ANEJO Nº 6.- ESTRUCTURAS

ANEJO Nº 6. ESTRUCTURAS

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1. Cuadro resumen

1. CUADRO RESUMEN

DENOMINACIÓN	TIPOLOGÍA DEL TABLERO	LUCES	ANCHO DEL TABLERO
VIADUCTO Nº 1 (P.K. 703+343 a P.K. 703+565)	Viga continúa de canto constante. Sección de cajón monocelular	CINCO VANOS (L_T =222,00) EXTREMAS=39,0 m CENTRALES:48,0 m	Ancho =14,00 m.
VIADUCTO Nº 2 (P.K. 711+258 a P.K. 711+815)	Viga continúa de canto constante. Sección de cajón monocelular	DOCE VANOS (L_T=558,00 m) EXTREMAS=39,0 m CENTRALES:48,0 m	Ancho =14,00 m..
PASO SUPERIOR P.K. 700+200	Vigas prefabricadas, sección en artesa de canto 1,10 m	UN VANO L_T=25,00 m	Ancho =8,40 m.
PASO SUPERIOR P.K. 706+000	Vigas prefabricadas, sección en artesa de canto 1,10 m	UN VANO L_T=25,00 m	Ancho =8,40 m.
PASO SUPERIOR P.K. 708+290	Vigas prefabricadas, sección en artesa de canto 1,10 m	UN VANO L_T=25,00 m	Ancho=8,4 0 m.
PASO SUPERIOR P,K . 710+895	Vigas prefabricadas, sección en artesa de canto 1,10 m	UN VANO L_T=25,00 m	Ancho=8,40 m.
PASO SUPERIOR P.K. 712+520	Losa	TRES VANOS 13,50-25,00-13,50	Ancho=11,20 m

DENOMINACIÓN	TIPOLOGÍA DEL TABLERO	LUCES	ANCHO DEL TABLERO
PASO SUPERIOR P.K. 713+290	Losa	TRES VANOS 13,50-25,00-13,50	Ancho=11,20 m
PASO INFERIOR P.K. 701+440	Pórtico de 8,00x5,30 (libre)	L_T=19,20 m	
PASO INFERIOR P.K. 702+190	Marco de 8,00x8,40 (total)	L_T=34,60 m	
PASO INFERIOR P.K. 703+190	Bóveda triarticulada	L_T=124,90 (incluido pico de flauta)	
PASO INFERIOR P.K. 704+362	Marco de 8,00x5,30 (libre)	L_T=23,20 m	
PASO INFERIOR P.K. 704+676	Pórtico de 8,00x5,30 (libre)	L_T=43,95 m	
PASO INFERIOR P.K. 709+149	Pórtico de 12,00x5,30	L_T=18,00 m	
PASO INFERIOR P.K. 710+070	Bóveda triarticulada	L_T=56,239 (incluido pico de flauta)	
PASO INFERIOR P.K. 710+635	Bóveda triarticulada	L_T=52,333 (incluido pico de flauta)	
PASO INFERIOR P.K. 712+200	Marco de 8,00x6,00 (total)	L_T=24,28 m	
PASO INFERIOR P.K. 713+745	Bóveda triarticulada (Falso túnel)	L_T=231,982 (incluido pico de flauta)	
PASO INFERIOR P.K. 714+140	Marco de 8,00x5,92 (Total)	L_T=38,20 m	
PASO INFERIOR P.K.714+460	Marco de 5,00x 4,00 (Total)	L_T=19,70 m	
PASO INFERIOR P.K. 714+695	Marco de 8,00x5,92 (Total)	L_T=20,30 m	

2. Descripción: Topología, aparatos de apoyo, juntas, impermeabilización, etc.

2. DESCRIPCIÓN: TIPOLOGÍA, APARATOS DE APOYO, JUNTAS, IMPERMEABILIZACIÓN, ETC.

La descripción de las estructuras a que e refiere este epígrafe está recogida dentro de este mismo anejo en “Proyecto Constructivo. 2. Descripción de las estructuras”

3. Definición geométrica

3. DEFINICIÓN GEOMÉTRICA

La definición geométrica de las estructuras está recogida, dentro del Proyecto Constructivo en el epígrafe: “2. Descripción de las estructuras”.

Las modificaciones realizadas posteriormente a la elaboración del Proyecto Constructivo en las estructuras, y por tanto la definición de las mismas, están recogidos dentro del epígrafe que aparece como “Proyecto Construido”

ESTRUCTURAS

1. **INTRODUCCIÓN**

Para resolver los cruces con ríos y otros cauces, y como elementos de permeabilidad de la traza al tráfico local, se han proyectado 20 estructuras para este subtramo.

Las estructuras pueden considerarse agrupadas en la forma siguiente:

2 viaductos
7 pasos superiores
10 pasos inferiores
1 falso túnel

Debido a las características de muy baja población y reducida actividad económica del área atravesada por el subtramo, sólo una de las 20 estructuras proyectadas corresponde a una carretera comarcal, estando destinadas las restantes al cruce con caminos y cursos de agua.

Entre los PK 713+860 y 714+009 se ha proyectado un falso túnel, como alternativa a fuertes medidas de estabilización de un desmonte de 30 m de altura.

2. **DESCRIPCION DE LAS ESTRUCTURAS DEL TRAMO**

2.1. **VIADUCTOS**

2.1.1. **Descripción general**

De acuerdo con los análisis tipológicos realizados, se ha seleccionado la misma tipología estructural para los dos viaductos existentes en el presente tramo, lo que evidentemente proporciona claras ventajas de orden técnico, estético y económico.

El viaducto ubicado entre los P.K. 703+053 y 703+565 tiene una longitud total de 511,8 m, entre ejes de apoyo de estribos. Está compuesto por dos vigas continuas de hormigón pretensado con una distribución de luces, entre ejes de apoyos, de 37,5+7x45,0+38,4 en la primera y 38,4+45,0+37,5 metros en la segunda, separadas mediante una junta situada sobre una pila.

El viaducto ubicado entre los P.K. 711+258 y 711+815, tiene una longitud total de 556,8 m y está compuesto, al igual que el anterior, por dos vigas continuas con la siguiente distribución de luces: 37,5+45,0+38,40 metros en la primera y 38,4+8x45,0+37,5 metros en la segunda.

A continuación se describen los elementos de los viaductos: tablero, apoyos, pilas y estribos, siendo las características descritas válidas para ambas estructuras.

Tablero

El tablero está constituido por una viga cajón monocelular con canto constante de 3,10 m en el eje, de sección trapecial con voladizos de 3,50 m.

El forjado superior, de 14,00 m de anchura, tiene un espesor variable entre 0,30 m en la zona central y 0,50 m en las zonas laterales del cajón, acarteladas 1,25 m hacia las almas; en los voladizos varía entre 0,20 m en el borde hasta 0,50 m en su unión a las almas, acartelada también 1,25 m.

El forjado inferior, de 6,50 m de anchura, tiene un espesor variable entre 0,25 m en la zona central, y 0,45 m en las zonas laterales, acarteladas 0,75 m hacia las almas. En las proximidades de las pilas el espesor de 0,25 m aumenta linealmente hasta 0,50 m en la traviesa, perdiéndose el acartelamiento.

El espesor de las almas es constante e igual a 0,50 m, excepto en las proximidades de las pilas, que aumenta linealmente hasta 0,80 m en la traviesa.

En las zonas de apoyo sobre pilas y estribos se disponen traviesas de 1,60 m de espesor en pilas, y 1,00 m en estribos. Todas ellas disponen de un paso de hombre.

El tablero longitudinalmente se divide en dovelas de 22,50 m de longitud, excepto la primera, la última y las colindantes con la junta entre tramos, que son de 3,75 m.

Tanto en el forjado superior como en el inferior se disponen tacones de anclaje para el pretensado de continuidad, en las zonas próximas a las juntas entre dovelas.

El pretensado está constituido por tendones formados por cordones de acero superestabilizado de 0,6", distribuidos según las siguientes familias:

Pretensado de lanzamiento: Está constituido por 16 tendones, de los cuales 8 tendones están situados en el forjado superior junto a las almas. Los otros 8 tendones están situados en la zona inferior de las almas. Se tesan alternadamente la mitad de los tendones de cada grupo según la dovela sea par o impar, y se empalman mediante dispositivos de acoplamiento, en las juntas entre dovelas.

Pretensado de continuidad: Está formado por dos grupos de familias diferentes:

a) sobre pilas: se dispone en el forjado superior de las dovelas de pila, y está constituído por 12 tendones por dovela.

b) de vanos: se dispone en el forjado inferior de las dovelas de vano. Está constituído por 12 tendones por dovela en los vanos centrales y por 13 tendones por dovela en los vanos de 37,50 m.

Pretensado de unión entre tablero y estribos: Para crear los puntos fijos en el tablero se une éste a los estribos mediante pretensado. Se dispone en la traviesa de estribo por un lado y en el muro del estribo por otro. En los estribos de lanzamiento se disponen 14 ó 15 tendones, correspondientes a los viaductos 1 y 2, en tanto que en los estribos de recepción se disponen 4 tendones en cada uno.

Pretensado provisional de cosido de tableros: Durante el periodo de lanzamiento se solidarizan las dovelas adyacentes a la junta entre tableros mediante 10 tendones dispuestos en el forjado superior y otros 10 tendones dispuestos en el forjado inferior. Una vez completado el proceso de lanzamiento se procederá al destesado de los tendones provisionales.

Apoyos

El apoyo del tablero sobre estribos y pilas se realiza a través de aparatos de apoyo de neopreno-teflón unidireccionales. Estos apoyos definitivos se utilizan provisionalmente durante la fase de empuje del tablero, para lo que es necesario bloquear durante la misma las placas inferior y superior de aquellos. Está última debe disponer además de la pendiente correspondiente para el deslizamiento del tablero. Cuando éste está en posición definitiva, se suelda la placa superior del apoyo a unas chapas de acero embebidas en la traviesa del tablero y se desbloquea aquél.

Pilas

Cada pila está constituida por un fuste de forma tronco-piramidal hueca, con sección transversal en cajón rectangular. El espesor de las paredes es de 0,30 m en el viaducto 1 y de 0,35 m en el viaducto 2. La anchura es constante de 7,00 m, mientras el canto es variable desde un mínimo de 2,00 m en cabeza, aumentando con taludes del 2%.

La parte superior del fuste es maciza en dos metros de altura.

La cimentación es profunda excepto en las pilas 11 y 12 del viaducto 2, que es superficial y se realiza mediante pilotes, de 1,80 m de diámetro, unidos en cabeza a través de un encepado. Este tiene 2,5 m de canto en el viaducto nº 1 y 3,0 m de canto en el viaducto nº 2. Las zapatas tienen igualmente 2,5 m de canto.

El número y la longitud de los pilotes es de 6 y 30 m en el viaducto nº 1 y de 7 y 48 m como máximo en el viaducto nº 2.

Las pilas bajo junta entre tableros, mantiene la misma configuración que las anteriores, pero con un canto de 3,0 m en cabeza.

Estribos

El estribo contrario al del empuje es un muro de hormigón armado 4,50 m de espesor, cimentado directamente sobre una zapata de 12 m (viaducto 2) y 12,5 m (en viaducto 1) x 17,5 y 2,5 m de canto. Dispone de aletas independientes, que forman 45º con el eje del ferrocarril, de espesor variable de 0,40 m en coronación y talud 1/10 en el trasdós. La cimentación también es directa sobre zapata.

El estribo desde donde se materializa el empuje del tablero está formado por un muro de frente de 6,80 m de espesor, cimentado mediante una zapata de 3,25 m de canto. La parte superior de este muro, que se hormigona una vez ha finalizado el lanzamiento del tablero, de 4,80 m de espesor, dispone de un paso de hombre para acceder al interior del tablero. En esta zona se aloja el pretensado de unión entre tablero y estribo, que a su vez se cose al resto del muro mediante barras de pretensado de 36 mm de diámetro, que se empalman mediante acoplamientos roscados. Antes de hormigonar esta zona, la coronación del muro sirve para alojar los gatos de elevación y empuje del tablero.

El estribo dispone de aletas independientes, que forman 45º con el eje del ferrocarril, de espesor variable de 0,40 m en coronación y talud 1/10 en el trasdós. La cimentación es directa sobre la zapata.

Situado en el trasdós del muro de frente está el parque de fabricación de dovelas. Se realiza mediante sendos muros de hormigón armado de 22,50 m de longitud, situados bajo las almas del tablero, de 0,50 m de espesor, y cimentados mediante zapatas corridas de 1,00 m de canto. Estos muros se unen al muro de frente del estribo mediante sendas vigas de hormigón armado, de 11,40 m de longitud, 0,50 m de anchura y unos 2,50 m de canto.

2.1.2. Proceso constructivo

El proceso constructivo de pilas y estribos es convencional utilizándose encofrado trepador en los alzados de pilas. El del tablero es mediante sistema de empuje desde el estribo situado a menor cota.

Para ello, en el trasdós de este estribo se adosa una estructura auxiliar que forma el parque de fabricación de dovelas. En él se distinguen dos zonas: la zona de deslizamiento, de 18,25 m de longitud desde el eje del estribo, y la zona de fabricación de dovelas propiamente dicha, de 22,50 m de longitud tras la anterior.

El sistema de empuje previsto, situado en la parte superior del muro de frente, consiste en una pareja de gatos hidraúlicos acoplados por cada apoyo, uno para elevación del tablero y otro para traslación del anterior, y por tanto del tablero, sobre una plataforma de deslizamiento.

La longitud total del tablero se divide en dovelas, todas de 22,50 m de longitud, excepto la primera, adosada a la nariz de lanzamiento la última y las colindantes con la junta entre tramos, que son de 3,75 m de longitud.

Durante el proceso de empuje del tablero, los dos tramos en que está dividido, permanecen unidos mediante una junta seca, con llaves de cortante, cosida por un pretensado local, que hace que, a todos los efectos, se comporte monolíticamente como un tablero único, permitiendo el lanzamiento desde un solo estribo.

La nariz de lanzamiento es una estructura metálica auxiliar, de 26,40 m de longitud, dividida en tres módulos de 8,90 + 8,50 + 9,00 metros. Consiste en dos vigas metálicas de alma

llena, separadas 5,20 m, de canto variable entre 1,98 m en la punta, y 3,00 m en la unión con el tablero. Ambas vigas están arriostradas horizontal y verticalmente. En la zona frontal de ambas vigas van dispuestos sendos gatos de elevación para alcanzar la cota de apoyo de las pilas y del estribo final. La zona dorsal de dichas vigas se une al tablero mediante barras de pretensado.

Los apoyos del tablero en pilas y estribos que se utilizan durante el empuje del tablero son, como se ha descrito, los definitivos de neopreno-teflón que se encuentran bloqueados provisionalmente. Entre ellos y el tablero se disponen almohadillas de neopreno-teflón y una lámina de acero inoxidable para facilitar el deslizamiento durante el empuje.

Una vez que el tablero está en posición definitiva, se desmonta la nariz de lanzamiento, se desbloquean los apoyos y se une la placa superior de éstos al tablero.

Se procede a continuación a la fijación de cada tramo continuo a su correspondiente estribo y a la apertura simultánea de la junta seca existente entre los dos tramos, mediante tiro con el pretensado de conexión a los estribos, ayudado, si es preciso, con gatos situados, entre los labios de la junta, en unos huecos dispuestos a tal efecto.

2.1.3. Estudio de tipologías para los viaductos

2.1.3.1. Introducción

El estudio de tipologías de los viaductos se ha planteado simultáneamente para las dos estructuras presentes en el tramo, dada la similitud de los condicionantes locales existentes en sus emplazamientos, buscando una deseable homogeneidad de las mismas.

Para proceder al análisis de las alternativas más idóneas se ha partido de los datos que se poseen en esta fecha, sobre las condiciones del entorno: topografía, geología, geotecnia, trazado de la vía, etc..., estudiando posteriormente su influencia sobre las posibles soluciones estructurales.

A continuación se presenta un resumen de los condicionantes locales, a los que nos hemos referido anteriormente, para cada uno de los viaductos.

a) Viaducto entre P.K. 703+053 y 703+565

Topografía

En el presente Proyecto Constructivo se ha utilizado la cartografía restituída a escala 1:1000, contrastada y complementada con taquimétricos de detalle.

De dicha cartografía se deduce que el valle que salva la estructura es muy poco escarpado en las proximidades del estribo E-1 y cruza practicamente ortogonal a la traza de la vía con un fondo de vaguada de aproximadamente 200,0 m, girando a continuación hasta situarse prácticamente paralelo a la traza en aproximadamente 300,0 m con un fondo de vaguada más reducido, del orden de 80 m. En las proximidades del estribo E-2, el valle se hace más escarpado con un desnivel de 50,0 m.

La rasante discurre con una altura máxima de 22,0 m sobre el fondo del valle.

Geología y Geotecnia

Los datos geológicos y geotécnicos del terreno que se han considerado en este Proyecto Constructivo, para el diseño y dimensionamiento de las cimentaciones del Viaducto, han sido tomados del informe realizado por la Empresa "Proyectos, Análisis, Medio Ambiente S.A." (PAYMASA) en Diciembre de 1997, el cual se ha complementado por una campaña geotécnica adicional.

De acuerdo con los datos disponibles, el terreno de apoyo del Viaducto está constituido por un depósito cuaternario (eluvial-aluvial-coluvial), de constitución muy heterogénea sobre un sustrato resistente mesozoico de formación keuper.

El primer estrato de depósitos contiene desde niveles de gravas y bolos calcáreos hasta niveles de arcillas limo-arenosas, predominando estas últimas litologías. La potencia de este estrato varía de 4,0 m en las proximidades del estribo E-1 a 8,6 m en la meseta del valle.

El sustrato resistente (keuper) se halla constituido por un primer nivel de arcillas de baja consistencia (keuper alterado) aumentando su consistencia a medida que se profundiza, llegando a constituir formaciones de roca blanda (lutitas rojizas con nódulos de yesos). La potencia del keuper alterado varía entre 13,0 y 17,0 m en zona de estribos y de 8,0 a 13,0 m en el valle.

De acuerdo con las recomendaciones del Informe, la cimentación debe ser profunda mediante pilotes, empotrados al menos cuatro diámetros en los niveles competentes del keuper.

Para el dimensionamiento de los pilotes se han considerado los siguientes parámetros:

- Resistencia por fuste:

. Depósito cuaternario	rf = 0,20 Kp/cm2
. Keuper alterado	rf = 0,50 Kp/cm2
. Keuper	rf = 0,50 Kp/cm2

- Resistencia por punta:

. Keuper	rp = 12,0 Kp/cm2

siendo todos ellos valores admisibles de cálculo, afectados de los habituales coeficientes de seguridad: 3 para la resistencia por punta y 2 para la resistencia por fuste.

