385	2.150	14.785	-40.692	-13.082	0.412
23	1.370	2.150	14.785	-40.247	-12.478	0.399
24	1.355	2.150	14.785	-39.803	-11.881	0.387
25	1.340	2.150	14.785	-39.360	-11.290	0.374
26	1.325	2.150	14.785	-38.917	-10.707	0.362
27	1.310	2.150	14.785	-38.476	-10.129	0.350
28	1.295	2.150	14.785	-38.035	-9.559	0.337
29	1.280	2.150	14.785	-37.595	-8.995	0.325
30	1.265	2.150	14.785	-37.155	-8.438	0.312
31	1.250	2.150	14.785	-36.716	-7.887	0.300
32	1.125	2.150	14.785	-34.672	-3.553	0.300
33	1.000	2.150	14.785	-31.023	0.325	0.300
34	0.875	2.150	14.785	-27.373	3.747	0.300
35	0.750	2.150	14.785	-23.723	6.712	0.300
36	0.625	2.150	14.785	-20.073	9.221	0.300
37	0.500	2.150	14.785	-16.424	11.274	0.300
38	0.375	2.150	14.785	-12.774	12.871	0.300
39	0.250	2.150	14.785	-9.124	14.011	0.300
40	0.125	2.150	14.785	-5.475	14.696	0.300
41	0.000	2.150	14.785	-1.825	14.924	0.300

R = 0.43531E+02 M = -.13445E+02 H = -.15681E+02 V = 0.15677E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	7.424	-1.271	13.445	43.531	37.119
1.260	7.229	-1.489	7.700	38.569	36.146
1.120	7.012	-1.595	2.639	33.752	35.021
0.980	6.787	-1.603	-1.758	29.090	33.937
0.840	6.567	-1.526	-5.513	24.584	32.837
0.700	6.363	-1.378	-8.648	20.228	31.817
0.560	6.184	-1.172	-11.183	16.006	30.921
0.420	6.037	-0.919	-13.135	11.898	30.187
0.280	5.928	-0.632	-14.519	7.880	29.642
0.140	5.861	-0.322	-15.345	3.925	29.307
0.000	5.839	0.000	-15.619	-0.000	29.195

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A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	7.953	0.000
2	1.400	0.200	2.250	5.199	0.000
3	1.400	0.400	2.250	3.348	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.580	0.000
10	1.400	1.800	2.250	3.973	0.000
11	1.400	2.000	2.250	6.558	0.000
12	1.400	2.015	2.343	6.156	0.000
13	1.400	2.030	2.436	5.789	0.000
14	1.400	2.045	2.529	5.464	0.000
15	1.400	2.060	2.622	5.173	0.000
16	1.400	2.075	2.715	4.911	0.000
17	1.400	2.090	2.808	5.027	0.000
18	1.400	2.105	2.901	4.981	0.000
19	1.400	2.120	2.994	4.885	0.000
20	1.400	2.135	3.087	4.785	0.000
21	1.400	2.150	3.180	7.088	11.119
22	1.385	2.150	3.087	6.965	11.893
23	1.370	2.150	2.994	6.850	12.565
24	1.355	2.150	2.901	6.731	13.286
25	1.340	2.150	2.808	6.609	14.062
26	1.325	2.150	2.715	6.481	14.897
27	1.310	2.150	2.622	6.349	15.800
28	1.295	2.150	2.529	6.210	16.780
29	1.280	2.150	2.436	6.065	17.845
30	1.265	2.150	2.343	5.911	19.008
31	1.250	2.150	2.250	5.749	20.282
32	1.125	2.150	2.250	2.250	18.202
33	1.000	2.150	2.250	2.250	14.489
34	0.875	2.150	2.250	2.250	10.775
35	0.750	2.150	4.554	2.250	7.062
36	0.625	2.150	7.127	2.250	3.348
37	0.500	2.150	9.294	2.250	0.000
38	0.375	2.150	11.022	2.250	0.000
39	0.250	2.150	12.282	2.250	0.000
40	0.125	2.150	13.048	2.250	0.000
41	0.000	2.150	13.305	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	13.399	2.250	27.216
2	1.260	-0.150	7.432	2.250	22.167
3	1.120	-0.150	3.046	2.250	17.266
4	0.980	-0.150	2.250	2.250	12.522
5	0.840	-0.150	2.250	5.266	7.938
6	0.700	-0.150	2.250	8.388	3.505
7	0.560	-0.150	2.250	10.997	0.000
8	0.420	-0.150	2.250	13.066	0.000
9	0.280	-0.150	2.250	14.566	0.000
10	0.140	-0.150	2.250	15.477	0.000
11	0.000	-0.150	2.250	15.782	0.000

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Ordenador Personal

P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R.4+495

Fecha ..... : 29/7/97

HIPOTESIS III

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 0

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.77 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.30
SOBRECARGA q ..... = 1.03 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m
COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	45.838	-10.364	-13.186	0.300
2	1.400	0.200	45.718	-9.321	-11.321	0.300
3	1.400	0.400	45.478	-7.262	-9.869	0.300
4	1.400	0.600	45.238	-5.241	-8.821	0.300
5	1.400	0.800	44.998	-3.259	-8.169	0.300
6	1.400	1.000	44.758	-1.316	-7.906	0.300
7	1.400	1.200	44.518	0.588	-8.024	0.300
8	1.400	1.400	44.278	2.453	-8.514	0.300
9	1.400	1.600	44.038	4.279	-9.370	0.300
10	1.400	1.800	43.798	6.066	-10.583	0.300
11	1.400	2.000	43.558	7.814	-12.146	0.300
12	1.400	2.015	43.429	8.739	-12.277	0.312
13	1.400	2.030	43.411	8.867	-12.410	0.325
14	1.400	2.045	43.391	8.995	-12.545	0.337
15	1.400	2.060	43.371	9.123	-12.682	0.350
16	1.400	2.075	43.350	9.250	-12.821	0.362
17	1.400	2.090	43.328	9.377	-12.961	0.374
18	1.400	2.105	43.306	9.504	-13.104	0.387
19	1.400	2.120	43.282	9.631	-13.248	0.399
20	1.400	2.135	43.258	9.757	-13.395	0.412
21	1.400	2.150	9.883	-43.234	-13.543	0.424
22	1.385	2.150	9.946	-42.986	-12.898	0.412
23	1.370	2.150	9.946	-42.517	-12.260	0.399
24	1.355	2.150	9.946	-42.048	-11.630	0.387
25	1.340	2.150	9.946	-41.580	-11.006	0.374
26	1.325	2.150	9.946	-41.113	-10.389	0.362
27	1.310	2.150	9.946	-40.647	-9.780	0.350
28	1.295	2.150	9.946	-40.181	-9.177	0.337
29	1.280	2.150	9.946	-39.716	-8.581	0.325
30	1.265	2.150	9.946	-39.252	-7.992	0.312
31	1.250	2.150	9.946	-38.789	-7.411	0.300
32	1.125	2.150	9.946	-36.629	-2.832	0.300
33	1.000	2.150	9.946	-32.774	1.265	0.300
34	0.875	2.150	9.946	-28.918	4.880	0.300
35	0.750	2.150	9.946	-25.062	8.012	0.300
36	0.625	2.150	9.946	-21.206	10.663	0.300
37	0.500	2.150	9.946	-17.351	12.832	0.300
38	0.375	2.150	9.946	-13.495	14.519	0.300
39	0.250	2.150	9.946	-9.639	15.724	0.300
40	0.125	2.150	9.946	-5.784	16.447	0.300
41	0.000	2.150	9.946	-1.928	16.688	0.300

R = 0.45838E+02 M = -.13186E+02 H = -.10364E+02 V = 0.17892E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	7.892	-1.528	13.186	45.838	39.458
1.260	7.662	-1.737	7.139	40.561	38.308

1.120	7.411	-1.829	1.820	35.453	37.053
0.980	7.154	-1.817	-2.796	30.524	35.771
0.840	6.906	-1.718	-6.734	25.771	34.529
0.700	6.677	-1.543	-10.020	21.187	33.384
0.560	6.477	-1.307	-12.674	16.753	32.384
0.420	6.313	-1.022	-14.716	12.447	31.566
0.280	6.192	-0.701	-16.164	8.241	30.961
0.140	6.118	-0.357	-17.027	4.103	30.590
0.000	6.093	0.000	-17.314	0.000	30.465

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	7.426	0.000
2	1.400	0.200	2.250	5.715	0.000
3	1.400	0.400	2.250	4.125	0.000
4	1.400	0.600	2.250	3.509	0.000
5	1.400	0.800	2.250	2.897	0.000
6	1.400	1.000	2.250	2.641	0.000
7	1.400	1.200	2.250	2.800	0.000
8	1.400	1.400	2.250	3.323	0.000
9	1.400	1.600	2.250	3.908	0.000
10	1.400	1.800	2.250	5.111	0.000
11	1.400	2.000	2.250	6.893	0.000
12	1.400	2.015	2.343	6.385	0.000
13	1.400	2.030	2.436	5.923	0.000
14	1.400	2.045	2.529	5.513	0.000
15	1.400	2.060	2.622	5.145	0.000
16	1.400	2.075	2.715	4.841	0.000
17	1.400	2.090	2.808	4.960	0.000
18	1.400	2.105	2.901	4.814	0.000
19	1.400	2.120	2.994	4.660	0.000
20	1.400	2.135	3.087	4.501	0.000
21	1.400	2.150	3.180	7.574	12.709
22	1.385	2.150	3.087	7.428	13.526
23	1.370	2.150	2.994	7.285	14.237
24	1.355	2.150	2.901	7.137	14.999
25	1.340	2.150	2.808	6.983	15.818
26	1.325	2.150	2.715	6.821	16.701
27	1.310	2.150	2.622	6.652	17.656
28	1.295	2.150	2.529	6.474	18.690
29	1.280	2.150	2.436	6.286	19.816
30	1.265	2.150	2.343	6.087	21.044
31	1.250	2.150	2.250	5.874	22.391
32	1.125	2.150	2.250	2.250	20.194
33	1.000	2.150	2.250	2.250	16.271
34	0.875	2.150	3.780	2.250	12.347
35	0.750	2.150	6.485	2.250	8.424
36	0.625	2.150	9.232	2.250	4.501
37	0.500	2.150	11.552	2.250	0.578
38	0.375	2.150	13.406	2.250	0.000
39	0.250	2.150	14.760	2.250	0.000
40	0.125	2.150	15.585	2.250	0.000
41	0.000	2.150	15.862	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	13.120	2.250	29.564
2	1.260	-0.150	6.872	2.250	24.194
3	1.120	-0.150	2.250	2.250	18.997
4	0.980	-0.150	2.250	3.185	13.981
5	0.840	-0.150	2.250	6.469	9.146
6	0.700	-0.150	2.250	9.789	4.481
7	0.560	-0.150	2.250	12.572	0.000
8	0.420	-0.150	2.250	14.783	0.000
9	0.280	-0.150	2.250	16.390	0.000
10	0.140	-0.150	2.250	17.366	0.000
11	0.000	-0.150	2.250	17.693	0.000

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IBM

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P R O G R A M A

A R C O

CALCULO DE ARCOS,PASOS INFERIORES Y GALERIAS ENTERRADAS

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P R O Y E C T O : L.A.V. SUBTRAMO I

Referencia ..... : O.R. 4+495

Fecha ..... : 29/7/97

HIPOTESIS IV

D A T O S D E L A E S T R U C T U R A

NUMERO DE SEGMENTOS ..... = 40
SALTO ..... = 1

TIPO DE GEOMETRIA :

TIPO 0 : POLIGONAL ARBITRARIA DADA POR COORDENADAS
TIPO 1 : ARCO CIRCULAR DEFINIDO POR .....: f,a
TIPO 2 : PARABOLA CON y'(0)=0, DEFINIDA POR.....: f,a
TIPO 3 : PARABOLA CON y'(0)=0, DEFINIDA POR .....: a,c,b
TIPO 4 : PARABOLA CON y'(0)<>0 DEFINIDA POR .....:f,a,c,b
TIPO 5 : CUBICA CON y'(0)=0 DEFINIDA POR .....:f,a,c,b
TIPO 6 : PORTICO CIRCULAR DEFINIDO POR .....:f,a,H,B
TIPO 7 : CURVA GENERAL DEFINIDA POR PUNTOS DE PASO
TIPO 8 : GEOMETRIA ANTERIOR ALMACENADA EN FICHERO DE DATOS

2a = CUERDA , f = FLECHA , (c,b) = COORDENADAS DE UN PUNTO

TIPO = 8

TIPO DE CONDICIONES DE APOYO :

TIPO 0 : TRIARTICULADO (EN APOYOS Y CLAVE)
TIPO 1 : BIARTICULADO (EN APOYOS)
TIPO 2 : EMPOTRADO EN EXTREMOS
TIPO 3 : EMPOTRADO EN EXTREMOS CON ROTULA EN CLAVE
TIPO 4 : EMPOTRADO ELASTICAMENTE
TIPO 5 : ATIRANTADO EN EXTREMOS

TIPO = 2

ESPESOR DEL ARCO ..... = 0.300 m
PESO ESPECIFICO DEL HORMIGON ..... = 2.50 t/m3
RESISTENCIA CARACTERISTICA DEL HORMIGON ..... fck = 250 Kp/cm²
COEFICIENTE DE MINORACION DE fck ..... ¥c = 1.50
LIMITE ELASTICO CARACTERISTICO DEL ACERO .... fyk = 5100 Kp/cm²
COEFICIENTE DE MINORACION DE fyk ..... ¥s = 1.15
RECUBRIMIENTO DE LAS ARMADURAS ..... c = 4 cm
SE DISPONEN ARMADURAS MINIMAS DE FLEXOCOMPRESION

ALTURA DE TIERRAS DESDE LA BASE ..... = 10.77 m
PESO ESPECIFICO DE LAS TIERRAS ..... = 2.03 t/m3
COEFICIENTE EMPUJE TIERRAS ..... = 0.45
SOBRECARGA q ..... = 1.03 t/m²

CARGAS CONCENTRADAS EN LOS NUDOS : NINGUNA

COEFICIENTE DE MAYORACION DE LAS CARGAS ..... ¥f = 1.60

EXISTE LOSA DE CIMENTACION :

SOBRECARGA DE LA LOSA DE CIMENTACION ..... Q = 0.00 t/m²
CANTO DE LA LOSA DE CIMENTACION ..... t = 0.30 m

COEFICIENTE DE BALASTO DEL TERRENO ..... K = 5000 t/m3

E S F U E R Z O S E N E L A R C O

SEC	X (m)	Y (m)	AXIL (t/m)	CORTANTE (t/m)	FLECTOR (txm/m)	ESPESOR (m)
1	1.400	0.000	45.838	-15.647	-14.017	0.300
2	1.400	0.200	45.718	-14.082	-11.201	0.300
3	1.400	0.400	45.478	-10.993	-9.002	0.300
4	1.400	0.600	45.238	-7.961	-7.410	0.300
5	1.400	0.800	44.998	-4.988	-6.412	0.300
6	1.400	1.000	44.758	-2.074	-5.998	0.300
7	1.400	1.200	44.518	0.782	-6.154	0.300
8	1.400	1.400	44.278	3.580	-6.870	0.300
9	1.400	1.600	44.038	6.319	-8.134	0.300
10	1.400	1.800	43.798	8.999	-9.934	0.300
11	1.400	2.000	43.558	11.621	-12.258	0.300
12	1.400	2.015	43.429	13.009	-12.453	0.312
13	1.400	2.030	43.411	13.201	-12.651	0.325
14	1.400	2.045	43.391	13.393	-12.852	0.337
15	1.400	2.060	43.371	13.584	-13.056	0.350
16	1.400	2.075	43.350	13.775	-13.262	0.362
17	1.400	2.090	43.328	13.965	-13.472	0.374
18	1.400	2.105	43.306	14.156	-13.684	0.387
19	1.400	2.120	43.282	14.346	-13.899	0.399
20	1.400	2.135	43.258	14.535	-14.117	0.412
21	1.400	2.150	14.725	-43.234	-14.338	0.424
22	1.385	2.150	14.819	-42.986	-13.693	0.412
23	1.370	2.150	14.819	-42.517	-13.056	0.399
24	1.355	2.150	14.819	-42.048	-12.425	0.387
25	1.340	2.150	14.819	-41.580	-11.801	0.374
26	1.325	2.150	14.819	-41.113	-11.184	0.362
27	1.310	2.150	14.819	-40.647	-10.575	0.350
28	1.295	2.150	14.819	-40.181	-9.972	0.337
29	1.280	2.150	14.819	-39.716	-9.376	0.325
30	1.265	2.150	14.819	-39.252	-8.788	0.312
31	1.250	2.150	14.819	-38.789	-8.206	0.300
32	1.125	2.150	14.819	-36.629	-3.627	0.300
33	1.000	2.150	14.819	-32.774	0.470	0.300
34	0.875	2.150	14.819	-28.918	4.084	0.300
35	0.750	2.150	14.819	-25.062	7.217	0.300
36	0.625	2.150	14.819	-21.206	9.868	0.300
37	0.500	2.150	14.819	-17.351	12.037	0.300
38	0.375	2.150	14.819	-13.495	13.724	0.300
39	0.250	2.150	14.819	-9.639	14.929	0.300
40	0.125	2.150	14.819	-5.784	15.652	0.300
41	0.000	2.150	14.819	-1.928	15.893	0.300

R = 0.45838E+02 M = -.14017E+02 H = -.15647E+02 V = 0.16743E-02m

LONGITUD DEL SEMIARCO = 3.550 LONGITUD DE TRANSPORTE = 2.566

LOSA DE CIMENTACION SOBRE TERRENO ELASTICO

X (m)	W (mm)	GIRO (1000xrad)	FLECTOR (txm/m)	CORTANTE (t/m)	REACCION (t/m)
1.400	7.817	-1.366	14.017	45.838	39.086
1.260	7.609	-1.592	7.968	40.606	38.043
1.120	7.377	-1.701	2.641	35.528	36.884
0.980	7.137	-1.706	-1.988	30.616	35.686
0.840	6.903	-1.623	-5.940	25.870	34.516
0.700	6.686	-1.465	-9.239	21.283	33.431
0.560	6.496	-1.245	-11.906	16.839	32.480
0.420	6.340	-0.976	-13.959	12.517	31.700
0.280	6.224	-0.671	-15.415	8.290	31.122
0.140	6.153	-0.341	-16.284	4.128	30.767
0.000	6.129	0.000	-16.572	0.000	30.647

A R M A D U R A S E N E L A R C O

SEC	X (m)	Y (m)	Ainterior (cm²/m)	Aexterior (cm²/m)	Acortante (cm²/m)
1	1.400	0.000	2.250	8.360	0.000
2	1.400	0.200	2.250	5.579	0.000
3	1.400	0.400	2.250	3.647	0.000
4	1.400	0.600	2.250	2.250	0.000
5	1.400	0.800	2.250	2.250	0.000
6	1.400	1.000	2.250	2.250	0.000
7	1.400	1.200	2.250	2.250	0.000
8	1.400	1.400	2.250	2.250	0.000
9	1.400	1.600	2.250	2.973	0.000
10	1.400	1.800	2.250	4.393	0.000
11	1.400	2.000	2.250	7.020	0.000
12	1.400	2.015	2.343	6.572	0.000
13	1.400	2.030	2.436	6.165	0.000
14	1.400	2.045	2.529	5.805	0.000
15	1.400	2.060	2.622	5.482	0.000
16	1.400	2.075	2.715	5.193	0.000
17	1.400	2.090	2.808	5.027	0.000
18	1.400	2.105	2.901	5.148	0.000
19	1.400	2.120	2.994	5.049	0.000
20	1.400	2.135	3.087	4.944	0.000
21	1.400	2.150	3.180	7.522	12.709
22	1.385	2.150	3.087	7.390	13.526
23	1.370	2.150	2.994	7.266	14.237
24	1.355	2.150	2.901	7.138	14.999
25	1.340	2.150	2.808	7.005	15.818
26	1.325	2.150	2.715	6.867	16.701
27	1.310	2.150	2.622	6.724	17.656
28	1.295	2.150	2.529	6.573	18.690
29	1.280	2.150	2.436	6.415	19.816
30	1.265	2.150	2.343	6.248	21.044
31	1.250	2.150	2.250	6.072	22.391
32	1.125	2.150	2.250	2.250	20.194
33	1.000	2.150	2.250	2.250	16.271
34	0.875	2.150	2.487	2.250	12.347
35	0.750	2.150	5.061	2.250	8.424
36	0.625	2.150	7.799	2.250	4.501
37	0.500	2.150	10.110	2.250	0.578
38	0.375	2.150	11.958	2.250	0.000
39	0.250	2.150	13.307	2.250	0.000
40	0.125	2.150	14.128	2.250	0.000
41	0.000	2.150	14.404	2.250	0.000

A R M A D U R A S E N L A L O S A

SEC	X (m)	Y (m)	Ainferior (cm²/m)	Asuperior (cm²/m)	Acortante (cm²/m)
1	1.400	-0.150	14.019	2.250	29.564
2	1.260	-0.150	7.701	2.250	24.240
3	1.120	-0.150	3.047	2.250	19.073
4	0.980	-0.150	2.250	2.415	14.075
5	0.840	-0.150	2.250	5.684	9.246
6	0.700	-0.150	2.250	8.988	4.579
7	0.560	-0.150	2.250	11.756	0.057
8	0.420	-0.150	2.250	13.956	0.000
9	0.280	-0.150	2.250	15.554	0.000
10	0.140	-0.150	2.250	16.525	0.000
11	0.000	-0.150	2.250	16.851	0.000

LINEA DE ALTA VELOCIDAD.
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

5. ENVOLVENTE DE CAPACIDADES MECANICAS

5. ENVOLVENTE DE CAPACIDADES MECANICAS

El cajón se divide en tres elementos estructurales: solera, hastial y dintel. Para cada elemento se calcula la capacidad mecánica máxima requerida por las cuatro hipótesis y consecuentemente se establece el armado. Las capacidades mécanicas máximas requeridas y dispuestas en cada uno de los elementos del cajón son recogidas en el siguiente cuadro:

ELEMENTO	ARMADURA	REQUERIDO U_s (Ton)	DISPUESTO ARMADURA	U_s (Ton)
HASTIAL	Interior	10	ϕ 10 A 0.20	17.4
	Exterior	37.1	ϕ 16 A 0.20	44.6
DINTEL	Interior	62.3	ϕ 20 A 0.20	69.6
	Exterior	27	ϕ 16 A 0.20	44.6
SOLERA	Inferior	34.1	ϕ 16 A 0.20	44.6
	Superior	78.5	ϕ 25 A 0.20	108.8

La armadura longitudinal se dispone según EH-91 como se explica en la siguiente página.

ARMADURA LONGITUDINAL (REPARTO)

- HASTIAL

  * Elemento: Muro vertical
    Acero: AEH-500 } Cuantía mínima = 0,90 ‰
  * $A_C = 2 \times 0,3 = 0,6\ m^2$
  * $A_S = 10.8 \times 10^{-4}\ m^2$ ⇒ $5,4 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 2 m ⇒ $8,64 \times 10^{-4}\ m^2$ por cara } Válido

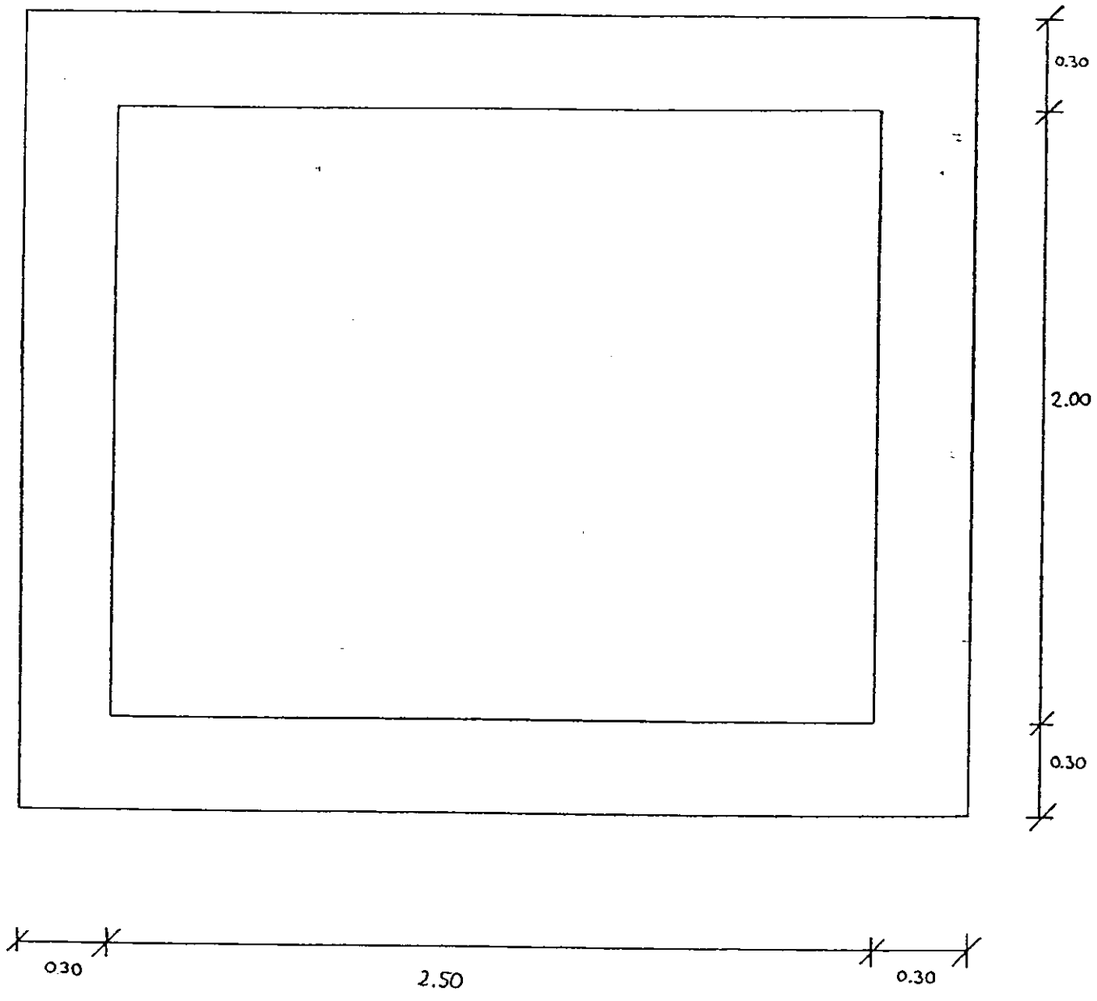
- DINTEL

  * Elemento: Muro horizontal
    Acero: AEH-500 } Cuantía mínima = 1,6 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,88 \times 10^{-4}\ m^2$ ⇒ $7,44 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

- SOLERA

  * Elemento: Losa
    Acero: AEH-500 } Cuantía mínima = 1,5 ‰
  * $A_C = 3,1 \times 0,3 = 0,93\ m^2$
  * $A_S = 14,0 \times 10^{-4}\ m^2$ ⇒ $7,0 \times 10^{-4}\ m^2$ por cara
    Φ 10 A 0,20 en 3,1 m ⇒ $10,21 \times 10^{-4}\ m^2$ por cara } Válido

II. PLANOS



SECCION TRANSVERSAL

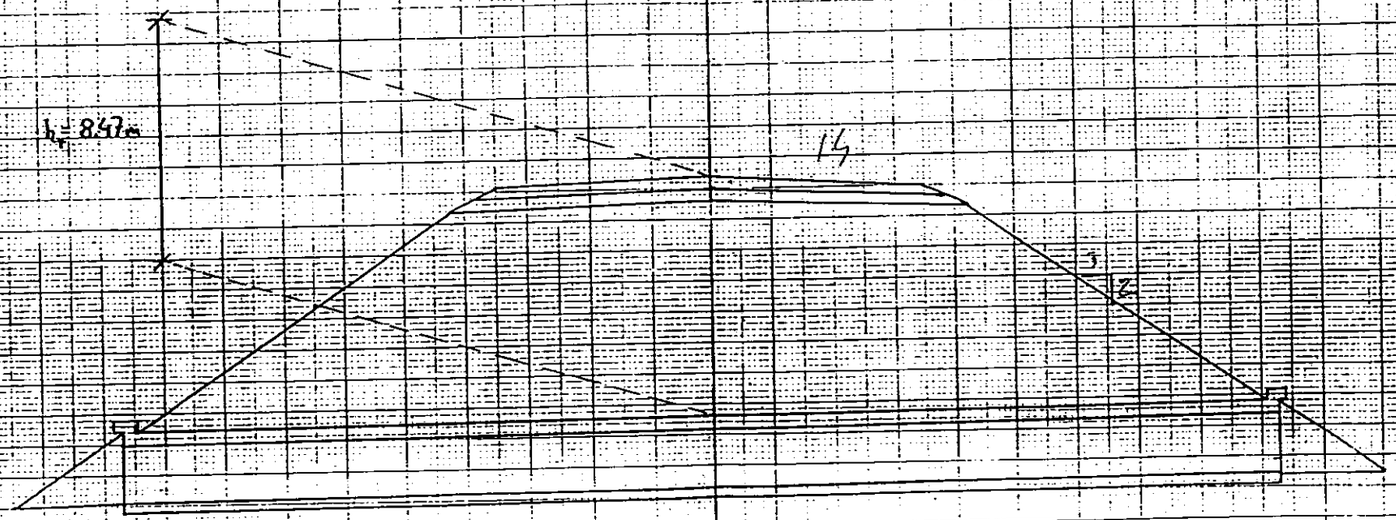
DEFINICION GEOMETRICA

ESCALA 1 : 20

272

O. R. 4+495

SECCION LONGITUDINAL



OBRAS DE RIEGO

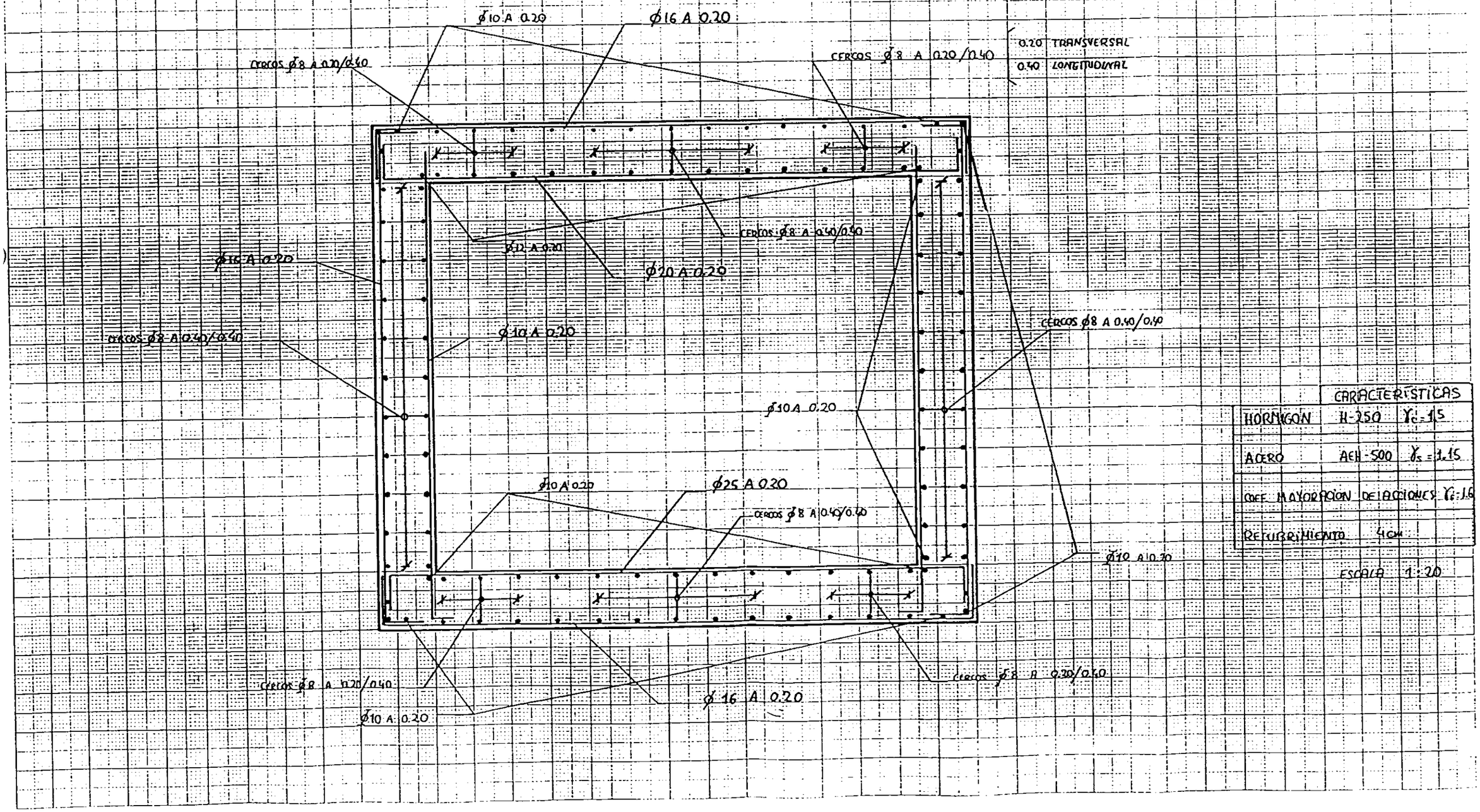
SECCIÓN LONGITUDINAL

ESCALA 1:200

O. R. 4+495

SECCION TRANSVERSAL

ARMADURAS



CARACTERISTICAS		
HORMIGON	H-250	$\gamma_c = 1.5$
ACERO	AEH-500	$\gamma_s = 1.15$
COEF MAYORACION DE ACCIONES		$\gamma_f = 1.6$
RECUBRIMIENTO	4 cm	

ESCALA 1:20

LINEA DE ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

OBRAS DE RIEGO.