Trazado de la vía

El trazado en planta de la vía ferrea, en la zona ocupada por la estructura, discurre en curva circular de radio 8000 m.

El trazado en alzado inicialmente estaba configurado mediante un acuerdo parabólico cóncavo de parámetro Kv = 45000 y rampa de salida del 2,2%, el cual afectaba una zona importante del puente. Posteriormente y fruto de un análisis interactivo trazado/estructura, se realizó una modificación desplazando el acuerdo hacia los P.K. decrecientes sacándolo prácticamente de la estructura.

b) <u>Viaducto entre P.K. 711+258 y 711+815</u>

Topografía

El cauce del río Blanco en la zona del viaducto está formado por una amplia llanura de inundación, prácticamente horizontal, de cerca de 300 m de anchura, a partir de la cual el terreno sube, en ambos lados, con pendientes 1V/3H. Sobre este terreno la rasante de la vía discurre a una altura máxima de 60 m que se conserva en una amplia zona.

En este proyecto básico se ha utilizado la cartografía 1:1000 restituida, cotejada y complementada con taquimétricos de detalle de las laderas del valle.

Geología y Geotecnia

Los datos geológicos y geotécnicos del terreno que se han considerado en este Proyecto Constructivo, para el diseño y dimensionamiento de las cimentaciones del viaducto, han sido tomados del informe realizado por Cotas Internacional-Codexsa (Diciembre 1997). Este estudio se ha completado con una campaña geotécnica adicional.

De acuerdo con los datos disponibles el terreno de apoyo del viaducto en el cauce del río Blanco está constituido por un depósito aluvial situado sobre un sustrato resistente identificado como una formación Keuper.

El depósito aluvial está formado por limos arenosos y arenas limosas con ocasionales interelaciones de gravas. El espesor del aluvial varía entre 5,0 m en las márgenes de la llanura de inundación del río y 24,0 m en la zona central de ésta.

El subtramo resistente (Keuper) está constituido por arcillas y arcillas margosas de consistencia muy firme a dura, con ocasionales intercalaciones de yeso fibroso y especular.

El nivel freático se ha detectado, en toda la llanura de inundación, a una profundidad de 1,0 m.

De acuerdo con las recomendaciones del Informe la cimentación debe ser profunda, mediante pilotes empotrados un mínimo de cuatro diámetros en la formación Keuper, en todas las pilas ubicadas en la zona de depósito aluvial. En las pilas situadas fuera de esta zona y en los estribos la cimentación puede ser directa mediante zapatas apoyadas en la formación Carniolas, contando una tensión media admisible de 7,0 Kp/cm2.

Para el dimensionamiento de los pilotes se han considerado los siguientes valores:

Resistencia por fuste: en limos y aluvial: 0,30 Kp/cm2 a partir de 10 m de profundidad
en Keuper 1,00 Kp/cm2

Resistencia por punta: en Keuper sano 36,0 Kp/cm2

aplicando posteriormente un coeficiente de seguridad de 3 para la resistencia por punta y 2 para la resistencia por fuste.

Trazado de la vía

El trazado en planta del ferrocarril en la zona ocupada por la estructura es una recta. El trazado en alzado es una rampa del 1,25%.

2.1.3.2. Longitudes de los viaductos y distribuciones de luces

Por las características de los valles, alturas de la rasante sobre el terreno, condiciones geotécnicas del terreno y condicionantes de la normativa de acciones para los trenes de Alta Velocidad, se ha considerado fuera de contexto, por una parte, tipologías de grandes luces y por otra parte las pequeñas luces, inferiores a 30,0 m, centrando el estudio en luces intermedias, comprendidas entre 40 y 50 m. El estudio económico comparativo para luces de 40, 45 y 50 m, con cimentación profunda, indica que existe poca diferencia entre estas luces, dependiendo en gran parte del proceso constructivo y del aprovechamiento máximo de los pilotes que se dispongan.

La distribución de luces se ha realizado por tanto en función del encaje geométrico de la estructura, teniendo en cuenta la longitud total necesaria para conseguir unos estribos de altura adecuada para constituirse en puntos fijos de la estructura y absorber los grandes esfuerzos horizontales producidos por el frenado de los trenes.

Este objetivo se ha logrado, seleccionando una distribución de luces de:

<u>Viaducto nº 1:</u> (37,5 + 45,0 + 37,5) + (37,5 + 7 x 45,0 + 37,5) que proporciona una longitud total de 511,8 m entre ejes de apoyos de estribos.

<u>Viaducto nº 2:</u> (37,5 + 45,0 + 37,5) + (37,5 + 8 x 45,0 + 37,5) que proporciona una longitud total de 556,8 m entre ejes de apoyos de estribos.

2.1.3.3. Recomendaciones de diseño en normativa

En las alternativas planteadas se han tenido muy en cuenta las recomendaciones sobre el diseño de las estructuras, facilitadas por el G.I.F. Entre ellas, cabe destacar las siguientes:

- La plataforma tendrá una anchura, en estructura, de 14,0 m.

- Para cada grupo de estructuras se elegirán el menor número posible de diseños, con el fin de facilitar la construcción y dar una coherencia a todo el trazado.

- Son recomendables tableros hiperestáticos pues su comportamiento frente al frenado es más favorable.

- Los aparatos de apoyo, en general, serán del tipo POT, neopreno confinado y teflón fijos o móviles, no debiéndose disponer neoprenos zunchados.

- En puentes construidos por empujes sucesivos, el estribo fijo que recoja el frenado debe ser el ocupado por el parque de prefabricación.

- En casos debidamente justificados se podrá plantear el empleo de soluciones prefabricadas, isostáticas o preferiblemente hiperestáticas. En estos casos se utilizarán dos elementos de sección en artesa.

- Para vanos superiores a 30 m se utilizarán tableros de hormigón pretensado con secciones transversales en cajón.

- Las pilas serán de sección en cajón o macizas dependiendo de su altura y dimensiones.

- No se considerarán longitudes continuas de tablero superiores a 450 m.

- Los materiales a utilizar serán:

. HORMIGONES

En tableros pretensados "in situ"	H-400
En alzados de pilas	H-300
En cimentaciones	H-250

. ACEROS

Armaduras pasivas	AEH-500
Armaduras activas	A-190-SE

2.1.3.4. Tipologías estudiadas

En el ámbito de luces indicado en el apartado 3.2, la tipología estructural más idónea es la de viga continua de canto constante con sección en cajón monocelular. Se ha adoptado esta tipología optimizando las anchuras del cajón, voladizos y espesores de almas y forjados, así como el canto total del tablero. Dado que no son aceptables, por requisitos de la vía, tableros continuos de más de 450 m de longitud, se han dividido los puentes en dos tramos, disponiendo junta entre estos tramos y en los estribos. Las longitudes desiguales de los tramos se han adoptado para cargar la mayor parte del frenado sobre el estribo, que, en razón del proceso constructivo finalmente escogido, es el más idóneo para absorber dicha fuerza.

La tipología seleccionada para el tablero, va implícitamente ligada a unos procesos constructivos, que en esencia pueden resumirse en los siguientes:

- Cimbrado convencional del puente
- Autocimbra
- Cimbrado por tramos sucesivos
- Empuje desde un estribo

El primero no parece recomendable, dada la altura de la rasante y la longitud del puente.

La autocimbra necesita unos medios constructivos muy específicos y de gran coste de adquisición, que no están al alcance de la mayoría de los constructores. Sin descartar este procedimiento se han analizado con más detalle los dos últimos procesos: cimbrado por tramos y empuje desde un estribo.

Los puentes de ferrocarril son muy aptos, por la relación sobrecargas/peso propio, para el procedimiento del empuje, si bien requieren unas características del trazado en planta y alzado que hagan posible su lanzamiento. Estas características son satisfechas siempre que el eje del trazado sea una curva espacial correspondiente a un arco de circunferencia, una hélice o una recta.

Un inconveniente para la solución empujada, que podría incluso aconsejar su eliminación, es la división del tablero en dos tramos para respetar la condición de máxima longitud continua inferior a 450 m. En un primer análisis sería necesario efectuar el empuje de cada tramo desde su estribo correspondiente lo que obligaría a duplicar las instalaciones de fabricación de dovelas. Se producirían además interferencias del pescante del segundo tramo empujado cuando se aproximase al tramo ya construido obligando a su desmontaje parcial o total antes de concluir el empuje, haciendo necesaria la construcción de una pila provisional auxiliar en el vano anterior a la junta para reducir la longitud en voladizo que deberá soportar el tablero de hormigón al no contar con el pescante metálico.

Para eliminar este problema se ha adoptado una solución que permite el empuje de todo el tablero desde un solo estribo. Para ello se dispone entre los dos tramos una junta seca con llaves de cortante, que se cose, durante todo el proceso de empuje, con un pretensado local. Finalizado el empuje esta junta queda situada sobre una pila y se procede al atado con pretensado de los dos extremos del tablero a los estribos; se elimina a continuación el pretensado de cosido de la junta y desde el estribo más próximo a ella se tira del tramo pequeño, con ayuda del pretensado, produciendo la abertura de la junta hasta alcanzar la separación necesaria entre labios (unos 20 cm), que permita las posibles dilataciones térmicas de los dos tramos.

El cimbrado por tramos se presenta como una alternativa interesante para el caso en que no se cumplen las condiciones de trazado necesarias, y para las estructuras de longitud inferior a 250 m, en las que el empuje pierde interés económico, a no ser que, por homogeneidad con otras estructuras y si ya se dispone de los equipos, pueda ser interesante su utilización. Asímismo, en estos casos y si la altura de la rasante es reducida, inferior a 20 m, pueden ser competitivas soluciones prefabricadas isostáticas o con continuidad posterior.

Como ya se ha comentado en el apartado 3.1, el trazado en planta y alzado inicialmente encajado en la zona del viaducto nº 1, no permitía el empuje de la estructura razón por la que se analizó y definió una solución con dos vigas artesas, sin continuidad longitudinal. Para mejorar el comportamiento de la sección frente a torsión y dar mayor rigidez transversal al tablero, las vigas artesa son asimétricas, con el alma exterior inclinada y el alma interior vertical y se disponen juntas, conectándolas superiormente mediante el forjado y en la parte inferior, mediante llaves de cosido cada 2,0 m.

La elección de esta posible tipología frente a la losa aligerada continua, que también resulta adecuada para luces comprendidas entre 25 y 35 m, acordes con la reducida altura de la rasante en este viaducto, se ha basado en razones constructivas y económicas. Las losas isostáticas o hiperestáticas requieren la utilización de cimbras convencionales o autocimbras, cuyo coste repercute de forma importante en el precio de la estructura.

Una modificación del trazado en alzado, en la zona de ubicación del viaducto nº 1, realizada posteriormente, ha permitido conseguir las condiciones necesarias para el lanzamiento del tablero desde uno de los estribos, perdiendo interés la alternativa de vigas artesa prefabricadas estudiada con anterioridad a esta modificación.

Como conclusión de este apartado se describen a continuación, en forma resumida, las características principales de las tipologías que han sido objeto de un análisis comparativo desarrollado en el apartado 3.5.

Tipología I: Viga continua de hormigón pretensado
Construida mediante empuje desde un estribo
Sección cajón-monocelular
Luces extremas 37,5 m
Luces centrales 45,0 m
Canto constante de 3,10 m

Tipología II: Viga continua de hormigón pretensado
Construida por tramos sucesivos
Sección cajón-monocelular
Luces extremas 36,0 m
Luces centrales 45,0 m
Canto constante de 3,10 m

Tipología III: Tableros isostáticos con vigas prefabricadas
Dos vigas artesas asimétricas unidas
Luces de 28,0 m
Canto constante de 1,90 m

2.1.3.5. Análisis comparativo de las soluciones y solución elegida

En los apartados anteriores ya se han ido comentando, al presentar las alternativas analizadas, sus ventajas e inconvenientes desde los puntos de vista: estructurales, constructivos y funcionales. En este apartado se incluye una comparación económica de las soluciones.

COMPARACION ECONOMICA

Se analizan las tres variantes definidas anteriormente: cajón empujado, cajón construido por tramos sucesivos y vigas artesa isostáticas.

- En la solución empujada desde un estribo se dispone un pretensado centrado de lanzamiento, formado por dieciséis tendones de 19Ø0,6" y 14Ø0,6". Este pretensado va corrido a lo largo de todo el puente y se empalma a medida que progresa el lanzamiento del tablero mediante acoplamientos dispuestos alternadamente en las juntas de dovela. Una vez finalizado el proceso de empuje y con el tablero en su posición definitiva, se procede a efectuar el pretensado de segunda fase, que está formado por doce tendones de 19Ø0,6" para las dovelas sobre pilas, situados en el forjado superior, y doce o trece tendones de 12Ø0,6" para las dovelas de vano, situados en el forjado inferior. Este pretensado de segunda fase se tesa desde unos tacones interiores en forjado superior o inferior, corridos a toda la anchura del cajón.

- La variante del tablero cimbrado por tramos dispone de dos familias de pretensado. Una de trazado curvo en alzado y que discurre a lo largo de las almas, está constituída por ocho tendones de 19Ø0,6" (4 por alma), que se prolonga mediante conectores situados en la junta entre fases. La otra familia está formada por tendones rectos de 12Ø0,6" alojados, en número de 9 y 5, en forjado superior e inferior respectivamente. Estos tendones se cruzan en la zona de traviesa de pila, con los de la fase siguiente, y van corridos a lo largo de todo el tablero.

- La variante de vigas artesa prefabricadas está formada por 20 vanos de 28,0 m de luz. La longitud total es de 560 m.

Las vigas artesa son de canto constante 1,90 m. La losa del forjado tiene un espesor medio de 0,30 m que se hormigona sobre unas prelosas autoportantes de 6 cm de espesor.

Cada una de las vigas consta de un forjado inferior de 3,0 m de anchura, un alma exterior inclinada y un alma interior vertical, con sendas cabezas superiores de 0,67 m y 0,40 m respectivamente. El espesor de almas y forjado es de 0,25 m. En la zona de apoyo, las vigas están macizadas en una anchura de 0,40 m.

A fin de que el comportamiento de las vigas sea conjunto y resulte como un cajón bicelular monolítico, ambas vigas van cosidas mediante unas llaves de unión situadas en la parte inferior de las almas verticales, cada 2,0 m.

Con estos datos y aplicando las cuantías de acero pasivo normales en estas soluciones se realiza a continuación una comparación económica entre las tres soluciones centrada únicamente en las Unidades de Obra que son diferentes en las tres soluciones.

SOLUCION EMPUJADA

DESIGNACION DE LA UNIDAD	MEDICION	PRECIO	TOTAL
HORMIGONES			
M3 hormigón H-400 en tablero convencional		14.500	0
M3 hormigón H-400 en tablero empujado	5.710	13.000	74.230.000
ENCOFRADOS			
M2 encofrado oculto en tablero convencional		2.400	0
M2 encofrado visto en tablero convencional		3.800	0
M2 encofrado en tablero empujado	17.200	550	9.460.000
ACEROS			
Kg acero activo en tablero convencional	265.000	380 350	0 92.750.000
Kg acero activo en tablero empujado		110	0
Kg acero pasivo AEH-500 N ó F en tablero convencional	1.100.000	100	110.000.000
Kg acero pasivo AEH-500 N ó F en tablero empujado		65.000.000	0
VARIOS			
M3 cimbra en dos tramos	1	17.000.000	17.000.000
Ud equipo de lanzamiento, gatos de cremallera, teflones, barras tiro, etc	1	25.000.000	25.000.000
Ud puesta a disposición de obra de taller de fabricación de dovelas de tablero empujado, moldes, etc	1	9.500.000	9.500.000
Ud pescante metálico			

TOTAL UNIDADES CONSIDERADAS (EJECUCION MATERIAL)
337.940.000

SOLUCION: VANOS SUCESIVOS CIMBRADOS

DESIGNACION DE LA UNIDAD	MEDICION	PRECIO	TOTAL
HORMIGONES			
M3 hormigón H-400 en tablero convencional	6.200	14.500	89.000.000
M3 hormigón H-400 en tablero empujado		12.100	0
ENCOFRADOS			
M2 encofrado oculto en tablero convencional	6.100	1.800	10.980.000
M2 encofrado visto en tablero convencional	11.000	2.800	30.800.000
M2 encofrado en tablero empujado		500	0
ACEROS			
Kg acero activo en tablero convencional	234.000	380 320	88.920.000 0
Kg acero activo en tablero empujado	1.100.000	110	121.000.000
Kg acero pasivo AEH-500 N ó F			

en tablero convencional		100	0
Kg acero pasivo AEH-500 N ó F en tablero empujado			65.000.000
VARIOS			
M3 cimbra en dos tramos		15.000.000	0
Ud equipo de lanzamiento, gatos de cremallera, teflones, barras tiro, etc		23.000.000	0
Ud puesta a disposición de obra de taller de fabricación de dovelas de tablero empujado, moldes, etc		9.500.000	0
Ud pescante metálico			

TOTAL PRESUPUESTO EJECUCION MATERIAL 406.600.000

SOLUCION VIGAS ARTESA

DESIGNACION DE LA UNIDAD	MEDICION	PRECIO	TOTAL
HORMIGONES			
M3 hormigón H-250 en forjado sobre vigas	2.160	10.850	23.436.000
ENCOFRADOS			
M2 prelosa autoportante de 6 cm	6.900	7.180	49.542.000
ACEROS			
Kg acero pasivo AEH-500 N ó F en forjado	194.000	110	21.340.000
VARIOS			
Ml viga artesa prefabricada	1.136	168.400	191.302.400
Ud transporte y colocación de vigas prefabricadas	40	2.000.000	80.000.000

TOTAL UNIDADES CONSIDERADAS (EJECUCION MATERIAL)	**365.620.000**

A la vista de esta comparación económica resulta más ventajosa la solución empujada, que por otra parte tiene claras ventajas funcionales, estructurales, constructivas y estéticas respecto a la solución de vigas artesa y condiciones iguales, en estos aspectos, la solución de cajón construido por tramos sucesivos.

En consecuencia se ha seleccionado la solución de viga cajón continua de hormigón pretensado, construido por empuje desde un estribo para ambos viaductos, lado que con la corrección realizada en el trazado en alzado del viaducto nº 1, es posible aplicar este procedimiento constructivo.