ALETAS.

ALETAS PARA OBRAS DE RIEGO.

El presente informe recoge el cálculo de la seción tipo de las aletas definidas para las Obras de Riego. Se recogen en el mismo los siguientes aspectos:

- Características del terreno y de los materiales.
- Definición geometrica de la sección.
- Estudio de tensiones admisibles por el terreno.
- Coeficientes de seguridad al vuelco y al deslizamiento.
- Armado de la seeción.

El cálculo se ha realizado según la teoría de Coulomb para suelos granulares recogida pod J. Calavera en su libro "MUROS DE CONTENCION Y MUROS DE SOTANO".

LINEA DE ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA. SUBTRAMO I

I. CALCULOS

CARACTERISTICAS DEL RELLENO Y LOS MATERIALES.

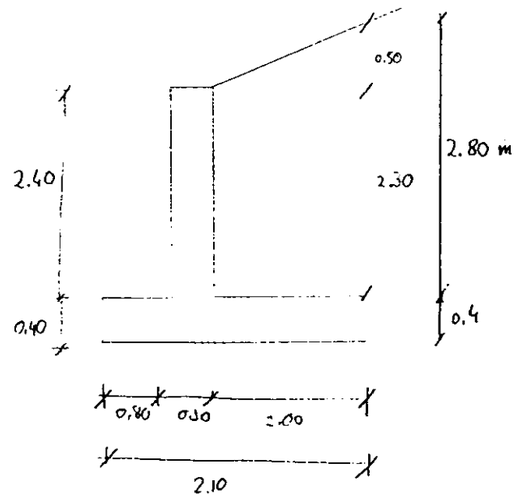
CARACTERISTICAS DEL RELLENO.

PESO ESPECIFICO (t/m^3):	1.90
ANGULO DE ROZAMIENTO Φ :	33.00°
ANGULO DE ROZAMIENTO TERRENO-MURO $\Phi = \delta$	33.00°
(Hipótesis de Coulomb)	
ANGULO DE ROZAMIENTO DEL TERRENO β	26.56°
PENDIENTE DE INCLINACION DEL TRASDOS:	86.16°

CARACTERISTICAS DE LOS MATERIALES:

RESISTENCIA CARACTERISTICA DEL HORMIGON:	250	Kg/cm^2
LIMITE ELASTICO DEL ACERO:	5100	Kg/cm^2
RECUBRIMIENTO DE LAS ARMADURAS	4	cm

I CÁLCULOS. EMPUJES.



$\rho = \delta = 33°$

$\alpha = 90°$

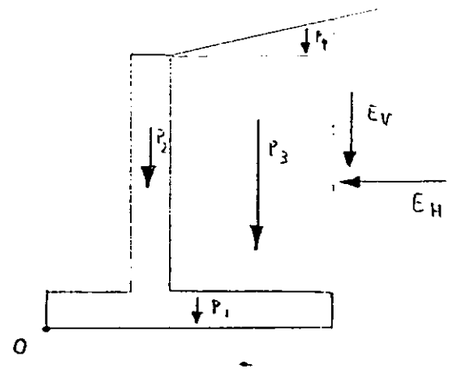
$\beta = 26.56°$

$$\lambda_H = \frac{\sin^2(123)}{\left[1 + \sqrt{\frac{\sin(66)\cdot\sin(6.44)}{\sin 57 \cdot \sin(116.56)}}\right]^2} = 0.375$$

$$\lambda_V = \lambda_H \operatorname{cotg}(57) = 0.2435$$

$$E_a = \frac{1}{2} H^2 \gamma_s = \frac{1}{2} \cdot 3.2^2 \cdot 1.9 = 9.728\ t \quad \begin{cases} E_H = 3.65\ t \\ E_V = 2.37\ t \end{cases}$$

I. CALCULOS. EMPUJES.



EMPUJE (t)	DISTANCIA O (m)	MOMENTO EN O (t/m)
E_H = 3.65	1.07	-3.89
E_V = 2.37	2.10	4.977
P_1 = 2.1	1.05	2.205
P_2 = 1.725	0.95	1.64
P_3 = 4.37	1.60	6.992
P_4 = 0.475	1.766	0.839

ΣF_V = 11.04

ΣF_H = 3.65

M_o = 12.763 mt

$\Sigma M_{e,H}$ = 16.65

ΣM_{vde} = 3.89

I. CALCULOS

COMPROBACIÓN DE TENSIÓN ADMISIBLE EN CIMENTACIÓN.

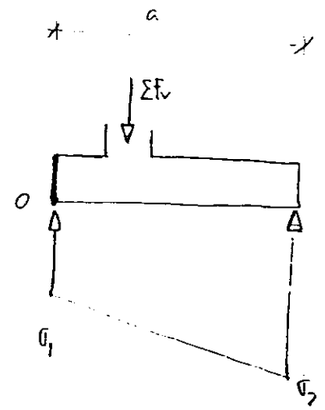


Figura 1. Esquema de tensiones en cimentación.

- Cálculo de σ_1 y σ_2. Ecuaciones:

(I) $(\sigma_1 + \sigma_2)\frac{1}{2}a = \Sigma F_V$; $\sigma_1 + \sigma_1 = 10.51$

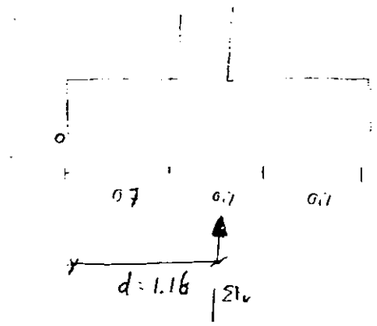
(II) $(\sigma_2 a)\frac{a}{2} + \frac{2}{3}a(\sigma_1 - \sigma_2)\frac{a}{2} = M_o$ $2\sigma_2 - \sigma_1 = 17.36$

σ_1 = 3.65 t/m²

σ_2 = 6.8 t/m²

$\sigma_2 = 6.88$ t/m² $\leq \sigma_{adm} = 25$ t/m²

VÁLIDO



$d = \frac{M_o}{\Sigma F_V} = 1.16$ → No aparecen tracciones.

Puesto que la resultante pasa por el tercio central

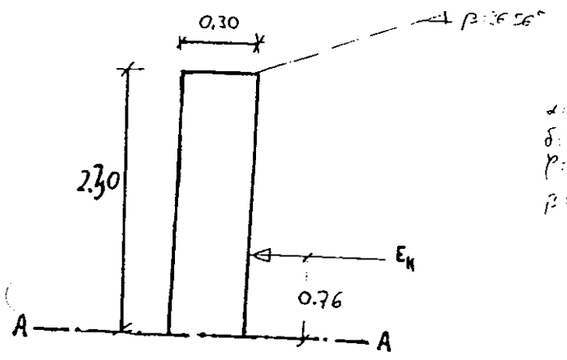
COEFICIENTES DE SEGURIDAD

Coeficiente de seguridad al vuelco $C_{sv} = \frac{\Sigma M_e}{\Sigma M_v} = 4.28$

Coeficiente de seguridad al deslizamiento $C_{sd} = 1.96$

I. CALCULOS.

ARMADO DEL ALZADO. SECCIÓN A-A.



$\alpha = 90°$
$\delta = 72°$
$\rho = 32°$
$\beta = 26.56°$

$$\lambda_H = \frac{\sin^2(122)}{\left[\sin(122+32)\sqrt{\frac{\sin 32 \sin 6.44}{\sin 68 \sin 116}}\right]^2} = 0.396$$

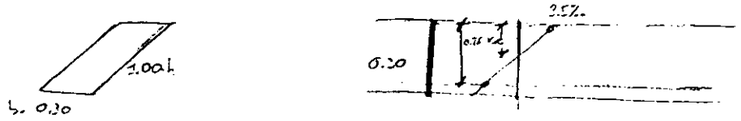
$E_H = 0.396 \times \frac{1}{2} \times 2.30 \times (1.90 + 2.30) = 2.00$ t

$M_A = 1.51$ mt

Coeficiente de mayoración de acciones: $\gamma_f = 1.6$

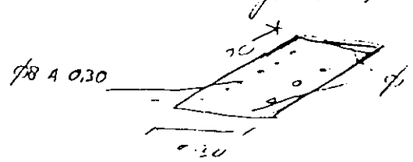
$M_d = 1.6 \times 1.51 = 2.42$ mt

ARMADO SECCIÓN A-A.

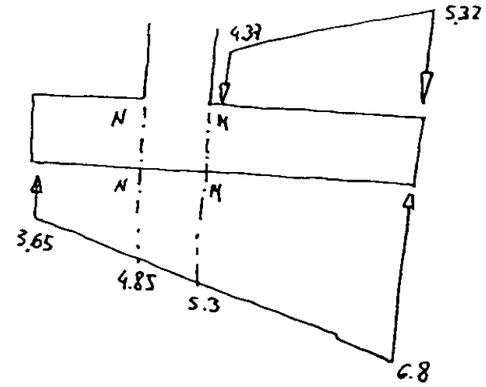


Para la cuantía mínima: $\begin{cases} 8\phi 20 \text{ por ml} \\ = \phi 16 \text{ por ml} \\ = \phi 10 \text{ por ml} \\ = \phi 25 \text{ por ml} \end{cases} \rightarrow \phi 20 \text{ s } 0.30$

Armadura a compresión: Mínima Geométrica - $\phi 8$ a 0.30



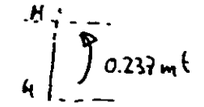
I. CALCULOS. ARMADO DE ZAPATAS.



El momento en M es:

$$M_{dM} = 1.6 \left[4.37 \times 0.5 + \frac{1}{2} \times 0.95 \times \frac{2}{3} + 0.4 \times 0.5 \times 2.5 - 5.3 \times 0.5 - \frac{2}{3} \times 1.5 \times \frac{1}{2} \right] =$$

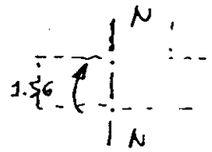
$M_M = -0.237$ mt



El momento en N es:

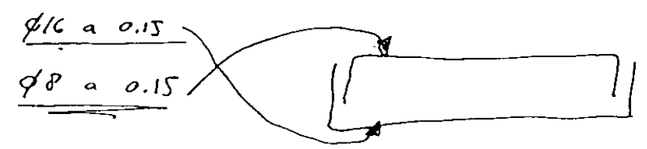
$$M_{dN} = 1.6 \left[0.8 \times 0.4 \times 2.5 \times 0.4 - 3.65 \times 0.8 \times 0.4 - \frac{1}{2} \times 1.2 \times 0.8 \times \frac{1}{3} 0.8 \right]$$

$= -1.5616$ mt.



Luego el armado se realiza con la cuantía mínima:

Inferior $\phi 16$ a 0.15
Superior $\phi 8$ a 0.15



I. CALCULOS. CUANTÍAS MÍNIMAS.

- Muro vertical EHE-500

$0.9‰ = \frac{A_s}{A_c}$; $b_c = 0.3 m^2$

$A_s = 2.7 \cdot 10^{-4} m^2 \longrightarrow 1.35 \cdot 10^{-4} m^2$ por cara.

- Losa EHE-500

$1.5‰ = \frac{A_s}{A_c}$

Armadura transversal = $A_c = 0.4 m^2$; $A_s = 6 \cdot 10^{-4} m^2$

$\longrightarrow 3 \cdot 10^{-4} m^2$ por cara

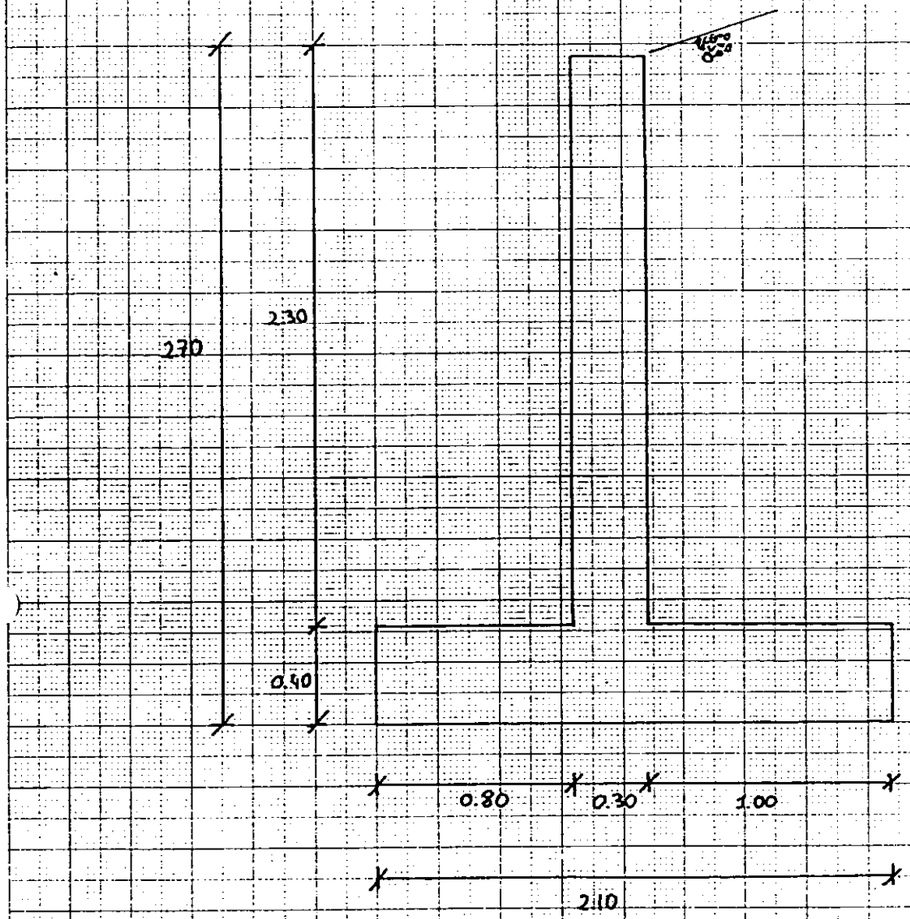
Longitudinal = $A_c = 2 \times 1 \times 0.4 = 0.84$; $A_s = 12.6 \cdot 10^{-5}$

$6.3 \cdot 10^{-4} m^2$ por cara.

▷ Armado de 2 capas en dirección longitudinal

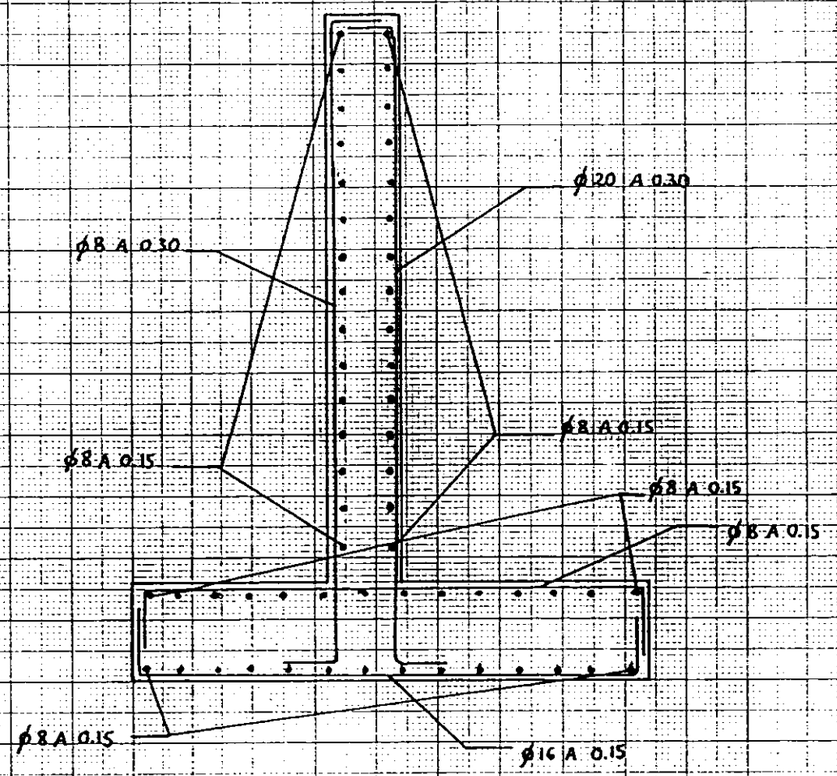
$\phi 8 \; a \; 0.15$

II. PLANOS



SECCION TRANSVERAL

DEFINICION GEOMETRICA
ESCALA 1:25



SECCION TRANSVERAL

ARMADURA
ESCALA 1:25

PROYECTO LINEA ALTA VELOCIDAD
MADRID-BARCELONA-FRONTERA FRANCESA
TRAMO: ZARAGOZA-LLEIDA
SUBTRAMO: I

PASOS INFERIORES PREFABRICADOS

Y

TUBERIA D.= 1800 mm.

1.-OBJETO:

El objeto del presente estudio es el cálculo y las mediciones de los marcos y tubos prefabricados que se van a instalar en la línea de alta velocidad Madrid-Barcelona-Frontera Francesa, tramo Zaragoza-Lleida, Subtramo I, de acuerdo al proyecto del Ministerio de Obras Públicas, Transportes y Medio Ambiente, de Marzo de 1.995.

Para calcular la armadura que deben llevar los marcos y los tubos descritos en dicho proyecto, se han tenido en cuenta las siguientes acciones:

- Peso propio de las tierras.....1.800 kg/m^3
- Peso propio del hormigón en masa.....2.200 kg/m^3
- Peso propio del acero corrugado.....7.850 kg/m^3
- Peso propio del agua.....1.000 kg/m^3

El tren de cargas considerado en el correspondiente al LAV, con cuatro ejes de 17,2 T. cada uno, con una carga por rueda de 8,6 T. La separación entre ejes extremos será de 3,00 m., entre ejes centrales de 3,275 y entre ruedas del mismo eje 1,435 m., es decir, el ancho de vía. Igualmente se ha tenido en cuenta una separación de vias de 3,066 m.

El coeficiente de impacto para este estudio se ha considerado en función de una velocidad del mismo de 350 km/h., y la carga actuante sobre los marcos ó tubos se calculará teniendo en cuenta que la carga del vehículo (en su posición mas desfavorable) se transmite a ellos según el procedimiento indicado por BOUSSINESQ, teniendo en cuenta la incidencia en cada sección de la carga máxima por rueda en su vertical, como la del resto de ruedas, situadas a las distancias indicadas anteriormente.

En todos los casos se ha tenido en cuenta una carga mínima correspondiente a una altura de tierras de 1,00 m., que es el relleno mínimo de balasto.

Como no se dispone de estudio geotécnico del terreno actuante, se ha considerado como genérico un coeficiente de empuje activo horizontal del terreno 0,33

Teniendo en cuenta todo lo expuesto anteriormente, se llega a una distribución de cargas sobre el marco que desglosamos a continuación.

q_{pp} = peso propio del elemento en estudio, de acuerdo a los pesos específicos anteriores
q_{1pp} =carga vertical que soporta el marco debida al peso de las tierra.
q_{1sc} =carga vertical que soporta el marco debida a la sobrecarga del ferrocarril.
q_{3pp} =carga horizontal que soporta el marco en su cota superior debida al peso de las tierras.
q_{3sc} =carga horizontal que soporta el marco debida en su cota superior debida a la sobrecarga del ferrocarril.
q_{4pp} =carga horizontal que soporta el marco en su cota inferior debida al peso de las tierras.
q_{4sc} =carga horizontal que soporta el marco debida en su cota inferior debida a la sobrecarga del ferrocarril.

Con cada una de las acciones anteriores, cuyo valor estará en función de la cota a la que se encuentre con respecto a la cota del ferrocarril (dato dado en el proyecto citado), se han calculado los esfuerzo normal, cortante y flector en cada sección del marco, con los cuales, mediante los métodos de la norma EH-91, se han dimensionado las armaduras correspondientes, teniendo en cuenta los coeficientes de mayoración de acciones y de minoración de resistencias del hormigón y del acero corrugado de acuerdo al nivel de control exigido para este proyecto.

Las resistencias del hormigón, acero, coeficientes y recubrimientos se ha redactado en el apartado 2 de este estudio.

Todo este estudio podemos dividirlo en principio en dos grandes bloques:

a) Cálculo de marcos.

b) Cálculo de tubos.

Antes de entrar en cada uno de ellos, siguiendo el proceso del proyecto, hacemos las siguientes puntualizaciones, todas ellas tendentes a mayorar la capacidad interior de alguno de dichos elementos, cambiando incluso la forma de los mismos, pero por ser más operativos bien a la hora de su fabricación ó a la de su transporte.

Por ello dentro del estudio de marcos podemos distinguir:

a1) Marcos de 300 x 250 (POD 9).
Se mantienen las medidas interiores pero se varían los espesores y longitudes (por la razón apuntada anteriormente), calculando dichos espesores con la condición de no tener que absorber esfuerzo cortante con estribos, es decir, todo el esfuerzo cortante será absorbido con el hormigón.

a2) Marcos de 250 x 250 (POD 13).
Se mantienen las medidas interiores pero se varían los espesores y longitudes (por la razón apuntada anteriormente), calculando dichos espesores con la condición de no tener que absorber esfuerzo cortante con estribos, es decir, todo el esfuerzo cortante será absorbido con el hormigón

b1)Tubos de diámetro interior 1800 (POD 6, POD 8, POD 15, POD 17, POD 18)
Se mantienen las medidas interiores y se predimensiona con un espesor de 19,5 cm. (en el proyecto no consta dicho espesor no armaduras).

2.- MATERIALES Y EJECUCIÓN

Los materiales que han tenido en cuenta, de acuerdo al citado proyecto han sido:

- Hormigón..... H-250
-Acero corrugado..... AEH-500 S

cuyas resistencia característica y límite elástico son 250 kg/cm^2. y 5.100 kg/cm^2. respectivamente. Los coeficientes de minoración de estos materiales serán:

-Hormigón..... 1,50
-Acero corrugado..... 1,15

El nivel de control del citado proyecto está previsto sea NORMAL, con lo que, según el artº 31.1 de la Norma EH - 91, el coeficiente de seguridad aplicado es 1,60, correspondiente a obras cuyo fallo puede ocasionar daños de tipo medio. El recubrimiento exigido para las armaduras es variable, de 5, 3, 2,50 ó 1,50 cm., según el elemento, según el elemento consta en los cuadros de especificaciones técnicas del proyecto.

3.- OTRAS CONSIDERACIONES:

Los peso específicos de los materiales relacionados en apartados anteriores han sido:

- Hormigón en masa..... 2.200 kg/m^3
-Acero corrugado..... 7.850 kg/m^3

Todos los redondos colocados en la parte exterior del marco (cara pegada a las tierras ó a solera) llevarán y prolongarán con un ángulo de 90º una longitud de 30 cm. si el redondo es de diámetro 12 ó diámetro 16, y 25 cm. si el diámetro del redondo es menor podrán terminarse sin prolongación en ángulo. Los colocados en la parte interior podrán terminarse sin prolongación en ángulo.

Los redondos radiales en los tubos se solaparán una longitud de 30 cms., tanto los colocados en la parte exterior del tubo como los de la parte interior.

Para el cálculo de los tubos de hormigón armado, se ha seguido la instrucción del Instituto Eduardo Torroja, partiendo de las cargas en función de la altura a la que se encuentren de la cota del ferrocarril, tomando los pesos específicos de materiales y sobrecargas ya descritos en apartando anteriores.

Todos estos datos se encuentran para cada tubo en particular en la hoja "Datos de entrada". En la siguiente denominada "Esfuerzos", se encuentran la compresión y momento máximos actuantes en cada una de las secciones críticas del tubo: en la clave, en los riñones y en la base. Con los valores de éstas se ha armado cada uno de los tubos según el esquema representado en la página siguiente, todo ello con acero AEH - 500 S y hormigón H - 350.

Zaragoza, 30 de mayo de 1.997

Fdo.: D. LUIS FORCANO OBON

PASOS INFERIORES

PREFABRICADOS

CALCULOS

Y

PLANOS

MARCO POD 9

HORMIGON H- 250 — ACERO AEH-500 S
COEF MAY CARGAS 1.6 — RECUBRIMIENTO 3 cm.

LONGITUD HORIZONTAL HUECO	300 cm.	ESPESOR	30 cm.
LONGITUD VERTICAL HUECO	250 cm.	ESPESOR	25 cm.
LONGITUD CARTELA	70 cm.	CANTO CARTELA	20 cm.
PESO PROPIO TIERRAS	1800 kg/m3	ALTURA MAXIMA TIERRAS	8.89 m.
CARGA MAXIMA POR RUEDA	8600 kg.	VELOCIDAD MAXIMA	300 km/h
ANCHO VIA	1.435 m.	SEPARACION VIAS	3.066 m.
PARACION RUEDAS V-V	3 m.	SEPARACION RUEDAS M-V	3.275 m.
COEF EMPUJE ACT HORIZ	.33		

CARGAC (kg/m) Q1 = 27509 Q3 = 8830 Q4 = 11330

MOMENTOS VANO HORIZONTAL M IZQ = -11531 M DCH = -11531
MOMENTOS VANO VERTICAL M ABA = -11602 M ARR = -11531

RESULTADOS VANO HORIZONTAL

CORTANTE HORMIGON SIN CARTELA (kg) 20554
CORTANTE HORMIGON CON CARTELA (kg) 36366
ESFUERZO CORTANTE SIN CARTELA (kg) 14855 NO HACE FALTA ESTRIBOS EN VANO
ESFUERZO CORTANTE CON CARTELA (kg) 34111 NO HACE FALTA ESTRIBOS EN CARTELA

X= 0	M=-11531	N= 12051	US1 = 32857	US2 = 10431
X= .7	M= 10614	N= 12051	US1 = 30744	US2 = 10431
X= 1.5	M= 19417	N= 12051	US1 = 69854	US2 = 10431
X= 2.3	M= 10614	N= 12051	US1 = 30744	US2 = 10431
X= 3	M= 11531	N= 12051	US1 = 32857	US2 = 10431

ARMADURA TRANSVERSAL US = 10431 kgs. EN CADA CARA

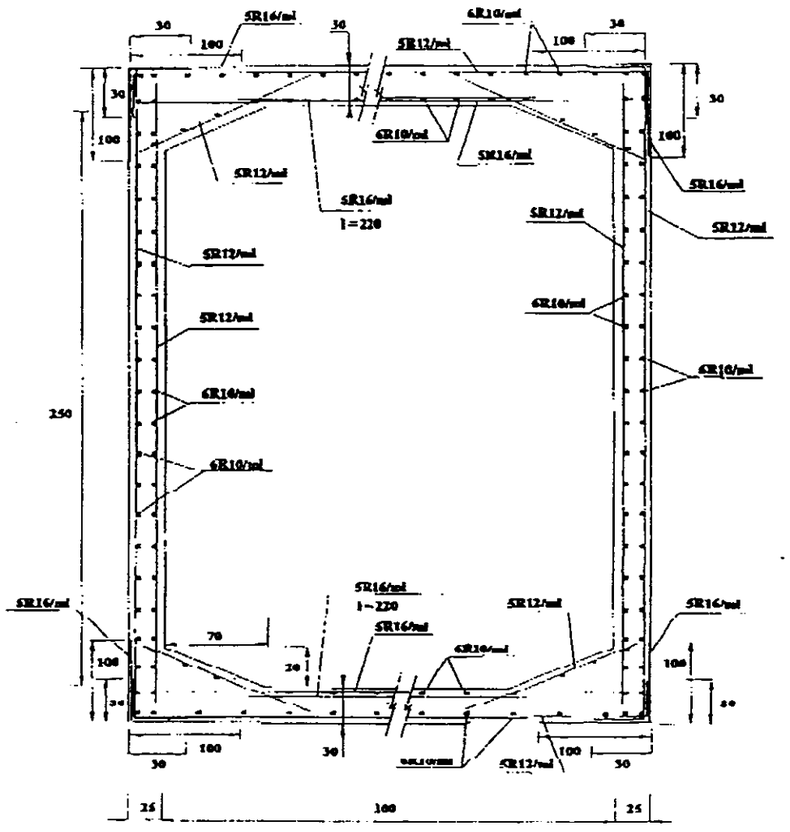
RESULTADOS VANO VERTICAL

CORTANTE HORMIGON SIN CARTELA 16601
CORTANTE HORMIGON CON CARTELA 71941
ESFUERZO CORTANTE SIN CARTELA 8430 NO HACE FALTA ESTRIBOS EN VANO
ESFUERZO CORTANTE CON CARTELA 10108 NO HACE FALTA ESTRIBOS EN CARTELA

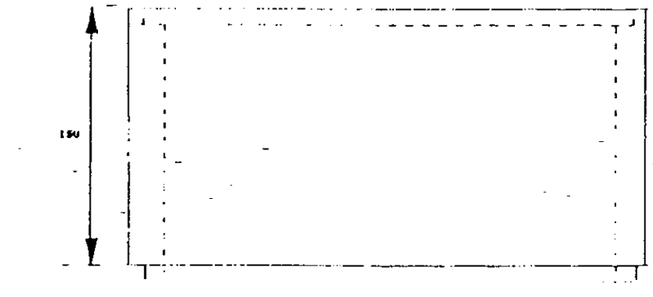
X= 0	M=-11531	N= 41263	US1 = 65000	US2 = 8693
X= .2	M=-9299	N= 41263	US1 = 15000	US2 = 8693
X= 1.27	M=-3689	N= 41263	US1 = 15000	US2 = 8693
X= 2.3	M=-9198	N= 41263	US1 = 15000	US2 = 8693
X= 2.5	M=-11602	N= 41263	US1 = 65000	US2 = 8693

ARMADURA TRANSVERSAL US = 8693 kgs. EN CADA CARA

MODIFICACIÓN MARCO PREFABRICADO P.O.D. Nº 9:



ALZADO



PLANTA

MARCO POD 13

HORMIGON H- 250 ACERO AEH-500 S
COEF MAY CARGAS 1.6 RECUBRIMIENTO 3 cm.