2.2. PASOS SUPERIORES

2.2.1. Condicionantes

Todos los pasos superiores del tramo, que corresponden a caminos, quedan emplazados en áreas en que la línea de ferrocarril se aloja en profundas trincheras con fuertes taludes.

La plataforma resulta considerablemente ensanchada por las cunetas Ritchie dispuestas para recogida de previsibles caídas, dadas las características de los terrenos atravesados, y con la función adicional de recogida de la nieve, muy frecuente en los parajes atravesados por este tramo.

Las tensiones admisibles para cimentación son medias para el plano de explanación y algo más reducidas en la parte alta de los taludes, donde su efecto sobre las tipologías planteables se acentúa con los ángulos de resguardo a respetar. Las condiciones de cimentación son las que aparecen en el siguiente cuadro:

Condiciones de cimentación de los pasos superiores

p.k.	T. Admisible en pilas (kg/cm2)	T. Admisible en estribos (kg/cm2)	Angulo en taludes	
			Estribo 1	Estribo 2
700+240	7	5.0	30	45
705+020	7	5.0	45	45
706+000	4	3.5	45	45
707+700	7	5.0	35	35
708+100	4	3.5	35	35
710+900	7	5.0	40	40
712+620	4	4.0	35	35

Bajo estas condiciones, se han planteado, distintas tipologías que pueden agruparse en dos familias:

1. Puentes de un solo vano, con 25 m de luz, que permiten la continuidad de las cunetas.

2. Puentes de tres vanos, con el vano central de 25,00 m. de luz, con el que se aumenta la distancia de las pilas a las vías, eliminando además la afección de la construcción de las pilas a la plataforma.

A continuación se describen las opciones planteadas para cada estructura.

Paso superior PK 700+240

En esta estructura se han contemplado tres posibles soluciones.

La primera solución consiste en un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor.

La segunda solución consiste en tres vanos de luces 10, 16 y 10 m y losa de hormigón postensado.

La tercera solución es también una estructura de tres vanos de 16 m de luz cada uno.

Esta última solución resulta desequilibrada en cuanto a la compensación que suponen los vanos laterales por otra parte como se puede ver en la valoración económica es la más cara de las tres y por lo tanto no se la considera.

La segunda estructura si bien podría resultar adecuada resulta un 75% más cara que la primera sin aportar ninguna ventaja especial sobre ella.

Como resultado de todo lo anterior se elige la primera solución.

La valoración obtenida para las distintas soluciones resulta:

Solución 1. Vigas prefabricadas, 25 m de luz, ancho de tablero 8,20 m
Superficie: 25.8,20 = 205 m^2
m^2 paso superior de vigas prefabricadas, incluido estribos, tablero, pilas y cimentación 80.000 PTA
Valoración: 205 m^2 . 8000 PTA/m^2 = 16.400.000 PTA

Solución 2. Losa postensada con luces de 10, 16 y 10 m
Superficie: 36.8,20 = 295,2 m^2

m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación: 98.000 PTA
Valoración 295,2 m^2 . 98.000 PTA/m^2 = 28.929.600 PTA

Solución 3. Losa postensada con luces de 16, 16 y 16 m
Superficie: 48.8,20 = 393,6
m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación : 98.000 PTA
Valoración 393,6 m^2 . 98000 PTA/m^2 = 38.572.800 PTA

Se adopta la solución 1.

Paso superior PK 705+020

Se estudian dos soluciones:

La primera solución es de un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor.

La segunda solución es de tres vanos de luces 10, 16 y 10 m y tablero de losa postensada.

Se elige la primera solución porque la segunda no aporta ninguna ventaja técnica y sin embargo resulta un 75% más cara que la primera como puede apreciarse en la valoración.

Valoración de las dos soluciones:

Solución 1. Vigas prefabricada, 25 m de luz, ancho de tablero 8,20 m.
Superficie 25 . 8,20 = 205 m^2
m^2 paso superior de vigas prefabricada, incluido estribos, tablero, pilas y cimentación: 80.000 PTA
Valoración 205 m^2. 80000 PTA/m^2 = 16.400.000 PTA

Solución 2. Losa postensada con luces de 10, 16 y 10 m
Superficie = 36.8,20 = 295,2 m^2
m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación: 98.000 PTA
Valoración 295,2 m^2.92000 PTA/m^2 = 28.929.600 PTA

Se adopta la solución 1.

Paso superior PK 706+000

En esta estructura se han estudiado también dos soluciones. La primera solución es de un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La segunda solución es de tres vanos de 10, 16 y 10 m de luz con losa postensada.

al igual que en la estructura anterior se elige la solución primera porque la segunda no aporta ninguna ventaja técnica y sin embargo, como puede comprobarse en la valoración económica resulta un 75% más cara.

La valoración de las soluciones resulta:

Solución 1. Vigas prefabricadas, 25 m de luz, ancho del tablero 8,20 m
Superficie: 25 . 8,20 = 205 m^2
m^2 paso superior de vigas prefabricadas, incluido estribos, tablero, pilas y cimentación: 80.000 PTA
Valoración 205 m^2.80.000 Pta = 16.400.000 PTA

Solución 2. Losa postensada con luces de 10, 16 y 10 m
Superficie 36 . 8,20 = 295,2 m^2
m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación: 98.000 PTA
Valoración 295,2 m^2.98.000PTA7m^2 = 28.929.600 PTA

Se adopta la solución 1.

Paso superior PK 707+700

Esta estructura, igual que la anterior, se han estudiado también dos soluciones. La primera solución es un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La segunda solución es de tres vanos de 10, 16 y 10 m de luz con losa postensada.

Al igual que en la estructura anterior se elige la solución primera porque la segunda no aporta ninguna ventaja técnica y sin embargo, como puede comprobarse en la valoración económica resulta un 75% más cara.

Valoración de las soluciones:

Solución 1. Vigas prefabricadas, 25 m de luz, ancho de tablero 8,20 m.
Superficie 25 . 8,20 = 205 m^2

m² paso superior de vigas prefabricadas, incluido estribos, tablero, pilas y cimentación 80.000 PTA
Valoración 205 m² . 80.000 PTA/m² = 16.400.000 PTA

Solución 2. Losa postensada con luces del 10,16 y 10 m.
Superficie 36 . 8,20 = 295,2 m^2
m² paso superior de losa postensada, incluido estribos, tablero, pilas y cimentación 98.000 PTA
Valoración 295,2 m² . 98.000 PTA/m² = 28.929.600 PTA

Se adopta la solución 1.

Paso superior PK 708+100

En la elección de la solución definitiva hay que tener en cuenta dos condicionantes fundamentales: el ancho de la cuneta que hay que respetar y la inclinación de los taludes impuesta por geotecnia.

Con los condicionantes expuestos la solución 2 adolece de tener unos estribos demasiado altos que hay que cimentar, por otra parte, a bastante profundidad.

La solución 3, si bien tiene los estribos algo más bajos resulta desequilibrada en cuanto a la luz de los vanos, ya que tiene los vanos laterales demasiado grandes, cosa que no se puede evitar, ya que la situación de la zapata respecto al frente del talud viene impuesta por geotecnia situando su esquina en un ángulo de 35º con la horizontal desde la base de éste.

Por todo lo anterior se adopta la solución 1, ya que a pesar de ser algo más cara, técnicamente resulta idónea.

Valoración de las tres soluciones:

Solución 1. Losa postensada con luces de 13,50, 25 y 13,50 m, ancho del tablero 8,20 m
Superficie: 52 . 8,20 = 426,4 m^2
m^2 paso superior con losa postensada, incluido estribos, tablero, pilas y cimentación: 98,000 PTA
Valoración 426,4 m^2.98.000 PTA/m² = 41.787.200 PTA

Solución 2. Losa postensada con luces de 10, 16 y 10 m
Superficie 36 . 8,20 = 295,2 m^2
m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación: 98.000 PTA
Valoración 295,2 m^2.98.000PTA7m^2 = 28.929.600 PTA

Solución 3. Losa postensada con luces de 16,16 y 16 m
Superficie 48 x 8,20 = 393,6 m²
m² paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación 98.000 PTA
Valoración 393,6 m² . 98.000 PTA/m² = 38.572.800 PTA

Se adopta la solución 1.

Paso superior PK 710+900

En esta estructura, igual que en otras, se han estudiado dos soluciones. La primera con un sólo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La segunda solución es de tres vanos de 10,16 y 10 m de luz con losa postensada.

Al igual que en otras ocasiones se elige la solución primera porque la segunda no aporta ninguna ventaja técnica y sin embargo resulta un 75% más cara.

Valoración de las dos soluciones:

Solución 1. Vigas prefabricadas, 25 m de luz, ancho del tablero 8,20 m
Superficie: 52 . 8,20 = 205 m^2
m^2 paso superior de vigas prefabricadas, incluido estribos, tablero, pilas y cimentación: 80.000 PTA
Valoración 205 m^2 . 80.000 PTA/m² = 16.400.000 PTA

Solución 2. Losa postensada con luces de 10, 16 y 10 m
Superficie 36 . 8,20 = 295,2 m^2
m^2 paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación: 98.000 PTA
Valoración 295,2 m^2.98.000PTA7m^2 = 28.929.600 PTA

Se adopta la solución 1.

Paso superior PK 712+620

En la elección de la solución definitiva hay que tener en cuenta una serie de condicionantes fundamentales:

1. Existe un ancho de cuneta que hay que respetar.
2. Hay unas inclinaciones de taludes prescritas por geotecnia.

3. Las zapatas de los estribos tienen que tener su extremo en una línea que forma 35° con la horizontal trazadas ambas dos desde la base del talud.

Con los condicionantes anteriores la solución 2 con un vano central de 16 m lleva a unos vanos laterales también de 16 m por lo que el conjunto resulta descompensado. Por otra parte, los estribos resultan demasiado altos y cimentados bastante profundamente.

Por todo lo anterior se elige la solución 1 que cumple todos los condicionantes con una dimensión de estribos pequeña y vanos muy compensados. Técnicamente resulta idónea.

Las dos soluciones estudiadas se han valorado en:

Solución 1. Losa postensada con luces de 13,50, 25 y 13,50 m, ancho de tablero 11,20 m.
Superficie 52 . 11,20 = 582,4 m²
m² paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación 98.000 PTA
Valoración 582,4 m² . 98.000 PTA/m² = 57.075.200 PTA

Solución 2. Losa postensada con luces de 16,16 y 16 m
Superficie 48 . 11,20 = 537,6 m²
m² paso superior con losa postensada, incluso estribos, tablero, pilas y cimentación 98.000 PTA
Valoración 537,6 m² . 98.000 PTA/m² = 52.684.800 PTA

Se adopta la solución 1.

2.2.2. Descripción de las estructuras.

Paso superior PK 700+240

La solución consiste en un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La altura de los estribos es aproximadamente de 11 m apoyándose en unas zapatas de 6.65 m de ancho, 1.30 de canto y 8.40 de largo.

Paso superior PK 705+020

La solución es de un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La altura de los estribos es de algo mas de 10 m apoyándose en unas zapatas de 8.40 m de largo, 6.30 de ancho y 1.30 de canto.

Paso superior PK 706+000

La solución es de un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La altura de los estribos es de 9.5 m. con unas zapatas de 10.05 m de largo 8.90 m de ancho y 1.50 m de canto.

Paso superior PK 707+700

La solución es un solo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La altura de los estribos está entre 9.75 m y 10.75 m con unas zapatas de 8.90 m de largo, 6.30 m de ancho y 1.30 m de canto.

Paso superior PK 708+100

La solución consiste en una losa postensada con luces de 13,50, 25 y 13,50 m, ancho del tablero 8,20 m. Los estribos son de 4.40 m de altura apoyándose en una zapata de 3.30 m de ancho y 0.70 m de canto. Las pilas tienen una planta de 1.80 X 1 m rematada por dos semicírculos de 1 m de diámetro, su altura es de 10.73 m y se apoyan sobre unas zapatas de 6 m de largo por 4.40 m de ancho y 1.30 m de canto.

Paso superior PK 710+900

En esta estructura, igual que en otras, se han estudiado dos soluciones. La solución Consiste en un sólo vano de 25 m de luz formado por dos vigas en artesa de 1,10 m de canto y una losa de 0,25 m de espesor. La altura de los estribos es de 10 m con unas zapatas de 8.90 m de largo, 6.55 m de ancho y 1.35 m de canto.

Paso superior PK 712+620

La **solución consiste en una losa** postensada con luces de 13,50, 25 y 13,50 m, ancho de tablero 11,20 m. Los estribos son de 4.20 m de altura , con unas zapatas de 11.2 m de largas, 4 m de anchas y 0.80 m de canto. Los ejes de pilares son de dos fustes circulares cada uno, con un diámetro de 1.10 m de diámetro y 13.3 m de altura. Las zapatas en las que se apoyan estas pilas son de 8.90 m de largo, 3.40 m de ancho y 1.65 m de canto.

2.3. PASOS INFERIORES

2.3.1 Condicionantes

Destinados al paso de caminos (con una sola excepción), todos ellos se plantean para gálibos de 8,00 m de ancho y 5,30 m de altura.

La tipología seleccionada lo es en función de la carga de tierras que debe soportar y de la capacidad de carga del terreno en que se emplazan.

En trasdós de los pórticos y marcos alojados en los rellenos de la línea y cuyo recubrimiento de tierras sea inferior a 2 m se realizará la transición de rigidez mediante bloques técnicos.

Las condiciones de cimentación son las que figuran en el siguiente cuadro:

Condiciones de cimentación de los pasos inferiores

p.k.	T. admisible en zapatas (kg/cm2)	T. admisible en aletas o picos de flauta (kg/cm2)	Coeficiente de balasto (K30, T/m3)
701+440	3.5	3.5	
702+100		4.0	8000
704+360		2.5	5000
704+680	7.0	7.0	
709+140	5.0		
710+070	6.0		10000
710+635	6.0		10000
713+790	6.0		10000
714+140		2.5	5000
714+695	6.0	6.0	

2.3.2 Descripción de las estructuras

Paso inferior PK 701+440

Paso inferior de camino en el que no hay sobrecarga de tierras, con unas condiciones de cimentación aceptables (tensión admisible del terreno 3,5 kg/cm²). En estas condiciones se proyecta un pórtico de 19,20 m de largo cimentado mediante zapatas de 3,60 m de ancho y 0.80 m de canto a 2,50 m de profundidad desde la rasante del camino al que abre paso bajo el terraplén del ferrocarril. Las aletas a los lados del pórtico son tres de ellas en prolongación y la cuarta, oblicua, para facilitar la entrada en curva del camino.

Paso inferior PK 702+100

Una sobrecarga de tierras de más de 10 m condiciona, en esta estructura, a proyectar una bóveda. La luz es de 10,04 m y la flecha de 7,16 m. El espesor de la bóveda será de 0,30 m. Con estas dimensiones se encierra interiormente un gálibo de 7,14 m de ancho por 5 m de alto.

Al ser los taludes del terraplén del ferrocarril bastante tendidos, los picos de flauta determinación de la bóveda resultan bastante largos (39.6 m entre los dos) frente a un cuerpo de bóveda de 84.60 m.

La cimentación es una losa de hormigón armado de 2,80 m de canto y 11.20 m de ancho. La cimentación en los picos de flauta consiste en zapatas de 1.550 m de ancho y 0.7m de canto, en la zona en que la altura de la ménsula curva no supera los 3 m. y el mismo canto pero un ancho de 3.7 m para el resto en el que la altura del muro en ménsula supera los 3 m En las boquillas se dispone una solera de hormigón en masa de 30 cm de espesor rematada en un rastrillo de hormigón en masa de 0.60 de ancho por 1.50 de profundidad, para eliminar el riesgo de erosión por el agua que, en ocasiones, puede circular bajo la bóveda con una considerable velocidad

Paso inferior PK 704+360

Las condiciones de cimentación y las sobrecargas que permiten la construcción de un marco con las dimensiones de 8 m de luz por 5,30 de altura libre, un espesor de solera de 0.80 m y del dintel de 1 m y 0,80 m de espesor de hastiales. La longitud total del marco es de 23,20 m y tiene cuatro aletas en prolongación ya que el camino al que abre paso incide perpendicularmente a la vía. El marco, en su interior lleva un cunetón de 0.75 m de ancho y 0.5 m de profundidad, dispuesto en el relleno de tierras que va sobre la losa inferior, para evitar la erosión cuando circule el agua. El cunetón se extiende hasta donde terminan la aletas.

Paso inferior PK 704+680

Las sobrecargas en esta estructura son relativamente pequeñas y las condiciones de cimentación son más que suficientes, por lo que se adopta la solución de pórtico con una luz entre paramentos de 8 m y una altura libre de 5,30 m. Los espesores son 1 m en el dintel y 0,80 en los hastiales El pórtico tiene una longitud de 44 m debido a que el esviaje respecto de la traza de la vía es grande. La disposición de los taludes y la longitud del pórtico hace que sólo sean necesarias dos aletas. Las zapatas resultan de 2.60 m de ancho y 0.80 m de canto. La profundidad de la cimentación es 1,50 m bajo la rasante del camino al que abre paso.

Paso inferior PK 709+140

El paso inferior sirve a una carretera, por lo que la luz entre paramentos es 12,00 m. Para esta luz se considera más adecuada una solución con tablero isostático sobre estribos de hormigón armado.

Para 14,00 m de ancho de plataforma y 12,90 m de luz entre apoyos, el tablero estará constituido por 12 vigas prefabricadas de hormigón pretensado, sobre las que se hormigona una losa de 25 cm de espesor.

Los estribos contienen los derrames mediante aletas vueltas, y su cimentación es directa, con zapatas de hormigón armado a profundidad reducida respecto a la rasante.

Paso inferior PK 710+070

Esta estructura tiene una sobrecarga de tierras suficientemente fuerte como para que sea aconsejable una solución bóveda. La bóveda elegida tiene una luz de 10,04 m, una flecha de 7,06 m y una espesor de 0,30 m, resultando un gálibo de 7,14 m de ancho por 5 m de alto. El cuerpo central de la bóveda tiene 38,70 m de longitud mientras que los picos de flauta de las boquillas tienen en total 28,8 m.