LONGITUD HORIZONTAL HUECO . 250 cm. ESPESOR ..... 30 cm.
LONGITUD VERTICAL HUECO ... 250 cm. ESPESOR ..... 25 cm.
LONGITUD CARTELA ..... 70 cm. CANTO CARTELA ..... 20 cm.

PESO PROPIO TIERRAS ..... 1800 kg/m3 ALTURA MAXIMA TIERRAS . 3.76 m.
CARGA MAXIMA POR RUEDA .... 8500 kg. VELOCIDAD MAXIMA ..... 300 km/h
ANCHO VIA ..... 1.435 m. SEPARACION VIAS ..... 3.066 m.
SEPARACION RUEDAS V-V..... 3 m. SEPARACION RUEDAS M-V.. 3.275 m.
COEF EMPUJE ACT HORIZ ..... .33

CARGAS (kg/m) Q1 = 16369 Q3 = 5154 Q4 = 6927

MOMENTOS EMP. PERFECTO (mkg/m)

M 1 = 8525 M 3 = -3054 M 4 = 3238

MOMENTOS VANO HORIZONTAL M IZQ = -5090 M DCH = -5090
MOMENTOS VANO VERTICAL M ABA = -5154 M ARR = -5090

RESULTADOS VANO HORIZONTAL

RTANTE HORMIGON SIN CARTELA (kg) 20554
CORTANTE HORMIGON CON CARTELA (kg) 36366
ESFUERZO CORTANTE SIN CARTELA (kg) 4747 NO HACE FALTA ESTRIBOS EN VANO
ESFUERZO CORTANTE CON CARTELA (kg) 16205 NO HACE FALTA ESTRIBOS EN CARTELA

X= 0	M=-5090	N= 7156	US1 = 32857	US2 = 10431
X= .7	M= 5223	N= 7156	US1 = 18571	US2 = 10431
X= 1.25	M= 7699	N= 7156	US1 = 23467	US2 = 10431
X= 1.8	M= 5223	N= 7156	US1 = 18571	US2 = 10431
X= 2.5	M=-5090	N= 7156	US1 = 32857	US2 = 10431

ARMADURA TRANSVERSAL US = 10431 kgs. EN CADA CARA

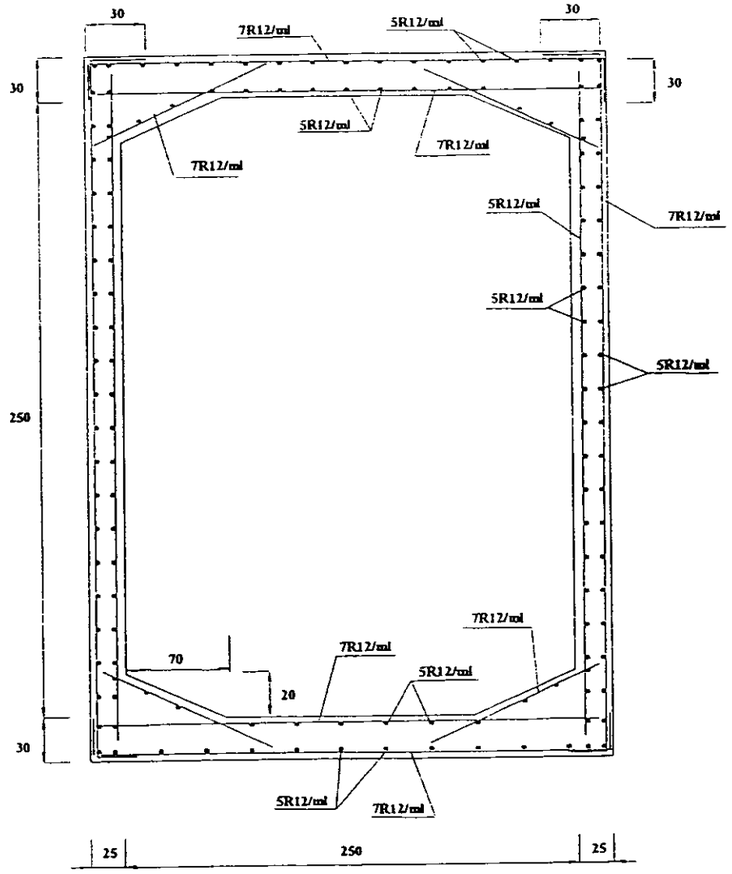
RESULTADOS VANO VERTICAL

CORTANTE HORMIGON SIN CARTELA 16601
CORTANTE HORMIGON CON CARTELA 71941
ESFUERZO CORTANTE SIN CARTELA 5042 NO HACE FALTA ESTRIBOS EN VANO
ESFUERZO CORTANTE CON CARTELA 6022 NO HACE FALTA ESTRIBOS EN CARTELA

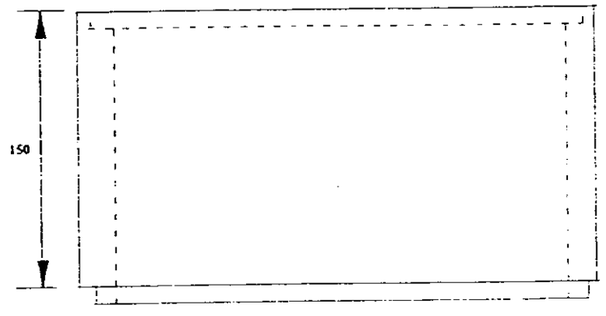
X= 0	M=-5090	N= 20461	US1 = 65000	US2 = 8693
X= .2	M=-3762	N= 20461	US1 = 15000	US2 = 8693
X= 1.27	M=-400	N= 20461	US1 = 15000	US2 = 8693
X= 2.3	M=-3702	N= 20461	US1 = 15000	US2 = 8693
X= 2.5	M=-5154	N= 20461	US1 = 65000	US2 = 8693

ARMADURA TRANSVERSAL US = 8693 kgs. EN CADA CARA

ARMADURA MARCO PREFABRICADO TIPO P.O.D. Nº 13:



ALZADO



PLANTA

TUBERIA D = 1800 m.m.

CALCULOS

Y

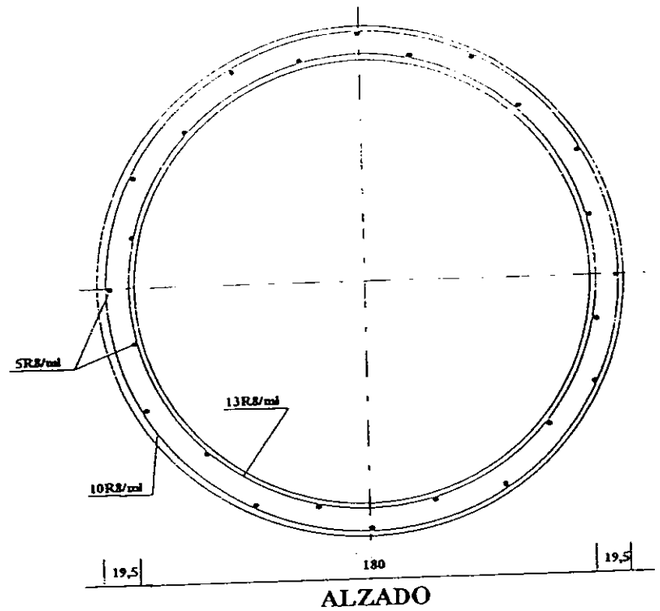
PLANOS

ARMADURA TUBOS TIPO P.O.D. N° 6

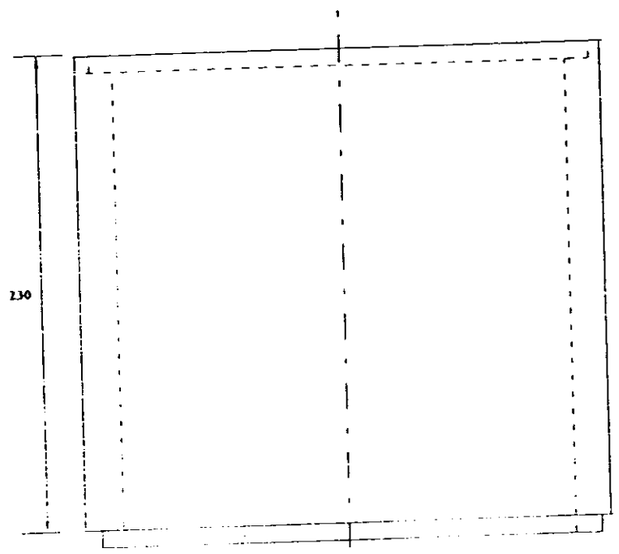
DATOS DE ENTRADA	Nombre	Unidad	Valore
TUBO	P.O.D. N° 6		
Diámetro nominal	DN	mm	1800
Dámetro interno	di	mm	1800
Diámetro externo	D	mm	2190
Espesor	e	mm	195
Tipo hormigón			H-350
Armadura Interior	Ai	cm2/m	6,53
Armadura Exterior	Ae	cm2/m	5,03
Peso específico	Y_R	kN/m3	25
Módulo de elasticidad (valor a largo plazo)	E_{RL}	N/mm2	35000
Clase de tubo			D
Coeficiente de seguridad de fallo por rotura del material	v		1.6
TERRENO			
Suelo natural adyacente			G3
Grupo de terreno	Dpr	%	95
Grado de compactación	ρ'	°	25
Angulo de coeficiente interno			No
Caracteristicas del suelo obtenidas mediante ensayos [Si, No]			No
Agua freática: [Si, No]			H-200
Cama:			
Relleno hasta 30 cm. de la calbe del tubo			G3
Grupo de terreno	Dpr	%	97
Grado de compactación	Y_B	kN/m3	20
Peso específico			G3
Resto del relleno:	Dpr	%	97
Grupo de terreno	Y_B	kN/m3	20
Grado de compactación	ρ'	°	25
Peso específico			
Angulo de rozamiento interno			
CONDICIONES DE INSTALACIÓN			
Altura de relleno sobre la clave del tubo	H	m	9.3
Anchura de la zanja	B >	m	10
Angulo de talud	β	°	0
Caso de compactación del relleno sobre la zona de influencia del tubo			A2
Caso de compactación del relleno enla la zona de influencia del tubo			B2
Tipo de apoyo para la verificación de la tensión: ángulo de apoyo	2α	°	120
Descarga relativa	a		1
Módulos de deformación EB			
Sobre el tubo	E_1	N/mm2	8
Junto al tubo	E_2	N/mm2	8
Suelo natural lateral al tubo	E_3	N/mm2	8
Suelo natural bajo el tubo	E_4	N/mm2	5
Relación K1			0.5
Angulo de rozamiento de las paredes	ρ	°	8.333
CARGA DE TRÁFICO			
Carga de superficie		Tn	90

ESFUERZOS	Unidades	Valores
Apoyo Tipo II / 120°		
Clave		
M_{qvt}	kNm/m	42.4987
M_{qh}	kNm/m	-22.4972
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.5231
M_w	kNm/m	-
Suma de M	kNm/m	21.62
N_{qvt}	kN/m	-3.5504
N_{qh}	kN/m	-93.3252
N_{qh^*}	kN/m	-
N_g	kN/m	0.5106
N_w	kN/m	-
Suma de N	kN/m	**-96.37**
Riñones		
M_{qvt}	kNm/m	-42.4987
M_{qh}	kNm/m	22.1093
M_{qh^*}	kNm/m	-
M_g	kNm/m	-1.7559
M_w	kNm/m	-
Suma de M	kNm/m	**-22.15**
N_{qvt}	kN/m	-177.5217
N_{qh}	kN/m	0.0000
N_{qh^*}	kN/m	-
N_g	kN/m	-7.6395
N_w	kN/m	-
Suma de N	kN/m	**-185.16**
Base		
M_{qvt}	kNm/m	35.7697
M_{qh}	kNm/m	-18.1335
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.4115
M_w	kNm/m	-
Suma de M	kNm/m	**19.06**
N_{qvt}	kN/m	-99.0571
N_{qh}	kN/m	-52.4954
N_{qh^*}	kN/m	-
N_g	kN/m	-9.3269
N_w	kN/m	-
Suma de N	kN/m	-160.88
Valores de la sección de la pared del tubo		
Area A	cm2/m	1950.0000
Momento resistente W	cm3/m	6337 5000

Esquema de armaduras de Tubo P.O.D. nº 6



ALZADO



PLANTA

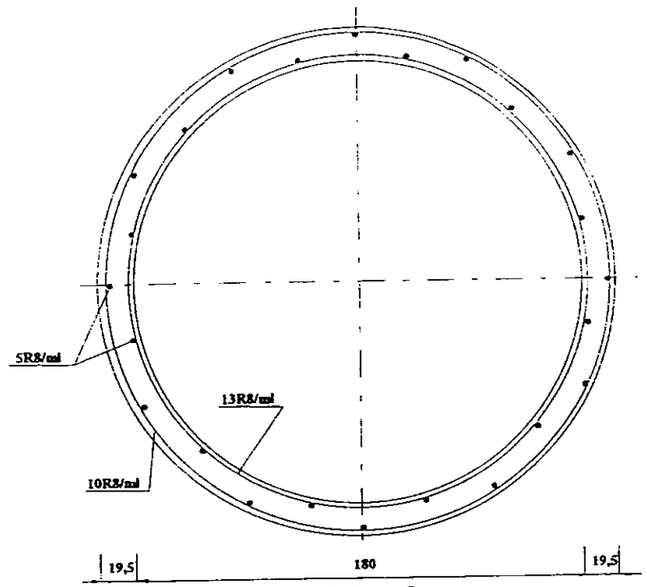
FOMENTO DE PREFABRICADOS ARAGON S.L AVE ZARAGOZA-BARCELONA-FRANCIA

ARMADURA TUBOS TIPO P.O.D. Nº 8:

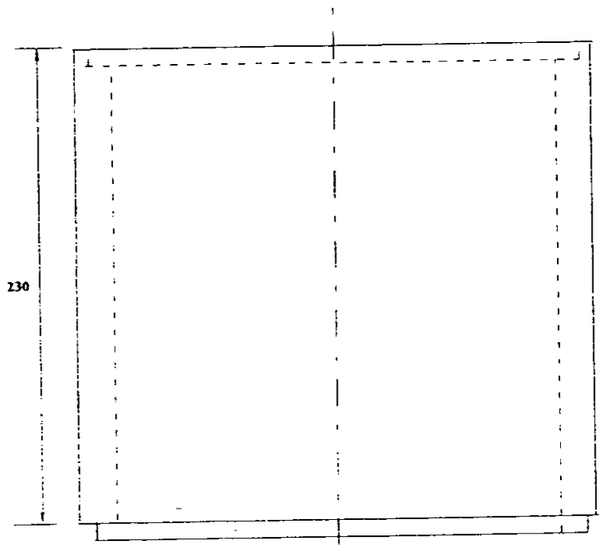
DATOS DE ENTRADA	Nombre	Unidad	Valores
TUBO	**P.O.D. Nº 8**		
Diámetro nominal	DN	mm	1800
Dámetro interno	di	mm	1800
Diámetro externo	D	mm	2190
Espesor	e	mm	195
Tipo hormigón			H-350
Armadura Interior	Ai	cm2/m	6,53
Armadura Exterior	Ae	cm2/m	5,03
Peso específico	Y_R	kN/m3	25
Módulo de elasticidad (valor a largo plazo)	E_{RL}	N/mm2	35000
Clase de tubo			D
Coeficiente de seguridad de fallo por rotura del material	v		1.6
TERRENO			
Suelo natural adyacente			G3
Grado de compactación	Dpr	%	95
Angulo de coeficiente interno	ρ'	°	25
Caracteristicas del suelo obtenidas mediante ensayos [Si, No]			No
Agua freática: [Si, No]			No
Cama:			H-200
Relleno hasta 30 cm. de la calbe del tubo			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Resto del relleno:			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Angulo de rozamiento interno	ρ'	°	25
CONDICIONES DE INSTALACIÓN			
Altura de relleno sobre la clave del tubo	H	m	9.3
Anchura de la zanja	B >	m	10
Angulo de talud	β	°	0
Caso de compactación del relleno sobre la zona de influencia del tubo			A2
Caso de compactación del relleno enla la zona de influencia del tubo			B2
Tipo de apoyo para la verificación de la tensión: ángulo de apoyo	2α	°	120
Descarga relativa	a		1
Módulos de deformación E_B			
Sobre el tubo	E_1	N/mm2	8
Junto al tubo	E_2	N/mm2	8
Suelo natural lateral al tubo	E_3	N/mm2	8
Suelo natural bajo el tubo	E_4	N/mm2	5
Relación K_1			0.5
Angulo de rozamiento de las paredes	ρ	°	8.333
CARGA DE TRÁFICO			
Carga de superficie		Tn	90

ESFUERZOS	Unidades	Valores
Apoyo Tipo II / 120º		
Clave		
M_{qvt}	kNm/m	42.4987
M_{qh}	kNm/m	-22.4972
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.5231
M_w	kNm/m	-
Suma de M	kNm/m	**21.52**
N_{qvt}	kN/m	-3.5504
N_{qh}	kN/m	-93.3252
N_{qh^*}	kN/m	-
N_g	kN/m	0.5106
N_w	kN/m	-
Suma de N	kN/m	**-96.37**
Riñones		
M_{qvt}	kNm/m	-42.4987
M_{qh}	kNm/m	22.1093
M_{qh^*}	kNm/m	-
M_g	kNm/m	-1.7559
M_w	kNm/m	-
Suma de M	kNm/m	**-22.15**
N_{qvt}	kN/m	-177.5217
N_{qh}	kN/m	0.0000
N_{qh^*}	kN/m	-
N_g	kN/m	-7.6395
N_w	kN/m	-
Suma de N	kN/m	**-186.16**
Base		
M_{qvt}	kNm/m	35.7697
M_{qh}	kNm/m	-18.1335
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.4115
M_w	kNm/m	-
Suma de M	kNm/m	**19.06**
N_{qvt}	kN/m	-99.0571
N_{qh}	kN/m	-52.4954
N_{qh^*}	kN/m	-
N_g	kN/m	-9.3269
N_w	kN/m	-
Suma de N	kN/m	**-160.88**
valores de la sección de la pared del tubo		
Area A	cm2/m	1950.0000
Momento resistente W	cm3/m	6337.5000

Esquema de armaduras de Tubo P.O.D. nº 8



ALZADO



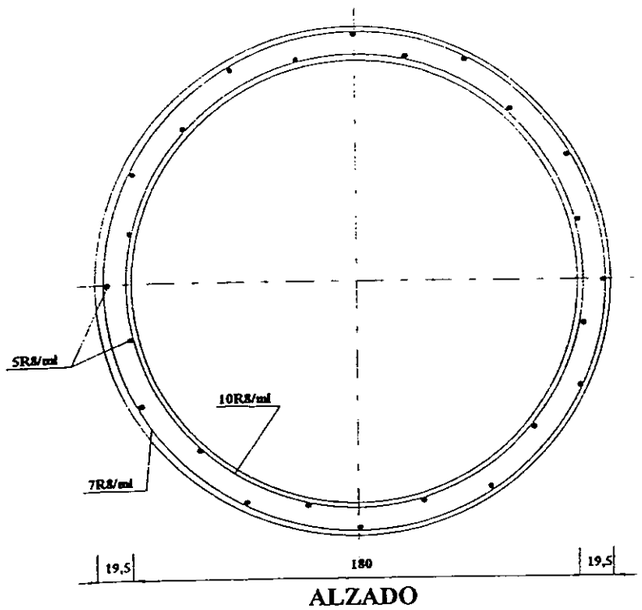
PLANTA

ARMADURA TUBOS TIPO P.O.D. Nº 15:

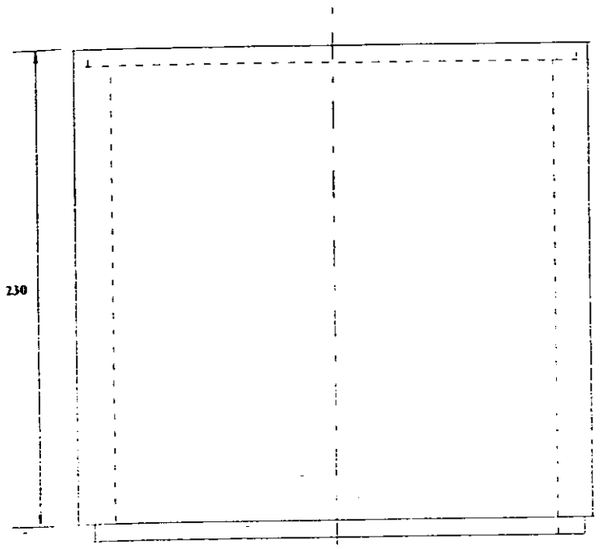
DATOS DE ENTRADA	Nombre	Unidad	Valores
TUBO	**P.O.D. Nº 15**		
Diámetro nominal	DN	mm	1800
Dámetro interno	di	mm	1800
Diámetro externo	D	mm	2190
Espesor	e	mm	195
Tipo hormigón			H-350
Armadura Interior	Ai	cm2/m	5,03
Armadura Exterior	Ae	cm2/m	3,52
Peso específico	Y_R	kN/m3	25
Módulo de elasticidad (valor a largo plazo)	E_{RL}	N/mm2	35000
Clase de tubo			C
Coeficiente de seguridad de fallo por rotura del material	v		1.6
TERRENO			
Suelo natural adyacente			
Grupo de terreno			G3
Grado de compactación	Dpr	%	95
Angulo de coeficiente interno	ρ'	°	25
Caracteristicas del suelo obtenidas mediante ensayos [Si, No]			No
Agua freática: [Si, No]			No
Cama:			H-200
Relleno hasta 30 cm. de la calbe del tubo			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Resto del relleno:			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Angulo de rozamiento interno	ρ'	°	25
CONDICIONES DE INSTALACIÓN			
Altura de relleno sobre la clave del tubo	H	m	6.3
Anchura de la zanja	B >	m	10
Angulo de talud	β	°	0
Caso de compactación del relleno sobre la zona de influencia del tubo			A2
Caso de compactación del relleno enla la zona de influencia del tubo			B2
Tipo de apoyo para la verificación de la tensión: ángulo de apoyo	2α	°	120
Descarga relativa	a		1
Módulos de deformación EB			
Sobre el tubo	E_1	N/mm2	8
Junto al tubo	E_2	N/mm2	8
Suelo natural lateral al tubo	E_3	N/mm2	8
Suelo natural bajo el tubo	E_4	N/mm2	5
Relación K1			0.5
Angulo de rozamiento de las paredes	ρ	°	8.333
CARGA DE TRÁFICO			
Carga de superficie		Tn	90

ESFUERZOS	Unidades	Valores
Apoyo Tipo II / 120°		
Clave		
M_{qvt}	kNm/m	30.8958
M_{qh}	kNm/m	-16.3146
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.5231
M_w	kNm/m	-
Suma de M	kNm/m	**16.10**
N_{qvt}	kN/m	-2.5811
N_{qh}	kN/m	-67.6779
N_{qh^*}	kN/m	-
N_g	kN/m	0.5106
N_w	kN/m	-
Suma de N	kN/m	**-69.75**
Riñon		
M_{qvt}	kNm/m	-30.8958
M_{qh}	kNm/m	16.0333
M_{qh^*}	kNm/m	-
M_g	kNm/m	-1.7559
M_w	kNm/m	-
Suma de M	kNm/m	**-16.62**
N_{qvt}	kN/m	-129.0552
N_{qh}	kN/m	0.0000
N_{qh^*}	kN/m	-
N_g	kN/m	-7.6395
N_w	kN/m	-
Suma de N	kN/m	**-136.69**
Base		
M_{qvt}	kNm/m	26.0040
M_{qh}	kNm/m	-13.1501
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.4115
M_w	kNm/m	-
Suma de M	kNm/m	**14.27**
N_{qvt}	kN/m	-72.0128
N_{qh}	kN/m	-38.0688
N_{qh^*}	kN/m	-
N_g	kN/m	-9.3269
N_w	kN/m	-
Suma de N	kN/m	**-119.41**
Valores de la sección de la pared del tubo		
Area A	cm2/m	1950.0000
Momento resistente W	cm3/m	6337.5000

Esquema de armaduras de Tubo P.O.D. nº 15



ALZADO



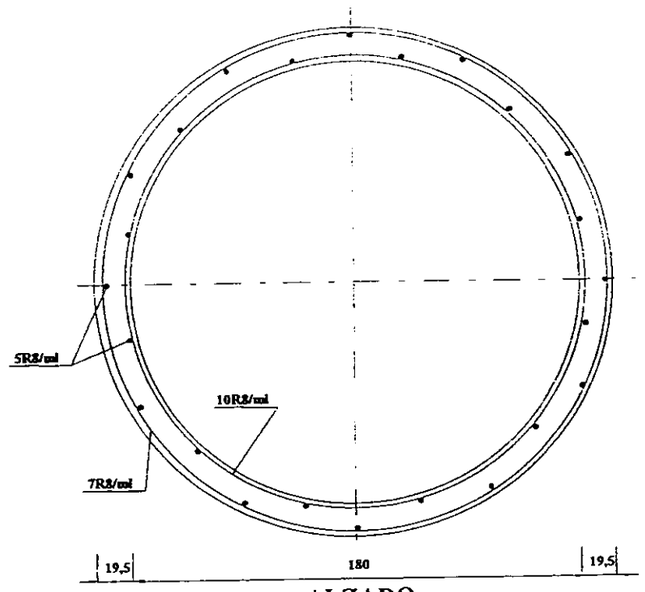
PLANTA

ARMADURA TUBOS TIPO P.O.D. Nº 17:

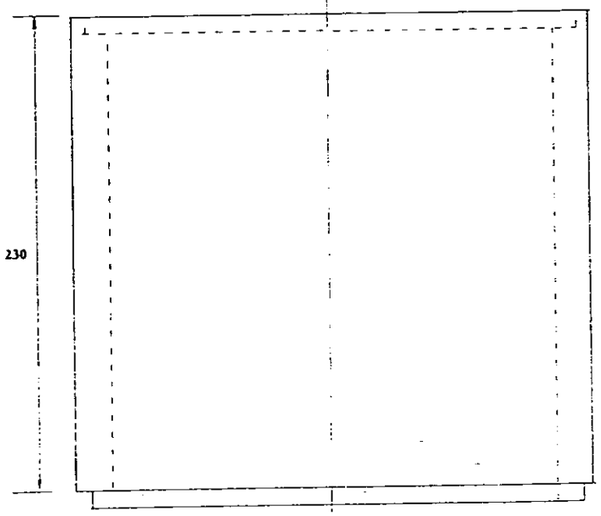
DATOS DE ENTRADA	Nombre	Unidad	Valores
TUBO	**P.O.D. Nº 17**		
Diámetro nominal	DN	mm	1800
Diámetro interno	di	mm	1800
Diámetro externo	D	mm	2190
Espesor	e	mm	195
Tipo hormigón			H-350
Armadura Interior	Ai	cm2/m	5,03
Armadura Exterior	Ae	cm2/m	3,52
Peso específico	Y_R	kN/m3	25
Módulo de elasticidad (valor a largo plazo)	E_{RL}	N/mm2	35000
Clase de tubo			C
Coeficiente de seguridad de fallo por rotura del material	v		1.6
TERRENO			
Suelo natural adyacente			
Grupo de terreno			G3
Grado de compactación	Dpr	%	95
Angulo de coeficiente interno	ρ'	°	25
Caracteristicas del suelo obtenidas mediante ensayos [Si, No]			No
Agua freática: [Si, No]			No
Cama:			H-200
Relleno hasta 30 cm. de la calbe del tubo			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Resto del relleno:			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Angulo de rozamiento interno	ρ'	°	25
CONDICIONES DE INSTALACIÓN			
Altura de relleno sobre la clave del tubo	H	m	2.3
Anchura de la zanja	B >	m	10
Angulo de talud	β	°	0
Caso de compactación del relleno sobre la zona de influencia del tubo			A2
Caso de compactación del relleno enla la zona de influencia del tubo			B2
Tipo de apoyo para la verificación de la tensión: ángulo de apoyo	2α	°	120
Descarga relativa	a		1
Módulos de deformación E_B			
Sobre el tubo	E_1	N/mm2	8
Junto al tubo	E_2	N/mm2	8
Suelo natural lateral al tubo	E_3	N/mm2	8
Suelo natural bajo el tubo	E_4	N/mm2	5
Relación K_1			0.5
Angulo de rozamiento de las paredes	ρ	°	8.333
CARGA DE TRAFICO			
Carga de superficie		Tn	90

ESFUERZOS		Unidades	Valores
Apoyo Tipo II / 120°			
Clave			
	M_{qvt}	kNm/m	19.1831
	M_{qh}	kNm/m	-7.6817
	M_{qh^*}	kNm/m	-
	M_g	kNm/m	1.5231
	M_w	kNm/m	-
	Suma de M	kNm/m	**13.02**
	N_{qvt}	kN/m	-1.6026
	N_{qh}	kN/m	-31.8658
	N_{qh^*}	kN/m	-
	N_g	kN/m	0.5106
	N_w	kN/m	-
	Suma de N	kN/m	**-32.96**
Riñones			
	M_{qvt}	kNm/m	-19.1831
	M_{qh}	kNm/m	7.5492
	M_{qh^*}	kNm/m	-
	M_g	kNm/m	-1.7559
	M_w	kNm/m	-
	Suma de M	kNm/m	**-13.39**
	N_{qvt}	kN/m	-80.1300
	N_{qh}	kN/m	0.0000
	N_{qh^*}	kN/m	-
	N_g	kN/m	-7.6395
	N_w	kN/m	-
	Suma de N	kN/m	**-87.77**
Base			
	M_{qvt}	kNm/m	16.1458
	M_{qh}	kNm/m	-6.1917
	M_{qh^*}	kNm/m	-
	M_g	kNm/m	1.4115
	M_w	kNm/m	-
	Suma de M	kNm/m	**11.37**
	N_{qvt}	kN/m	-44.7125
	N_{qh}	kN/m	-17.9245
	N_{qh^*}	kN/m	-
	N_g	kN/m	-9.3269
	N_w	kN/m	-
	Suma de N	kN/m	**-71.96**
Valores de la sección de la pared del tubo			
	Area A	cm2/m	1950.0000
	Momento resistente W	cm3/m	6337.5000