La cimentación es mediante zapatas, a una profundidad de cimentación de 2 m. Las dimensiones de las zapatas son de 3.0 m de ancho por 1.15 m. de canto La cimentación en los picos de flauta consiste en zapatas de 1.550 m de ancho y 0.7 m de canto , en la zona en que la altura de la ménsula curva no supera los 3 m. y el mismo canto pero un ancho de 3.7 m para el resto en el que la altura del muro en ménsula supera los 3 m

A lo largo de toda la bóveda (ya que la cimentación en este caso es sobre zapatas),incluidos los picos de flauta, se dispone una solera de hormigón en masa de 30 cm de espesor rematada en un rastrillo de 0.60 de ancho por 1.50 de profundidad para eliminar la erosión producida por el agua que, en ocasiones, puede circular bajo la bóveda con una considerable velocidad

Paso inferior PK 710+640

En esta estructura la sobrecarga de tierras también conduce a elegir la solución bóveda. Dicha bóveda resulta de una longitud de 39,60 m en el cuerpo principal y 28.8 m en los picos de flauta.

La cimentación es mediante zapatas, a una profundidad de cimentación de 2 m. Las dimensiones de las zapatas son de 3.0 m de ancho por 1.25 m. de canto La cimentación en los picos de flauta consiste en zapatas de 1.550 m de ancho y 0.7m de canto, en la zona en que la altura de la ménsula curva no supera los 3 m. y el mismo canto pero un ancho de 3.7 m para el resto en el que la altura del muro en ménsula supera los 3 m

Como en el caso anterior, a lo largo de toda la bóveda (ya que la cimentación en este caso es sobre zapatas),incluidos los picos de flauta se dispone una solera de hormigón en masa de 30 cm de espesor rematada en un rastrillo de 0.60 de ancho por 1.50 de profundidad, para evitar la erosión producida por el agua que, en avenidas, puede circular bajo la bóveda con una considerable velocidad

Paso inferior PK 713+790

Esta estructura tiene una altura de tierras de más de 14 m sobre ella, por lo que se impone una bóveda. La longitud del cuerpo principal de dicha bóveda es de 81 m con unos picos de flauta que en total suman 30.6 m.

La cimentación es mediante zapatas, a una profundidad de cimentación de 3 m. Las dimensiones de las zapatas son de 3.75 m de ancho por 1.50 m. de canto La cimentación en los picos de flauta consiste en zapatas de 1550 m de ancho y 0.7m de canto , en la zona en que la altura de la ménsula curva no supera los 3 m. y el mismo canto pero un ancho de 3.7 m para el resto en el que la altura del muro en ménsula supera los 3 m

Como en casos anteriores, a lo largo de toda la bóveda (ya que la cimentación en este caso es sobre zapatas), incluidos los picos de flauta se dispone una solera de hormigón en masa de 30 cm de espesor rematada en un rastrillo de hormigón en masa de 0.60 de ancho por 1.50 de profundidad. Su función será evitar la erosión producida por el agua que, en ocasiones, puede circular bajo la bóveda con una considerable velocidad

Paso inferior PK 714+140

En esta estructura la tipología se impone directamente por la geotecnia, prescribiéndose un marco por parte de estos especialistas. Las dimensiones serán de 8 m de luz entre paramentos y 5,30 m de altura libre. El canto del dintel será de 1 m y la solera de 0.80 m , los espesores de los hastiales serán de 0,8 m. La longitud total del marco es de 37,65 m y tiene cuatro aletas prácticamente iguales y en prolongación.

El marco, en su interior lleva un cunetón de 0.75 m de ancho y 0.5 m de profundidad, dispuesto en el relleno de tierras que va sobre la losa inferior, para canalizar el agua. El cunetón se extiende hasta el límite exterior de las boquillas.

Paso inferior PK 714+695

La tipología de esta estructura es el pórtico. Las dimensiones serán, como en los otros pasos, de 8 m de luz entre paramentos y 5,3 m de altura libre. El canto del dintel es de 1m y el espesor de los hastiales de 0,80 m. Las zapatas son de 2.60 m de largo por 0.80 m de canto La longitud total del cajón es de 18 m y además tiene cuatro aletas en prolongación.

Como en casos anteriores, a lo largo de todo el pórtico, incluidas las aletas se dispone un cunetón lateral a lo largo de toda la solera de 0.75 m de ancho y 0.5 m de profundidad para el agua que, en ocasiones, puede circular bajo el pórtico con una cierta velocidad.

2.4 FALSO TUNEL P.K. 713+860 A P.K. 714+040 (No se ejecutó)

El talud sudeste de la trinchera de más de 30 m de profundidad que debería excavarse en esta zona del trazado, presenta graves problemas de estabilidad debidos a la existencia de un potente paquete de calizas sobre arcillas del Keuper estratificadas con un buzamiento de 15º hacia la excavación.

Para eliminar la tendencia al deslizamiento de este sistema se han planteado las alternativas de construir un gran muro fuertemente anclado, o un falso túnel.

Esta última solución se considera más adecuada, ya que elimina la necesidad de instalar gran número de anclajes permanentes que harían imprescindible la instalación de dispositivos de control y la dependencia de un mantenimiento frecuente y caro, en evitación de fallos imprevistos.

El falso túnel, de hormigón armado, tiene una longitud de 137 metros, y su sección es circular truncada, con un radio interior de 6.92 metros, cuyo centro se sitúa a 1.83 metros por encima de la cota de carril, obteniéndose una sección libre que supera ligeramente los 100 m2. La contrabóveda es también circular de radio interior 12.10 metros y centro en el eje. Los espesores son de 2 metros en hastiales, 0,70 metros en clave y 0,80 metros en clave de la contrabóveda.

Las boquillas de entrada y salida se han diseñado en pico de flauta, como secciones en "U", en los 5 metros más próximos al falso túnel, y con zapatas independientes en el resto de espesor variable entre 1 y 1.5 metros.

La altura máxima de tierras sobre el túnel es de unos 27 metros. Asimismo se han proyectado anclajes temporales que cosen los estratos que pueden deslizar. Tras la construcción del falso túnel se rellenará hasta llegar a la cota del terreno natural. (No se ejecutó)

2.5. CRITERIOS DE DISEÑO

Características de los materiales

1. Hormigones

. Tableros pretensados construidos in situ	H-400
. Tableros armados	H-300
. Vigas prefabricadas	H-450
. Alzados de pilas	H-300
. Forjados sobre vigas e impostas	H-250
. Pórticos enterrados	H-250
. Cimentación y estribos	H-250
. Nivelación y rellenos	H-125

2. Aceró

. Armaduras pasivas	AEH-500N
. Armaduras activas	A-190-SE

3. Características del acero de pretensado

. Relajación del 2,5% para una tensión del	70% de $f_{MAX.K}$ aplicada durante 1.000 horas
. Tensiones máximas en anclajes	
- Tendones reemplazables	
. Al tesar	0,80 $f_{MAX.K}$
. Al bloquear	0,75 $f_{MAX.K}$
- Tendones no reemplazables	
. Al tesar	0,75 $f_{MAX.K}$
. Al bloquear	0,75 $f_{MAX.K}$

Normativa aplicada

- Instrucción para el Proyecto y Ejecución de las obras de hormigón en masa y armado EH-91.

- Instrucción relativa a las acciones a considerar en el Proyecto de Puentes de Ferrocarril. IPF.75.

- Eurocódigo 1: Bases de proyecto y acciones en estructuras. Parte 1: Bases de proyecto. (ECI.3) y subsidiariamente:

- "Norma UIC. Ficha 776.1". (UIC 776.1)
- "Norma UIC. Ficha 774.2". (UIC 774.2)
- "Norma UIC. Ficha 702.0". (UIC 702.0)

Para el establecimiento de hipótesis se empleará la Instrucción:

- Eurocódigo 1: Bases de proyecto y acciones en estructuras. Parte 1: Bases de proyecto. (ECI.1).

Para el estudio de la fatiga de los materiales se utilizará la Norma:

- Eurocódigo 2. Diseño de estructuras de hormigón. Parte 2: Puentes de hormigón. (EC".2) y subsidiariamente:

- "Norma UIC ficha 774.1" (UIC 774.1) art. 8.2 a 8.6.

Para la comprobación de flechas, deformaciones y vibraciones, se utilizará la Norma:

- Eurocódigo 2. Diseño de estructuras de hormigón. Parte 2: Puentes de hormigón. (EC2.2) y subsidiariamente:

- " Norma UIC. Ficha 776.3". (UIC 776.3).

3 CALCULOS

3.1 VIADUCTOS

VIADUCTOS

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   - 1.2. MATERIALES
2. CÁLCULOS JUSTIFICATIVOS
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     - 2.3.2. ESTRIBOS DE RECEPCIÓN
   - 2.4. PRUEBA DE CARGA (PROYECTO)

1- MEMORIA

1.1- BASES DE CALCULO

BASES DE CÁLCULO

1) Generalidades

I) Para la obtención de las solicitaciones de cálculo y su empleadas en la comprobación de los diferentes Estados Límite se seguirá una doble vía:

a) Calculo 1- Se aplicara:

- IPF-75 -
- NCSE-94 - $a_c < 0{,}06\,g$ (exenta de aplicación)

Se establecen las combinaciones de cálculo de acuerdo con:

- EH-91
- EP-93

b) Cálculo 2 - Se aplicará

- EC1.3 (ENV 1991-3/1995)

Subsidiariamente, en lo no contemplado en EC1.3 se aplica:
- UIC 776.1 7/79
- UIC 774.2 7/74
- UIC 702.0 1/74

Se establecen las combinaciones de cálculo de acuerdo con:

- EC1.1 (UNE-ENV 1991-1/1997)

II) Para dimensionamiento y comprobación de secciones de obligación:

- EH-91
- EP-93 (Clase II)

III) Para estudio de fatiga se aplicará:

- EC2.2 (ENV-1992.2-6/1995)

Subsidiariamente, en lo no contemplado en EC2.2 se aplica:
- UIC 774.1 - 7/74 - Art. 8.2 a 8.6

IV) Para comprobación de flechas, deformaciones y vibraciones se aplicará:

- EC2.2 (ENV-1992.2-6/1995)

Subsidiariamente, en lo no contemplado en EC2.2 se aplica:
- UIC 776.3 - 1/89

2) - Cargas permanentes

2.1. Peso propio - Hormigón masa - 2,4 Mp/m³
Hormigón armado o pretensado - 2,5 Mp/m³
Acero estructural - 7,85 Mp/m³

2.2. Cargas muertas -

a) Balasto - $g_o = A \times \gamma$; A - Area de balasto
γ - 1,6 Mp/m³

Valor superior característico - $1,20 \cdot g_o$
Valor inferior característico - $1,00 \cdot g_o$ - E.L.U.

Estados Transitorios de Desbalastado

- 50% del balasto de 1 vía en toda la longitud del puente.
- 100% del balasto de 1 vía en 15 m de longitud

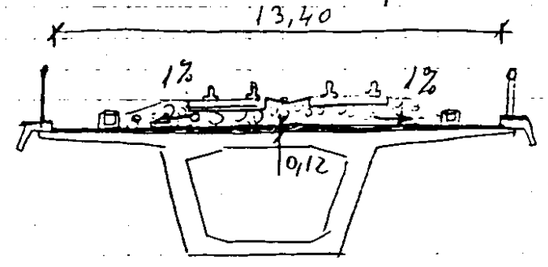
b) Traviesas y carriles -

$g_{traviesas}$ = 0,52 Mp/ml/vía
$g_{carriles}$ = 0,12 Mp/ml/vía
} · 0,64 × 2 = 1,28 Mp/ml para doble vía

NOTA - El desbalastado lo suponemos incompatible con la presencia de las traviesas y los carriles de la vía donde se haya retirado aquel.

c) Hormigón de forma -

Se adopta una capa de hormigón de forma de 0,12 m en el centro y pendiente transversal del 1%.



(Será similar a 0,15 m en centro y pte transversal del 2%

$$P = \left(0,12 - \frac{0,067}{2}\right) \times 13,40 \times 2,4 = \underline{2,78 \text{ Mp/ml}}$$

d) Conductos de cableado, cables y paseos:

$g_{cond+cables}$ = 0,30 Mp/ml / lateral → 0,6 Mp/ml puente

La sobrecarga de 0,5 T/m² en paseos la consideraremos en el apartado de sobrecargas.

e) Soportes de catenarias -

De acuerdo con bases de calculo de Eurocodigo - Lineas Mixtas de ferrocarril

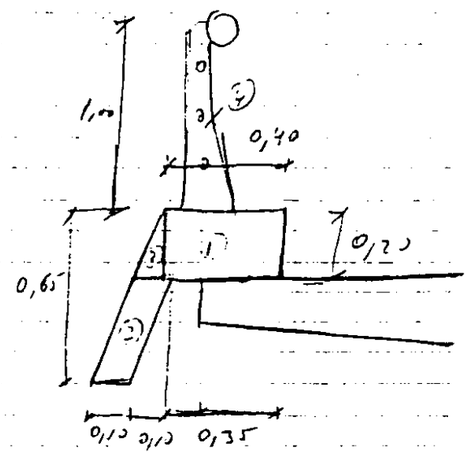
Postes + catenarias: | Horizontal - 0,5 Mp | Vertical - 0,5 Mp | M base - 9,0 Mp·m } por poste

Se dispone 1 poste / pila en cada lateral - D ≤ 60 m

Estado accidental de rotura de una catenaria:

H = 2 Mp
M = 2·7 = 14 Mp·m } en la base del poste

f) Impostas y barandillas -



Imposte -

	A
①	0,2 × 0,4 = 0,08
②	0,046 × 0,2/2 = 0,0046
③	0,10 × 0,45 = 0,045

P = (0,1796 × 2,5 + 0,05) × 2 = 0,75 Mp/ml

2.3. Cargas de terreno

$\phi = 35°$

Empuje activo - $K_a = tg^2(45 - \phi/2)$ → 0,271 (1,0 m roca)

Empuje pasivo - $K_p = 0,6\, tg^2(45 + \phi/2)$ → 2,214 (3,690 en terreno sin cohesión)

Empuje al reposo - $K_o = 1 - \sin\phi$ → 0,426

En estribos anclados (al tablero) → Se utilizará K_o entre

El empuje pasivo no actua en 10%H desde superficie

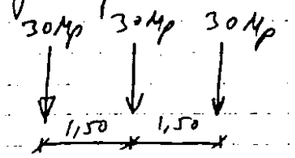
3. Sobrecargas

3.1. Sobrecargas de uso -

- **IPF-75**

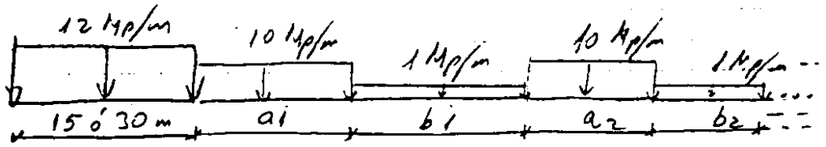
a) Trenes de cargas para vía RENFE -

Tipo A



$\Sigma = 90$ Mp

Tipo B

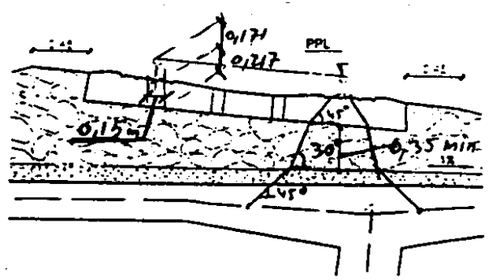


a_i, b_i → pésimos Σ = ilimitada

Aceras: → 0,50 Mp/m² en aceras → 1,45 × 0,5 × 2 = 1,45 Mp/m (Supone anchura de canaleta = 0,30 m)

Solo 50% de aceras en concomitante con sobrecarga ferroviaria

Reparto local de cargas
- 1:1 en traviesa
- 1H : 2V en balasto
- 1:1 en H. forme y elemento
- Anchura carga superior - pésima



Impacto:

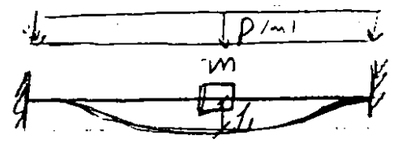
→ Tramos apoyados continuos $L = 45$ m, $V = 200$ Km/h

$$I = 65\,\frac{\mu}{1-\mu+\mu^2} \qquad \mu = \frac{V \cdot T}{2L}$$

siendo: V - velocidad del tren en Km/hora
T - periodo fundamental vibración del elemento cargado en sg.
L - Luz en m.

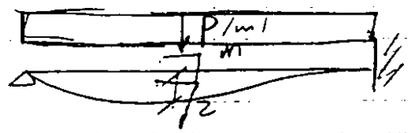
Calculo T de flexión - Consideramos 1 grado de libertad

Sistema 1



$$T = 2\pi\sqrt{\frac{m}{K}}$$

Sistema 2



$$\delta_{st} = \frac{mg}{K} = \frac{P}{K}$$

Sistema 3 - biapoyado

S1 - $\delta_{max} = \frac{PL^4}{384EI} = \frac{P}{K} \rightarrow K = \frac{384EI}{L^4}$

S2 - $\delta = \frac{PL^4}{185EI} \Rightarrow K = \frac{185EI}{L^4}$

S3 - $\delta = \frac{5PL^4}{384EI} \rightarrow K = \frac{768EI}{L^4}$

$m_t^{pp} = 45\,m \times 8{,}80\,m^2 \times 2{,}5\,Mp/m^3 = 990$ Tm tablero

$E = 2.100.000$ Tn/m²

$I_{xx} = 12{,}026$ m⁴

$L = 45$ m

$K_1 = 3942$ Tn/m² $= \frac{Ton}{m \cdot m}$ → $T_1 = 3{,}149$ s/

$K_2 = 1899$ Tn/m → $T_2 = 4{,}537$ s/

Con $T_1 \rightarrow \mu_1 = 7{,}00 \rightarrow I_1 = 10{,}6 \rightarrow$ Coef.c = 1,106

Con $T_2 \rightarrow \mu_2 = 10{,}08 \rightarrow I_2 = 7{,}08 \rightarrow$ Coef.c = 1,071

Con RCP - $m = 4{,}7 + 1{,}6 + 1{,}28 + 0{,}6 + 2{,}78 + 0{,}75 = 12{,}9$ Ton/m

$45 \times 12{,}9 = 582$ Ton

Repitiendo el calculo con este mesc adicional -

$T_1' = 3{,}968 \rightarrow \mu_1' = 8{,}817 \rightarrow I_1' = 8{,}20 \rightarrow$ Coef.c = 1,082

$T_2' = 5{,}717 \rightarrow \mu_2' = 12{,}704 \rightarrow I_2' = 5{,}52 \rightarrow$ Coef.c = 1,055

Consideremos del lado de la seguridad -

$$C = \frac{1{,}106 + 1{,}082}{2} = 1{,}094$$

b) Frenado y arranque -

Actuan en cabezas de carriles

- Frenado = $\frac{1}{8}$ · Tren tipo (sin aplicar coefic impacto)

Tren tipo A - $F_A = \frac{90}{7} = 11{,}25$ Mp

Tren tipo B - $F_B^{max} = \frac{1}{8}[30 \times 12 + (L-30) \times 10] =$

$= [1{,}25(L-30) + 45]$ Mp

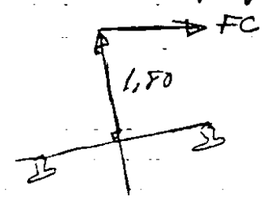
Para $L = 436{,}5 \rightarrow F_B^{max} = 553$ Mp - TG - V2

$L = 391{,}5 \rightarrow F_B^{max} = 497$ Mp - TG - V1

$L = 121{,}5 \rightarrow F_B^{max} = 159$ Mp - TP-V1,V2

- Arranque = $\frac{1}{8} \times \underbrace{12 \times 30}_{\text{mayores}} = 45$ Mp

c) Fuerza centrifuga - (Para Viaducto nº 1 - R = 5000 m)



$F_c = Q \cdot \frac{v^2}{127r}$ donde

Q - Sobrecarga tren

v - velocidad Km/h

r - radio

$v = 200$ Km/h

Para Viaducto 1 - $F_c = \frac{Q}{25{,}4}$ Mp/m

Para tren B - Fc mayores = $\frac{1{,}094 \times 12}{25{,}4} = 0{,}52$ Mp/ml

Fc valor mínimo = $\frac{1{,}094 \times 10}{25{,}4} = 0{,}43$ Mp/ml

→ La fuerza centrífuga puede ser simultánea en las dos vías.