Esquema de armaduras de Tubo P.O.D. nº 17



ALZADO



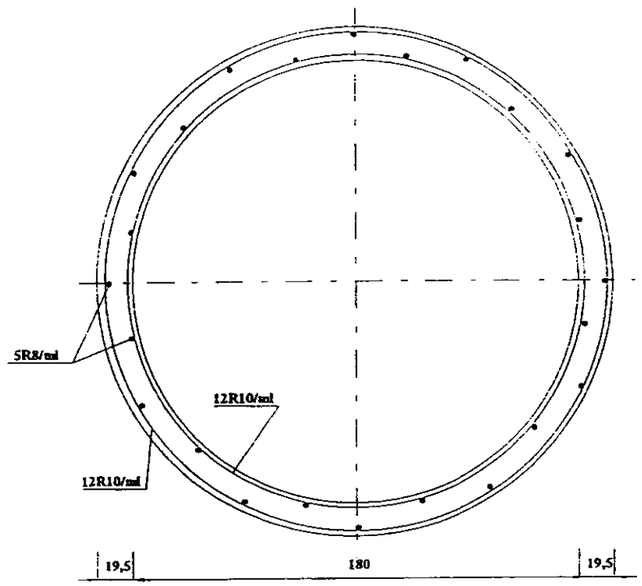
PLANTA

ARMADURA TUBOS TIPO P.O.D. Nº 18:

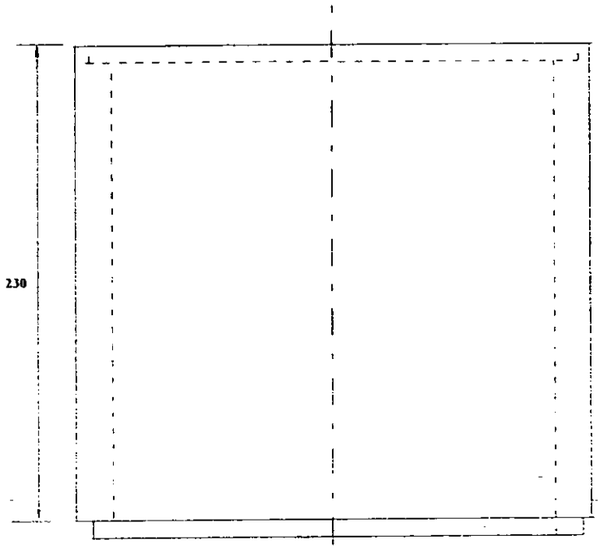
DATOS DE ENTRADA	Nombre	Unidad	Valores
TUBO	**P.O.D. Nº 18**		
Diámetro nominal	DN	mm	1800
Dámetro interno	di	mm	1800
Diámetro externo	D	mm	2190
Espesor	e	mm	195
Tipo hormigón			H-350
Armadura Interior	Ai	cm2/m	9,43
Armadura Exterior	Ae	cm2/m	7,86
Peso específico	Y_R	kN/m3	25
Módulo de elasticidad (valor a largo plazo)	E_{RL}	N/mm2	35000
Clase de tubo			>D
Coeficiente de seguridad de fallo por rotura del material	v		1.6
TERRENO			
Suelo natural adyacente			
Grupo de terreno			G3
Grado de compactación	Dpr	%	95
Angulo de coeficiente interno	ρ'	°	25
Caracteristicas del suelo obtenidas mediante ensayos [Si, No]			No
Agua freática: [Si, No]			No
Cama:			H-200
Relleno hasta 30 cm. de la calbe del tubo			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Resto del relleno:			
Grupo de terreno			G3
Grado de compactación	Dpr	%	97
Peso específico	Y_B	kN/m3	20
Angulo de rozamiento interno	ρ'	°	25
CONDICIONES DE INSTALACIÓN			
Altura de relleno sobre la clave del tubo	H	m	14.8
Anchura de la zanja	B >	m	10
Angulo de talud	β	°	0
Caso de compactación del relleno sobre la zona de influencia del tubo			A2
Caso de compactación del relleno enla la zona de influencia del tubo			B2
Tipo de apoyo para la verificación de la tensión: ángulo de apoyo	2α	°	120
Descarga relativa	a		1
Módulos de deformación E_B			
Sobre el tubo	E_1	N/mm2	8
Junto al tubo	E_2	N/mm2	8
Suelo natural lateral al tubo	E_3	N/mm2	8
Suelo natural bajo el tubo	E_4	N/mm2	5
Relación K_1			0.5
Angulo de rozamiento de las paredes	ρ	°	8.333
CARGA DE TRAFICO			
Carga de superficie		Tn	90

ESFUERZOS	Unidades	Valores
Apoyo Tipo II / 120°		
Clave		
M_{qvt}	kNm/m	64.0329
M_{qh}	kNm/m	-33.2428
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.5231
M_w	kNm/m	-
Suma de M	kNm/m	**32.31**
N_{qvt}	kN/m	-5.3494
N_{qh}	kN/m	-137.9014
N_{qh^*}	kN/m	-
N_g	kN/m	0.5106
N_w	kN/m	-
Suma de N	kN/m	**-142.74**
Riñones		
M_{qvt}	kNm/m	-64.0329
M_{qh}	kNm/m	32.6697
M_{qh^*}	kNm/m	-
M_g	kNm/m	-1.7559
M_w	kNm/m	-
Suma de M	kNm/m	**-33.12**
N_{qvt}	kN/m	-267.4725
N_{qh}	kN/m	0.0000
N_{qh^*}	kN/m	-
N_g	kN/m	-7.6395
N_w	kN/m	-
Suma de N	kN/m	**-275.11**
Base		
M_{qvt}	kNm/m	53.8944
M_{qh}	kNm/m	-26.7949
M_{qh^*}	kNm/m	-
M_g	kNm/m	1.4115
M_w	kNm/m	-
Suma de M	kNm/m	**28.51**
N_{qvt}	kN/m	-149.2496
N_{qh}	kN/m	-77.5695
N_{qh^*}	kN/m	-
N_g	kN/m	-9.3269
N_w	kN/m	-
Suma de N	kN/m	**-236.15**
Valores de la sección de la pared del tubo		
Area A	cm2/m	1950.0000
Momento resistente W	cm3/m	6337.5000

Esquema de armaduras de Tubo P.O.D. nº 18



ALZADO



PLANTA

Pontón en la carretera de la Cartuja a Torrecilla de Valmadrid

ANEJO DE CALCULOS DE TABLERO DE PUENTE PARA CARRETERA

1.- Programa de cálculo :

Los cálculos del tablero se han desarrollado mediante el programa **"Puente Losa"** en una Red Local, compuesta de varios ordenadores Personales (PCs) con memoria RAM de 8 Mb. y disco duro en cada uno de ellos.-

2.- Datos de cargas :

Se consideran los siguientes pesos especificos para la evaluación de las cargas permanentes y pesos propios:

Hormigón armado ó pretensado : 2,50 Tn/m^3
Hormigón en masa : 2,40 Tn/m^3
Pavimento asfáltico : 2,40 Tn/m^3

La carga permanente de aceras, barreras y barandillas se introduce en los cálculos como cargas lineales situadas longitudinalmente en el C. de G. de cada acera.

La sobrecarga considerada es la especificada en la "Instrucción relativa a las acciones a considerar en el proyecto de puentes de Carreteras" **(Orden del M.O.P. de 28 de Febrero de 1.972)** situado el carro en la posición pésima.

3.- Desarrollo del Cálculo :

Para la obtención de los esfuerzos en cada viga se aplica la teoria de la losa ortótropa equivalente, deduciendo los valores de coeficiente de excentricidad $K\alpha$ mediante la fórmula que lo expresa directamente, sin interpolaciones.

Por aplicación de estos coeficientes se hallan los momentos flectores y las tensiones correspondientes en las vigas de borde y 2ª, con el fin de estudiar la más desfavorable

Se estudian a continuación las tensiones producidas por el pretensado tanto durante la fabricación (en el instante de la transferencia) como a largo plazo, considereando respectivamente unas pérdidas del 5% y 20% .

La adición de estas tensiones a las producidas por las cargas exteriores conduce a las tensiones reales (en fibra superior e inferior de la viga, y fibra superior de la losa) que aparecen en las distintas fases, fabricación, servicio bajo cargas permanentes, y servicio bajo máxima sobrecarga.

Se comprueba que las tracciones (si existen) son admisibles en función de la clase de comportamiento de la estructura y se obtiene la resistencia característica del hormigón en cada fase para soportar las compresiones exitentes.

Para el cálculo de la armadura pasiva transversal y comprobación del hormigón frente a esfuerzos cortantes se sigue la **NORMA "EP-93"** distinguiendo entre zona AB y zona C .

Los esfuerzos rasantes entre viga y losa se resisten exclusivamente con armadura pasiva, sin contar con la colaboración del hormigón.

La flexión transversal de la losa de reparto se obtiene evaluando la que corresponde a la deformación transversal general del tablero, **con 7 términos del desarrollo en serie de la carga**, y la local por efecto de las cargas puntuales.**(Método de Westergaard)** .

4.- Notación utilizada :

Para poder interpretar la salida de la impresora debe tenerse en cuenta la siguiente notación :

Datos Geométricos

B = Ancho real del tablero
B_o = Ancho eficaz del tablero
B_1 = Anchura de cada acera
D_1 = Distancia del eje de la última viga al borde del tablero.

Cargas

P_1 = Peso propio de la viga
P_2 = Peso de la losa correspondiente a una viga
P_3 = Peso del pavimento, por viga
P_3' = Carga permanente de 1 acera (Exceso sobre la carga de pavimento)
P_4 = Sobrecarga repartida (400 Kg/m^2), correspondiente a una viga

Caracteristísticas Mecánicas

Va_i = Distancia fibra superior viga a fibra neutra en sección inicial homogeneizada
Vb_i = Distancia fibra inferior viga a fibra neutra en sección inicial homogeneizada
Va_f = Distancia fibra superior viga a fibra neutra en sección final homogeneizada
Vb_f = Distancia fibra inferior viga a fibra neutra en sección final homogeneizada
Vc_f = Distancia fibra inferior Losa a fibra neutra en sección final homogeneizada

A = Area de la sección inicial homogeneizada
I = Inercia de la sección inicial homogeneizada
If = Inercia de la sección final homogeneizada

$K(Rasante) = \frac{SR}{IF}$: SR = Momento estático (en m^3.) de la losa respecto a la Fibra neutra de la sección final homogeneizada.

Reparto Transversal

K (FLEXION) = Parámetro de flexión θ

K (TORSION) = Parámetro de torsión $\sqrt{\alpha}$

$Y(1) = \frac{Y3}{Bo/2}$: Y3 = Distancia al eje del Tablero desde la carga lineal de una acera

$Y(2) = \frac{Y4}{Bo/2}$: Y4 = Distancia al eje del Tablero desde la carga lineal de otra acera

$Y(3) = \frac{Y1}{Bo/2}$: Y1 = Distancia al eje del Tablero desde un cuchillo de cargas puntuales

$Y(4) = \frac{Y2}{Bo/2}$ Y2 = Distancia al eje del Tablero desde otro cuchillo de cargas puntules

Bo = Ancho efectivo del Tablero

Esfuerzos Longitudinales

M_1 = Momento en el centro de la luz de la viga producido por p.p. de la viga.
M_2 = Momento en el centro de la luz de la viga producido por peso de la losa.
M_3 = Momento en el centro de la luz de la viga producido por la carga de Pavimento..
M_3' = Momento en el centro de la luz de la viga producido por la carga de aceras
M_4 = Momento en el centro de la luz de la viga producido por la sobrecarga uniforme
M_5 = Momento en el centro de la luz de la viga producido por sobrecarga puntual móvil

Cálculo de Tensiones

SA = Tensión en fibra superior de la viga
SB = Tensión en fibra inferior de la viga
SC = Tensión en fibra superior de la losa

Pretensado

N = Esfuerzo axil de pretensado inicial, en bancada.
Exc. = Excentridad del esfuerzo de pretensado con respecto a la fibra neutra de la sección inicial homogeneizada de la viga.
PA = Tensión en fibra superior de viga, producida por el pretensado.
PB = Tensión en fibra inferior de viga, producida por el pretensado.

Cálculo armadura cortantes

FY = Límite elástico del acero pasivo
FCT'K = Resistencia a tracción del hormigón
U = Cortante máximo en la sección considerada
URD = Cortante mayorado
SIGMA CL, D = Tensión normal en fibra extrema más traccionada o menos comprimida, bajo la actuación de los esfuerzos normales de cálculo más desfavorables

Armadura Rasante

ESF. RAS.: Esfuerzo cortante producido por las cargas que actúan exclusivamente sobre la sección final.
CAP. MEC. NEC. . Capacidad mecánica necesaria de armadura de conexión.
CAP. MEC. EXIST. ESTRIBOS DE CORTANTE : Capacidad mecánica de los estribos de cortante que se dejan vistos en la viga
CAP. MEC. SUPL. : Capacidad mecánica de la armadura suplementaria a disponer.

Armadura de la Losa

RES. CARAC : Resistencia característica del hormigón de la losa de reparto
REC. : Recubrimiento de las armaduras de la losa de reparto.
ARM. MIN. : Capacidad mecánica mínima de armadura.
ARM. PRAL. : Armadura principal (Transversal a las vigas)
ARM. REP.. : Armadura de reparto (Longitudinal)

Placas Apoyo de Neopreno

MOD. ELAS. H. : Módulo elasticidad hormigón en Tn/m²

CARGA MIN. AP. : Carga vertical minima por apoyo.

CARGA MAX. AP : Carga vertical máxima por apoyo.

CARGA DE FRE. AP : Carga horizontal de Frenado.

GIRO DE AP. : Giro del apoyo debido a las sobrecargas

DESPL. HOR. POR RETR. FLUENCIA Y TEMP. : Movimiento horizontal del apoyo por retracción y fluencia del hormigón y variaciones de temperatura.

TEN. MIN. COMP. : Tensión minima de compresión en le apoyo de neopreno

TEN. MAX.COMP. : Tensión máxima de compresión en le apoyo de neopreno

GIRO POR CARGAS LENTAS TG. : Deformación del apoyo por cargas lentas (retracción, fluencia y temperatura) medida por la tangente del ángulo de giro, es decir, deformación horizontal del neopreno dividido por la altura del neopreno.

GIRO FREN. TG : Deformación del apoyo por cargas de frenado medida por la tangente del ángulo de giro, es decir, deformación horizontal del neopreno dividido por la carga horizontal de frenado.

GIRO TOTAL TG. : Suma de los giros por cargas lentas y frenado.

FUERZA HOR. POR CARGA LENTA : Esfuerzo horizontal por unidad de apoyo por los conceptos de retracción, fluencia y temperatura.

COEF. 1 : Esfuerzo horizontal por unidad de apoyo por los conceptos de retracción, fluencia y temperatura dividido por la carga vertical minima por apoyo.

COEF. 2 : Carga horizontal de frenado más hormigón en Tn/m², dividido por carga vertical máxima por apoyo.

PUENTE LOSA CARRETERA (*)

Cliente ..... :
Lugar de la Obra : PONTON C/ TORRECILLA DE VALMADRID
Fecha ..... :

(*) En el cálculo de características finales no se considera el hormigón del relleno con tracciones superiores a la resis - tencia del hormigón a tracción.

DATOS GEOMETRICOS

SOLUCION ..... = 29 PL- 50
Ancho del Tablero .....[m] = 15
Ancho de Aceras .....[m] = 1.5
Ancho Eficaz [B0] .....[m] = 14.88486
Dis. eje V.Borde a Ex.Tablero [m] = .36
Luz de Cálculo .....[m] = 12.47
Angulo de Esviaje .....[g] = 67.77
Intereje .....[m] = .51
Espesor de la Losa .....[m] = .05
Canto Total .....[m] = .55
Peso del Carro .....[Tn] = 60
Distan. del carro a la Acera .[m] = .5
Espesor del Pavimento .....[cm] = 8
Peso aceras y Barandillas [Tn/ml] = 1.3
Res. Tracc. Horm. Relleno [Tn/m²] = 200

CARGAS [Tn/ml]

P1 = .309
P2 = .39225
P3 = .09792
P3'= 1.012
P4 = .2068966

CARACTERISTICAS MECANICAS

INICIALES

VaI .....[m] = .263
VbI .....[m] = .237
AREA ...[m²] = .1305
INERCIA [m4] = 3.78612E-03

FINALES

Viga Nº 1

VaF ..... [m] = .1938352
VbF ..... [m] = .3061647
VcF ..... [m] = .2438352
INER.FIN. [m4] = 6.845535E-03

Viga Centro

VaF .....[m] = .2053687
VbF .....[m] = .2946312
VcF .....[m] = .2553687
INER.FIN. [m4] = 6.312131E-03

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REPARTO TRANSVERSAL

K (Flexión) = .5968269
K (Torsión) = 1

	CARGA ACERA	CARRO EXCENTRI.	CARRO CENTRADO
Y 1	.903094	.739005	.134364
Y 2	-.903095	.470276	-.134365

COEFICIENTES EXCENTRICIDAD

Num. VIGA	C A R G A A C E R A	C A R R O EXCENTRICO	C A R R O C E N T R A D O
1	1.267457	1.658687	.8161469
2	1.222064	1.634359	.8404184
3	1.174908	1.608147	.8656603
4	1.127337	1.578241	.8922347
5	1.080735	1.54259	.9203105
6	1.036205	1.501016	.9498629
7	.9946274	1.453892	.9806643
8	.9566942	1.401001	1.012268
9	.9229475	1.341968	1.043988
10	.8938062	1.278418	1.074863
11	.869589	1.212434	1.103619
12	.8505334	1.145667	1.12862
13	.8368093	1.079414	1.147803
14	.8285312	1.014674	1.159192
15	.8257649	.9522021	1.162894
16	.8285312	.8925503	1.159192
17	.8368092	.836104	1.147803
18	.8505333	.7831106	1.12862
19	.8695889	.7337031	1.103619

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COEFICIENTES EXCENTRICIDAD
— C O N T I N U A C I O N —

Num. VIGA	C A R G A A C E R A	C A R R O EXCENTRICO	C A R R O C E N T R A D O
20	.8938062	.6879195	1.074863
21	.9229475	.6457167	1.043988
22	.9566942	.6069815	1.012268
23	.9946273	.5715401	.9806643
24	1.036205	.5391606	.949863
25	1.080735	.5095569	.9203106
26	1.127337	.4823867	.8922347
27	1.174908	.4572497	.8656604
28	1.222064	.4336802	.8404185
29	1.267457	.4111397	.816147

PUENTE LOSA CARRETERA

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COEFICIENTES MAS DESFAVORABLES

Número de VIGA	Y 1	Y 2	COEFICIENTE MAS DESFAVORABLE
1	.739	.47027	1.65868
2	.739	.47027	1.63435
3	.739	.47027	1.60814
4	.739	.47027	1.57824
5	.739	.47027	1.54258
6	.739	.47027	1.50101
7	.739	.47027	1.45389
8	.739	.47027	1.401
9	.739	.47027	1.34196
10	.739	.47027	1.27841
11	.739	.47027	1.21243
12	.739	.47027	1.14566
13	.13436	-.13437	1.1478
14	.13436	-.13437	1.15919
15	.13436	-.13437	1.16289
16	.13436	-.13437	1.15919
17	.13436	-.13437	1.1478
18	-.47028	-.73901	1.14566
19	-.47028	-.73901	1.21243
20	-.47028	-.73901	1.27841
21	-.47028	-.73901	1.34196
22	-.47028	-.73901	1.401
23	-.47028	-.73901	1.45389
24	-.47028	-.73901	1.50101
25	-.47028	-.73901	1.54258

PUENTE LOSA CARRETERA

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COEFICIENTES MAS DESFAVORABLES
— C O N T I N U A C I O N —

COEFICIENTES MAS DESFAVORABLES

Número de VIGA	Y 1	Y 2	COEFICIENTE MAS DESFAVORABLE
26	-.47028	-.73901	1.57824
27	-.47028	-.73901	1.60814
28	-.47028	-.73901	1.63435
29	-.47028	-.73901	1.65868

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ESFUERZOS LONGITUDINALES [Mtn.]

VIGA DE BORDE **VIGA Nº 2**

M1 = 6.0062 6.006
M2 = 8.4262 7.624
M3 = 1.9033 1.903
M3'= 1.7194 1.658
M4 = 4.0216 4.022
M5 = 8.9826 8.851

TENSIONES

TENSIONES DE FLEXION [Cargas Exteriores] ... [Tn/m²]

Sobre Sección Inicial

SA=1002.5377 946.8412
SB= 903.4275- 853.2371-

Sobre Sección Final

SA= 470.8030 534.6787
SB= 743.6382- 767.0742-
SC= 592.2471 664.8540

Totales

SA=1473.3408 1481.5198
SB=1647.0657- 1620.3113-
SC= 592.2471 664.8540

PRETENSADO

FILA	Nº CABLES	TIPO	COTA
1	6	0.5	4
2	1	0.6	4
3	2	0.5	46

N [Tn] = 133.3024
Exc.[m] = .107

TENSIONES DE PRETENSADO [Tn/m²]

Iniciales **Finales**

Pa= 25.2887 Pa= 21.2957
Pb=1822.0793 Pb=1534.3826

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RESUMEN DE TENSIONES [Tn/m²]

En fabricación (Extremo viga)

SA= 25.2887
SB=1822.0793

En servicio con cargas permanentes (Centro Viga)

SA=1126.4146
SB= 468.9273

Con cargas máximas

SA=1494.6366
SB= 112.6831-
SC= 592.2471

RESISTENCIA DE LOS HORMIGONES [Tn/m²]

AL DESTESAR .. = 2760.72
A LOS 28 DIAS = 2391.41 se dispone hormigón de 5000
EN LOSA ..... = 947.59 '' '' '' '' 2500

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ARMADURA DE CORTANTES [EP-93]

Acero Fy .....[Kg/cm²] >=5100
Espesor del Alma .. [Cm] = 40
Fct'k ..... [Kg/cm²] = 28.3482
Vcuo ..... [Tn] = 18.8982
Armadura Mínima [Cm²/ml] = 2.0100

ARMADURAS DE CORTANTES

'TO	X	U	URD	SIGMA	COTAG	Z	VCU	A90	Diam	S
1	0	14.51	23.23	-153.44	1.77	AB	18.89	2.01	6	25
2	1.24	8.14	13.03	-58.57	1.91	AB	18.89	2.01	6	25
3	2.49	6.47	10.36	15.22	2.02	AB	18.89	2.01	6	25
4	3.74	4.83	7.73	67.92	2.09	C	16.31	2.01	6	25
5	4.98	3.21	5.14	99.55	2.13	C	17.18	2.01	6	25

S I M B O L O G I A

PTO = Punto número
X = Distancia al apoyo en m.
U = Cortante en sección considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tensión normal en fibra extrema en Kg/cm² (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobación (Art. 48.1.3.3)
VCU = Contri. horm. resistencia esfu. cortante (Art. 48.1.3.4)
A90 = Area necesaria en estribos por metro lineal en Cm²/ml.
Diam. = Diametro de la barra en estribos en mm.
S = Separación entre estribos en cm.

FLEXION TRANSVERSAL LOSA REPARTO

M O M E N T O S

	POSITIVOS [MTn.]	NEGATIVOS [MTn]
DEFORMACION TRANSVERSAL	4.8625	-.4863
FLEXION LOCALIZADA	.4851	-.7
T O T A L E S	5.3476	-1.1863

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos
FLEXION LOCALIZADA : Obtenida por el método de Westergaard

PUENTE LOSA CARRETERA

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ARMADO LOSA

Res. Caracte. Hormigón ... [Tn/m²] = 2500
Res. Acero de la Losa .... [Tn/m²] = 41000
Recubrimiento ..... [cm] = 10
Armadura Mínima ..... [Tn] = 30.0000

CARA SUPERIOR

Armadura Principal se dispone 4 Φ 10 por ml
Armadura Reparto se dispone 4 Φ 10 por ml

CARA INFERIOR

Armadura Principal se dispone 2 Φ 20 por ml

PLACAS DE APOYO DE NEOPRENO

Módulo Elasticidad Hormigón [Tn/m²] = 3000000
Carga Mínima en Apoyo..... [Tn] = 5.534371
Carga Máxima en Apoyo..... [Tn] = 14.51906
Carga de Frenado en Apoyo..... [Tn] = .1188103
Giro de Apoyo ..... [Min] = .2440904
Des. Hori.[Retra. Flue. Temp.] [cm] = .43645

== APOYO DE 100 mm X 200 mm. EN PLANTA y 19 mm. de ALTURA ==

COMPROBACION

Tensión Mínima Compresión [Kg/cm²] = 27.6718
Tensión Máxima Compresión [Kg/cm²] = 72.5953
Giro por Cargas Lentas TG ..... = .43645
Giro Frenado TG ..... = 2.970259E-02
Giro Total TG ..... = .4661526
Fuerza Horizontal Carga Lenta [Kg] = 698.32
Coeficiente 1 = .1261
Coeficiente 2 = .0562
Giro Admisible de Apoyo .... [Min] = 103.11

[PLACA VALIDA]

PUENTE LOSA CARRETERA

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CALCULO A ROTURA

```
Pasiva en Tracción ........ [Tn] = 0
N de Rotura ............... [Tn] = 113.824
ZONA ......................... =  II
Pasiva en Compresión ...... [Tn] = 0
Recub. Pasiva Compresión .. [cm] = 5
Ancho Eficaz .............. [cm] = 51
Capa de Compresión ........ [cm] = 5
Ancho Cabeza Superior ..... [cm] = 30
Profundidad ............... [cm] = 15

Dis. Cdg Compres. Fibra Sup [cm] = 6.4
Profundidad de Compresiones [cm] = 11.43
Dis. Cdg Tracción Fibra Inf [cm] = 4
Canto Resistente .......... [cm] = 44.5985
MR [+] ................... [MTn] = 50.76

Zona II : Zona rectangular cabeza de la viga

M1 ...  [MTn] = 6.006
M2 ...  [MTn] = 8.426
M3 ...  [MTn] = 1.903
M3'...  [MTn] = 1.719
M4 ...  [MTn] = 4.021
M5 ...  [MTn] = 8.982
M TOTAL [MTn] = 31.059
```

[COEFICIENTE DE SEGURIDAD A ROTURA = 1.63 (ADMISIBLE)]

VOLUMEN DE TRACCIONES

```
SA [Tn/m2] =  1494.637
SB [Tn/m2] = -112.6831
X .... [m] =  3.505311E-02

Ancho Cabeza Inferior [cm] =  50
Volumen de Tracciones [Tn] =  .9874732
```

Fdo: Jesús Montaner Fragüet.
Ingeniero de Caminos.

PROGRAMA MURO ARMADO

1.- DESCRIPCION.

El programa aborda el cálculo de un muro de hormigón armado cuya definición geométrica viene definida en la figura que el propio programa genera.

Sobre este muro actúan las cargas correspondientes al empuje del terreno, pudiendo ser éste horizontal en la coronación del muro o bien formar un ángulo con dicha horizontal. Dicho ángulo (BO) viene especificado en el apartado de características.

Sobre el terreno actúa una sobrecarga uniforme y sobre el propio muro actúa una carga vertical máxima y otra mínima, así como una carga horizontal en cabeza debida a esfuerzos de frenado, retracción y fluencia y sismo. Todas estas cargas se consideran por metro lineal de longitud de coronación de muro.

En la figura existente el programa materializa el valor y la posición de la resultante del empuje de tierras.

El programa efectúa el cálculo de los coeficientes de seguridad al vuelco y deslizamiento del muro planteado, así como las tensiones en el cimiento en las hipótesis de carga máxima, carga mínima y sismo en su caso. Asimismo, efectúa el dimensionamiento de las 5 secciones principales del muro reflejadas en el segundo croquis, con su correspondiente comprobación de cuantías mínimas, tanto geométricas como mecánicas.

Con todo lo anterior, procede al armado del muro que figura en el croquis nº 3.

2.- DATOS DE ENTRADA.

Consisten en :

- Descripción geométrica del muro.
- Angulo BO que forma el terreno con la horizontal en la coronación del muro.
- Angulo de rozamiento del terreno.
- Densidad, características de hormigón y acero.
- Sobrecargas repartidas sobre el terreno en la coronación del muro.
- Cargas verticales y horizontales en cota de apoyo.
- Grado sísmico, en su caso.

3.- CÁLCULO.

El programa aplica la teoría de Rankine para el empuje del terreno, suponiendo éste sin cohesión.

En el caso de la existencia del sismo, se aplica lo contenido en la Norma Sismorresistente NCSE-94, Real Decreto 2543/1.994 de 29 de diciembre.

4.- RESULTADOS.

El programa efectúa el cálculo de los coeficientes de seguridad al vuelco y deslizamiento, comprueba las tensiones sobre la cimentación en todos los casos, y efectúa el cálculo del armado del muro.

5.- ORDENADOR.

El programa se ha procesado en una Red Local, compuesta de varios ordenadores Personales (PCs) con memoria RAM de 32 Mb. y disco duro en cada uno de ellos.

M U R O A R M A D O

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D A T O S G E N E R A L E S

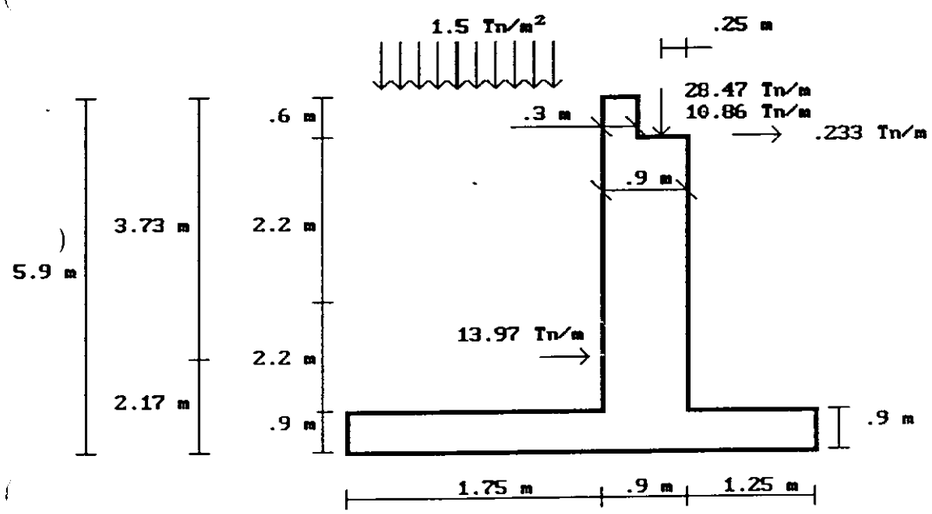
Cliente .....

Lugar de la obra ..... PONTON TORRECILLA DE VALMADRID

Fecha .....

C A R A C T E R I S T I C A S G E O M E T R I C A S

S E C C I O N M U R O A R M A D O



M U R O A R M A D O

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Caracteristicas y Coeficientes

[Caracteristicas varias]

Angulo B0 ..... = 0
Angulo Rozamiento [Sex.] = 30
Densidad terreno [Tn/m3] = 1.9
Fck ..... [Tn/m²] = 2000
Tipo acero ..... = AEH-500N
Recubrimiento ..... [Cm] = 5

[Coeficientes de Seguridad]

Vuelco ..... = 3.4214
Deslizamiento = 2.1323

Tensiones.-

[EMPUJE MAYORADO CON 1.5]

Resultante dentro del nucleo central

Tensión en puntera ..[Tn/m²] = 33.4355
Tensión en tacon ....[Tn/m²] = .4516

[EMPUJE SIN MAYORAR]

Resultante dentro del nucleo central

Tensión en puntera ..[Tn/m²] = 27.2113
Tensión en tacon ....[Tn/m²] = 6.6758

M U R O A R M A D O

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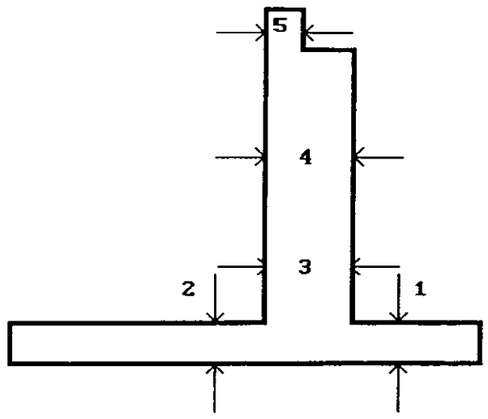
mado de secciones .-

SITUACION SECCIONES



E S F U E R Z O S

SECCION		M O M E N T O S	
Num	Canto	Flector	TOPE
1	0.90	21.26	337.17
2	0.90	17.99	337.17
3	0.90	20.47	303.45
4	0.90	4.79	303.45
5	0.30	0.11	26.25

A R M A D O

SECCION		A R M A D U R A S				
ım	Canto	Flexion	Mecanica	Geometrica	Fisuración	Reparto
L	0.90	40.19	45.33	30.04	65.25	11.33
2	0.90	33.83	45.33	30.04	65.25	11.33
3	0.90	38.79	40.80	25.04	52.44	44.51
4	0.90	8.82	40.80	25.04	52.44	44.51
5	0.30	0.70	12.00	8.35	20.97	14.84

ıadura Paramento Visto

(·ıl : 12.51818 Tn.
:ız .tal : 22.25455 Tn.

Fdo: Jesús Montaner Fragüet.
Ingeniero de Caminos.

5. Proceso constructivo

La ejecución de las estructuras siguió el mismo proceso constructivo.

Inicialmente se ejecutaban los pilotes, utilizando camisa de chapa recuperable hasta llegar a la roca de yeso, en donde se empotraban tres diámetros.
La resistencia exigida era de 200 Kg/cm^2

A continuación se realizaban los encepados para posteriormente seguir con los alzados de las pilas. Los encofrados utilizados en el hormigonado de las pilas fueron trepantes.
Las resistencias exigidas fueron de 250 Kg/cm^2 en los encepados y 300 Kg/cm^2 en los alzados.

Los tableros se ejecutaron siempre desde el lado Lérida, que es donde está situado el punto fijo. Tanto los de las estructuras 1 y 2, con losa aligerada como los de las 3, 4 y 5 de cajón hueco fueron postesados.
Los tableros tipo cajón sé hormigonaron en dos fase, siendo la segunda de ellas la parte superior-interior del cajón.
La resistencia exigida al hormigón de los tableros fue de 350 Kg/cm^2

El primer vano hormigonado era el que apoyaba en el estribo 2, en la pila más cercana y volaba aproximadamente un tercio de la longitud del vano siguiente. Cuando el hormigón alcanzaba los 275 Kg/cm^2 se efectuaba el correspondiente tesado y a continuación se iniciaba la ejecución del siguiente vano.
La unión del tablero al estribo 2 (punto fijo) se procuraba efectuarla rápidamente.

6. Resumen del control de calidad

Se incluye a continuación el resumen de los resultados de roturas de probetas de hormigón de los distintos elementos de las estructuras.

Indicamos también que se efectuó el ensayo sónico de integridad de pilotes por el método de cross-hole a todos y no hubo problemas en ninguno, salvo en la estructura -1, donde en el pilote nº 2 de la pila 15 se detectaron pérdidas de la señal de ultrasonido, lo que implicaba posibles defectos que afectaran a la estabilidad morfológica, estructural o de uniformidad del mismo. Como consecuencia de esto y tras efectuar dos sondeos se decidió ejecutar un nuevo pilote, redimensionando el encepado de la pila, como puede apreciarse en el plano correspondiente.

Debemos destacar también que los ensayos realizados a los aceros utilizados en las armaduras pasivas como los cables de tesado, que también se ensayaron en el laboratorio de la Escuela de C.C. y P. de Santander, dieron siempre resultados adecuados.

Estructura E-1

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Mpa) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1031	12	Estribo 1	Alzado	1ª fase	198	185	277	273	263	271
CH-1032	12	Estribo 1	Alzado	1ª fase	187	185	264	260	246	257
CH-1033	12	Estribo 1	Alzado	1ª fase	181	181	254	259	256	256
CH-1076	6	Estribo 1	Alzado y Orejeras	2ª fase	204	205	307	295	290	297
CH-1077	12	Estribo 1	Alzado y Orejeras	2ª fase	180	178	260	262	264	262
CH-1078	10	Estribo 1	Alzado y Orejeras	2ª fase	313	317	389	396	392	392
CH-0073	4	Estribo 1	Hormigón de Limpieza		54	49	86	81	83	83
CH-0904	17	Estribo 1	Pilote 1		166	165	243	237	245	242
CH-0905	18	Estribo 1	Pilote 1		175	169	278	257	250	262
CH-0917	19	Estribo 1	Pilote 2		155	163	244	227	245	239
CH-0918	18	Estribo 1	Pilote 2		145	141	234	232	230	232
CH-0920	18	Estribo 1	Pilote 3		133	122	234	218	221	224
CH-0921	18	Estribo 1	Pilote 3		118	116	206	206	222	211
CH-0922	18	Estribo 1	Pilote 4		139	144	226	227	227	227
CH-0923	18	Estribo 1	Pilote 4		132	134	260	253	263	259
CH-0924	15	Estribo 1	Pilote 5		153	156	240	243	239	241
CH-0925	17	Estribo 1	Pilote 5		139	134	214	210	215	213
CH-0926	20	Estribo 1	Pilote 6		121	118	196	195	195	195
CH-0927	19	Estribo 1	Pilote 6		121	128	185	189	189	188
CH-0928	17	Estribo 1	Pilote 7		134	128	249	238	241	243
CH-0929	19	Estribo 1	Pilote 7		124	121	219	213	221	218
CH-0984	1	Estribo 1	Zapata		174	182	262	268	266	265
CH-0985	8	Estribo 1	Zapata		180	169	258	256	249	254
CH-0986	8	Estribo 1	Zapata		181	184	232	249	231	237
CH-0987	13	Estribo 1	Zapata		158	151	229	221	222	224
CH-0988	10	Estribo 1	Zapata		135	135	195	195	185	192
CH-0989	3	Estribo 1	Zapata		116	117	164	164	169	166
CH-0314	8	Estribo 2	7ª Capa		280	271	378	383	370	377
CH-0315	6	Estribo 2	7ª Capa		288	304	417	408	409	411
CH-0316	7	Estribo 2	7ª Capa		298	306	409	409	393	404
CH-0194	12,5	Estribo 2	Alzado	1ª tongada	214	212	343	333	340	339
CH-0195	3	Estribo 2	Alzado	1ª tongada	242	240	376	376	375	376
CH-0196	5	Estribo 2	Alzado	1ª tongada	196	198	313	326	319	319
CH-0197	12	Estribo 2	Alzado	1ª tongada	192	203	320	330	340	330

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0198	9,5	Estribo 2	Alzado	1ª tongada	228	228	336	332	338	335
CH-0201	12	Estribo 2	Alzado	2ª tongada	209	209	326	325	334	328
CH-0202	7	Estribo 2	Alzado	2ª tongada	236	231	347	344	353	348
CH-0203	10,5	Estribo 2	Alzado	2ª tongada	202	202	325	326	329	327
CH-0204	6	Estribo 2	Alzado	2ª tongada	222	214	372	361	370	368
CH-0205	11	Estribo 2	Alzado	2ª tongada	209	205	331	326	325	327
CH-0211	7	Estribo 2	Alzado	3ª tongada	236	228	374	380	374	376
CH-0212	10,5	Estribo 2	Alzado	3ª tongada	226	214	340	353	341	345
CH-0213	12	Estribo 2	Alzado	3ª tongada	189	172	343	341	334	339
CH-0214	7	Estribo 2	Alzado	3ª tongada	226	223	337	343	339	340
CH-0215	8	Estribo 2	Alzado	3ª tongada	226	216	312	306	304	307
CH-0219	7	Estribo 2	Alzado	4ª tongada	243	248	378	360	367	368
CH-0220	12	Estribo 2	Alzado	4ª tongada	238	232	359	360	373	364
CH-0221	7	Estribo 2	Alzado	4ª tongada	209	206	378	385	385	383
CH-0222	6	Estribo 2	Alzado	4ª tongada	238	219	344	334	335	338
CH-0223	10	Estribo 2	Alzado	4ª tongada	215	213	388	389	402	393
CH-0260	12	Estribo 2	Alzado	5ª Fase	228	230	330	321	332	328
CH-0261	11,5	Estribo 2	Alzado	5ª Fase	224	219	326	331	332	330
CH-0262	10	Estribo 2	Alzado	5ª Fase	215	204	318	308	318	315
CH-0263	9	Estribo 2	Alzado	5ª Fase	200	212	302	304	306	304
CH-0304	13	Estribo 2	Alzado	6 Capa	235	238	345	358	360	354
CH-0305	11	Estribo 2	Alzado	6 Capa	216	218	385	396	385	389
CH-0306	9	Estribo 2	Alzado	6 Capa	296	287	376	370	369	372
CH-0349	8	Estribo 2	Alzado Final		224	228	329	315	317	320
CH-0704	8	Estribo 2	Espaldón		307	285	377	371	366	371
CH-0072	10	Estribo 2	Hormigón de Limpieza		65	65	90	83	90	87
CH-0152	11	Estribo 2	Zapata		163	172	291	306	305	301
CH-0153	13	Estribo 2	Zapata		174	169	313	322	315	317
CH-0154	10	Estribo 2	Zapata		173	171	267	274	272	271
CH-0155	8	Estribo 2	Zapata		204	198	336	334	332	334
CH-0156	15	Estribo 2	Zapata		174	186	328	321	332	327
CH-0157	4	Estribo 2	Zapata		229	222	376	389	387	384
CH-0158	15	Estribo 2	Zapata		170	172	313	320	321	318
CH-0159	12	Estribo 2	Zapata		166	166	289	300	300	296
CH-0160	12	Estribo 2	Zapata		164	160	303	317	309	310
CH-0161	10	Estribo 2	Zapata		202	203	355	353	362	357
CH-0162	16	Estribo 2	Zapata		174	174	322	318	317	319

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Bias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0163	15	Estribo 2	Zapata		180	177	320	338	319	326
CH-0164	4	Estribo 2	Zapata		223	218	350	354	360	355
CH-0165	13,5	Estribo 2	Zapata		173	173	284	288	309	294
CH-0166	10	Estribo 2	Zapata		212	227	390	381	388	386
CH-0668	9	Pila 01	Alzado		298	308	343	338	342	341
CH-0411	16	Pila 01	Pilote 1	2º Camión	177	182	275	266	277	273
CH-0412	18,5	Pila 01	Pilote 1	4º Camión	180	190	296	301	296	298
CH-0406	18	Pila 01	Pilote 2	2º Camión	220	225	329	336	342	336
CH-0407	20	Pila 01	Pilote 2	4º Camión	200	192	317	317	321	318
CH-0396	19	Pila 01	Pilote 3	2º Camión	258	258	379	385	381	382
CH-0397	20	Pila 01	Pilote 3	4º Camión	267	263	389	369	372	377
CH-0400	19	Pila 01	Pilote 4	2º Camión	278	285	383	371	368	374
CH-0401	21	Pila 01	Pilote 4	4º Camión	262	252	363	351	351	355
CH-0556	7	Pila 01	Zapata		252	247	341	344	351	345
CH-0557	10	Pila 01	Zapata		189	177	255	249	254	253
CH-0558	9	Pila 01	Zapata		206	208	314	311	308	311
CH-0663	12	Pila 02	Alzado		275	278	335	341	341	339
CH-0374	18	Pila 02	Pilote 1	2º Camión	207	197	336	320	336	331
CH-0375	15,5	Pila 02	Pilote 1	4º Camión	235	232	370	364	360	365
CH-0370	18	Pila 02	Pilote 2	2º Camión	219	224	357	333	333	341
CH-0371	19	Pila 02	Pilote 2	4º Camión	196	202	345	325	332	334
CH-0382	14	Pila 02	Pilote 3	2º Camión	263	252	314	317	311	314
CH-0383	18	Pila 02	Pilote 3	4º Camión	232	226	308	318	321	316
CH-0391	21	Pila 02	Pilote 4	2º Camión	218	226	361	342	351	351
CH-0392	16	Pila 02	Pilote 4	4º Camión	236	229	375	391	391	386
CH-0527	6	Pila 02	Zapata		167	161	280	262	272	271
CH-0528	5	Pila 02	Zapata		197	186	298	297	290	295
CH-0529	11	Pila 02	Zapata		166	169	264	255	260	260
CH-0655	12	Pila 03	Alzado	2ª fase	331	327	397	393	385	388
CH-0333	18	Pila 03	Pilote 1	2º Camión	227	217	340	335	334	336
CH-0334	16	Pila 03	Pilote 1	4º Camión	221	223	344	342	348	345
CH-0331	17	Pila 03	Pilote 2	2º Camión	204	197	320	314	325	320
CH-0332	19,7	Pila 03	Pilote 2	4º Camión	179	190	284	297	304	295
CH-0337	22	Pila 03	Pilote 3	2º Camión	226	214	351	356	331	346
CH-0338	17	Pila 03	Pilote 3	4º Camión	210	221	347	350	350	349
CH-0342	20	Pila 03	Pilote 4	2º Camión	214	222	343	362	359	355
CH-0343	15	Pila 03	Pilote 4	4º Camión	252	241	372	386	382	380

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0789	7	Pila 03	Riostra		333	335	396	385	407	396
CH-0514	6	Pila 03	Zapata		199	200	309	324	318	317
CH-0515	8	Pila 03	Zapata		210	207	328	325	304	319
CH-0516	9	Pila 03	Zapata		146	152	269	254	248	257
CH-0636	12	Pila 04	Alzado	1ª fase	296	293	333	340	324	332
CH-0648	12	Pila 04	Alzado	2ª fase	257	266	306	311	322	313
CH-0317	17	Pila 04	Pilote 1	2º Camión	255	268	391	384	377	384
CH-0318	14	Pila 04	Pilote 1	4º Camión	234	232	345	348	361	351
CH-0308	16	Pila 04	Pilote 2	2º Camión	223	222	345	333	339	339
CH-0309	17	Pila 04	Pilote 2	4º Camión	209	219	335	338	338	337
CH-0322	20	Pila 04	Pilote 3	2º Camión	219	224	354	363	358	358
CH-0323	16	Pila 04	Pilote 3		267	253	386	381	383	383
CH-0329	15,5	Pila 04	Pilote 4	1 Camión	230	225	362	348	358	356
CH-0330	14	Pila 04	Pilote 4	3º Camión	249	249	371	358	364	364
CH-0767	7	Pila 04	Riostra		355	343	391	396	419	402
CH-0492	10	Pila 04	Zapata		203	194	307	310	307	308
CH-0493	9	Pila 04	Zapata		186	183	281	283	283	282
CH-0494	10	Pila 04	Zapata		191	177	302	298	299	300
CH-0634	11	Pila 05	Alzado	2ª fase	266	271	338	328	343	336
CH-0350	17	Pila 05	Pilote 1	2º Camión	207	213	321	318	318	319
CH-0351	18	Pila 05	Pilote 1	4º Camión	221	217	353	338	335	342
CH-0347	16	Pila 05	Pilote 2	3º Camión	240	237	368	374	353	365
CH-0348	20	Pila 05	Pilote 2	5º Camión	219	218	338	345	329	337
CH-0357	15	Pila 05	Pilote 3		244	249	383	371	371	330
CH-0358	15	Pila 05	Pilote 3		258	264	376	396	387	386
CH-0363	17	Pila 05	Pilote 4	2º Camión	247	244	349	340	345	345
CH-0364	18	Pila 05	Pilote 4	4º Camión	237	228	321	338	325	328
CH-0760	9	Pila 05	Riostra		338	336	371	356	382	370
CH-0462	7	Pila 05	Zapata		212	220	311	321	311	314
CH-0463	9	Pila 05	Zapata		182	188	300	306	305	304
CH-0464	9	Pila 05	Zapata		178	175	278	279	287	281
CH-0605	5	Pila 06	Alzado	2ª fase	273	262	315	319	330	321
CH-0282	18,5	Pila 06	Pilote 1	2º Camión	200	199	307	289	288	295
CH-0283	19	Pila 06	Pilote 1	3º Camión	207	215	334	320	320	325
CH-0279	19	Pila 06	Pilote 2	2º Camión	186	190	307	294	307	303
CH-0280	20	Pila 06	Pilote 2	4º Camión	200	186	291	278	288	286
CH-0290	16	Pila 06	Pilote 3	2º Camión	266	277	355	370	348	358

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0291	18	Pila 06	Pilote 3	4º Camión	240	239	369	346	341	352
CH-0292	16	Pila 06	Pilote 4	2º Camión	217	206	323	332	317	324
CH-0293	17	Pila 06	Pilote 4	4º Camión	237	254	346	362	358	355
CH-0443	9	Pila 06	Zapata		218	201	327	309	305	314
CH-0444	10	Pila 06	Zapata		212	206	321	322	318	320
CH-0445	9	Pila 06	Zapata		231	243	377	373	373	374
CH-0600	6	Pila 07	Alzado	2ª fase	337	329	410	401	395	402
CH-0277	20	Pila 07	Pilote 1	2º Camión	201	216	315	311	328	318
CH-0278	16	Pila 07	Pilote 1	4º Camión	207	211	290	291	307	296
CH-0272	14	Pila 07	Pilote 2	2º Camión	223	218	347	348	351	349
CH-0273	16	Pila 07	Pilote 2	4º Camión	213	203	316	319	324	320
CH-0269	14	Pila 07	Pilote 3	2º Camión	218	210	328	323	340	330
CH-0270	17	Pila 07	Pilote 3	4º Camión	203	199	258	275	260	264
CH-0274	16	Pila 07	Pilote 4	2º Camión	192	187	308	311	317	312
CH-0275	16	Pila 07	Pilote 4	4º Camión	199	208	311	317	310	313
CH-0742	10	Pila 07	Riostra		352	349	419	407	407	411
CH-0352	10	Pila 07	Zapata		285	299	417	430	430	426
CH-0353	5	Pila 07	Zapata		314	311	470	467	476	471
CH-0354	7	Pila 07	Zapata		298	308	442	447	465	451
CH-0580	7	Pila 08	Alzado	2ª fase	252	252	300	312	303	305
CH-0324	18	Pila 08	Hormigón de Limpieza		107	102	174	166	167	169
CH-0264	14,5	Pila 08	Pilote 1	1º Camión	239	227	349	354	350	351
CH-0265	16	Pila 08	Pilote 1	3º Camión	224	227	325	323	325	324
CH-0254	15	Pila 08	Pilote 2	2º Camión	191	200	313	305	300	306
CH-0255	18	Pila 08	Pilote 2	4º Camión	198	203	307	313	323	314
CH-0249	15	Pila 08	Pilote 3	2º Camión	180	175	298	301	299	299
CH-0250	14	Pila 08	Pilote 3	4º Camión	208	202	266	266	263	265
CH-0257	15	Pila 08	Pilote 4	2º Camión	225	226	325	321	335	327
CH-0258	19	Pila 08	Pilote 4	3º Camión	195	204	302	291	303	299
CH-0344	10	Pila 08	Zapata		264	253	375	388	385	383
CH-0345	11	Pila 08	Zapata		272	259	392	393	401	395
CH-0346	5	Pila 08	Zapata		289	289	432	424	433	430
CH-0243	18	Pila 09	Pilote 1	2º Camión	160	160	257	269	262	263
CH-0244	17	Pila 09	Pilote 1	4º Camión	188	188	296	293	292	294
CH-0234	16	Pila 09	Pilote 2	2º Camión	207	214	314	324	321	320
CH-0235	17	Pila 09	Pilote 2	4º Camión	222	219	348	340	342	343
CH-0230	16	Pila 09	Pilote 3	2º Camión	223	216	340	347	348	345

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0231	14	Pila 09	Pilote 3	4º Camión	215	222	353	338	355	349
CH-0239	17	Pila 09	Pilote 4	3º Camión	195	188	304	304	307	305
CH-0240	16	Pila 09	Pilote 4	5º Camión	212	210	327	339	330	332
CH-0656	12	Pila 09	Zapata		187	195	334	330	344	336
CH-0657	12	Pila 09	Zapata		155	160	288	287	276	284
CH-0658	10	Pila 09	Zapata		230	238	382	369	361	371
CH-0659	9	Pila 09	Zapata		193	189	324	306	302	311
CH-0564	5	Pila 10	Alzado	2º Camión	282	295	362	354	349	355
CH-0216	17	Pila 10	Pilote 1	2º Camión	219	224	362	358	360	360
CH-0217	16,5	Pila 10	Pilote 1	4º Camión	223	233	370	377	367	371
CH-0227	16	Pila 10	Pilote 2	2º Camión	233	239	362	374	379	372
CH-0228	17,5	Pila 10	Pilote 2	3º Camión	232	226	356	361	350	356
CH-0224	17	Pila 10	Pilote 3	2º Camión	240	242	346	358	352	352
CH-0225	16	Pila 10	Pilote 3	4º Camión	247	249	358	350	370	359
CH-0209	16	Pila 10	Pilote 4	1 Camión	228	222	332	329	330	330
CH-0210	19	Pila 10	Pilote 4	2º Camión	249	237	370	366	366	367
CH-0721	8	Pila 10	Riostra		340	344	410	403	419	411
CH-0319	5,5	Pila 10	Zapata		259	255	380	401	383	388
CH-0320	12	Pila 10	Zapata		234	246	371	370	381	374
CH-0321	10	Pila 10	Zapata		254	252	397	409	388	398
CH-0543	12	Pila 11	Alzado	2ª fase	331	320	373	369	382	375
CH-0267	6	Pila 11	Hormigón de Limpieza		119	125	191	183	182	185
CH-0192	16	Pila 11	Pilote 1		195	201	323	336	324	328
CH-0193	19,5	Pila 11	Pilote 1		224	226	363	360	357	360
CH-0187	15	Pila 11	Pilote 2		214	205	320	312	318	317
CH-0188	18	Pila 11	Pilote 2		242	250	363	361	366	363
CH-0206	13	Pila 11	Pilote 3	1 Camión	195	192	331	330	324	328
CH-0207	13,5	Pila 11	Pilote 3	2º Camión	214	212	347	353	351	350
CH-0199	16	Pila 11	Pilote 4	2º Camión	216	211	342	333	337	337
CH-0200	19	Pila 11	Pilote 4	4º Camión	211	213	357	351	344	350
CH-0703	9	Pila 11	Riostra		298	283	376	385	379	380
CH-0287	10	Pila 11	Zapata	2º Camión	252	249	302	323	303	309
CH-0288	7	Pila 11	Zapata	6º Camión	247	248	395	390	404	396
CH-0289	8	Pila 11	Zapata	12º Camión	275	280	401	409	405	405
CH-0521	10	Pila 12	Alzado	2ª fase	307	290	359	366	366	364
CH-0185	16	Pila 12	Pilote 1	14 metros	222	220	321	326	334	327
CH-0186	15	Pila 12	Pilote 1	9 metros	235	235	355	353	340	349

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0181	14	Pila 12	Pilote 2	17 metros	227	224	345	344	355	348
CH-0182	19	Pila 12	Pilote 2		251	247	366	362	363	364
CH-0177	14	Pila 12	Pilote 3	18 metros	210	219	353	337	340	343
CH-0178	16	Pila 12	Pilote 3	9 metros	200	217	326	328	331	328
CH-0183	19	Pila 12	Pilote 4	15 metros	219	220	309	323	307	313
CH-0184	18	Pila 12	Pilote 4	6 metros	245	242	346	339	336	340
CH-0687	9	Pila 12	Riostra		323	337	409	396	396	400
CH-0284	9	Pila 12	Zapata	2º Camión	227	216	326	316	319	317
CH-0285	4	Pila 12	Zapata	5º Camión	270	258	373	372	363	369
CH-0286	11	Pila 12	Zapata	11º Camión	235	240	339	325	307	324
CH-0480	9	Pila 13	Alzado	Fuste 2	306	285	366	351	350	356
CH-0232	6	Pila 13	Hormigón de Limpieza		83	89	144	142	145	144
CH-0174	14	Pila 13	Pilote 1	19 metros	197	188	337	338	341	339
CH-0175	15	Pila 13	Pilote 1	10 metros	189	192	317	318	318	318
CH-0167	19	Pila 13	Pilote 2	17 metros	151	150	230	238	237	235
CH-0168	16	Pila 13	Pilote 2	8 metros	194	196	313	317	322	317
CH-0150	18	Pila 13	Pilote 3	2º camión	176	175	304	286	280	290
CH-0151	19	Pila 13	Pilote 3	3º camión	192	196	301	287	287	292
CH-0169	15	Pila 13	Pilote 4	18 metros	173	174	308	294	298	299
CH-0170	15	Pila 13	Pilote 4	7 metros	168	174	315	301	316	311
CH-0683	11	Pila 13	Riostra		330	328	367	370	370	369
CH-0246	9	Pila 13	Zapata	2º Camión	185	176	279	277	290	282
CH-0247	8	Pila 13	Zapata	8º Camión	186	179	295	302	292	296
CH-0248	10,5	Pila 13	Zapata	12 Camión	181	180	281	286	279	282
CH-0459	6	Pila 14	Alzado	Fuste 1	328	323	371	365	379	372
CH-0176	12	Pila 14	Hormigón de Limpieza		70	75	124	122	119	122
CH-0148	20	Pila 14	Pilote 1	17 metros	163	168	260	268	278	269
CH-0149	16	Pila 14	Pilote 1	6 metros	168	169	290	295	305	297
CH-0139	19	Pila 14	Pilote 2	16 metros	189	192	293	298	299	297
CH-0140	18	Pila 14	Pilote 2	7 metros	173	173	307	310	301	306
CH-0137	17	Pila 14	Pilote 3	15 metros	225	227	323	303	321	317
CH-0138	16	Pila 14	Pilote 3	7 metros	238	238	336	332	315	328
CH-0143	16	Pila 14	Pilote 4	17 metros	182	194	311	320	321	317
CH-0144	15	Pila 14	Pilote 4	8 metros	173	173	294	298	304	299
CH-0189	14,5	Pila 14	Zapata		203	207	317	320	322	320
CH-0190	5	Pila 14	Zapata		238	241	376	366	382	375
CH-0191	6	Pila 14	Zapata		236	236	367	361	366	365

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0509	10	Pila 15	Alzado	Fuste 1	263	268	323	323	323	323
CH-0135	18	Pila 15	Pilote 1	15 metros	155	152	279	248	260	262
CH-0136	19	Pila 15	Pilote 1	7 metros	194	204	354	348	351	351
CH-0129	14	Pila 15	Pilote 2	16 metros	199	194	325	316	317	319
CH-0130	16	Pila 15	Pilote 2	9 metros	194	191	318	319	319	319
CH-0436	18	Pila 15	Pilote 2 bis	2º Camión	178	182	313	304	314	310
CH-0437	19	Pila 15	Pilote 2 bis	4º Camión	206	211	309	292	296	299
CH-0126	16	Pila 15	Pilote 3	14 metros	174	183	286	315	286	296
CH-0127	15	Pila 15	Pilote 3	6 metros	194	199	326	319	328	325
CH-0133	17	Pila 15	Pilote 4	15 metros	193	194	333	334	331	332
CH-0134	16	Pila 15	Pilote 4	9 metros	179	177	325	323	319	322
CH-0654	9	Pila 15	Riostra		377	376	430	444	442	439
CH-0485	9	Pila 15	Zapata		214	209	330	328	336	331
CH-0486	6	Pila 15	Zapata		230	242	381	376	366	374
CH-0487	9	Pila 15	Zapata		210	206	335	334	312	327
CH-0446	9	Pila 16	Alzado	Fuste 1	276	261	357	346	350	351
CH-0128	13	Pila 16	Hormigón de Limpieza		67	69	110	118	122	117
CH-0111	16	Pila 16	Pilote 1	20 metros	183	183	285	280	285	283
CH-0112	15	Pila 16	Pilote 1	10 metros	187	192	319	306	306	310
CH-0120	15	Pila 16	Pilote 2	15 metros	208	193	303	301	298	301
CH-0121	14	Pila 16	Pilote 2	9 metros	196	197	292	291	292	292
CH-0122	13,5	Pila 16	Pilote 3	13,5 metros	183	186	282	282	279	281
CH-0123	15	Pila 16	Pilote 3	9,5 metros	201	203	305	298	313	305
CH-0114	16	Pila 16	Pilote 4	14 metros	185	175	291	303	290	295
CH-0115	16	Pila 16	Pilote 4	9 metros	183	189	293	286	292	290
CH-0171	12	Pila 16	Zapata		153	150	285	286	274	282
CH-0172	6	Pila 16	Zapata		155	164	274	264	278	272
CH-0173	10	Pila 16	Zapata		182	188	312	311	308	311
CH-0430	8	Pila 17	Alzado	Fuste 1	348	347	400	400	407	402
CH-0096	23	Pila 17	Pilote 1	15 metros	202	201	341	340	335	339
CH-0097	17	Pila 17	Pilote 1	7 metros	218	222	352	344	344	347
CH-0104	15	Pila 17	Pilote 2	15 metros	229	226	354	358	367	360
CH-0105	14	Pila 17	Pilote 2	22 metros	221	217	336	352	338	342
CH-0109	13	Pila 17	Pilote 3	12 metros	191	187	337	337	311	328
CH-0110	16	Pila 17	Pilote 3	8 metros	184	189	312	320	316	316
CH-0100	14	Pila 17	Pilote 4	6 metros	236	239	376	376	380	377
CH-0101	19	Pila 17	Pilote 4	22 metros	218	220	333	323	348	335