→ Superposición de Fuerza centrífuga y frenado

Cuando interviene la fuerza centrífuga se reducirán en un 50% los esfuerzos de frenado y arranque.

d) Efecto de lazo

Única fuerza de 5 Mp transversal al eje de la vía en cota superior del carril.

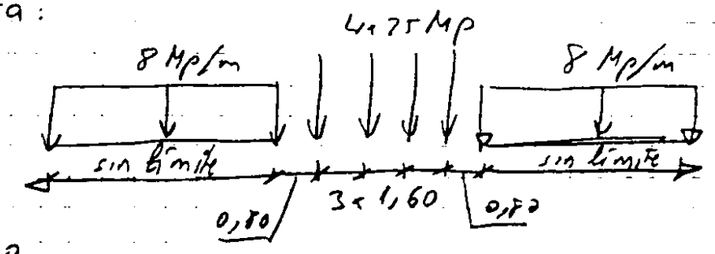
e) Ripado - 30cm en el sentido más desfavorable

g) Empuje sobre barandillas: 150 Kp/ml en elemento superior de la barandilla

— EC1.3

a) Trenes de carga:

Modelo 71 -

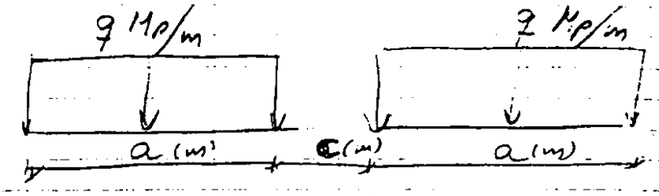


Factor $\alpha = 1,00$

Excentricidad de cargas $e \leq \frac{r}{18} = \frac{1,5}{18} = 0,083\ m$

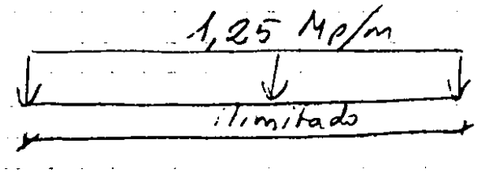
Tomamos $e = 0$ (...)

Modelos SW - (aplicables al caso)



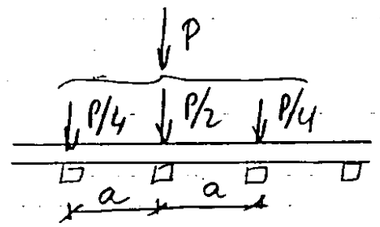
	q	a	c	Q tot
SW/0	13,3	15	5,3	400 Mp
SW/2	15,0	25,0	7,0	750 Mp

Tren descargado -



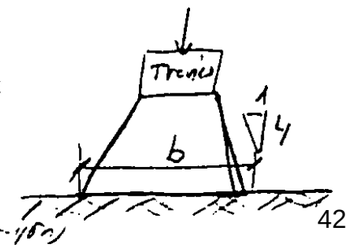
Reparto local de cargas

— A través del rail → (Longitudinal) Carga concentrada P se distribuye en 3 traviesas



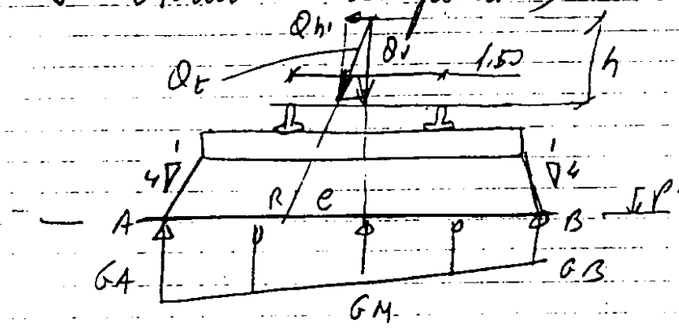
— A través de traviesas y balasto (longitudinal)

- Cargas puntuales de Modelo 71 se distribuyen uniformemente en sentido longitudinal
- Para cálculo tracción losas deformadas:

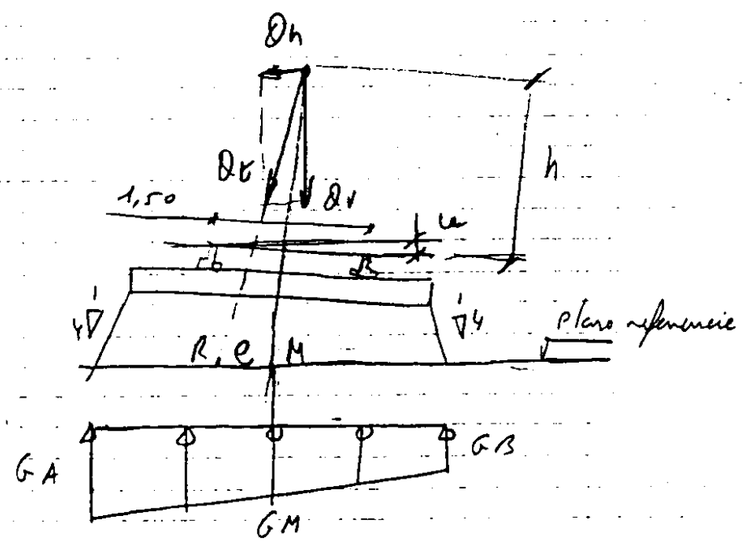


— A trenes de traviesas y balasto (transversal).

• Viaducto 2 (sin peralte)



• Viaducto 1 (con peralte)



→ Además de trenes de carga vertical:

→ En pasos $\underline{0,5\ Mp/m^2}$ → 1,45 Mp/ml (con anchura de 0,30 m)

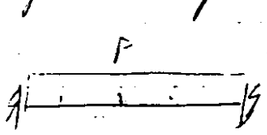
Solo el 50% de sobrecargas aeras es concomitante con la sobrecarga ferroviaria

Impacto

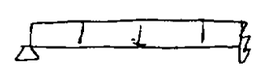
⊗ $\underline{V \leq 220\ Km/h\ (EC1)}$ (L=45 m) — $n_0^s = 94,76 \cdot L^{-0,748} = 5,50$ } Límite de la frecuencia natural
$n_0^i = 23,58 \cdot L^{-0,592} = 2,48$

$2,48 \leq n_0 \leq 5,50$ para aplicar coeficiente impacto EC1

$n_0 = \frac{17,75}{\sqrt{\delta_0}} = \frac{17,75}{\sqrt{\frac{P l^4}{384 EI} \cdot 10^3}} = \underline{5,96}$



$\frac{17,75}{\sqrt{\frac{P l^3}{17,5 EI} \cdot 10^3}} = \underline{4,13}$



Podremos considerar a $\underline{n_0}$ cerca del límite superior:

- Vía con mantenimiento cuidadoso:

$\phi_2 = \frac{1,44}{\sqrt{L\phi} - 0,2} + 0,82 \qquad 1,00 \leq \phi_2 \leq 1,67$

- Vía con mantenimiento estándar

$\phi_3 = \frac{2,16}{\sqrt{L\phi} - 0,2} + 0,73 \qquad 1,00 \leq \phi_3 \leq 2,00$

c) Efecto lazo –

Carga horizontal concentrada transversal al eje de la vía en la cota superior del carril. – Su valor es:

$Q_{sk} = 10\ Mp$ (única)

(siempre es concomitante con la sobrecarga vertical.)

d) Frenado y arranque –

Actúan en cabezas de carriles

– Frenado =

General { • Para Modelo 71 y SW0 → $Q_{1bk} = 2 \cdot L\ Mp \leq 600\ Mp$
• Para SW2 – $Q_{1bk} = 3,5 \cdot L\ Mp = 175\ Mp$

Alternativa – Modelo 71 – $Q_{1bk} = 0,25 \cdot Tren \leq 600\ Mp$

– Arranque =

General • Para 71 y SW – $Q_{1ak} = 3,3\ L \leq 100\ Mp$
Alternativa " " 71 → $Q_{1ak} = 0,25\ Tren \leq 100\ Mp$

Resumen – $L = 436,5\ m$ → $Q_{1ak} = 100\ Mp$; $Q_{1bk} = 500\ Mp$
$L = 391,5\ m$ → $Q_{1ak} = 100\ Mp$; $Q_{1bk} = 600\ Mp$
$L = 121,5\ m$ – $Q_{1ak} = 100\ Mp$; $Q_{1bk} = 255\ Mp$

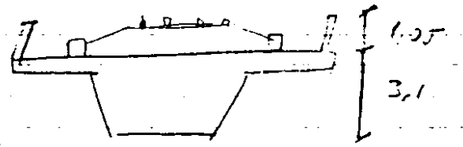
→ Proporción de fuerza de frenado y arranque transferida a los apoyos a través del tablero: (Tabla 6.4)

$L \leq 120\ m$ – 0,70
$L > 300\ m$ – 0,90

e) Ripado – Se toman 0,30 m como en IPF-75 en lugar de lo previsto en la EC1.3

4) Sobrecargas climáticas - Viento

Se emplean los parámetros y métodos de cálculo de la Instrucción IAP-96. No se aplica la componente vertical sobre el tablero, sino únicamente las componentes longitudinales.



- $h_{eq} = 4{,}50$ m (sin SC)
  $h_{eq} = 4{,}15 + 3{,}5 = 7{,}65$ m (con SC)

- $C_D = 2{,}5 - 0{,}3\left(\frac{B}{h_{eq}}\right) =$ Sin SC $\Rightarrow C_D = 1{,}69$ / Con SC $\Rightarrow C_D = 1{,}95$

$F = \frac{1}{2}\rho v_c^2 \cdot A \cdot C_D$ con | $A = 45 \cdot h_{eq}$; $\rho = 1{,}25$ Kg/m³ ; $V_c = V_{ref} \cdot C_r \cdot C_T \cdot C_z \cdot C_g$

$V_{ref} = 28$ m/s
$C_t = 1{,}1$
$C_r = 1{,}04$ (100 años)
C_z (Tipo II) $= 1{,}33$
$C_g = 1{,}40$
} $V_c = 59{,}64$ m/s

Resulte - $\frac{1}{2}\rho v_c^2$ = Sin SC = 2223,1 Kg/ms² / Con SC (50%) = 1111,5 Kg/ms²

F = Sin SC - F = 42,9 Mp (en 45m) / Con SC F = 66,60 Mp (en 45m)

Estados límites

I) Estados límites últimos

a) Estados límites de equilibrio:

- Vuelco y deslizamiento

Coeficientes de seguridad	
	1,50 en servicio
	1,35 en construcción
	1,35 en servicio cuando hay fren
	1,00 en caso de acciones accidenta

Rozamiento hormigón - terreno (ϕ)

	$\frac{1}{3}\phi$
- Roca sana	0,70
- Gravas y arenas	0,60
- Roca descompuesta arcillosa o carbonatada o yesífera	0,5
- Suelos arcillosos	0,30
- Suelos limosos	0,40

- Tensiones admisibles en el terreno:

Cimentaciones directas - $\sigma_{adm}^{acc} = 1{,}25\ \sigma_{adm}^{adm}$ (hipótesis
$\sigma_{adm}^{adm} = 1{,}30\ \sigma_{adm}^{adm}$ (dinámica de cada el

En hipótesis accidentales: Se incrementan tensiones admisibles en un 50%

1.2- MATERIALES

1.2.- MATERIALES

Se utilizarán en el proyecto los materiales siguientes:

1. Hormigones

- Tableros H-400
- Alzados de pilas H-300
- Impostas H-250
- Cimentaciones y estribos H-250
- Nivelación y rellenos H-125

2. Aceros

- Armaduras pasivas AEH-500
- Armaduras activas A-190-SE

3. Características del acero pretensado

- Relajación del 2,5% para una tensión del 70% de $f_{max,k}$ aplicada durante 1.000 horas.

Los niveles de control previstos son los siguientes:

- H-125 - Control reducido $\gamma_c = 1,70$
- H-250 - Control normal $\gamma_c = 1,50$
- H-300 - Control intenso $\gamma_c = 1,50$
- H-400 - Control intenso $\gamma_c = 1,50$
- AEH-500 - Control normal $\gamma_s = 1,15$
- A-190-SE - Control normal $\gamma_s = 1,15$

El nivel de control de ejecución será Intenso ($\gamma_f = 1,50$)

2- CALCULOS JUSTIFICATIVOS

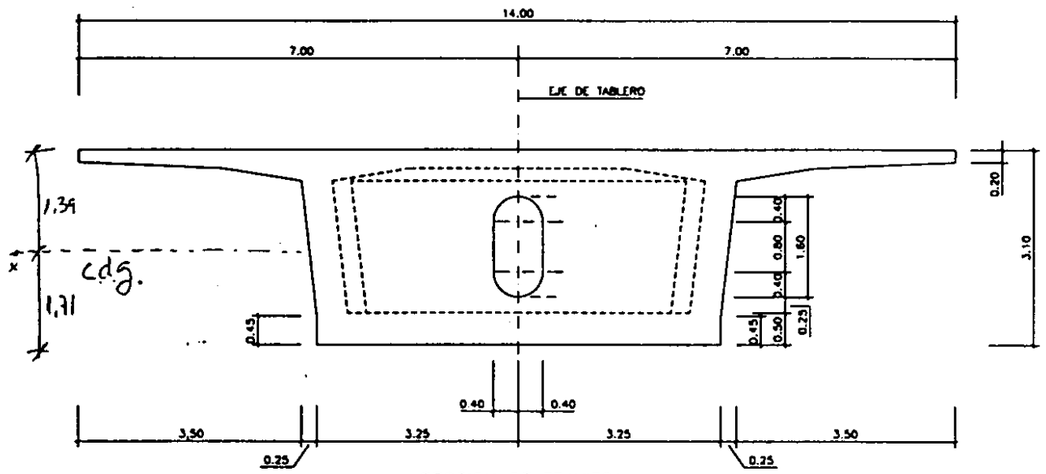
2.1- TABLERO

2.1.1- Cálculo de esfuerzos

CALCULO LONGITUDINAL

CARACTERÍSTICAS MECÁNICAS -

* SECCIÓN DE TRAVIESA -



SECCION DE TRAVIESA

$$\begin{cases} A = 17,92\ m^2 \\ I_{x,G} = 20,13\ m^4 \\ I_{y,G} = 134,74\ m^4 \end{cases} \longrightarrow \begin{cases} W_s = 14,48\ m^3 \\ W_{inf} = 11,77\ m^3 \end{cases}$$

Cálculo de la inercia a torsión

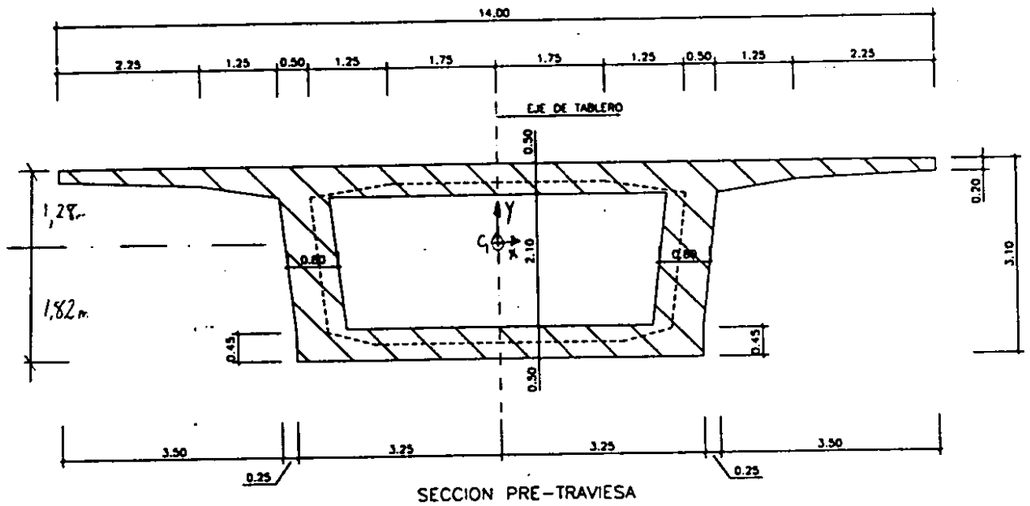
$$I_t \simeq \left[0,33 - 0.22\,\frac{a}{b} + 0,03\left(\frac{a}{b}\right)^2\right] a^3 \cdot b \ ; \text{ siendo:}$$