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0633	11	Pila 17	Riostra		257	264	315	320	312	316
CH-0119	6,5	Pila 17	Zapata	Hormigón de Limpieza	103	107	172	171	169	171
CH-0145	10	Pila 17	Zapata		136	118	243	247	250	247
CH-0146	7	Pila 17	Zapata		164	166	266	285	284	278
CH-0147	8	Pila 17	Zapata		172	175	278	288	278	281
CH-0500	9	Pila 18	Alzado	Fuste 1	274	269	330	328	328	329
CH-0431	17	Pila 18	Pilote 1	2º Camión	232	208	315	336	324	325
CH-0432	17	Pila 18	Pilote 1	4º Camión	235	238	353	336	341	343
CH-0441	18	Pila 18	Pilote 2	2º Camión	175	181	281	281	273	267
CH-0442	19	Pila 18	Pilote 2	4º Camión	183	180	276	285	280	280
CH-0423	19	Pila 18	Pilote 3	2º Camión	202	209	313	319	318	317
CH-0424	18	Pila 18	Pilote 3	4º Camión	205	205	325	327	337	330
CH-0604	6	Pila 18	Riostra		266	259	305	309	309	308
CH-0473	10	Pila 18	Zapata		225	221	340	320	335	332
CH-0474	7	Pila 18	Zapata		213	213	317	331	317	322
CH-0393	11	Pila 19	Alzado	Fuste 1	310	320	367	363	353	361
CH-0093	18	Pila 19	Pilote 1	26 metros	173	176	304	316	311	310
CH-0094	18	Pila 19	Pilote 1	10 metros	213	211	331	330	325	329
CH-0089	18	Pila 19	Pilote 2	15 metros	228	222	349	340	340	343
CH-0090	16	Pila 19	Pilote 2	9 metros	225	225	344	342	351	346
CH-0080	18,5	Pila 19	Pilote 3	22 metros	260	261	388	382	385	385
CH-0081	14	Pila 19	Pilote 3	12 metros	284	273	393	414	404	404
CH-0091	17	Pila 19	Pilote 4	20 metros	152	154	277	286	270	277
CH-0092	16	Pila 19	Pilote 4	10 metros	164	162	328	311	328	322
CH-0508	7	Pila 19	Riostra		265	257	303	306	300	303
CH-0116	4	Pila 19	Zapata		185	200	294	273	294	287
CH-0117	9	Pila 19	Zapata		185	187	266	256	272	265
CH-0118	12	Pila 19	Zapata		193	187	268	283	279	277
CH-0376	6,5	Pila 20	Alzado	Fuste 1	402	393	464	458	464	462
CH-0084	16	Pila 20	Pilote 1	20 metros	266	274	384	394	406	395
CH-0085	17	Pila 20	Pilote 1	10 metros	189	249	368	344	366	359
CH-0078	17	Pila 20	Pilote 2	16 metros	261	250	358	349	359	355
CH-0079	17	Pila 20	Pilote 2	5 metros	260	250	386	376	376	379
CH-0082	17	Pila 20	Pilote 3	18 metros	266	263	378	386	376	380
CH-0083	16	Pila 20	Pilote 3	9 metros	210	223	373	375	376	374
CH-0087	14	Pila 20	Pilote 4	13 metros	229	237	362	363	353	359
CH-0088	14	Pila 20	Pilote 4	6 metros	259	258	377	399	399	392

Análisis nº	Asiento UNE	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0106	7		268	265	389	384	383	385
CH-0107	10		214	207	334	338	351	341
CH-0108			189	186	321	306	316	314
CH-0405		Fuste 1	334	324	402	385	408	398
CH-0495	9		227	234	289	283	289	287
CH-0098	10		211	210	347	342	329	339
CH-0099	10		244	237	380	370	364	371
CH-1232	8	Fase 22	371	361	413	424	413	417
CH-1233	9	Fase 22	339	352	435	437	447	440
CH-1234	10	Fase 22	362	340	436	419	436	430
CH-1235	13	Fase 22	355	358	424	414	411	416
CH-1236	11	Fase 22	344	367	409	410	419	413
CH-1237	10	Fase 22	389	390	430	433	447	437
CH-1210	7	Fase 21		328	382	397	384	388
CH-1211		Fase 21		369	395	396	390	394
CH-1212	13	Fase 21		375	405	414	399	406
CH-1213	11	Fase 21		362	398	400	409	402
CH-1214	9	Fase 21		385	430	431	436	432
CH-1215	10	Fase 21		377	416	408	420	415
CH-1216	9	Fase 21		402	453	453	441	449
CH-1217	10	Fase 21		428	454	447	441	447
CH-1218	11	Fase 21		390	460	453	459	457
CH-1219	12	Fase 21		412	426	447	430	434
CH-1194	8	Fase 20	321	333	413	412	407	411
CH-1195	9	Fase 20	346	335	384	394	394	391
CH-1196	11	Fase 20	345	330	446	446	427	440
CH-1197	10	Fase 20	325	328	448	434	427	436
CH-1198	9	Fase 20	356	355	407	407	430	415
CH-1199	9	Fase 20	373	394	422	447	447	439
CH-1200	13	Fase 20	321	334	360	360	375	365
CH-1201	9	Fase 20	340	338	430	419	419	423
CH-1202	8	Fase 20	372	372	453	419	430	434
CH-1203	9	Fase 20	356	363	438	443	440	440
CH-1167	8	Fase 19	346		431	428	434	431
CH-1168	6	Fase 19	358		406	406	401	404
CH-1169	7	Fase 19	312		422	412	411	415
CH-1170	9	Fase 19	320		362	385	372	373

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1171	4	Vano 04	Tablero	Fase 19	323		404	398	408	403
CH-1172	8	Vano 04	Tablero	Fase 19	343		391	390	376	386
CH-1173	8	Vano 04	Tablero	Fase 19	331		396	371	386	384
CH-1174	10	Vano 04	Tablero	Fase 19	308		370	367	372	370
CH-1175	8	Vano 04	Tablero	Fase 19	304		391	376	370	379
CH-1176	10	Vano 04	Tablero	Fase 19	339		401	406	413	407
CH-1134	8	Vano 05	Tablero		330		392	389	389	390
CH-1135	7	Vano 05	Tablero		346		410	402	402	405
CH-1136	7,5	Vano 05	Tablero		335		383	385	371	380
CH-1137	7	Vano 05	Tablero		357		416	419	407	414
CH-1138	8	Vano 05	Tablero		372		426	437	430	431
CH-1139	6	Vano 05	Tablero		366		396	420	418	411
CH-1140	8	Vano 05	Tablero		331		417	414	419	417
CH-1141	7	Vano 05	Tablero		388		444	453	432	443
CH-1142	7	Vano 05	Tablero		352		427	434	437	433
CH-1143	8	Vano 05	Tablero		355		419	408	429	419
CH-1110	6,5	Vano 06	Tablero		374		394	397	396	395
CH-1111	7,5	Vano 06	Tablero		374		451	454	467	457
CH-1112	7	Vano 06	Tablero		378		452	446	459	452
CH-1113	10	Vano 06	Tablero		352		394	398	397	396
CH-1114	9	Vano 06	Tablero		359		413	401	408	407
CH-1115	12	Vano 06	Tablero		362		405	413	402	407
CH-1116	12	Vano 06	Tablero		300		417	400	400	406
CH-1117	9	Vano 06	Tablero		332		419	403	397	406
CH-1118	10	Vano 06	Tablero		351		393	393	386	391
CH-1119	10	Vano 06	Tablero		353		400	400	421	407
CH-1079	15	Vano 07	Tablero		389		455	431	441	442
CH-1080	8	Vano 07	Tablero		410		482	471	472	475
CH-1081	14	Vano 07	Tablero		390		449	455	444	449
CH-1082	12	Vano 07	Tablero		373		435	436	424	432
CH-1083	10	Vano 07	Tablero		376		422	418	419	420
CH-1084	12	Vano 07	Tablero		409		446	458	445	450
CH-1085	14	Vano 07	Tablero		378		449	422	429	433
CH-1086	9	Vano 07	Tablero		443		498	499	490	496
CH-1087	10	Vano 07	Tablero		438		489	507	498	498
CH-1088	10	Vano 07	Tablero		413		481	463	489	478
CH-1050	10	Vano 08	Tablero		360		441	441	433	439

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1051	11	Vano 08	Tablero		300		407	415	419	414
CH-1052	13	Vano 08	Tablero		373		444	455	444	448
CH-1053	14	Vano 08	Tablero		379		466	450	464	460
CH-1054	13	Vano 08	Tablero		374		428	441	425	431
CH-1055	13	Vano 08	Tablero		386		438	437	431	435
CH-1056	11	Vano 08	Tablero		357		461	452	454	456
CH-1057	12	Vano 08	Tablero		383		404	394	400	399
CH-1058	13	Vano 08	Tablero		377		454	424	443	440
CH-1059	12	Vano 08	Tablero		378		421	430	434	428
CH-1035	12	Vano 09	Tablero		360	362	414	433	427	425
CH-1036	11	Vano 09	Tablero		345	363	471	467	456	465
CH-1037	12	Vano 09	Tablero		323	326	398	400	392	397
CH-1038	14	Vano 09	Tablero		376	384	416	432	418	422
CH-1039	11	Vano 09	Tablero		354	360	448	440	432	440
CH-1040	12	Vano 09	Tablero		364	372	418	396	419	411
CH-1041	12	Vano 09	Tablero		384	394	460	476	453	463
CH-1042	10	Vano 09	Tablero		375	363	433	431	424	429
CH-1043	14	Vano 09	Tablero		344	322	392	383	393	389
CH-1044	12	Vano 09	Tablero		371	372	465	474	453	464
CH-1001	6	Vano 10	Tablero				399	385	395	393
CH-1002	7	Vano 10	Tablero				460	456	480	465
CH-1003	11	Vano 10	Tablero				457	461	458	459
CH-1004	14	Vano 10	Tablero				438	428	435	434
CH-1005	10	Vano 10	Tablero				380	385	394	386
CH-1006	11	Vano 10	Tablero				407	401	412	407
CH-1007	11	Vano 10	Tablero				412	409	405	409
CH-1008	10	Vano 10	Tablero				440	442	458	447
CH-1009	10	Vano 10	Tablero				422	420	421	421
CH-1010	10	Vano 10	Tablero				416	425	437	426
CH-0967	13	Vano 11	Tablero	Fase 12	306		430	415	420	422
CH-0968	10	Vano 11	Tablero	Fase 12	380		458	462	452	457
CH-0969	8	Vano 11	Tablero	Fase 12	417		497	486	485	489
CH-0970	10	Vano 11	Tablero	Fase 12	408		470	465	465	467
CH-0971	10	Vano 11	Tablero	Fase 12	360		448	452	439	446
CH-0972	12	Vano 11	Tablero	Fase 12	385		456	438	448	447
CH-0973	12	Vano 11	Tablero	Fase 12	370		450	448	436	445
CH-0974	11	Vano 11	Tablero	Fase 12	406		446	445	446	446

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0975	11	Vano 11	Tablero	Fase 12	401		489	477	483	483
CH-0976	13	Vano 11	Tablero	Fase 12	410		461	462	462	462
CH-0945	8	Vano 12	Tablero	Fase 11	381		466	463	475	468
CH-0946	7	Vano 12	Tablero	Fase 11	355		436	454	459	450
CH-0947	7	Vano 12	Tablero	Fase 11	361		460	465	453	459
CH-0948	10	Vano 12	Tablero	Fase 11	333		424	448	444	439
CH-0949	8	Vano 12	Tablero	Fase 11	355		443	462	461	455
CH-0950	4	Vano 12	Tablero	Fase 11	337		436	439	442	439
CH-0951	9	Vano 12	Tablero	Fase 11	359		444	462	440	449
CH-0952	9	Vano 12	Tablero	Fase 11	313		410	419	409	413
CH-0953	11	Vano 12	Tablero	Fase 11	342		446	422	432	433
CH-0954	7	Vano 12	Tablero	Fase 11	331		437	446	453	445
CH-0906	7	Vano 13	Tablero		414		489	461	489	480
CH-0907	10	Vano 13	Tablero		360		430	461	436	442
CH-0908	11	Vano 13	Tablero		367		403	413	413	410
CH-0909	8	Vano 13	Tablero		418		466	458	460	461
CH-0910	11	Vano 13	Tablero		356		434	435	424	431
CH-0911	9	Vano 13	Tablero		371		467	440	464	457
CH-0912	8	Vano 13	Tablero		388		451	448	448	449
CH-0913	9	Vano 13	Tablero		407		470	464	464	466
CH-0914	12	Vano 13	Tablero		366		453	453	453	453
CH-0915	12	Vano 13	Tablero		364		435	419	413	422
CH-0864	8	Vano 14	Tablero		333		406	395	399	400
CH-0865	8	Vano 14	Tablero		364		389	412	400	400
CH-0866	13	Vano 14	Tablero		352		401	416	410	409
CH-0867	10	Vano 14	Tablero		357		416	405	410	410
CH-0868	11	Vano 14	Tablero		364		393	396	296	395
CH-0869	6	Vano 14	Tablero		352		426	426	426	426
CH-0870	11	Vano 14	Tablero		367		388	372	390	383
CH-0871	10	Vano 14	Tablero		364		413	403	403	406
CH-0872	8	Vano 14	Tablero		368		384	400	394	393
CH-0873	6	Vano 14	Tablero		359		404	406	414	408
CH-0839	11	Vano 15	Tablero		373		400	400	393	398
CH-0840	9	Vano 15	Tablero		375		411	405	411	409
CH-0841	8	Vano 15	Tablero		367		384	385	386	385
CH-0842	6	Vano 15	Tablero		374		409	430	430	423
CH-0843	10	Vano 15	Tablero		363		417	430	420	422

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0844	4	Vano 15	Tablero		349		391	409	409	403
CH-0845	12	Vano 15	Tablero		340		402	419	396	406
CH-0846	7	Vano 15	Tablero		368		415	430	430	425
CH-0847	9	Vano 15	Tablero		366		430	410	416	419
CH-0848	9	Vano 15	Tablero		344		379	407	402	396
CH-0849	8	Vano 15	Tablero		368		431	417	424	424
CH-0812	13	Vano 16	Tablero		332		369	337	367	358
CH-0813	8	Vano 16	Tablero		336		382	376	389	382
CH-0814	5	Vano 16	Tablero		342		420	430	403	418
CH-0815	8	Vano 16	Tablero		365		400	398	390	396
CH-0816	12	Vano 16	Tablero		327		365	368	371	368
CH-0817	11	Vano 16	Tablero		313		364	371	395	377
CH-0818	8	Vano 16	Tablero		331		407	393	385	395
CH-0819	10	Vano 16	Tablero		348		376	384	381	380
CH-0820	9	Vano 16	Tablero		341		389	383	385	386
CH-0821	11	Vano 16	Tablero		310		387	392	375	385
CH-0822	11	Vano 16	Tablero		326		386	372	383	380
CH-0776	9	Vano 17	Tablero		352		390	393	368	384
CH-0777	10	Vano 17	Tablero		346		413	413	386	404
CH-0778	11	Vano 17	Tablero		356		393	385	385	388
CH-0779	11	Vano 17	Tablero		356		375	410	409	398
CH-0780	10	Vano 17	Tablero		346		389	387	404	393
CH-0781	8	Vano 17	Tablero		367		390	407	407	401
CH-0782	6	Vano 17	Tablero		321		373	398	385	385
CH-0783	12	Vano 17	Tablero		322		376	388	364	376
CH-0784	9	Vano 17	Tablero		338		375	386	403	388
CH-0785	9	Vano 17	Tablero		321		396	395	373	388
CH-0786	13	Vano 17	Tablero		314		349	346	364	353
CH-0748	12	Vano 18	Tablero		342		398	391	390	393
CH-0749	12	Vano 18	Tablero		351		374	396	373	381
CH-0750	11	Vano 18	Tablero		351		404	424	400	409
CH-0751	3	Vano 18	Tablero		337		382	400	382	388
CH-0752	5	Vano 18	Tablero		320		413	404	404	407
CH-0753	12	Vano 18	Tablero		343		407	399	397	401
CH-0754	9	Vano 18	Tablero		346		417	429	403	416
CH-0755	12	Vano 18	Tablero		325		387	366	388	380
CH-0756	10	Vano 18	Tablero		345		387	399	399	395

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0757	10	Vano 18	Tablero		349		407	413	383	401
CH-0758	12	Vano 18	Tablero		329		387	381	391	386
CH-0724	11	Vano 19	Tablero		311		345	345	361	350
CH-0725	12	Vano 19	Tablero		337		368	362	374	368
CH-0726	8	Vano 19	Tablero		334		362	357	362	360
CH-0727	12	Vano 19	Tablero		327		351	349	351	350
CH-0728	8	Vano 19	Tablero		333		345	345	343	344
CH-0729	7	Vano 19	Tablero		326		365	362	362	363
CH-0730	12	Vano 19	Tablero		286		317	329	317	321
CH-0731	10	Vano 19	Tablero		300		333	337	338	336
CH-0732	12	Vano 19	Tablero		291		336	337	330	334
CH-0733	10	Vano 19	Tablero		326		339	339	334	337
CH-0734	12	Vano 19	Tablero		290		348	348	340	345
CH-0708	9	Vano 20	Tablero		318		367	374	374	372
CH-0709	10	Vano 20	Tablero		322		374	374	375	374
CH-0710	9	Vano 20	Tablero		312		358	362	355	358
CH-0711	10	Vano 20	Tablero		340		388	376	379	381
CH-0712	11	Vano 20	Tablero		332		382	376	379	379
CH-0713	10	Vano 20	Tablero		318		366	364	365	365
CH-0714	12	Vano 20	Tablero		321		380	373	362	372
CH-0715	10	Vano 20	Tablero		330		371	362	355	363
CH-0716	12	Vano 20	Tablero		309		336	334	352	341
CH-0717	12	Vano 20	Tablero		326		384	363	373	374
CH-0718	10	Vano 20	Tablero		306		375	367	362	368
CH-0690	14	Vano 21	Tablero			337	397	390	397	395
CH-0691	12	Vano 21	Tablero			340	384	390	390	388
CH-0692	9	Vano 21	Tablero			342	385	385	385	385
CH-0693	10	Vano 21	Tablero			344	413	391	391	395
CH-0694	9	Vano 21	Tablero			335	392	389	382	388
CH-0695	11	Vano 21	Tablero			334	351	345	359	352
CH-0696	10	Vano 21	Tablero			340	368	389	369	375
CH-0697	7	Vano 21	Tablero			379	400	400	407	402
CH-0698	11	Vano 21	Tablero			374	404	404	414	407
CH-0699	14	Vano 21	Tablero			385	416	437	416	423
CH-0700	13	Vano 21	Tablero			293	385	385	396	389
CH-0669	7	Vano 22	Tablero			341	359	378	364	367
CH-0670	4	Vano 22	Tablero			337	385	378	385	383

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0671	5	Vano 22	Tablero		331	336	387	402	385	391
CH-0672	10	Vano 22	Tablero			310	362	352	364	359
CH-0673	9	Vano 22	Tablero		328	332	395	369	362	375
CH-0674	10	Vano 22	Tablero			327	399	386	389	391
CH-0675	6	Vano 22	Tablero		290	281	338	343	335	339
CH-0676	11	Vano 22	Tablero			386	472	453	453	459
CH-0677	9	Vano 22	Tablero		344	358	399	396	390	395

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Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-101	4	Estribo 1	Aletas		138	145	191	191	192	191
CH-071	10	Estribo 1	Alzado	2ª fase	220	219	355	325	326	335
CH-072	11	Estribo 1	Alzado	2ª fase	202	208	335	345	349	343
CH-074	11	Estribo 1	Alzado	3ª fase	253	244	351	357	340	349
CH-074	11	Estribo 1	Alzado	3ª fase	241	249	383	373	370	375
CH-047	19	Estribo 1	Pilote 1		168	174	280	263	268	270
CH-047	18	Estribo 1	Pilote 1		176	185	278	281	289	283
CH-047	19	Estribo 1	Pilote 2		163	159	247	260	248	252
CH-047	15	Estribo 1	Pilote 3		177	181	286	292	313	297
CH-047	20	Estribo 1	Pilote 3		174	178	297	285	272	285
CH-047	15	Estribo 1	Pilote 4		171	179	277	277	279	278
CH-048	18	Estribo 1	Pilote 5		178	184	282	308	298	296
CH-048	20	Estribo 1	Pilote 6	2º Camión	181	182	257	250	259	255
CH-048	20	Estribo 1	Pilote 6	4º Camión	187	180	264	259	253	259
CH-059	11	Estribo 1	Zapata		224	213	299	311	301	304
CH-059	1	Estribo 1	Zapata		229	237	355	332	337	341
CH-059	7	Estribo 1	Zapata		231	236	343	351	328	341
CH-059	8	Estribo 1	Zapata		230	236	353	360	338	350
CH-059	7	Estribo 1	Zapata		250	249	369	374	369	371
CH-059	8	Estribo 1	Zapata		212	218	333	318	340	330
CH-080	9	Estribo 2	Alzado	1ª fase	218	223	344	338	334	339
CH-080	10	Estribo 2	Alzado	1ª fase	239	237	365	381	375	374
CH-080	10	Estribo 2	Alzado	1ª fase	269	246	408	396	404	403
CH-083	8	Estribo 2	Alzado	2ª fase	153	163	260	259	253	257
CH-083	11	Estribo 2	Alzado	2ª fase	146	146	229	239	247	238
CH-133	9	Estribo 2	Espaldón	Ultima fase	268	261	306	321	304	310
CH-060	10	Estribo 2	Hormigón de limpiez		59	53	90	90	101	94
CH-096	7	Estribo 2	Orejeras		167	159	276	259	263	266
CH-050	18	Estribo 2	Pilote 1	2º Camión	138	129	228	229	236	231
CH-050	16	Estribo 2	Pilote 1	4º Camión	158	149	241	243	241	242

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-048	17	Estribo 2	Pilote 10		193	195	270	290	278	279
CH-049	18	Estribo 2	Pilote 10		184	194	284	281	284	283
CH-053	17	Estribo 2	Pilote 2		157	165	256	272	269	266
CH-053	17	Estribo 2	Pilote 2		174	167	282	292	290	288
CH-054	18	Estribo 2	Pilote 3	2º Camión	162	165	260	255	265	260
CH-054	20	Estribo 2	Pilote 3	4º Camión	167	168	279	273	255	269
CH-054	18	Estribo 2	Pilote 4	2º Camión	163	169	278	269	279	275
CH-054	15	Estribo 2	Pilote 4	4º Camión	183	194	308	296	295	300
CH-052	17	Estribo 2	Pilote 5	2º Camión	169	172	271	258	269	266
CH-052	17	Estribo 2	Pilote 5	4º Camión	156	167	248	263	275	262
CH-051	17	Estribo 2	Pilote 6	2º Camión	165	165	258	264	265	262
CH-051	20	Estribo 2	Pilote 6	4º Camión	148	139	238	244	227	236
CH-054	18	Estribo 2	Pilote 7	2º Camión	182	180	291	287	299	292
CH-054	17	Estribo 2	Pilote 7	4º Camión	169	172	274	273	268	272
CH-050	15	Estribo 2	Pilote 8	2º Camión	160	166	257	285	270	271
CH-050	17	Estribo 2	Pilote 8	4º Camión	178	170	290	294	290	291
CH-052	18	Estribo 2	Pilote 9	2º Camión	135	146	223	227	214	221
CH-052	17	Estribo 2	Pilote 9	4º Camión	153	159	249	258	253	253
CH-101	7	Estribo 2	Solera	Galería	151	157	238	238	242	239
CH-061	8	Estribo 2	Zapata		222	218	376	370	361	369
CH-061	7	Estribo 2	Zapata		222	214	353	362	355	357
CH-061	8	Estribo 2	Zapata		264	254	373	375	386	378
CH-061	4	Estribo 2	Zapata		263	265	395	397	389	394
CH-061	7	Estribo 2	Zapata		276	286	405	404	406	405
CH-061	6	Estribo 2	Zapata		274	288	412	415	405	411
CH-062	6	Estribo 2	Zapata		268	273	393	397	404	398
CH-062	9	Estribo 2	Zapata		262	277	384	396	392	391
CH-062	8	Estribo 2	Zapata		216	223	258	255	251	255
CH-070	10	Pila 01	Alzado		259	248	305	305	301	304
CH-046	20	Pila 01	Pilote 1	2º Camión	180	182	285	280	285	283
CH-046	16	Pila 01	Pilote 1	3º Camión	191	194	277	295	293	288
CH-046	19	Pila 01	Pilote 2	2º Camión	176	180	273	275	282	277

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-046	18	Pila 01	Pilote 2	4º Camión	181	189	263	263	279	268
CH-044	18	Pila 01	Pilote 3	2º Camión	173	180	284	278	286	283
CH-045	20	Pila 01	Pilote 3	4º Camión	161	164	271	254	269	265
CH-045	17	Pila 01	Pilote 4	2º Camión	219	207	311	322	311	315
CH-056	6	Pila 01	Zapata		226	229	355	364	351	357
CH-056	10	Pila 01	Zapata		183	179	299	300	313	304
CH-056	9	Pila 01	Zapata		200	200	309	315	305	310
CH-072	8	Pila 02	Alzado		256	266	317	324	318	320
CH-045	18	Pila 02	Pilote 1	2º Camión	212	207	285	298	275	286
CH-045	18	Pila 02	Pilote 1	4º Camión	214	210	296	291	287	291
CH-045	17	Pila 02	Pilote 2	1º Camión	194	210	303	296	288	296
CH-045	20	Pila 02	Pilote 2	3º Camión	185	192	264	274	281	273
CH-045	18	Pila 02	Pilote 3	2º Camión	169	173	266	266	279	270
CH-046	18	Pila 02	Pilote 4		167	173	268	270	273	270
CH-083	9	Pila 02	Riostra		214	205	279	274	276	276
CH-058	7	Pila 02	Zapata		178	180	284	287	295	289
CH-058	10	Pila 02	Zapata		172	172	306	300	302	303
CH-058	9	Pila 02	Zapata		209	215	344	335	350	343
CH-128	11	Vano 01	Tablero		321		352	363	379	365
CH-128	12	Vano 01	Tablero		333		385	416	384	395
CH-128	11	Vano 01	Tablero		259		288	311	310	303
CH-128	12	Vano 01	Tablero		320	318	351	390	384	375
CH-129	14	Vano 01	Tablero		319	307	375	372		374
CH-129	12	Vano 01	Tablero		245	237	281	308	318	302
CH-106	9,5	Vano 02	Tablero		335					
CH-126	10	Vano 02	Tablero		366	359	403	394	420	406
CH-126	9,5	Vano 02	Tablero		335		400	389	391	393
CH-127	12	Vano 02	Tablero		323	319	371	373	373	372
CH-127	14	Vano 02	Tablero		280	281	360	343		352
CH-128	14	Vano 02	Tablero		338	329	382	391	403	392
CH-128	14	Vano 02	Tablero		275		318	337		328
CH-128	11	Vano 02	Tablero		357	354	387	405	410	401

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-128	13	Vano 02	Tablero		300	312	385	380	372	379
CH-128	14	Vano 02	Tablero		203		302	314	310	309
CH-128	14	Vano 02	Tablero		300	290	344	354	357	352
CH-129	10	Vano 02	Tablero		323		346	373	379	366
CH-129	11	Vano 02	Tablero		256	262	297	301		299
CH-126	10	Vano 03	Tablero		334		373	391	403	389
CH-126	12	Vano 03	Tablero		270	286	338	297	344	326
CH-127	7	Vano 03	Tablero		269		292	323	313	309
CH-127	8,5	Vano 03	Tablero		310	331	389	363	389	380
CH-127	12	Vano 03	Tablero		280	277	318	323		321
CH-127	13	Vano 03	Tablero		303	300	341	340		341
CH-127	9	Vano 03	Tablero		336		381	389	381	384
CH-127	9	Vano 03	Tablero		298		374	325	380	360
CH-127	12	Vano 03	Tablero		260		279	282		281
CH-127	12	Vano 03	Tablero		332	325	323	378	373	358

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Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-041	10	Estribo 1	Alzado	2ª fase	264	280	391	390	410	397
CH-043	9	Estribo 1	Alzado	3ª fase	289	279	394	379	396	390
CH-043	10	Estribo 1	Alzado	3ª fase	238	252	323	313	334	323
CH-044	8	Estribo 1	Alzado	4ª fase	255	267	402	396	392	397
CH-040	11	Estribo 1	Alzado Central	1ª fase	268	267	382	362	396	380
CH-032	13	Estribo 1	Zapata		227	221	305	303	303	304
CH-032	7	Estribo 1	Zapata		231	237	357	336	343	345
CH-032	6	Estribo 1	Zapata		278	283	414	433	422	423
CH-032	6	Estribo 1	Zapata		270	274	396	398	407	400
CH-033	3	Estribo 2	Alzado	1º Fase	218	231	300	302	322	308
CH-034	7	Estribo 2	Alzado	1º Fase	278	266	389	394	402	395
CH-034	10	Estribo 2	Alzado	1º Fase	280	271	415	401	400	405
CH-042	8	Estribo 2	Alzado	2ª fase	297	284	439	438	440	439
CH-042	12	Estribo 2	Alzado	2ª fase	287	269	409	419	420	416
CH-042	10	Estribo 2	Alzado	2ª fase	305	308	445	444	440	443
CH-047	4	Estribo 2	Alzado	4ª fase	222	221	350	342	342	345
CH-047	9	Estribo 2	Alzado	4ª fase	218	212	336	341	333	337
CH-049	10	Estribo 2	Alzado	Aletas	197	196	263	264	266	264
CH-089	12	Estribo 2	Espaldon		155	149	257	269	264	263
CH-064	8	Estribo 2	Hormigón de Limpiez	Relleno Trasdos	111	114	194	207	196	199
CH-088	9	Estribo 2	Muro	Galería	205	211	299	278	287	288
CH-029	10	Estribo 2	Zapata		227	220	343	342	329	338
CH-029	12	Estribo 2	Zapata		203	206	314	308	307	310
CH-029	8,5	Estribo 2	Zapata		240	237	339	351	351	347
CH-029	6	Estribo 2	Zapata		259	266	400	404	417	407
CH-029	12	Estribo 2	Zapata		265	261	380	381	384	382
CH-029	14	Estribo 2	Zapata		234	230	358	363	340	354
CH-030	13	Estribo 2	Zapata		180	191	282	275	284	280
CH-030	13	Estribo 2	Zapata		183	178	270	274	266	270

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-030	12	Estribo 2	Zapata		221	221	291	282	271	281
CH-056	6	Pila 01	Alzado	1ª fase	254	245	316	313	312	314
CH-060	9	Pila 01	Alzado	2ª fase	268	271	304	312	319	312
CH-066	9	Pila 01	Capitel		286	282	339	334	340	338
CH-031	6	Pila 01	Zapata	2º Camión	265	260	410	405	420	412
CH-031	6	Pila 01	Zapata	7º Camión	312	302	420	426	408	418
CH-031	9	Pila 01	Zapata	12º Camión	233	231	382	374	380	379
CH-031	9	Pila 01	Zapata	15º Camión	244	249	374	380	389	381
CH-054	10	Pila 02	Alzado	1ª fase	307	309	348	366	366	360
CH-056	6	Pila 02	Alzado	2ª fase	322	325	376	368	368	371
CH-059	9	Pila 02	Alzado	3ª fase	314	309	376	353	377	369
CH-065	6	Pila 02	Capitel		320	307	371	361	371	368
CH-026	16	Pila 02	Pilote 1	2º Camión	194	201	311	289	304	301
CH-026	16	Pila 02	Pilote 2	1º Camión	226	215	337	346	336	340
CH-027	20	Pila 02	Pilote 3	2º Camión	194	190	279	278	289	282
CH-027	13	Pila 02	Pilote 4	2º Camión	218	206	333	336	322	330
CH-028	20	Pila 02	Pilote 5	2º Camión	203	206	294	284	285	288
CH-035	8	Pila 02	Zapata		316	316	411	425	415	417
CH-036	10	Pila 02	Zapata		260	249	403	401	396	400
CH-036	9	Pila 02	Zapata		257	269	361	360	367	359
CH-036	10	Pila 02	Zapata		244	258	362	367	376	368
CH-045	8,5	Pila 03	Alzado	1ª fase (4 mts)	255	270	337	331	334	334
CH-049	6	Pila 03	Alzado	2ª fase	293	293	339	347	339	342
CH-052	9	Pila 03	Alzado	3ª fase	282	266	327	322	320	323
CH-063	8	Pila 03	Capitel		295	301	341	346	342	343
CH-038	11	Pila 03	Zapata		260	254	358	355	362	358
CH-038	12	Pila 03	Zapata		242	239	388	400	388	392
CH-038	5	Pila 03	Zapata		290	289	435	428	453	439
CH-038	8	Pila 03	Zapata		275	280	422	426	429	426
CH-039	10	Pila 03	Zapata		303	302	418	406	418	414
CH-097	12	Vano 01	Tablero		406		508	488	503	500

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-097	13	Vano 01	Tablero		407	399	482	498	475	485
CH-097	12	Vano 01	Tablero		376	353	464	471	467	467
CH-098	9	Vano 01	Tablero		394	395	475	498	491	488
CH-098	8	Vano 01	Tablero		385	402	510	492	504	502
CH-098	11	Vano 01	Tablero		282	270	420	430	419	423
CH-099	10	Vano 01	Tablero	Losa Superior	371	386	437	422	446	435
CH-099	10	Vano 01	Tablero	Losa Superior	375	382	437	451	434	441
CH-093	8	Vano 02	Tablero	Fase 3	389	380	466	458	461	462
CH-093	14	Vano 02	Tablero	Fase 3	378	383	441	417	436	431
CH-093	15	Vano 02	Tablero	Fase 3	350	360	422	443	440	435
CH-093	15	Vano 02	Tablero	Fase 3	343	356	416	422	427	422
CH-093	12	Vano 02	Tablero	Fase 3	361	370	459	457	458	458
CH-094	12	Vano 02	Tablero	Fase 3	351	360	408	416	421	415
CH-094	12	Vano 02	Tablero	Fase 3	335	352	419	417	410	415
CH-094	13	Vano 02	Tablero	Fase 3	335	351	413	415	421	416
CH-094	13	Vano 02	Tablero	Fase 3	314	311	433	445	451	443
CH-094	12	Vano 02	Tablero	Fase 3	362	356	432	442	446	440
CH-095	13	Vano 02	Tablero	Losa superior	334	331	374	374	376	374
CH-095	12	Vano 02	Tablero	Losa superior	353	346	411	414	395	407
CH-087	8	Vano 03	Tablero	Fase A	364	382	396	408	393	399
CH-087	8	Vano 03	Tablero	Fase A	380	380	409	410	409	409
CH-087	11	Vano 03	Tablero	Fase A	331	321	387	389	390	389
CH-087	11	Vano 03	Tablero	Fase A	374	391	412	400	414	409
CH-087	11	Vano 03	Tablero	Fase A	359	361	386	392	387	388
CH-088	12	Vano 03	Tablero	Fase A	385	374	404	397	399	400
CH-088	9	Vano 03	Tablero	Fase A	369	369	398	409	406	404
CH-088	12	Vano 03	Tablero	Fase A	380	372	403	402	396	400
CH-088	12	Vano 03	Tablero	Fase A	379	375	404	420	425	416
CH-088	10	Vano 03	Tablero	Fase A	390	383	425	425	421	424
CH-088	13	Vano 03	Tablero	Fase A	363	374	401	400	399	400
CH-089	12	Vano 03	Tablero	Losa superior Fase B	365	373	455	455	453	454

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-089	11	Vano 03	Tablero	Losa superior Fase B	381	385	454	477	458	463
CH-079	12	Vano 04	Tablero	1ª fase	313	329	385	354	379	373
CH-079	8	Vano 04	Tablero	1ª fase	320	330	365	366	367	366
CH-079	10	Vano 04	Tablero	1ª fase	326	317	406	374	388	389
CH-079	8	Vano 04	Tablero	1ª fase	347	347	375	377	387	380
CH-079	11	Vano 04	Tablero	1ª fase	347	340	351	373	368	364
CH-079	12	Vano 04	Tablero	1ª fase	342	339	356	377	372	368
CH-079	8	Vano 04	Tablero	1ª fase	310	325	371	351	371	364
CH-080	11	Vano 04	Tablero	1ª fase	343	345	398	370	353	374
CH-080	9	Vano 04	Tablero	1ª fase	345	349	357	398	396	384
CH-080	10	Vano 04	Tablero	1ª fase	342	359	415	395	409	407
CH-085	11	Vano 04	Tablero	Cierre	295	281	335	340	341	339
CH-085	10	Vano 04	Tablero	Cierre	320	317	371	358	370	366

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Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0650	10	Estribo 1	Alzado	1ª fase	227	238	373	374	356	368
CH-0651	7	Estribo 1	Alzado	1ª fase	236	228	332	344	339	338
CH-0652	8	Estribo 1	Alzado	1ª fase	239	244	385	380	386	384
CH-0678	10	Estribo 1	Alzado	2ª fase	212	225	348	328	340	339
CH-0606	11	Estribo 1	Zapata		212	211	309	302	312	308
CH-0607	11	Estribo 1	Zapata		206	199	289	296	295	293
CH-0608	11	Estribo 1	Zapata		208	218	318	311	332	320
CH-0609	9	Estribo 1	Zapata		225	216	314	328	316	319
CH-0891	8	Estribo 2	Aletas	Izquierdo	214	221	318	320	312	317
CH-0701	10	Estribo 2	Alzado	1ª fase	191	209	329	318	338	329
CH-0702	8	Estribo 2	Alzado	1ª fase	246	261	353	345	350	349
CH-0735	10	Estribo 2	Alzado	2ª fase	259	249	357	352	347	352
CH-0736	9	Estribo 2	Alzado	2ª fase	280	280	362	362	372	365
CH-0737	8	Estribo 2	Alzado	2ª fase	261	252	351	372	354	359
CH-0738	8	Estribo 2	Alzado	2ª fase	245	244	353	341	339	344
CH-0772	12	Estribo 2	Alzado	3ª fase	230	223	364	354	349	356
CH-0773	7	Estribo 2	Alzado	3ª fase	252	251	386	385	374	382
CH-0774	9	Estribo 2	Alzado	3ª fase	246	243	371	374	395	380
CH-1304	12	Estribo 2	Alzado	Ultima fase	177	173	289	278	290	286
CH-0456	7	Estribo 2	Hormigón de limpieza		98	87	154	152	155	154
CH-1089	9	Estribo 2	Solera	Galería	239	232	315	317	331	321
CH-0638	5,5	Estribo 2	Zapata		227	232	346	347	339	344
CH-0639	10	Estribo 2	Zapata		186	181	312	317	313	314
CH-0640	9	Estribo 2	Zapata		222	224	330	332	333	332
CH-0641	7	Estribo 2	Zapata		232	237	326	337	358	340
CH-0642	9	Estribo 2	Zapata		217	229	357	345	345	349
CH-0643	7	Estribo 2	Zapata		232	232	376	367	363	369
CH-0644	10	Estribo 2	Zapata		231	233	366	371	360	366
CH-0645	10	Estribo 2	Zapata		241	226	400	381	383	388
CH-0646	5	Estribo 2	Zapata		239	232	346	357	360	354

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0381	10	Pila 03	Zapata		249	251	353	353	353	353
CH-0743	9	Pila 04	Alzado	2ª fase	285	284	357	347	354	353
CH-0482	10	Pila 04	Hormigón de Limpieza		79	88	123	118	124	122
CH-1177	6,5	Pila 04	Riostra		277	282	377	366	352	365
CH-0497	10	Pila 04	Zapata		229	216	325	318	316	320
CH-0498	9	Pila 04	Zapata		204	216	296	283	294	291
CH-0499	10	Pila 04	Zapata		201	200	278	276	280	278
CH-1336	9	Vano 01	Tablero	1ª Fase	387	365	442	420	436	433
CH-1337	13	Vano 01	Tablero	1ª fase	339	353	405	403	409	406
CH-1338	13	Vano 01	Tablero	1ª fase	331	340	397	399	404	400
CH-1339	10	Vano 01	Tablero	1ª fase	353	368	413	430	422	422
CH-1340	8	Vano 01	Tablero	1ª fase	360	376	400	419	416	412
CH-1341	9	Vano 01	Tablero	1ª Fase	358	340	399	407	410	405
CH-1342	12	Vano 01	Tablero	Losa Superior	340		426	437	412	425
CH-1343	11	Vano 01	Tablero	Losa Superior	348		401	433	400	411
CH-1322	10	Vano 02	Tablero	1ª fase	357	340	407	396	402	402
CH-1323	9	Vano 02	Tablero	1ª fase	362	354	419	407	396	407
CH-1324	8	Vano 02	Tablero	1ª fase	350	354	410	407	430	416
CH-1325	10	Vano 02	Tablero	1ªfase	342	344	407	407	396	403
CH-1326	6	Vano 02	Tablero	1ª Fase	332	330	416	407	401	408
CH-1327	11	Vano 02	Tablero	1ª Fase	337	321	396	407	413	405
CH-1328	11	Vano 02	Tablero	1ª fase	363	359	405	413	419	412
CH-1329	10	Vano 02	Tablero	1ª fase	351	350	396	402	402	400
CH-1330	8	Vano 02	Tablero	1ª fase	361	360	407	424	407	413
CH-1331	8	Vano 02	Tablero	1ª fase	356	362	403	401	402	402
CH-1332	13	Vano 02	Tablero	Losa Superior	347		413	424	407	415
CH-1333	13	Vano 02	Tablero	Losa Superior	341		411	413	405	410
CH-1308	11	Vano 03	Tablero	1ª fase	340	341	364	393	395	384
CH-1309	14	Vano 03	Tablero	1ª fase	331	346	393	391	407	397
CH-1310	10	Vano 03	Tablero	1ª fase	305	307	362	362	369	364
CH-1311	12	Vano 03	Tablero	1ª fase	307	307	369	361	379	370
CH-1312	7	Vano 03	Tablero	1ª fase	346	339	383	383	373	380

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1313	14	Vano 03	Tablero	1ª fase	324	318	351	364	364	360
CH-1314	10	Vano 03	Tablero	1ª fase	319	325	382	363	360	368
CH-1315	9	Vano 03	Tablero	1ª fase	347	336	379	394	392	388
CH-1316	10	Vano 03	Tablero	1ª fase	333	323	365	365	360	363
CH-1317	9	Vano 03	Tablero	1ª fase	330	329	376	376	386	379
CH-1318	11	Vano 03	Tablero	Losa Superior	357		388	406	398	397
CH-1319	10	Vano 03	Tablero	Losa Superior	390		438	421	448	436
CH-1294	13	Vano 04	Tablero	Primera fase	311	312	389	369	379	379
CH-1295	10	Vano 04	Tablero	Primera fase	341	328	403	366	376	382
CH-1296	9	Vano 04	Tablero	Primera fase	341	366	403	423	407	411
CH-1297	14	Vano 04	Tablero	Primera fase	340	335	377	352	383	371
CH-1298	6,5	Vano 04	Tablero	Primera fase	338	349	383	392	394	390
CH-1299	13	Vano 04	Tablero	Primera fase	333	355	395	379	387	387
CH-1300	12	Vano 04	Tablero	Primera fase	346	333	376	396	395	387
CH-1301	9	Vano 04	Tablero	Primera fase	330	330	409	403	398	403
CH-1302	13	Vano 04	Tablero	Primera fase	361	368	385	386	394	388
CH-1303	7,5	Vano 04	Tablero	Primera fase	345	350	411	395	397	401
CH-1305	9	Vano 04	Tablero	Losa superior	364		390	405	390	395
CH-1306	9	Vano 04	Tablero	Losa superior	335		418	413	407	413
CH-1252	9	Vano 05	Tablero	Fase 1 (1ª parte)	326	326	382	379	377	379
CH-1253	13	Vano 05	Tablero	Fase 1 (1ª parte)	336	336	372	355	366	364
CH-1254	12	Vano 05	Tablero	Fase 1 (1ª parte)	321	328	383	385	397	388
CH-1255	13	Vano 05	Tablero	Fase 1 (1ª parte)	295	298	377	370	367	371
CH-1256	6	Vano 05	Tablero	Fase 1 (1ª parte)	343	340	407	407	387	400
CH-1257	12	Vano 05	Tablero	Fase 1 (1ª parte)	341	331	392	375	380	382
CH-1258	14	Vano 05	Tablero	Fase 1 (1ª parte)	359	349	406	393	391	397
CH-1259	9	Vano 05	Tablero	Fase 1 (1ª parte)	330	354	396	393	389	393
CH-1260	10	Vano 05	Tablero	Fase 1 (1ª parte)	326	316	385	390	385	387
CH-1261	8	Vano 05	Tablero	Fase 1 (1ª parte)	328	353	399	399	409	402
CH-1262	6	Vano 05	Tablero	Fase 1 (1ª parte)	375	384	434	430	415	426
CH-1263	11	Vano 05	Tablero	Fase 1 (1ª parte)	376	373	436	411	410	419
CH-1264	12	Vano 05	Tablero	Fase 1 (2ª parte)		303	356	362	357	358

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1265	13	Vano 05	Tablero	Fase 1 (2ª parte)		328	369	375	369	371

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Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1092	9	Estribo 1	Alzado	1ª fase	171	164	257	268	264	263
CH-1093	12	Estribo 1	Alzado	1ª fase	128	142	233	241	234	236
CH-1094	12	Estribo 1	Alzado	1ª fase	153	152	247	258	254	253
CH-1095	12	Estribo 1	Alzado	1ª fase	148	156	271	261	249	260
CH-1127	10	Estribo 1	Alzado	Fase 2	270	257	336	315	341	331
CH-1128	12	Estribo 1	Alzado	Fase 2	266	268	325	319	340	328
CH-1164	13	Estribo 1	Alzado	3ª fase	298	302	334	346	324	335
CH-1165	13	Estribo 1	Alzado	3ª fase	281	275	318	310	329	329
CH-0990	10	Estribo 1	Relleno		61	58	88	92	86	89
CH-0991	7	Estribo 1	Relleno		59	64	95	95	93	94
CH-1014	8	Estribo 1	Zapata		128	113	200	192	203	198
CH-1015	13	Estribo 1	Zapata		159	155	227	237	232	232
CH-1016	13	Estribo 1	Zapata		143	142	222	226	228	225
CH-1017	13	Estribo 1	Zapata		153	154	250	249	244	248
CH-1018	13	Estribo 1	Zapata		175	174	257	251	248	252
CH-1019	13	Estribo 1	Zapata		162	159	266	255	279	267
CH-1020	11	Estribo 1	Zapata		165	169	265	258	267	263
CH-0611	9	Estribo 2	Alzado	1ª fase	235	230	335	328	313	325
CH-0612	9	Estribo 2	Alzado	1ª fase	222	233	308	305	318	310
CH-0613	7	Estribo 2	Alzado	1ª fase	249	235	345	335	348	343
CH-0660	8	Estribo 2	Alzado	2ª fase	182	172	331	311	309	317
CH-0661	13	Estribo 2	Alzado	2ª fase	178	159	289	288	278	285
CH-0662	10	Estribo 2	Alzado	2ª fase	235	249	376	371	363	370
CH-0688	10	Estribo 2	Alzado	3ª fase	248	241	359	374	357	363
CH-0689	10	Estribo 2	Alzado	3ª fase	244	243	354	375	365	365
CH-1061	8	Estribo 2	Losa	Galería	320	320	354	364	364	361
CH-1047	9	Estribo 2	Solera	Galeria	184	178	253	260	250	254
CH-1060	8	Estribo 2	Solera	Galería	264	262	326	325	320	324
CH-0567	6	Estribo 2	Zapata		197	208	329	318	315	321

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0568	3	Estribo 2	Zapata		204	221	337	328	337	334
CH-0569	12	Estribo 2	Zapata		183	185	288	302	302	298
CH-0570	11	Estribo 2	Zapata		162	157	287	272	277	279
CH-0571	9	Estribo 2	Zapata		178	170	321	317	330	323
CH-0572	11	Estribo 2	Zapata		184	194	317	298	309	308
CH-0573	14	Estribo 2	Zapata		155	161	283	288	270	280
CH-0574	12	Estribo 2	Zapata		164	176	312	297	294	301
CH-0575	12	Estribo 2	Zapata		168	172	285	288	287	287
CH-0576	7	Estribo 2	Zapata		181	184	310	325	316	317
CH-0577	11	Estribo 2	Zapata		147	149	246	250	246	247
CH-0578	10	Estribo 2	Zapata		169	172	254	269	264	262
CH-0579	9	Estribo 2	Zapata		153	140	264	250	259	258
CH-1133	7	Pila 00	Alzado	1ª fase	361	377	476	470	476	474
CH-1146	9	Pila 00	Alzado	Fase 2	302	312	387	405	378	390
CH-1159	5	Pila 00	Alzado	3ª fase	305	297	343	366	357	355
CH-1166	7	Pila 00	Capitel		392	392	449	437	454	447
CH-1126	21	Pila 00	Pilote 1		183	190	260	272	250	261
CH-1106	18	Pila 00	Pilote 2		346	345	375	389	400	388
CH-1107	20	Pila 00	Pilote 2		299	278	338	323	317	326
CH-1120	16	Pila 00	Pilote 3		232	226	301	283	300	295
CH-1121	19	Pila 00	Pilote 3		238	238	293	309	307	303
CH-1108	18	Pila 00	Pilote 4		325	313	347	333	337	339
CH-1109	20	Pila 00	Pilote 4		280	286	358	357	347	354
CH-1124	20	Pila 00	Pilote 5		203	187	249	236	240	242
CH-1125	19	Pila 00	Pilote 5		241	228	297	301	284	294
CH-1129	12	Pila 00	Zapata		305	303	373	345	364	361
CH-1130	11	Pila 00	Zapata		325	325	385	378	377	380
CH-1131	7	Pila 00	Zapata		336	330	393	370	383	382
CH-1132	6	Pila 00	Zapata		407	397	438	444	433	438
CH-0685	8	Pila 01	Alzado	1ª fase	250	250	299	300	299	299
CH-0859	11	Pila 01	Alzado	2ª fase	249	241	276	282	282	280

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0861	10	Pila 01	Alzado	3ª fase	199	199	245	251	244	247
CH-0862	12	Pila 01	Alzado	4ª fase	225	230	269	261	263	264
CH-0874	10	Pila 01	Alzado	5ª fase	256	259	287	290	292	290
CH-0887	9	Pila 01	Alzado	6ª fase	273	271	346	333	329	336
CH-0889	9	Pila 01	Alzado	7ª fase	267	256	321	322	323	322
CH-0916	9	Pila 01	Capitel		274	277	376	373	374	374
CH-0603	8	Pila 01	Hormigón de limpieza		113	107	178	175	160	171
CH-0433	17	Pila 01	Pilote 1		226	222	327	323	336	329
CH-0398	18	Pila 01	Pilote 2	2º Camión	261	263	366	388	388	381
CH-0426	20	Pila 01	Pilote 4	4º Camión	190	194	311	313	317	314
CH-0399	18	Pila 01	Pilote 5		242	253	369	377	358	368
CH-0425	19	Pila 01	Pilote 6	2º Camión	206	194	320	321	310	317
CH-0625	8	Pila 01	Zapata		246	228	354	351	346	350
CH-0626	10	Pila 01	Zapata		219	225	335	330	343	336
CH-0627	12	Pila 01	Zapata		207	207	314	310	306	310
CH-0628	11	Pila 01	Zapata		202	216	316	329	327	324
CH-0629	7	Pila 01	Zapata		246	242	337	341	337	338
CH-0630	8	Pila 01	Zapata		232	241	354	356	341	350
CH-0631	10	Pila 01	Zapata		218	216	322	327	308	319
CH-0632	8	Pila 01	Zapata		240	230	344	347	344	345
CH-0680	7	Pila 02	Alzado	1ª fase	270	261	325	324	324	324
CH-0825	6	Pila 02	Alzado	2ª fase	319	324	370	375	391	379
CH-0827	10	Pila 02	Alzado	3ª fase	309	306	361	335	334	343
CH-0831	8	Pila 02	Alzado	4ª fase	256	254	300	309	308	306
CH-0838	12	Pila 02	Alzado	5ª fase	238	237	289	285	284	286
CH-0850	10	Pila 02	Alzado	6ª fase	257	233	287	291	293	290
CH-0854	9	Pila 02	Alzado	7ª fase	268	252	300	305	305	303
CH-0863	10	Pila 02	Capitel		239	244	276	281	277	278
CH-0367	19	Pila 02	Pilote 1		186	184	290	284	289	288
CH-0307	20	Pila 02	Pilote 2		172	174	275	284	280	280
CH-0366	13	Pila 02	Pilote 3		220	225	315	327	310	317

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA [Días] 7 a]	7 b]	28 a]	28 b]	28 c]	Resistencia media
CH-0365	21	Pila 02	Pilote 4		198	147	253	253	243	250
CH-0303	20	Pila 02	Pilote 5	1º Camión	208	215	293	291	304	296
CH-0369	19	Pila 02	Pilote 6		209	218	319	322	334	325
CH-0585	7	Pila 02	Zapata		212	196	340	339	340	340
CH-0586	7	Pila 02	Zapata		207	197	314	298	327	313
CH-0587	9	Pila 02	Zapata		180	192	315	312	300	309
CH-0588	4	Pila 02	Zapata		203	206	332	328	323	328
CH-0589	9	Pila 02	Zapata		212	202	330	352	331	338
CH-0590	10	Pila 02	Zapata		192	194	315	314	314	314
CH-0591	7	Pila 02	Zapata		204	200	333	356	351	347
CH-0592	10	Pila 02	Zapata		190	198	321	299	295	305
CH-0624	7	Pila 03	Alzado	1ª fase	295	297	333	331	329	331
CH-0787	9	Pila 03	Alzado	2ª fase	333	323	376	402	382	387
CH-0788	7	Pila 03	Alzado	2ª fase	320	317	385	376	351	371
CH-0792	5	Pila 03	Alzado	4ª fase	359	357	409	429	407	412
CH-0804	12	Pila 03	Alzado	5ª fase	287	295	408	405	411	408
CH-0806	9	Pila 03	Alzado	6ª fase	283	282	341	325	335	334
CH-0811	6	Pila 03	Alzado	7ª fase	339	332	397	377	388	387
CH-0830	10	Pila 03	Capitel		237	240	272	280	283	278
CH-0418	16	Pila 03	Pilote 1	2º Camión	187	190	267	280	267	271
CH-0419	18	Pila 03	Pilote 1	5º Camión	194	194	309	317	306	311
CH-0377	18,5	Pila 03	Pilote 2		223	229	369	375	375	373
CH-0378	20,5	Pila 03	Pilote 2		222	231	354	343	362	353
CH-0402	16	Pila 03	Pilote 3		263	259	371	375	383	376
CH-0403	17	Pila 03	Pilote 3		260	250	389	371	381	380
CH-0408	21	Pila 03	Pilote 4		194	183	308	302	300	303
CH-0409	18	Pila 03	Pilote 4		194	208	314	312	316	314
CH-0394	21	Pila 03	Pilote 5	2º Camión	238	225	344	350	352	349
CH-0395	22	Pila 03	Pilote 5	6º Camión	240	239	341	343	355	346
CH-0413	20	Pila 03	Pilote 6		177	169	281	279	272	277
CH-0414	20	Pila 03	Pilote 6		173	168	280	289	295	288

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0548	10	Pila 03	Zapata		199	194	316	315	302	311
CH-0549	9	Pila 03	Zapata		194	190	296	308	293	299
CH-0550	7	Pila 03	Zapata		188	201	318	300	316	311
CH-0551	6	Pila 03	Zapata		215	216	362	354	340	352
CH-0552	9	Pila 03	Zapata		214	209	315	313	316	315
CH-0553	8	Pila 03	Zapata		196	207	307	316	316	313
CH-0554	7	Pila 03	Zapata		225	225	334	340	349	341
CH-0555	10	Pila 03	Zapata		213	214	353	351	345	350
CH-0741	11	Pila 04	Alzado	3ª fase	227	219	329	308	313	317
CH-0744	10	Pila 04	Alzado	4ª fase	327	331	383	370	372	375
CH-0747	12	Pila 04	Alzado	5ª fase	259	261	294	307	300	300
CH-0763	12	Pila 04	Alzado	6ª fase	371	378	430	431	436	432
CH-0765	8	Pila 04	Alzado	7ª fase	282	281	332	321	329	327
CH-0766	7	Pila 04	Alzado	7ª fase	286	275	331	337	319	329
CH-0771	7,5	Pila 04	Alzado	8ª fase	288	286	347	347	350	348
CH-0956	9	Pila 04	Capitel		246	249	294	298	296	296
CH-0507	12	Pila 04	Hormigón de Limpieza		47	47	87	72	78	79
CH-0373	21	Pila 04	Pilote 1		188	199	316	314	306	312
CH-0356	17	Pila 04	Pilote 2		198	208	335	343	346	341
CH-0372	18	Pila 04	Pilote 3		212	222	341	339	338	339
CH-0384	17	Pila 04	Pilote 4		248	242	319	300	316	312
CH-0355	21	Pila 04	Pilote 5		214	221	339	325	354	339
CH-0385	20,5	Pila 04	Pilote 6		237	234	318	299	299	305
CH-0530	11	Pila 04	Zapata		168	173	272	274	261	269
CH-0531	7	Pila 04	Zapata		182	180	299	284	300	294
CH-0532	6	Pila 04	Zapata		181	175	293	288	282	288
CH-0533	10	Pila 04	Zapata		169	168	294	289	289	291
CH-0534	9	Pila 04	Zapata		183	175	274	276	286	279
CH-0535	6	Pila 04	Zapata		179	188	303	308	298	303
CH-0536	9	Pila 04	Zapata		167	168	267	263	270	267
CH-0537	9	Pila 04	Zapata		182	190	285	291	296	291

Análisis nº	Asiento BNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0705	7	Pila 05	Alzado	1ª fase	265	270	338	321	327	329
CH-0707	10	Pila 05	Alzado	2ª fase	256	275	327	324	325	325
CH-0722	10	Pila 05	Alzado	3ª fase	252	258	312	310	307	310
CH-0739	9	Pila 05	Alzado	5ª fase	310	306	372	362	352	362
CH-0740	9	Pila 05	Alzado	5ª fase	308	315	347	351	348	349
CH-0931	9	Pila 05	Capitel		293	305	383	372	382	379
CH-0511	8	Pila 05	Zapata		191	194	296	281	280	286
CH-0512	14	Pila 05	Zapata		154	146	242	237	234	238
CH-0513	8	Pila 05	Zapata		211	221	335	355	357	349
CH-1242	13	Vano 01	Tablero	Fase 7 (1ª parte)	375	359	418	409	419	415
CH-1243	10	Vano 01	Tablero	Fase 7 (1ª parte)	391	395	441	424	438	434
CH-1244	13	Vano 01	Tablero	Fase 7 (1ª parte)	357	349	404	409	399	404
CH-1245	12	Vano 01	Tablero	Fase 7 (1ª parte)	354	359	407	408	424	413
CH-1246	12	Vano 01	Tablero	Fase 7 (1ª parte)	379	364	405	419	424	416
CH-1247	10	Vano 01	Tablero	Fase 7 (1ª parte)	402	388	441	453	441	445
CH-1248	10	Vano 01	Tablero	Fase 7 (2ª parte)		331	414	402	405	407
CH-1249	11	Vano 01	Tablero	Fase 7 (2ª parte)		355	427	433	441	434
CH-1222	10	Vano 02	Tablero	Fase 6 (1ª parte)	366	376	437	447	447	444
CH-1223	11	Vano 02	Tablero	Fase 6 (1ª parte)	355	342	419	419	430	423
CH-1224	13	Vano 02	Tablero	Fase 6 (1ª parte)	345	356	390	399	399	397
CH-1225	11	Vano 02	Tablero	Fase 6 (1ª parte)	372	380	431	429	452	437
CH-1226	10	Vano 02	Tablero	Fase 6 (1ª parte)	374	399	431	446	434	437
CH-1227	10	Vano 02	Tablero	Fase 6 (1ª parte)	389	384	430	424	441	432
CH-1228	8	Vano 02	Tablero	Fase 6 (1ª parte)	406	390	449	464	460	458
CH-1229	9	Vano 02	Tablero	Fase 6 (1ª parte)	391	408	453	437	446	445
CH-1230	8	Vano 02	Tablero	Fase 6 (1ª parte)	370	376	447	429	429	435
CH-1231	9	Vano 02	Tablero	Fase 6 (1ª parte)	388	398	451	471	467	463
CH-1238	12	Vano 02	Tablero	Fase 6 (2ª parte)	338		427	421	421	423
CH-1239	10	Vano 02	Tablero	Fase 6 (2ª parte)	332		408	408	419	412
CH-1184	7	Vano 03	Tablero	Fase 5	306	307		344	344	344
CH-1185	12	Vano 03	Tablero	Fase 5	327	302		359	368	364

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1186	11	Vano 03	Tablero	Fase 5	298	302	351	332	331	338
CH-1187	10	Vano 03	Tablero	Fase 5	278	291	354	352	352	353
CH-1188	8	Vano 03	Tablero	Fase 5	274	290	317	319	321	319
CH-1189	6	Vano 03	Tablero	Fase 5	305	312	351	331	345	342
CH-1190	8	Vano 03	Tablero	Fase 5	279	277	330	330	333	331
CH-1191	9	Vano 03	Tablero	Fase 5	301	306	338	333	324	332
CH-1192	11	Vano 03	Tablero	Fase 5	296	300		327	335	331
CH-1193	13	Vano 03	Tablero	Fase 5	297	290	332	321	330	328
CH-1204	12	Vano 03	Tablero	Losa Superior	283		344	366	373	361
CH-1205	11	Vano 03	Tablero	Losa Superior	284		335	373	372	360
CH-1147	8	Vano 04	Tablero		304	314	385	379	391	385
CH-1148	6	Vano 04	Tablero		340	338	403	405	409	406
CH-1149	8	Vano 04	Tablero		356	354	442	431	423	432
CH-1150	10	Vano 04	Tablero		342	338	408	402	407	406
CH-1151	9	Vano 04	Tablero		337	334	392	390	382	388
CH-1152	6	Vano 04	Tablero		365	344	411	436	431	426
CH-1153	5	Vano 04	Tablero		288	286	385	382	367	378
CH-1154	10	Vano 04	Tablero		346	338	394	391	397	394
CH-1155	10	Vano 04	Tablero		330	339	386	386	390	387
CH-1156	10	Vano 04	Tablero		316	334	429	421	418	423
CH-1161	7	Vano 04	Tablero	Losa Superior	306		386	379	400	388
CH-1162	13,5	Vano 04	Tablero	Losa Superior	288		336	341	334	337
CH-1096	11	Vano 05	Tablero		379	386	447	441	440	443
CH-1097	6	Vano 05	Tablero		402	386	467	467	464	466
CH-1098	10	Vano 05	Tablero		360	365	438	443	421	431
CH-1099	9	Vano 05	Tablero		365	382	452	460	444	452
CH-1100	10	Vano 05	Tablero		373	384	445	453	443	447
CH-1101	14	Vano 05	Tablero		340	352	415	422	425	421
CH-1102	12	Vano 05	Tablero		377	367	388	409	397	398
CH-1103	14	Vano 05	Tablero		362	354	424	398	417	413
CH-1104	11	Vano 05	Tablero		352	364	433	444	425	434