$a = 3,10\ m$

$b = 6,30\ m$

$$I_t = 44,9\ m^4$$

* SECCION PRE-TRAVIESA



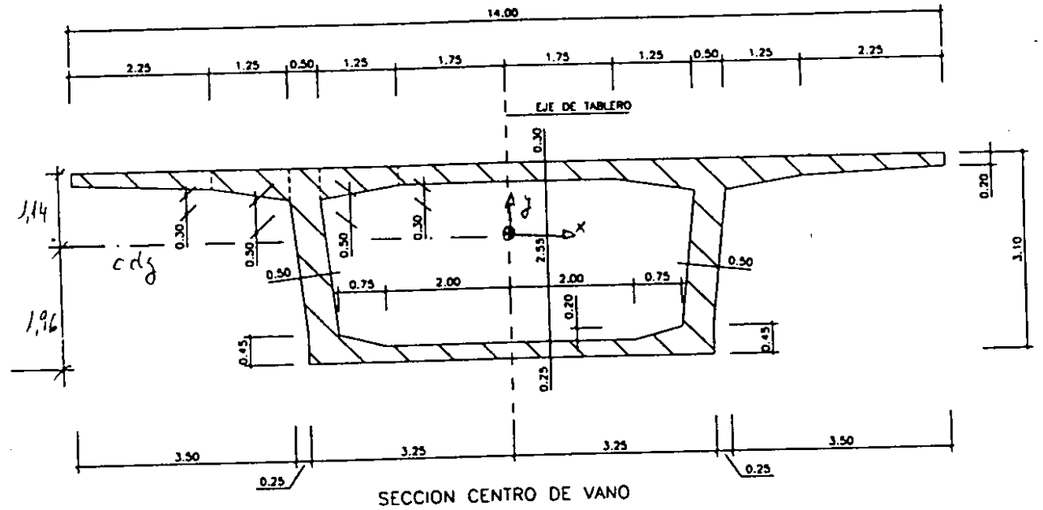
SECCION PRE-TRAVIESA

$$\begin{cases} A = 12{,}235\ m^2 \\ I_{x,G} = 16{,}02\ m^4 \\ I_{y,G} = 110{,}76\ m^4 \end{cases} \longrightarrow \begin{cases} W_s = 9{,}56\ m^3 \\ W_i = 6{,}72\ m^3 \end{cases}$$

Cálculo de la inercia a torsión

$$I_t = \frac{4\,(A_{media})^2}{\oint \frac{ds}{e}} = \frac{4\,(5{,}70 \times 2{,}6)^2}{\frac{3{,}10 \times 2}{0{,}80} + \frac{6{,}50}{0{,}50} + \frac{7{,}0}{0{,}50}} = 25{,}28\ m^4$$

* SECCION TIPO (centro de vano)



SECCION CENTRO DE VANO

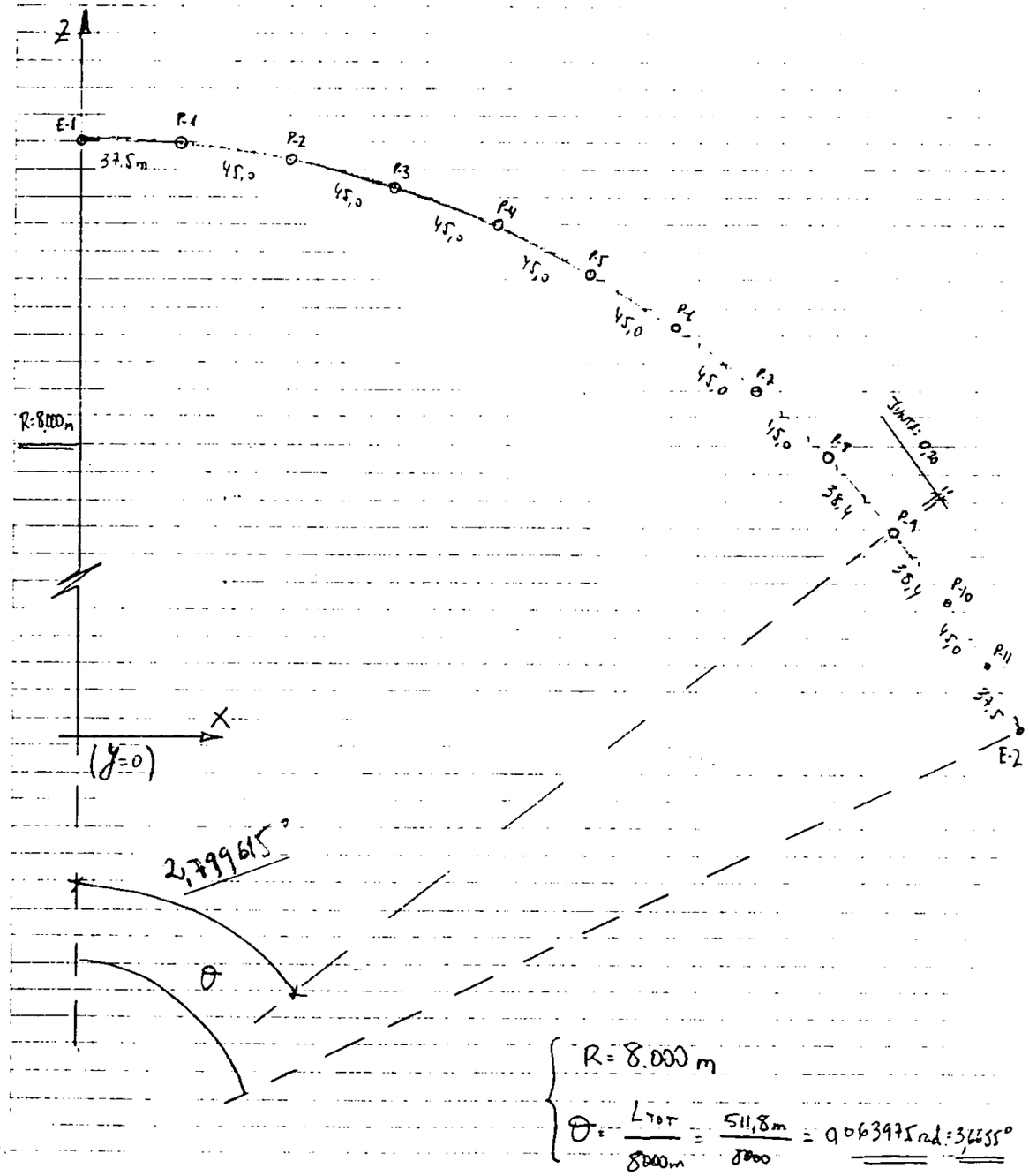
$$\begin{cases} A = 8{,}8\ m^2 \\ I_{x,G} = 12{,}026\ m^4 \\ I_{y,G} = 96{,}93\ m^4 \end{cases} \longrightarrow \begin{cases} W_s = 10{,}55\ m^3 \\ W_{inf} = 6{,}136\ m^3 \end{cases}$$

Cálculo de la inercia a torsión

$$I_t = \frac{4\,(A_{media})^2}{\oint \frac{ds}{e}} = \frac{4 \times (6 \times 4{,}825)^2}{\frac{3{,}10 \times 2}{0{,}50} + \frac{6{,}50}{0{,}25} + \frac{7{,}0}{0{,}30}} = 18{,}62\ m^4$$

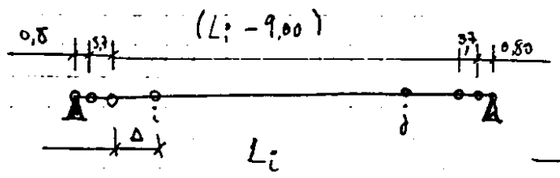
DISCRETIZACIÓN

(VIGA CURVA ESPACIAL)



$$\begin{cases} R = 8.000\ m \\ \theta = \dfrac{L_{TOT}}{8000m} = \dfrac{511,8m}{8000} = 0,063975\ rad = 3,6655° \end{cases}$$

Cada vano se dividirá en



Li	nº puntos	Δ
37,5	5	4,75
45,0	7	4,50
38,4	5	4,90

COORDENADAS

	COORDENADAS DE LOS NUDOS					
	PUNTO	X	Z	Distancia a E-1	Longitud de barra	Nº DE BARRA
E-1	1	0	8000	0		(B-1 : NUDO 1 a 2)
	2	0.800000	7999.99996	0.8	0.8	1
	3	4.500000	7999.99873	4.5	3.7	2
	4	9.249998	7999.99465	9.25	4.75	3
	5	13.999993	7999.98775	14	4.75	4
	6	18.749983	7999.97803	18.75	4.75	5
	7	23.499966	7999.96548	23.5	4.75	6
	8	28.249941	7999.95012	28.25	4.75	7
	9	32.999906	7999.93194	33	4.75	8
	10	36.699871	7999.91582	36.7	3.7	9
PILA-1	11	37.499863	7999.91211	37.5	0.8	10
	12	38.299854	7999.90832	38.3	0.8	11
	13	41.999807	7999.88975	42	3.7	12
	14	46.499738	7999.86486	46.5	4.5	13
	15	50.999655	7999.83744	51	4.5	14
	16	55.499555	7999.80749	55.5	4.5	15
	17	59.999438	7999.77500	60	4.5	16
	18	64.499301	7999.73999	64.5	4.5	17
	19	68.999145	7999.70244	69	4.5	18
	20	73.498966	7999.66236	73.5	4.5	19
	21	77.998764	7999.61975	78	4.5	20
	22	81.698580	7999.58282	81.7	3.7	21
PILA-2	23	82.498538	7999.57461	82.5	0.8	22
	24	83.298495	7999.56632	83.3	0.8	23
	25	86.998285	7999.52694	87	3.7	24
	26	91.498005	7999.47674	91.5	4.5	25
	27	95.997696	7999.42401	96	4.5	26
	28	100.497357	7999.36874	100.5	4.5	27
	29	104.996985	7999.31095	105	4.5	28
	30	109.496581	7999.25062	109.5	4.5	29
	31	113.996142	7999.18776	114	4.5	30
	32	118.495667	7999.12238	118.5	4.5	31
	33	122.995154	7999.05446	123	4.5	32
	34	126.694703	7998.99672	126.7	3.7	33
PILA-3	35	127.494602	7998.98401	127.5	0.8	34
	36	128.294500	7998.97122	128.3	0.8	35
	37	131.994011	7998.91102	132	3.7	36
	38	136.493377	7998.83551	136.5	4.5	37
	39	140.992700	7998.75747	141	4.5	38
	40	145.491979	7998.67690	145.5	4.5	39
	41	149.991211	7998.59379	150	4.5	40
	42	154.490396	7998.50816	154.5	4.5	41
	43	158.989532	7998.41999	159	4.5	42
	44	163.488618	7998.32929	163.5	4.5	43
	45	167.987652	7998.23606	168	4.5	44
	46	171.686818	7998.15752	171.7	3.7	45
PILA-4	47	172.486633	7998.14031	172.5	0.8	46
	48	173.286446	7998.12302	173.3	0.8	47
	49	176.985560	7998.04202	177	3.7	48
	50	181.484430	7997.94120	181.5	4.5	49
	51	185.983243	7997.83785	186	4.5	50
	52	190.481997	7997.73197	190.5	4.5	51

COORDENADAS

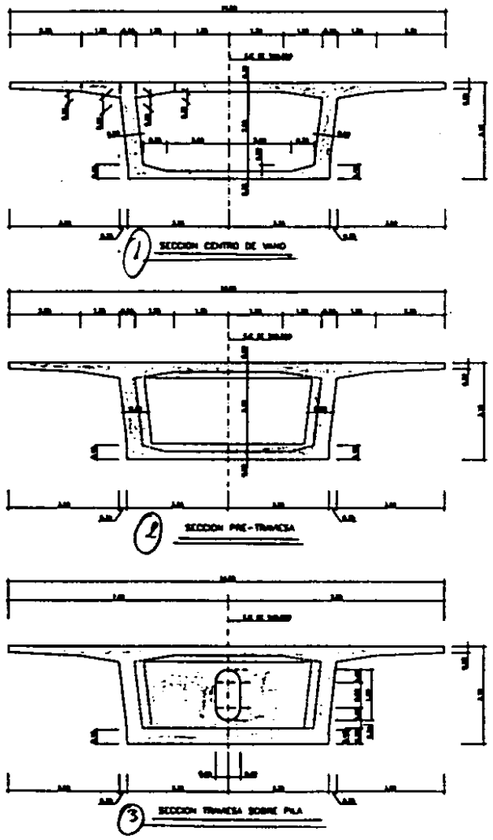
	53	194.980691	7997.62356	195	4.5	52
	54	199.479323	7997.51261	199.5	4.5	53
	55	203.977892	7997.39914	204	4.5	54
	56	208.476397	7997.28314	208.5	4.5	55
	57	212.974835	7997.16461	213	4.5	56
	58	216.673501	7997.06525	216.7	3.7	57
PILA-5	59	217.473206	7997.04354	217.5	0.8	58
	60	218.272910	7997.02175	218.3	0.8	59
	61	221.971509	7996.91995	222	3.7	60
	62	226.469741	7996.79382	226.5	4.5	61
	63	230.967901	7996.66517	231	4.5	62
	64	235.465989	7996.53398	235.5	4.5	63
	65	239.964002	7996.40027	240	4.5	64
	66	244.461939	7996.26403	244.5	4.5	65
	67	248.959798	7996.12525	249	4.5	66
	68	253.457579	7995.98395	253.5	4.5	67
	69	257.955280	7995.84011	258	4.5	68
	70	261.653328	7995.71995	261.7	3.7	69
PILA-6	71	262.452899	7995.69375	262.5	0.8	70
	72	263.252467	7995.66746	263.3	0.8	71
	73	266.950435	7995.54485	267	3.7	72
	74	271.447886	7995.39343	271.5	4.5	73
	75	275.945252	7995.23947	276	4.5	74
	76	280.442530	7995.08299	280.5	4.5	75
	77	284.939720	7994.92397	285	4.5	76
	78	289.436819	7994.76243	289.5	4.5	77
	79	293.933827	7994.59836	294	4.5	78
	80	298.430742	7994.43176	298.5	4.5	79
	81	302.927562	7994.26262	303	4.5	80
	82	306.624876	7994.12166	306.7	3.7	81
PILA-7	83	307.424287	7994.09096	307.5	0.8	82
	84	308.223694	7994.06018	308.3	0.8	83
	85	311.920914	7993.91677	312	3.7	84
	86	316.417443	7993.74005	316.5	4.5	85
	87	320.913871	7993.56080	321	4.5	86
	88	325.410198	7993.37902	325.5	4.5	87
	89	329.906422	7993.19472	330	4.5	88
	90	334.402542	7993.00788	334.5	4.5	89
	91	338.898555	7992.81851	339	4.5	90
	92	343.394462	7992.62662	343.5	4.5	91
	93	347.890260	7992.43219	348	4.5	92
	94	351.586722	7992.27044	351.7	3.7	93
PILA-8	95	352.385948	7992.23524	352.5	0.8	94
	96	353.185169	7992.19996	353.3	0.8	95
	97	356.881524	7992.03576	357	3.7	96
	98	361.776579	7991.81567	361.9	4.9	97
	99	366.671498	7991.59258	366.8	4.9	98
	100	371.566279	7991.36650	371.7	4.9	99
	101	376.460921	7991.13741	376.6	4.9	100
	102	381.355422	7990.90533	381.5	4.9	101
	103	386.249779	7990.67025	386.4	4.9	102
	104	389.945423	7990.49076	390.1	3.7	103
PILA 9	105	390.744470	7990.45172	390.9	0.8	104

ACCIONES

VIADUCTO 1

- ACCIONES

* PESO PROPIO



① P: 22,3 t/m
L = 27,0 } 602,1 Mp

11 L = 4,5 m x2
P = (22,3+23,7)/2 = 23,0 } P: 207 Mp

② P: 30,60 t/m
P = (30,6+23,7)/2 = 27,15
L = 4,5 x 2 = 9 m } P: 244,4 Mp

③ P: 54,67 t/m
L = 1,60 m } P: 87,5 Mp

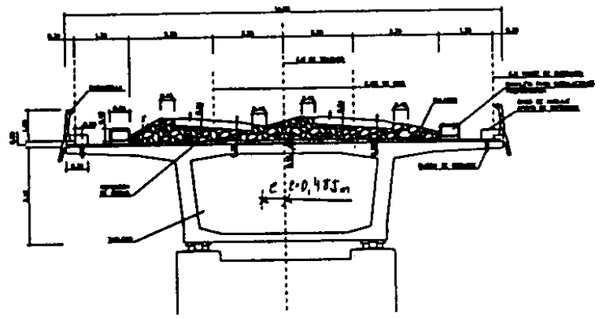
∴ 1141,0 Mp

Tacos de pretensado: 4 tacos/pila x 3,0 m³ x 2,5 = 30 Mp

1171 Mp

* CARGAS MUERTAS

BALASTO:



$A_{balasto} = 4{,}70\ m^2$
$\gamma_{balasto} = 1{,}6\ Mp/m^3$ } $q_0 = 7{,}52\ t/m$

$q_s = 9{,}02\ t/m \rightarrow Q = 45 \times q_s = 406{,}1\ Mp$

Excentricidad del balasto:

Sección completa (En recta): $0{,}485 \times q_s = 4{,}37\ Mp\,m/ml$

Sobre cada pista: $M = 196{,}86\ Mp \cdot m$
Sobre eje de vía: $98{,}43\ Mp\,m$

Estados transitorios:

a) 50% vía en toda su longitud: $q_s = 5{,}80\ Mp/m \rightarrow$ (15m) $\rightarrow 261{,}5\ Mp$

(Concomit con 50% SC ferrov.)

$m_t = q_s \times 2{,}127 = 12{,}34\ Mp\,m/m \xrightarrow{(45)} 555{,}15\ Mp\,m$

b) 100% vía en 15m: $q_s = 4{,}51\ Mp/m$; $m_t = \frac{2}{3} \times 5{,}164 = 23{,}2\ Mp/m$

* Traviesas + carriles: $q = 1{,}28\ Mp/m \rightarrow 2 = 45\,q = 57{,}6\ Mp$

* Conducciones, calzado y pasos: $q = 2{,}05\ Mp/m$; $2 = 45\,q = 92{,}3\ Mp$

* Hormigón de forma: $S = 1{,}11\ m^2$
$\gamma = 2{,}4\ t/m^3$ | $q = 2{,}66\ t/m \rightarrow 2 = 45\,q = 120\ Mp$

* Impostas + bordillo: $q = 0{,}4 \times 2 = 0{,}8\ Mp/m \rightarrow 2 = 36\ Mp$ (0,8 t)

* Soportes de catenaria: $H_T = 0{,}5t$, $V = 0{,}5t$; $M_T = 9{,}0\ mt$

TOTAL CARGAS MUERTAS + P. PROPIO:

a) Máximo: $V = 1883{,}5\ Mp$. $H_T = 0{,}5\ Mp$
$M_{LONG,\ CONC} = 0\ mMp$
$M_{TRANSV,\ CONC} = 205{,}86\ Mp\,m$

b) Descentrado 50%: $V_{CONC} = 1738{,}9$ $H_T = 0{,}5\ Mp$

(CONCOMITANTE SÓLO CON 50% SC FERROVIARIA)

$M_{LONG,\ CONC} = 0\ mMp$
$M_{TRANS,\ MAX} = 564{,}15$

c) Descentrado vía completa en 15m de longitud (*)

((Concomit con 50% sc ferrov)

$V_{CONC} = 1815{,}85\ Mp$; $H_T = 0{,}5\ Mp$
$M_{long} = 0$
$M_{TRANS,\ MAX} = 489{,}81$

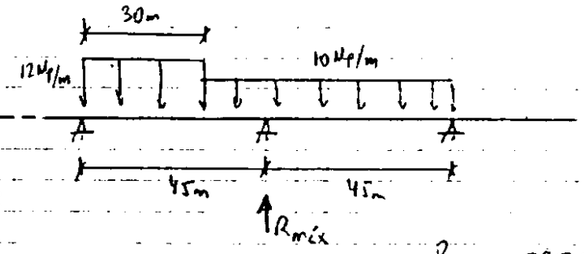
(*) Centrados los 15m sobre eje de apoyo → $M_{transv,\ máx}$.

← Menos desfavorable

* SOBRECARGAS

ESTUDIO 1 — IAPF-75:

* (Tren tipo):



$R_{máx} = 538\ Mp$

Reacción total por doble vía: $2 \times R_{máx} = 1076\ Mp$

En caso de actuar un solo tren: $N_{TRANSV} = 538 \times 2{,}25 = 1210{,}5\ Mp \cdot m$

* Ripado de vía: $N_{TRANSV,\ CONCOM} = 0{,}3 \times 538 \times 2 = 322{,}8\ Mpm$

* Efecto lateral:

$H_{TRANSV} = 5\ Mp$

$M_{T,CONC} = 2{,}137\ m \times 5\ Mp = 10{,}69\ mMp$

dist borde superior carril - cdg = 2,137 m

* Reducción de pateo concomitante con SC ferroviaria

$-50\%\ [0{,}50\ t/ml] = -0{,}25\ t/ml \rightarrow Q = -11{,}25\ Mp$

* Empuje sobre barandillas:

Solo el 50% concomitante con la sobrecarga ferroviaria, siguiendo la filosofía marcada en las Normas de cálculo:

$H_T = 0{,}15 \times 45 \times 0{,}5 = 3{,}4\ Mp$

$M_T = 3{,}4 \times 2{,}264 = 7{,}7\ mMp$

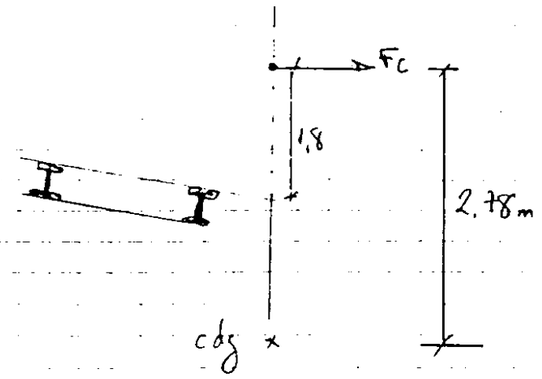
dist (barandilla - cdg) = 2,264 m

* Fuerza centrífuga: $f_c = Q \times \frac{v^2}{127 r} \Rightarrow H_T = 42{,}36\ Mp$

(r = 8000 m)

V = 200 km/h

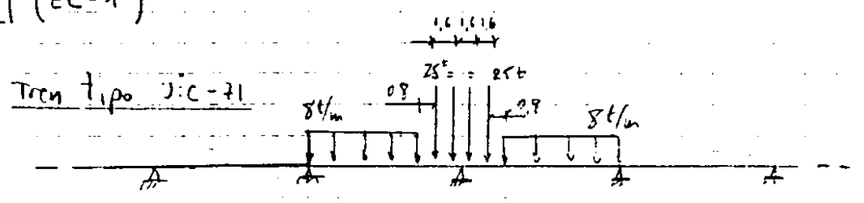
$Q = 2 \times 538 = 1076\ Mp$



$M_T = H_T \times 2{,}78 = 42{,}36 \times 2{,}78 = 117{,}76\ Mpm$

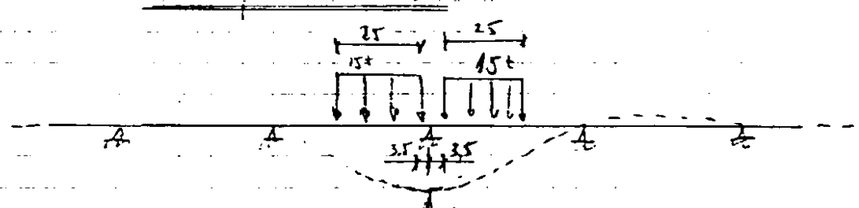
CALCULO 2 (EC-1)

* Tren tipo UIC-71



$R_{máx} = 484{,}8\ Mp$

* Tren pesado SW-2



$R_{máx} = 567{,}5\ Mp$

- $V_{máx}$: (1 SW2 + 1 UIC-71) = 567,5 + 484,8 = 1052,3 Mp
- $M_{TRANS,\ CONCOMITANTE} = (567{,}5 - 484{,}8) \times 2{,}25 = 186{,}1\ Mpm$
- En caso de que actúe un solo tren (SW2): $M^{SC}_{TRA,máx} = 567{,}5 \times 2{,}25 = 1276{,}8\ Mp$; $V_{CONC} = 567{,}5\ Mp$

* Reducción sc pateo en un 50% concomitante con sc ferroviaria

Igual que en cálculo 1:

$Q = -11{,}25\ Mp$

* Efecto lateral: $H_T = 10^t$

$M_{T,cons} = 10 \cdot 2{,}137 = 21{,}37$ Mpm

* Ripado de la vía

Se considerará con SW1 por resultar más desfavorable:

$M_{TRANSV} = 0{,}30(567{,}5 + 484{,}8) = 315{,}7$ Mpm

* F. CENTRÍFUGA:

$$F = \frac{V^2}{127\,r} f\,Q$$

Q (SW2) $= 567{,}5 \rightarrow V = 80$ km/h $\rightarrow F_{SW2}|_{f=1} = 3{,}575$ Mp

Q (Vic-71) $= 484{,}8 \rightarrow V = 300$ km/h $\rightarrow F|_{f=1} = 42{,}94$ Mp

f: $f = \left[1 - \frac{V-120}{1000}\left(\frac{814}{V} + 1{,}75\right)\left(1 - \sqrt{\frac{2{,}38}{L}}\right)\right]$ para tren Vic-71

$V = 300$ km/h, $L \geq 150$ m $\Rightarrow f = 0{,}31$ para tren Vic-71

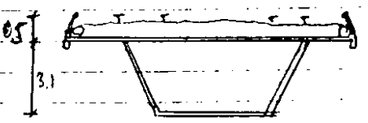
$f = 1$ para SW2

F centrífuga concomit. con V_{nieve}: $0{,}31 \times 42{,}94 + 3{,}575 = 16{,}9$ Mp

$M_T = 16{,}9 \times 2{,}78 = 47{,}0$ Mpm

VIENTO (Según IAP-97)

a) Viento sobre tablero: Horizontal



a.1) Sin sc: $h_{ef} = 4{,}15$ m

a.2) Con sc: $h_{ef} = 4{,}15 + 3.5 = 7{,}65$ m

$C_D = 2.5 - 0.3\left(\frac{B}{h_{ef}}\right)$: Sin sc: $C_D = 1{,}48$; Con sc: $C_D = 1{,}95$

$F = \frac{1}{2}\rho V_c^2 \times A \times C_D$ siendo: $A = 45 \times h_{ef}$

$\rho = 1{,}25$ Kg/m^3

$V_c = V_{ref} \times C_t \times C_r \times C_2 \times C_g$

$V_{ref} = 28$ m/s

$C_t = 1.1$

$C_r = 1{,}04$ ($T = 100$ años)

$C_t = (\text{Tipo II}) = 1{,}18$

$C_g = 1{,}42$

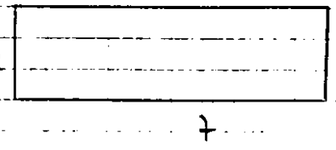
$\Rightarrow V_c = 53{,}67$ m/s

Sustituyendo: $\frac{1}{2}\rho V_c^2$: sin sc: $1800{,}3$ Kg/ms^2; con sc (50%): $190{,}15$

F: sin sc: $F = 49{,}75$ Mp ($z = 45$ m)

con sc: $F = 59{,}24$ Mp ($z = 45$ m)

b) Viento sobre pila



$\frac{B}{h} = \frac{7}{2} = 3,5 \rightarrow C_D = 1,2$

$F = \underbrace{\frac{1}{2} \rho V_c^2}_{(\text{sin sc})} C_D A = 0,43 \text{ t/m}$

c) Viento sobre tablero: Vertical (Concomitante con sc)

$f = \frac{1}{2} \rho V_c^2 \Big|_{\text{con sc}} \times 14 \times 1 \times 0,5 = 0,63 \text{ t/m}$

$F_{ver} = f \times 45 = 28,35 \text{ Mp}$

d) Momento volcador: (Concomitante con sc)

Por empuje vertical: $0,63 \times 45 \times \frac{14}{4} = 99,2 \text{ Mpm}$

Por empuje horizontal: $59,24 \times (0,6 \times 7,65) = 271,9 \text{ Mpm}$

$M_T = 371,1 \text{ Mpm}$

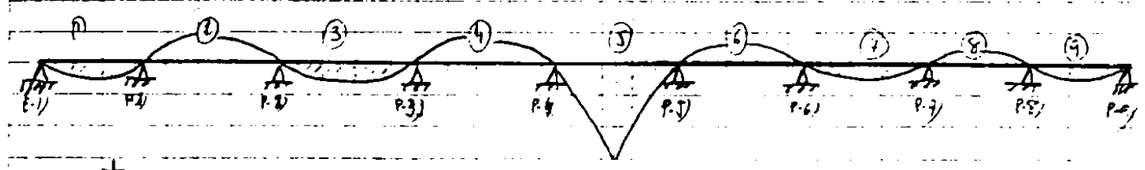
* ROZAMIENTO: 5% (C.P. + PP) (Concom. con sc)

} F. horizontal longitudinal
Común a ambos cálculos parciales

$H_{L,max} = 5\%$ { a) $1883,5 - 11,25 = 1872,25 \Rightarrow 93,6 \text{ Mp}$
b) $1680,75 - 11,25 = 1669,10 \Rightarrow 83,5 \text{ Mp}$

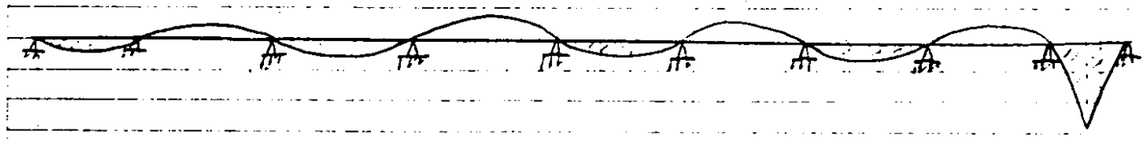
LÍNEAS DE INFLUENCIA

$M^+_{máx}$ en c.v. ⑤

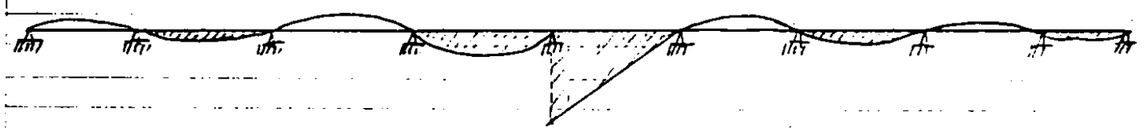


+

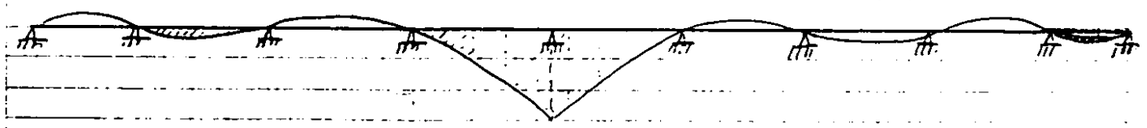
$M^+_{máx}$ en c.v. ⑨



$Q_{apoyo\ P-4}$



M^-_{min} apoyo P-4



HIPÓTESIS DE CARGA

Nº DE CASO		DESCRIPCIÓN	VALORES
C.P	LOAD 1	P. Propio Ballesto sección completa Resto C.P.	$q = 15{,}82$ t/m ; $m_t = 4{,}37$ tm/m $q - 0{,}25 = 15{,}57$ t/m
	LOAD 2	P. PROPIO DESBALASTADO 50% de una vía; compl. completo (concomitante. Sólo con 50% SC transitoria) RESTO C.P.	(reducir a parte concomit con SC) $q = 12{,}60$ t/m ; $m_t = 12{,}34$ tm/m $-0{,}25$ $q = 12{,}35$
	LOAD 3	P. PROPIO DESBALASTADO 100% de una vía, en L=15m *) (concomitante sólo con 50% transit. RESTO C.P. (Sin vía ni transición en 1 vía) *) Se contará el desbalastado sobre pila P-4.	$q = 10{,}03$ t/m ; $m_t = 26{,}22$ tm/m $-0{,}25$ 9,78 t/m en 15m *
	LOAD 4	→ Pretensado (LANZAM. + CONTINUIDAD)	
SC	LOAD 5	→ Pretensado (LANZAMIENTO)	
IAPF-75: 1 vía	LOAD 10	SC en 1 vía; L. Influencia $M^+_{máx}$ c.v ⑤ : SC vertical (anexo 2,25 m) + Lateral + Frenado + Fuerza centrífuga (coincid con dicha SC V.)	
	LOAD 11	SC en 1 vía, LI $M^+_{máx}$ c.v ⑨ :	"
	LOAD 12	SC en 1 vía; LI M^-_{min} pila P-4 :	"
	LOAD 13	SC en 1 vía; LI $Q_{máx}$ pila P-4	"
2 vías	LOAD 14	SC en 2 vías; LI $M^+_{máx}$ c.v ⑤	"
	LOAD 15	SC en 2 vías; LI $M^+_{máx}$ c.v ⑨	"
	LOAD 16	SC en 2 vías; LI M^-_{min} pila P-4	"
	LOAD 17	SC en 2 vías; LI $Q_{máx}$ pila P-4	"
	LOAD 18	Empuje sobre barandillas + efecto losa	$h_t = 0{,}186$ t/m ; $m_t = 0{,}4$ m/m
	LOAD 19	Retracción de forma convencional SC	$q = -0{,}25$ t/m²

Se pone q a su valor contrario: $q = +0{,}25$ t/m² (1)

SOBRECARGAS EC-1.

1 vía SW2

LOAD 20	SC en 1 vía; L Inf	$M^{+}_{max,CV(5)}$:	SC vert. + Rípido + Frenado (brazo: 2,25)
LOAD 21	SC en 1 vía; L Inf	$M^{+}_{max,CV(9)}$:	"
LOAD 22	SC en 1 vía; L Inf	$M^{-}_{min\ P-4}$:	"
LOAD 23	SC en 1 vía, L Inf	$Q_{max\ P4}$:	"

1 vía Tren tipo UIC-71

LOAD 24	=	$M'_{max,CV(5)}$	"
LOAD 25	=	$M^{+}_{max,CV(9)}$	"
LOAD 26	=	$M^{-}_{max,P-4}$	"
LOAD 27	=	$Q_{max,P-4}$	"

2 vías 2 tren tipo UIC-71

LOAD 28	SC en 2 vías;	$M^{+}_{max,CV(5)}$	brazo sc: 0m
LOAD 29	"	$M^{+}_{max,CV(9)}$	SC vertical fcmv + Rípido + frenado
LOAD 30	"	$M^{-}_{min,P-4}$	"
LOAD 31	"	$Q_{max,P-4}$	"

2 vías SW-2 + UIC-71

LOAD 32	"	LOAD 20 + LOAD 24	(Oportuno sumar los Mpositivos Cuando el resto)
LOAD 33	"	LOAD 21 + LOAD 25	
LOAD 34	"	LOAD 22 + LOAD 26	
LOAD 35	"	LOAD 23 + LOAD 27	

VIENTO

LOAD 40 Viento característico en toda la longitud según IAP-97

LOAD 41 − Viento (−1,0 x LOAD 40)

TEMPERATURA

LOAD 50 Gradiente de temperatura: ΔT: 10°C

DESCENSO DE APOYOS

LOAD 60 Descenso de 1,25 cm la pila P-4

LOAD 61 " " " " " P-9

Envolventes (+: Composición de máximos)

CARGAS PERMANENTES (Para combinar con SC)

L1-EHE = MAX SELECTIVOS (1,5 LOAD 1; 0,9 LOAD 1)

L23-EH = MAX SELECTIVOS (1,5 LOAD 2; 0,9 LOAD 2; 1,5 LOAD 3, 0,9 LOAD 3)

L1-ECE = MAX SELECTIVOS (LOAD 1; LOAD 1 + 0,35 LOAD 1)

L23-EC = MAX SELECTIVOS (LOAD 2; LOAD 3; LOAD 2 + 0,35 LOAD 2; LOAD 3 + 0,35 LOAD 3)

CARGAS PERM. AISLADAS (No concomit con SC)

CP = MAX (1,5 LOAD 1; 1,5 LOAD 2; 1,5 LOAD 3) + 1,5 LOAD 19 + LOAD 4

DE SOBRECARGAS: (Con C.P. Concomitantes)

A) A-EH: L1-EH + 1,5 x MAX SELECTIVO (LOAD 10 a LOAD 17) + 1,50 x LOAD 18 + LOAD 4

A-EC GR11: L1-EC + 1,45 x MAX SELECTIVO (LOAD 20 a LOAD 35) + 1,45 LOAD 18 + LOAD 4

A-EC GR14: L1-EC + 1,45 x MAX SELECTIVO (LOAD 20 a LOAD 35) + 0,775 x 1,45 x LOAD 18 + LOAD 4

B) B-EH: L23-EH + 1,5 x MAX SELECTIVO (LOAD 10 a LOAD 15) + 1,5 LOAD 18 + LOAD 4

B-EC GR11: L23-EC + 1,45 x MAX SELECTIVO (LOAD 20 a LOAD 27) + 1,45 LOAD 18 + LOAD 4

B-EC GR14: L23-EC + 1,45 x MAX SELECTIVO (LOAD 20 a LOAD 27) + 0,775 x LOAD 18 + LOAD 4

VIENTO: V1: 1,5 x CP + 1,5 MAX (LOAD 40; LOAD 41)