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-1105	12	Vano 05	Tablero		374	351	416	414	410	413
CH-1122	7,5	Vano 05	Tablero	Losa Superior	342	347	477	477	477	477
CH-1123	11	Vano 05	Tablero	Losa Superior	370	369	437	441	437	438
CH-1063	12	Vano 06	Tablero		403	396	450	451	464	455
CH-1064	13	Vano 06	Tablero		367	388	442	451	444	446
CH-1065	14	Vano 06	Tablero		370	370	443	443	443	443
CH-1066	13	Vano 06	Tablero		395	375	437	430	442	436
CH-1067	12	Vano 06	Tablero		394	377	446	433	438	439
CH-1068	14	Vano 06	Tablero		387	377	430	427	426	428
CH-1069	7	Vano 06	Tablero		432	427	460	467	472	466
CH-1070	14	Vano 06	Tablero		395	391	470	461	472	468
CH-1071	9	Vano 06	Tablero		395	386	440	449	462	450
CH-1072	13	Vano 06	Tablero		399	383	422	421	445	429
CH-1073	9	Vano 06	Tablero	Losa Superior	386		475	474	487	479
CH-1074	13	Vano 06	Tablero	Losa Superior	379		444	463	441	450
CH-1021	11	Vano 07	Tablero		363	354	428	427	429	428
CH-1022	13	Vano 07	Tablero		399	405	484	485	483	484
CH-1023	10	Vano 07	Tablero		353	382	432	430	423	428
CH-1024	10	Vano 07	Tablero		391	400	478	483	473	478
CH-1025	10	Vano 07	Tablero		352	363	420	403	406	410
CH-1026	7	Vano 07	Tablero		382	376	392	386	405	394
CH-1027	9	Vano 07	Tablero		374	387	463	441	452	452
CH-1028	11	Vano 07	Tablero		433	433	517	522	501	513
CH-1029	8	Vano 07	Tablero		432	434	487	483	494	488
CH-1030	11	Vano 07	Tablero		414	419	486	474	473	478
CH-1045	10	Vano 07	Tablero	Losa Superior	333		361	368	358	362
CH-1046	10	Vano 07	Tablero	Losa Superior	338		433	415	411	420

PASO INFERIOR LA CARTUJA

					ROTURA (Dias)					
Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0961	7	Alzado Muro y Aleta	Lado Lérida		168	176	292	288	290	290
CH-0962	8	Alzado Muro y Aleta	Lado Lérida		164	162	267	254	252	258
CH-0963	11	Alzado Muro y Aleta	Lado Lérida		142	147	241	246	234	240
CH-0995	7	Dintel			165	167	240	256	256	251
CH-0996	6	Dintel			112	108	186	201	201	196
CH-0997	11	Dintel			111	111	170	176	176	174
CH-0998	14	Dintel			80	78	134	140	140	138
CH-0999	12	Dintel			94	100	171	173	173	172
CH-1000	9	Dintel			100	99	180	172	180	177
CH-0894	12	Solera	Zapata		105	105	173	175		174
CH-0895	12	Solera	Zapata		132	139	222	218		220
CH-0896	7	Solera	Zapata		158	162	257	257		257
CH-0897	10	Solera	Zapata		158	146	273	275	292	279
CH-0898	9	Solera	Zapata		144	128	255	252	243	250
CH-0899	2	Solera	Zapata		153	169	265	258	258	260
CH-0900	6	Solera	Zapata		160	148	240	234	248	241
CH-0901	12	Solera	Zapata		156	150	274	272	274	273
CH-0902	9	Solera	Zapata		162	170	243	241	238	241
CH-0903	6	Solera	Zapata		194	191	289	281	289	286
CH-0932	14	Muro y Aletas	Lado Zaragoza		119	109	190	206	200	199
CH-0933	6	Muro y Aletas	Lado Zaragoza		167	159	258	270	254	261
CH-0934	4	Muro y Aletas	Lado Zaragoza		149	145	265	263	256	261

PASOS SUPERIORES

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
P.S. 6+461										
CH-0018	12	Estribo 2	Zapata	muro acompañamiento	274	262	328	319	316	321
CH-0035	6,5	Estribo 1	Alzado 2.1		251	241	298	306	318	307
CH-0032	13	Estribo 1	Alzado 1.1	1ª fase	268	269	331	335	325	330
CH-0031	8	Estribo 1	Alzado 1.1	1ª fase	269	282	310	306	327	314
CH-0007	11	Estribo 1	Zapata 1.2	1ª Fase	149	131	341	329	345	338
CH-0006	15	Estribo 1	Muro	Zapata	136	148	264	249	262	258
CH-0005	8	Estribo 1	Muro	Zapata	273	282	345	339	332	338
CH-0004	6	Estribo 1	Muro	Zapata	279	285	364	378	359	367
CH-0003	8	Estribo 1	Muro	Zapata	264	298	336	326	317	326
CH-0002	3	Estribo 1	Muro	Zapata	261	278	371	309	346	342
CH-0001	7	Estribo 1	Muro	Zapata	268	268	368	355	360	360
CH-0008	8	Estribo 1	Zapata 1.2	1ª Fase	339	331	392	404	417	404
CH-0020	10	Estribo 2	Zapata 2.2	1ª Fase	268	258	333	341	345	340
CH-0023	8	Estribo 1	Alzado muro 1.1	1ª Fase	256	244	304	311	302	306
CH-0017	13	Estribo 2	Zapata	muro acompañamiento	266	327	405	401	402	403
CH-0016	13	Estribo 2	Zapata	muro acompañamiento	300	294	393	390	390	391
CH-0015	4	Estribo 2	Zapata	muro acompañamiento	325	312	381	381	383	381
CH-0014	5	Estribo 1	Zapata 1.1	2ª Fase	323	337	398	393	406	399
CH-0019	10	Estribo 2	Zapata 2.2	1ª Fase	271	261	330	339	327	332
CH-0013	6	Estribo 1	Zapata 1.1	2ª Fase	308	319	387	377	377	380
CH-0012	11	Estribo 1	Zapata 1.1	2ª Fase	305	294	405	416	403	408
CH-0011	3	Estribo 1	Zapata 1.1	2ª Fase	341	342	417	402	402	407
CH-0010	3	Estribo 1	Zapata 1.2	1ª Fase	300	304	373	356	369	366
CH-0009	8	Estribo 1	Zapata 1.2	1ª Fase	339	339	413	411	416	413
CH-0021	11	Estribo 2	Zapata 2.2	1ª Fase	281	286	341	342	354	346
CH-0053	10	Estribo 1	Alzado 1.2	2ª Fase	230	225	340	340	314	331
CH-1157	10	Losa Transició	Lado Izquierdo		263	258	296	296	296	296
CH-0068	7	Estribo 2	Alzado Muro 2.2 y 1.2		223	223	340	331	331	334

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0063	8	Estribo 2	Alzado 1.2		191	252	353	350	350	351
CH-0062	12,5	Estribo 2	Alzado 1.2		230	230	284	290	290	288
CH-0061	7,5	Estribo 2	Alzado 2.2		211	206	292	306	301	299
CH-0060	12	Estribo 2	Alzado 2.2		198	211	321	320	313	318
CH-0058	9,5	Estribo 1	Alzado 2.2		221	224	322	316	318	319
CH-0037	10	Estribo 1	Alzado 2.1		256	242	307	307	308	307
CH-0054	10,5	Estribo 1	Alzado 1.2		215	229	292	303	303	299
CH-0022	9	Estribo 2	Zapata 2.2	1ª Fase	231	220	317	302	313	311
CH-0051	9,5	Estribo 2	Alzado 1.1	1ª Fase	272	265	286	289	302	292
CH-0050	9	Estribo 2	Alzado 1.1	1ª Fase	260	282	291	317	307	305
CH-0047	12	Estribo 2	Alzado 2.1		235	251	302	287	297	295
CH-0046	12,5	Estribo 2	Alzado 2.1		241	218	293	293	282	289
CH-0042	5,5	Estribo 2	Alzado muro 1.1		237	226	265	269	251	262
CH-0029	10	Estribo 1	Alzado muro 2.1	1ª fase	268	274	346	373	346	355
CH-0027	10	Estribo 2	Zapata 2.1	2ª Fase	316	316	424	424	424	424
CH-0026	6	Estribo 2	Zapata 2.1	2ª Fase	281	290	340	340	337	339
CH-0025	7,5	Estribo 2	Zapata 2.1	2ª Fase	258	266	394	391	396	394
CH-0024	9	Estribo 2	Zapata 2.1	2ª Fase	341	340	421	407	410	413
CH-0057	12	Estribo 1	Alzado 2.2		208	219	286	307	310	301
P.S. 8+120										
CH-1144	8	Estribo 1	Zapata		214	218	312	298	290	300
CH-1145	9	Estribo 2	Zapata		252	246	311	296	304	304
CH-1183	10	Estribo 1	Alzado		273	273	331	317	328	325
CH-1182	11	Estribo 1	Alzado		279	289	356	340	330	342

PEQUEÑAS OBRAS DE DRENAJE

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
O.F. 02+640										
CH-0853	12	Alzado	Lado Zaragoza		167	182	256	240	233	242
CH-0855	11	Dintel			203	204	282	266	266	271
CH-0837	10	Solera			202	195	272	279	275	275
O.F. 03+020										
CH-0829	7	Alzado	Lado Zaragoza		266	256	376	364	373	371
CH-0833	8	Dintel			155	165	257	252	253	254
CH-0823	3	Solera			245	256	358	339	335	344
O.F. 03+260										
CH-0828	10	Alzado	Lado Lérida		241	234	343	334	324	334
CH-0826	10	Solera			228	238	365	361	350	359
O.F. 03+280										
CH-0857	10	Zapata	Aletas	Lado Lérida	167	168	255	252	260	266
O.F. 03+350										
CH-0824	10	Alzado			227	220	343	314	322	326
CH-0810	10	Solera			215	215	331	323	328	327
O.F. 03+480										
CH-0860	4	Alzado	Aletas		171	180	265	261	260	262
CH-0856	11	Dintel			184	174	256	263	263	261
CH-0832	8	Solera			212	210	312	314	316	314
O.F. 03+780										
CH-0790	7	Aletas	zapatas		212	208	331	339	352	341
CH-0803	14	Dintel			191	191	299	297	293	296
CH-0770	12	Solera			252	251	389	389	396	391
O.F. 04+220										
CH-0791	12	Aletas	zapatas		169	170	272	271	303	282
CH-0805	8	Dintel			235	243	395	386	386	389

					ROTURA (Dias)					
Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0775	10	Solera			225	220	353	345	330	343
O.F. 04+495										
CH-0769	14	Alzado	Lado Lérida		260	239	389	385	389	388
CH-0761	15	Solera			203	193	323	318	325	322
O.F. 05+454										
CH-0028	11	Solera			268	274	316	323	323	321
O.F. 05+533										
CH-0075	9	Aleta 1.1	Alzado		195	201	335	298	372	310
CH-0071	10	Aleta 1.2	Zapata		294	282	334	339	357	343
O.F. 06+260										
CH-0077	10	Solera	Tubos		190	174	262	263	265	263
O.F. 09+027										
CH-0679	10	Aleta 1.1	Zapata		227	229	332	326	328	329
CH-0684	8	Aleta 1.1 y 2.1	Alzado		220	229	328	338	365	344
CH-0686	7	Aleta 2.1	Zapata		271	252	387	373	376	378
CH-0566	9	Alzado	Lado Zaragoza		213	224	353	335	343	344
CH-0584	11	Alzado	Lado Lérida		175	178	316	320	326	321
CH-0559	10	Solera			228	234	362	361	357	360
O.F. 09+247										
CH-1034	12	Aletas	Izda	Solera	99	99	148	151	145	148
CH-0086	5,5	Aletas 1.1			203	202	309	303	314	309
O.F. 09+917										
CH-0069	7	Aleta 1.2	Alzado		231	240	339	348	331	339
CH-0070	8	Aleta 2.2	Alzado		288	285	394	391	394	393
CH-0043	9	Alzado	Lateral		252	248	314	291	306	305
CH-0036	6	Alzado	Central 2.2	2ª fase	224	224	290	290	284	288
CH-0034	9	Alzado	Central 1.1	1ª fase	240	238	279	296	288	288
CH-0055	9,5	Dintel Techo			212	196	296	298	285	293
CH-0056	7,5	Dintel Techo	laterales		232	229	332	313	324	323
CH-0033	13	Solera			289	279	336	332	343	337

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días) 7 a)	7 b)	28 a)	28 b)	28 c)	Resistencia media
CH-0030	10	Solera			274	263	334	323	323	327
O.F. 10+100										
CH-0048	10	Solera			213	198	257	265	263	262
O.F. 10+835										
CH-0076	6,5	Aleta	Alzado		236	241	338	331	338	335
CH-0074	6	Aleta 2.1	Alzado		202	251	345	351	369	355
CH-0059	9	Alzado	Laterales	2ª Fase	206	204	297	307	297	300
CH-0049	8,5	Alzado	Central	2ª fase	242	251	303	315	297	305
CH-0052	8	Alzado	Lateral	1ª Fase	267	256	309	306	291	302
CH-0045	7	Alzado	Central	1ª fase	242	190	286	285	297	289
CH-0065	10	Dintel	Central		230	226	316	316	294	309
CH-0066	11	Dintel	Central		251	267	349	335	357	347
CH-0067	4,5	Dinteles	Laterales		260	270	350	361	354	355
CH-0041	9	Solera	Central		254	218	292	301	294	296
CH-0064	10,5	Solera	Aletas		249	249	333	330	338	333
CH-0040	7	Solera	Central		230	252	321	305	303	310
CH-0044	11	Solera	Lateral		255	259	333	316	331	327
O.F. 11+050										
CH-0038	12,5	Solera			203	181	245	236	253	245
O.F. 12+360										
CH-0039	7,5	Solera			195	190	239	236	246	240
O.F. 13+595										
CH-0242	3	Aleta 1.2	Alzado		241	255	366	366	378	370
CH-0142	10	Alzado	Lateral Izquierdo 2	2ª Fase	167	170	295	297	294	295
CH-0131	6	Alzado	Central 2.2		171	174	304	288	299	297
CH-0141	11	Alzado	Lateral Izquierdo 2	1ª Fase	134	143	238	236	237	237
CH-0179	12	Alzado	Lateral 2.2	2ª Fase	244	244	387	373	372	377
CH-0124	6	Alzado	Central 1.2		182	181	301	294	300	298
CH-0132	7	Alzado	lateral izdo 1.1		180	179	328	304	321	318
CH-0113	8	Alzado	Central 2.1		176	180	275	286	285	282

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Dias) 7 a]	7 b]	28 a]	28 b]	28 c]	Resistencia media
CH-0368	8	Dintel	Lateral Izdo		245	241	385	372	390	382
CH-0336	6	Dintel	Central		258	254	382	398	382	387
CH-0335	9	Dintel	Central		203	219	319	320	323	321
CH-0095	6	Hormigón de Lim			40	40	78	76	81	78
CH-0102	12,5	Solera	Central		218	209	330	324	341	332
CH-0103	8	Solera	Central		248	246	376	377	368	374
CH-0125	8	Solera	Lateral	Izda	166	172	302	301	293	299
CH-0180	12	Zapata	Aleta 1.1		225	223	353	349	351	351
O.F. 13+937										
CH-0623	8	Aleta 1.1	Alzado		230	241	352	350	353	352
CH-0610	6	Aleta 1.2	Alzado		240	250	385	374	384	381
CH-0635	8	Aleta 2.1	Alzado		254	245	368	344	343	352
CH-0510	10	Alzado	Central 2.2	2ª fase	152	145	258	242	252	251
CH-0469	7	Alzado	Central	1ª fase	224	203	346	348	348	347
CH-0517	5	Alzado	Lateral 2.2	2ª fase	192	184	317	304	312	311
CH-0502	12	Alzado	Central 1.2	2ª fase	159	156	265	259	258	261
CH-0501	9	Alzado	Central 1.2	2ª fase	161	153	270	262	256	263
CH-0488	10	Alzado	Lateral 2.1	1ª fase	213	213	316	319	325	320
CH-0468	11	Alzado	Central	1ª fase	195	196	306	305	322	311
CH-0526	11	Alzado	Lateral 1.1	2ª fase	170	172	270	260	255	262
CH-0664	7	Dintel	Central		197	209	345	332	338	338
CH-0665	11	Dintel	Central		192	187	305	306	319	310
CH-0666	6	Dintel	Central		187	179	280	287	268	278
CH-0681	4	Dintel	Lateral	Izquierdo	240	241	343	343	352	346
CH-0682	11	Dintel	Lateral	Derecho	248	250	361	362	356	360
CH-0429	11,5	Solera	Central		311	311	425	428	428	427
CH-0428	12,5	Solera	Central		318	305	429	429	429	429
CH-0427	12	Solera	Central		311	296	424	417	408	416
CH-0447	8	Solera	Lateral	2º Camión	243	249	371	382	372	375
CH-1048	9	Solera	Aletas	Aguas abajo	71	83	108	104	104	105

PONTON CRTA. VALMADRID

Análisis nº	Asiento UNE	Elemento	Sub-Elemento	Sub-Sub-Elemento	ROTURA (Días)					Resistencia media
					7 a)	7 b)	28 a)	28 b)	28 c)	
CH-132	10	Zapata	Dcha		216	218	334	327	321	327
CH-132	9	Zapata	Izda		238	234	341	345	348	345
CH-133	10	Estribo 2	Alzado y Aletas		203	206	338	339	329	335
CH-134	5	Estribo 1	Alzado y Aletas		253	252	338	342	343	341
CH-134	7	Dintel y Losa			351	361	414	401	400	407

7. Accesos y elementos para mantenimiento

A todas las estructuras puede accederse por caminos agrícolas o carreteras, excepto a la E - 4.

A la E - 1 puede llegarse por la carretera de acceso a La Tudor desde la de Valmadrid.

A la E - 2 se llega a través de caminos existentes en las fincas de La Tudor y del Acampo del Marqués.
A la E - 3 se puede llegar por el camino agrícola que hubo de reponerse y pasa por debajo de ella.

A la E - 4 solo puede accederse por terrenos labrados a lo largo del Val de Macho, donde se encuentra ubicada.

A la E - 5 se llega a través del camino agrícola que se prolonga por el Val de Vares donde está situada la estructura.

Como elementos para mantenimiento se han dejado en los estribos nº 2 de cada estructura unas cámaras cerradas por ambos lados, con puertas metálicas. Aquí pueden guardarse útiles para mantenimiento y puede efectuarse el tesado, si fuese necesario, del anclaje del tablero del estribo.

A los tableros de las estructuras 3, 4 y 5, puede accederse a través de las pilas.

8. Recomendaciones para la conservación y el mantenimiento

En las estructuras deben observarse:

- **APOYOS.**

  Al ser de tipo Pot, es acero inoxidable debe mantenerse limpio y el teflón lubricado.

  Los apoyos puestos en este tramo llevan un guardapolvo que ayudarán al buen mantenimiento de los mismos.

- **ANCLAJES TABLERO - ESTRIBO.**

  Vigilar y reponer la grasa dentro de la cazoleta que protege los rabos de los cables del anclaje para evitar su degradación.

PROYECTO: L.A.V. MADRID-BARCELONA. SUBTRAMO I DE ZARAGOZA-LLEIDA

FECHA: 14-IV-00

HOJA N.º: 1

CURVAS DE RETRACCIÓN Y FLUENCIA DE CIMENTACIÓN. MOVIMIENTO

1.- RETRACCIÓN

$\varepsilon_{cs}(t,t_s) = \varepsilon_{cso}\,\beta_s(t-t_s)$

t = Edad del hormigón en el instante de la evaluación.

t_s = " " " al comienzo de la retracción.

ε_{cso} = coeficiente básico de retracción.

$\varepsilon_{cso} = \varepsilon_c\,\beta_{HR}$

$\varepsilon_s = (570 - 5\,f_{ck})\,10^{-6}$.

$f_{ck} = 40\ N/mm^2$

$\varepsilon_s = 370\times10^{-6}$

$\beta_{HR} = -1.55\left[1-\left(\frac{HR}{100}\right)^3\right]$

$HR = 60\%$.

$\beta_{HR} = -1.55\left[1-\left(\frac{60}{100}\right)^3\right] = -1,215$

$\beta_s(t-t_s) = \sqrt{\frac{t-t_s}{0.035\,e^2+(t-t_s)}}$

e = espesor medio = $\frac{2A_c}{U}$

Hastiales E-1 y E-2: $e = \frac{2\times 9.634}{2(0.20+6.85+3.14+1.14+3.40)} = 0.654\,m. = 654\,mm$

Hastiales E-3, E-4, E-5: $e = \frac{2\times 8.843}{2(6.85+0.20+3.01+1.77+3.25+2.50+0.80+1.35+0.40+2.50)} = 0.387\,m. = 387\,mm$

PROYECTO:

FECHA:

HOJA N.º: 2

Fecha de inicio y finalización de construcción de hastiales:

		Media
E-1:	VI-97 al II-98	X-97
E-2:	IX-98 al VI-98	V-98
E-3:	VII-97 al XII-97	IX-97
E-4:	IV-98 al VIII-98	VI-98
E-5:	XII-97 al III-98	I-98

Días transcurridos hasta el 14-IV-00:

E-1: $t-t_s \simeq 2\times365+6\times30 = 910$ días

E-2: $t-t_s \simeq 365+11\times30 = 695$ días

E-3: $t-t_s \simeq 2\times365+7\times30 = 940$ días

E-4: $t-t_s \simeq 365+10\times30 = 665$ días.

E-5: $t-t_s \simeq 2\times365+3\times30 = 820$ días

Valor de la retracción producida el 14-IV-00.

E-1: $\varepsilon_{cs}(t,t_s) = 370\times10^{-6}\times(-1,215)\sqrt{\frac{910}{0.035\times654^2+910}} = -107\times10^{-6}$

E-2: $\varepsilon_{cs}(t,t_s) = 370\times10^{-6}(-1,215)\sqrt{\frac{695}{0.035\times654^2+695}} = -94\times10^{-6}$

E-3: $\varepsilon_{cs}(t,t_s) = 370\times10^{-6}(-1,215)\sqrt{\frac{940}{0.035\times387^2+940}} = -175\times10^{-6}$

E-4: $\varepsilon_{cs}(t,t_s) = 370\times10^{-6}(-1,215)\sqrt{\frac{665}{0.035\times387^2+665}} = -150\times10^{-6}$

E-5: $\varepsilon_{cs}(t,t_s) = 370\times10^{-6}(-1,215)\sqrt{\frac{820}{0.035\times387^2+820}} = -165\times10^{-6}$

PROYECTO ..... FECHA .....

HOJA N.º 3

Retracción que falta por producirse:

E-1:	$-450\times10^{-6}+107\times10^{-6}=-343\times10^{-6}$	$\delta_r=-540\times\varepsilon_r=185$ mm.
E-2:	$-450\times10^{-6}+94\times10^{-6}=-356\times10^{-6}$	$\delta_r=-625\times\varepsilon_r=-23$mm.
E-3:	$-450\times10^{-6}+175\times10^{-6}=-275\times10^{-6}$	$\delta_r=-120\times\varepsilon_r=-33$mm
E-4:	$-450\times10^{-6}+150\times10^{-6}=-300\times10^{-6}$	$\delta_r=-153\times\varepsilon_r=-46$mm.
E-5:	$-450\times10^{-6}+165\times10^{-6}=-285\times10^{-6}$	$\delta_r=-219\times\varepsilon_r=-63$mm.

2. FLUENCIA

$$\varepsilon_{cc}(t,t_0)=\sigma(t_0)\left[\frac{1}{E_{0,t_0}}+\frac{\varphi(t,t_0)}{E_{0,28}}\right]$$

E_{0,t_0} = mód. de deformación al aplicar la carga

Se supone que el hormigón se pondrá a los 7 días.

$$E_{0,7}=8500\sqrt[3]{f_{cm,7}}=10.000\sqrt[3]{0,75\times40}=31072\ N/mm^2=304.800\ kg/cm^2$$

$$E_{0,28}=8500\sqrt[3]{f_{cm,28}}=10.000\sqrt[3]{40}=34.200\ N/mm^2=335.500\ kg/cm^2$$

$$\varphi(t,t_0)=\varphi_0\,\beta_c(t-t_0)$$

$$\varphi_0=\varphi_{HR}\,\beta(f_{cm})\,\beta(t_0)$$

$$\varphi_{HR}=1+\frac{100-HR}{9,5\sqrt[3]{e}}\quad (HR=60\%)$$

Hormigón E-1, E-2: $\varphi_{HR}=1+\frac{100-60}{9,5\sqrt[3]{65}}=1,465$

Hormigón E-3, E-4, E-5: $\varphi_{HR}=1+\frac{100-60}{9,5\sqrt[3]{38}}=1,554$

$$\beta(f_{cm})=\frac{16,8}{\sqrt{40+8}}=2,425$$

PROYECTO ..... FECHA .....

HOJA N.º 4

$$\beta(t_0)=\frac{1}{0,1+7^{0,2}}=0,635$$

$$\beta_c(t-t_0)=\left[\frac{t-t_0}{\beta_H+(t-t_0)}\right]^{0,3}$$

$$\beta_H=1,5\cdot e\left[1)\cdot(0,012\,HR)^{18}\right]+250\neq1500$$

Hormigón E-1 y E-2: $\beta_H=1234$

Hormigón E-3, E-4, E-5: $\beta_H=832$.

Hormigón E-1 y E-2: $\sigma(t_0)=\frac{4.450}{7.434}=430\ kg/cm^2=43,0\ kp/cm^2$

Hormigón E-3, E-4, E-5: $\sigma(t_0)=\frac{4000,3}{8,243}=484\ kg/cm^2=48,4\ kp/cm^2$

Por tanto, valor final de la fluencia:

Hormigón E-1 y E-2: $\varphi(\infty,t_0)=1,465\times2,425\times0,635=2,256$

Hormigón E-3, E-4, E-5: $\varphi(\infty,t_0)=1,554\times2,425\times0,635=2,393$

Deformación producida el 14-IV-00.

$$E\text{-}1:\ 43,0\left[\frac{1}{304.800}+\frac{2,256\times\left[\frac{910}{1234+910}\right]^{0,3}}{335.500}\right]=141\times10^{-6}+128\times10^{-6}\times0,773\times2,256$$

$$=141\times10^{-6}+223\times10^{-6}=364\times10^{-6}$$

$$E\text{-}2:\ 43,0\left[\frac{1}{304.800}+\frac{2,256\times\left[\frac{695}{1234+695}\right]^{0,3}}{335.500}\right]=141\times10^{-6}+128\times10^{-6}\times0,736\times2,256$$

$$=141\times10^{-6}+213\times10^{-6}=354\times10^{-6}$$

$$E\text{-}3:\ 48,4\left[\frac{1}{304.800}+\frac{2,393\left[\frac{940}{832+940}\right]^{0,3}}{335.500}\right]=159\times10^{-6}+144\times10^{-6}\times0,827\times2,393$$

$$=159\times10^{-6}+285\times10^{-6}=444\times10^{-6}$$

PROYECTO ..... FECHA .....

HOJA N.º 5

$\varepsilon_{-5}: 484\left[\frac{1}{804,80} + \frac{2,393\left[\frac{820}{832+820}\right]^{0,3}}{335,5\,mm}\right] = 159\times10^{-6} +$

$+144\times10^{-6}\times0,870\times2,393 = 159\times10^{-6} + 279\times10^{-6} = 438\times10^{-6}$

Fluencia que falta por producirse:

		Movimientos
$\varepsilon_{-1} = -(1-0,773)\times2,256\times128\times10^{-6} = -66\times10^{-6}$		$\delta_f = 540\times\varepsilon_f = -36\,mm$
$\varepsilon_{-2} = -(1-0,730)\times2,256\times128\times10^{-6} = -76\times10^{-6}$		$\delta_f = 65\times\varepsilon_f = -5\,mm$
$\varepsilon_{-3} = -(1-0,827)\times2,393\times144\times10^{-6} = -60\times10^{-6}$		$\delta_f = 120\times\varepsilon_f = -7\,mm$
$\varepsilon_{-4} = -(1-0,784)\times2,393\times144\times10^{-6} = -75\times10^{-6}$		$\delta_f = 153\times\varepsilon_f = -12\,mm$
$\varepsilon_{-5} = -(1-0,870)\times2,393\times144\times10^{-6} = -66\times10^{-6}$		$\delta_f = 219\times\varepsilon_f = -15\,mm$

3.- INCREMENTO DE TEMPERATURA.

$\Delta T = k\cdot z^a\cdot h^b\cdot s^c$

ε_{-1} y ε_{-2}: $k = 24,91$

$\varepsilon_{-3}, \varepsilon_{-4}, \varepsilon_{-5}$: $k = 29,13$.

$z = 4$

$\varepsilon_{-1}, \varepsilon_{-2}$: $h = 1,67\,m > 1,50 \rightarrow 1,50\,m$

$\varepsilon_{-3}, \varepsilon_{-4}, \varepsilon_{-5}$: $h = 2,45\,m$

$s = 1$

$\varepsilon_{-1}, \varepsilon_{-2}$: $a = 0,292$; $b = -0,172$; $c = 0$

$\varepsilon_{-3}, \varepsilon_{-4}, \varepsilon_{-5}$: $a = 0,381$; $b = -0,148$; $c = 0$

PROYECTO ..... FECHA .....

HOJA N.º 6

Por tanto:

ε_{-1} y ε_{-2}: $\Delta T = 24,91\times4^{0,292}\times1,50^{-0,172}\times1^{0} = 35^{\circ}C$.

$\varepsilon_{-3}, \varepsilon_{-4}$ y ε_{-5}: $\Delta T = 29,13\times4^{0,381}\times2,45^{-0,148}\times1^{0} = 39^{\circ}C$.

Error cometido en medida de temperatura:

$\varepsilon_{-1}, \varepsilon_{-2}$ $\Delta T = \pm 0,80\times35^{\circ}C = \pm28^{\circ}C$.

$\varepsilon_{-3}, \varepsilon_{-4}, \varepsilon_{-5}$: $\Delta T = \pm 0,80\times39^{\circ}C = \pm31,2^{\circ}C$.

Movimientos

ε_{-1}: $\pm 540\times280\times10^{-6} = \pm151\,mm$.

ε_{-2}: $\pm 65\times280\times10^{-6} = \pm18\,mm$

ε_{-3}: $\pm 120\times312\times10^{-6} = \pm38\,mm$.

ε_{-4}: $\pm 153\times312\times10^{-6} = \pm48\,mm$

ε_{-5}: $\pm 219\times312\times10^{-6} = \pm69\,mm$

- RESUMEN DE MOVIMIENTOS QUE FALTAN POR PRODUCIRSE, EN EL ESTRIBO LIBRE, EL 14-IV-00 (mm)

	RETRACCIÓN	FLUENCIA	TEMPERATURA	TOTALES	
E-1	−185	−36	± 157	−372	+157
E-2	−23	−5	± 18	−46	+18
E-3	−33	−7	± 38	−78	+38
E-4	−46	−12	± 48	−106	+48
E-5	+63	−15	± 69	−147	+69

+ ALARGAMIENTO

− ACORTAMIENTO