V2-EH: 0,9 x MAX (A-EH; B-EH) + 1,35 MAX (LOAD 40; LOAD 41)

V2-EC: MAX (A-EC GR11; A-EC GR14; B-EC GR11; B-EC GR14) + 0,9 MAX (LOAD 40; LOAD 41)

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REALIZO:

TEMPERATURA

T-EH: MAX (A-EH; B-EH) + 1,5 x LOAD 50

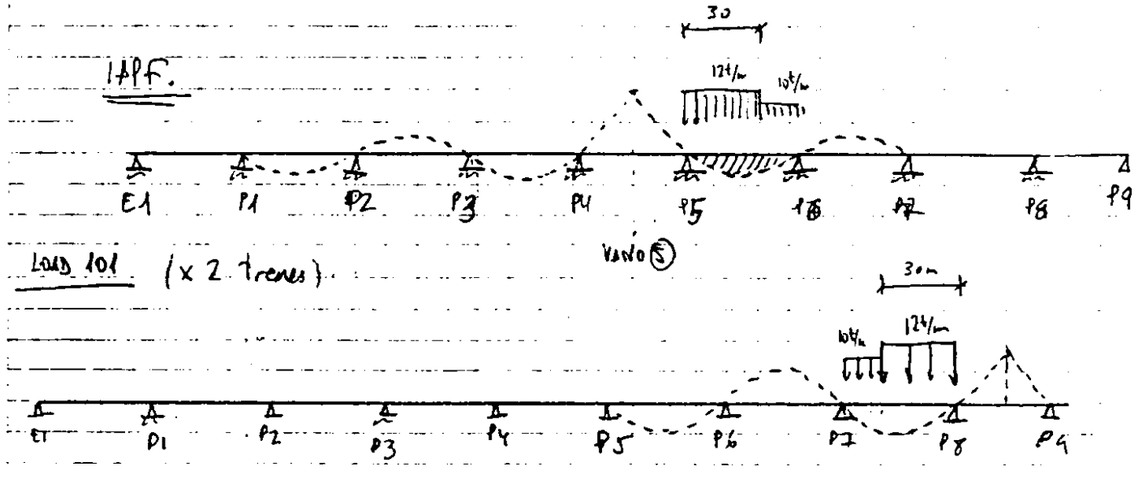
T-EC: MAX (A-EC GR11; A-EC GR14; B-EC GR11; B-EC GR14; 0,9 LOAD

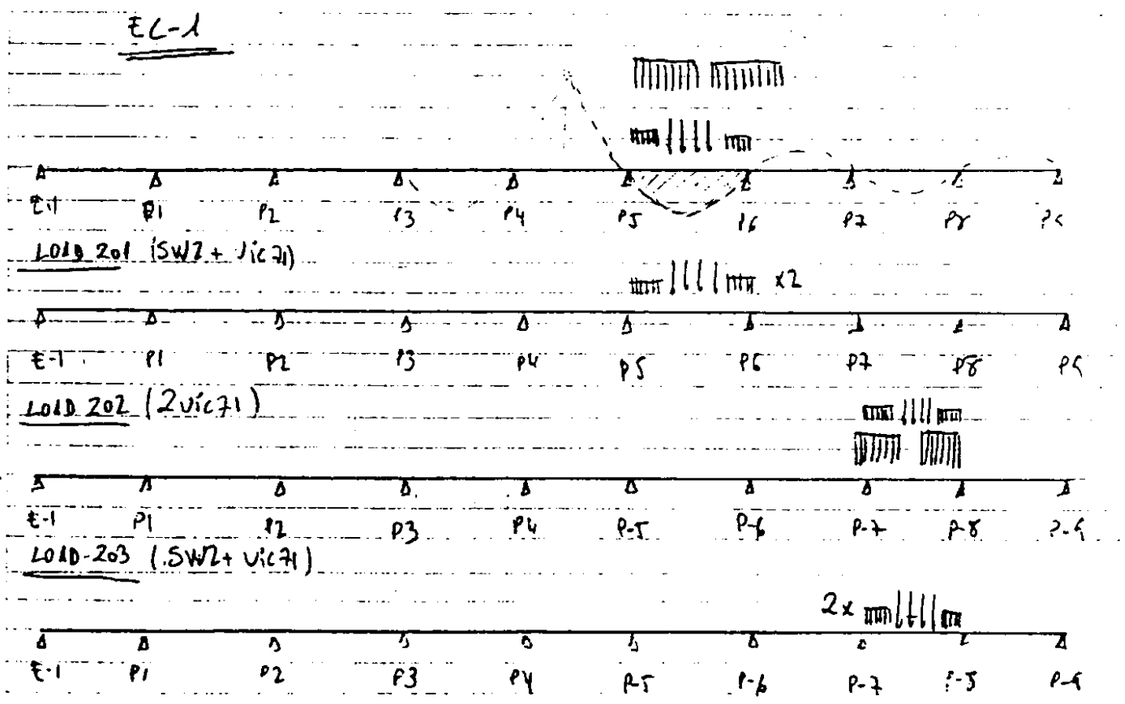
T-1: 1,5 x CP + 1,5 x LOAD 50

T-EHV: V2-EH + 1,35 x LOAD 50

T-ECV: V2-EC + 0,9 x LOAD 50

Para buscar los momentos mínimos en vano (5) y (9) se dispondrán las siguientes cargas

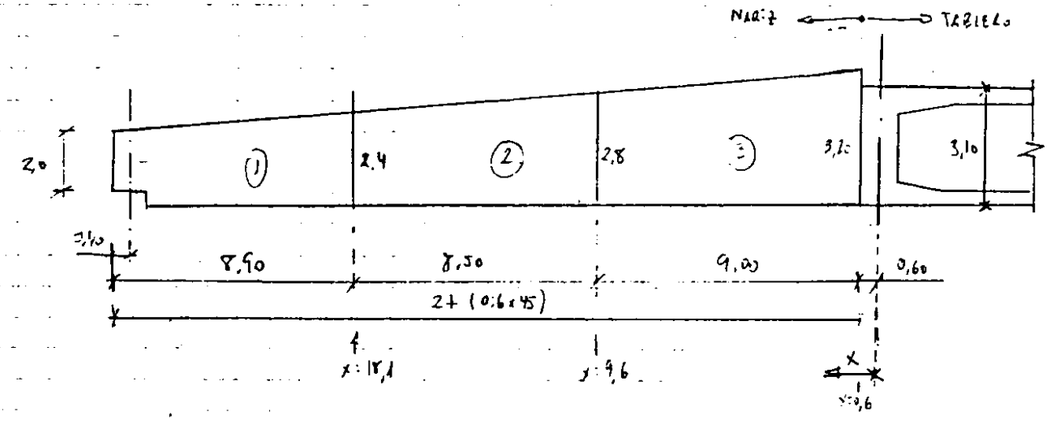




CONSTRUCCIÓN

CARGAS ACTUANTES

1.1. Nariz de lanzamiento (Pescante)



Peso del pescante metálico: $q_1 = 0{,}70\ t/m^2$

4% arriostramiento: $0{,}28\ t$ → $q = 0{,}728\ t/m^2$

$P_{①} = q \times 2{,}2 \times 8{,}9 = 14{,}25\ t$

$P_{②} = q \times 2{,}6 \times 3{,}5 = 16{,}09\ t$

$P_{③} = q \times 3{,}0 \times 9{,}0 = 19{,}66\ t$

$$P_{TOT} = 50\ t$$

$$X_G = \frac{P_1 \times 22{,}55 + P_2 \times 13{,}85 + P_3 \times 3{,}1}{P_{TOT}}$$

$$X_G = 12{,}75\ m$$

2. Peso de la TRAVIESA DE ENTRE EJES

$$P = 54{,}67 \times 0{,}6 + 0{,}4 \times (54{,}67 - 22{,}3) = 45{,}75\ tn$$

(sección cortina ↑ tablero tipo)

talones de anclaje

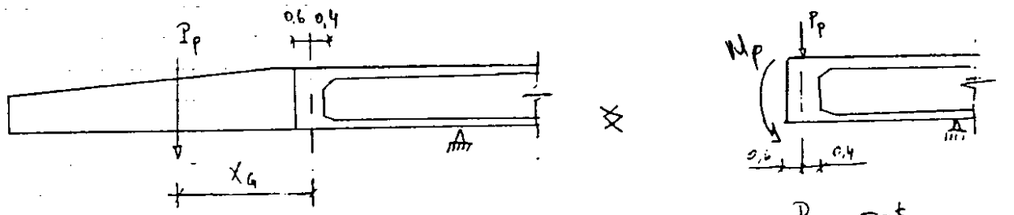
- Estribos de empuje (E-1 en V-1 y E-2 en V-2)

$P = (2{,}1 \times 1{,}6 \times 1{,}0) \times 2{,}5 = 8{,}4\ tn/talón \times 2 \rightarrow 16{,}8\ tn$

- Estribos frontales (E-2 en V-1 y E-1 en V-2)

$P = 2{,}5 \times (2{,}1 \times 2 \times 0{,}5) = 5{,}25\ tn/talón \times 2 \rightarrow 10{,}5\ tn$

CARGAS EQUIVALENTES EN EL EJE DE LA VIA = 1/4



$P_p = 50^t$ $X_G = 12{,}75\ m$

$P_p = 50^t$

$M_p = 50 \cdot (12{,}75) = 637{,}5\ mt$

Considerando el peso de la traviesa

$$P_p = 50 + 45{,}75 + 10{,}5 = 106\ tn$$

$$M_p = 637{,}5\ mt$$

COMPROBACIÓN DE LA ESTABILIDAD INICIAL

Para el levantamiento de las primeras dovelas, es necesaria una estabilidad suficiente hasta que el pescante metálico alcance la primera pila y se salve así el vano lateral.

Esto se consigue con un apoyo provisional tras estribo que define, hasta éste, la "zona de deslizamiento". Detrás de él queda la "zona de fabricación", donde se hormigonan las dovelas.

Además del peso propio del pescante y del tablero hay que considerar unas "Cargas de construcción = Q_{pca}", que actuando en la posición más desfavorable del tablero, consisten en:

- Carga uniforme: $50\ kg/m^2 \rightarrow 0{,}05 \times 14 = \underline{0{,}7\ t/ml}$
- Carga puntual: $\underline{10\ tn}$

Los coeficientes de ponderación a considerar son:

EH-91:
- $\frac{1{,}45}{1{,}3} = 1{,}1$ desfavorable
- 0,9 favorable

} para C.P + P.P

1,5 para sobrecargas

EC-1.3:
- 1,05 desf.
- 0,95 favorable

} PP + CP

1,5 SC

Se adoptará el criterio de la normativa española.

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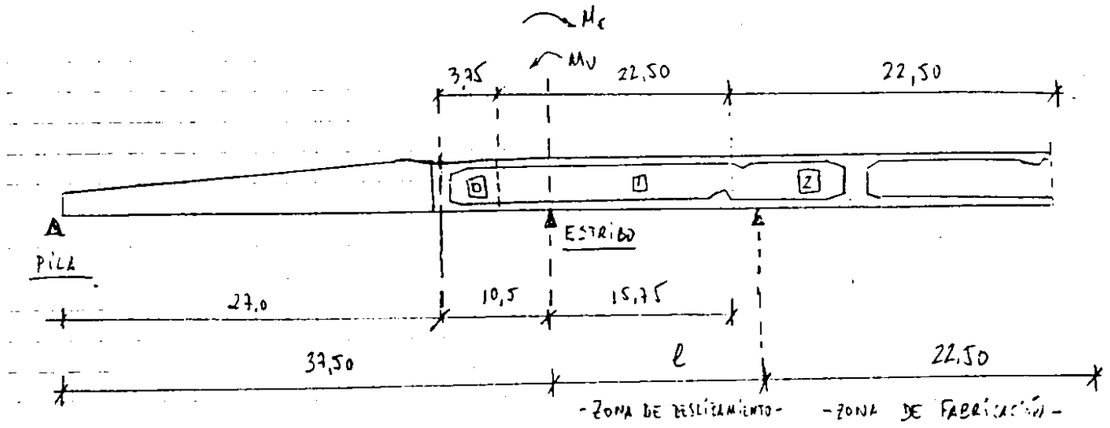
REALIZO:



$$\underline{M_V} = 1{,}10 \times \left(637{,}5 + 106 \times 10{,}5 + \underset{P.P.}{22{,}3} \times \frac{10{,}5^2}{2}\right) + 1{,}5 \times \left(0{,}7 \times \frac{10{,}5^2}{2} + 10 \cdot 10{,}5\right)$$

$$M_V = 1{,}1 \times 2979{,}8 + 1{,}5 \times 143{,}6 = \underline{3493{,}16\ mt}$$

$$\underline{M_E} = 0{,}9 \times \underset{\text{P.P.}}{22{,}3} \times \frac{\ell^2}{2} = \underline{10{,}035\ \ell^2\ mt}$$

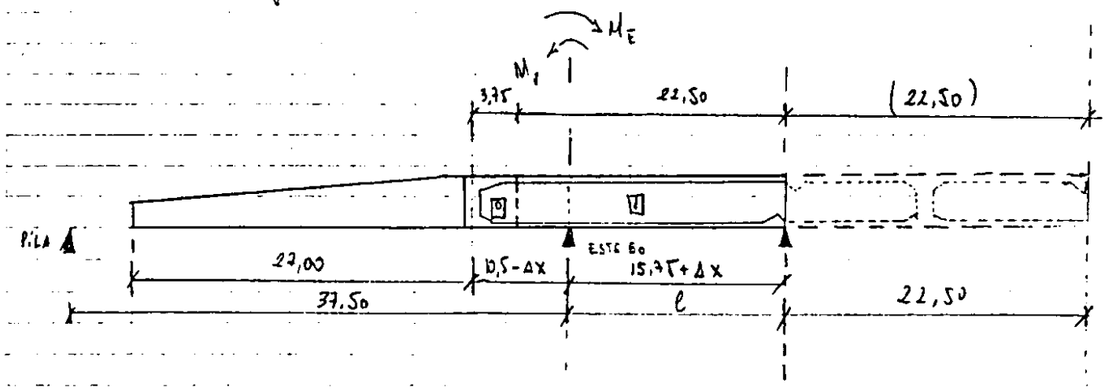
$$C.S. = \frac{M_E}{M_V} = \frac{10{,}035\ \ell^2}{3493{,}16} \Rightarrow$$

C.S.	1	1,1	1,2	1,3	1,35
ℓ	18,65	19,37	20,11	21,27	21,68

Como para $C.S. \geq 1$ se tiene $\ell \geq 18{,}65\ m$, necesitamos ℓ mayor que 15,75 que es donde tenemos la junta entre dovelas. En la figura representada ya estaría construida la dovela 2 y entonces el M_E sería mayor. Luego la situación más desfavorable respecto al equilibrio es justo antes de hormigonar la dovela 2, y en esa situación el pescante y las dovelas 0 y 1 ya construidas están más retrasadas, de forma que la junta entre 1 y 2 esté en el lado trasero ("zona de fabricación").

Para aquella situación (antes de hormigonar la dovela 2)

el conjunto sea estable, necesitamos que ℓ:



$$\underline{M_V}: 1,1\left[637,5+106(10,5-\Delta x)+22,3\frac{(10,5-\Delta x)^2}{2}\right]+1,5\left[0,7\frac{(10,5-\Delta x)^2}{2}+10(10,5-\Delta x)\right]$$

$$\underline{M_E}: 0,9\times 22,3\times\frac{(15,75+\Delta x)^2}{2}$$

Suponiendo $\Delta x = 2,50$ m ⇒ | $M_V = 1,1\times 2199,1+1,5\times 102,4 = \underline{2572,6\ tm}$

| $M_E = 0,9\times 3713,6 = \underline{3342,3\ mt}$

C.S. = 1,30

$$\underline{\ell} = 15,75+2,50 = \underline{18,25\ m}$$

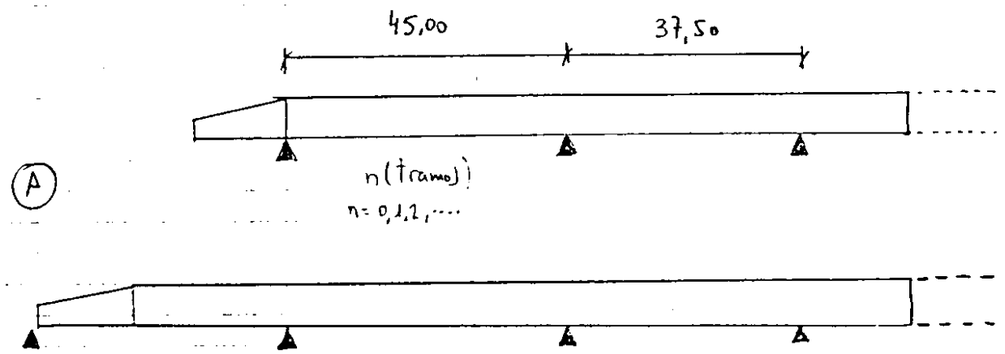
ESFUERZOS EN LAS SECCIONES

El estudio se realiza en secciones cada 4,50m, considerando las sucesivas fases, correspondientes a avances en el lanzamiento de 4,50m.

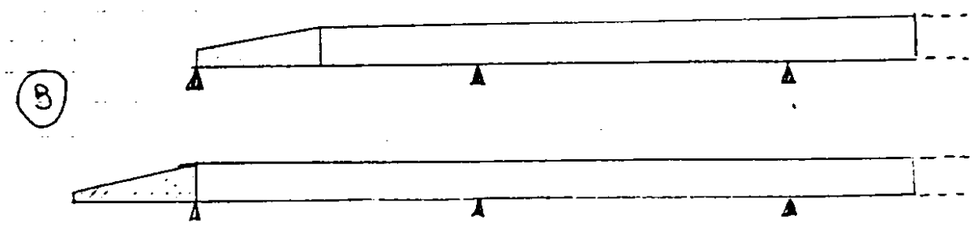
Se distinguen para el cálculo 2 etapas:

A) Cuando la totalidad del pescante está en voladizo, sin haber llegado a tocar la siguiente pila.

Comprende todas las celdas con el siguiente esquema:

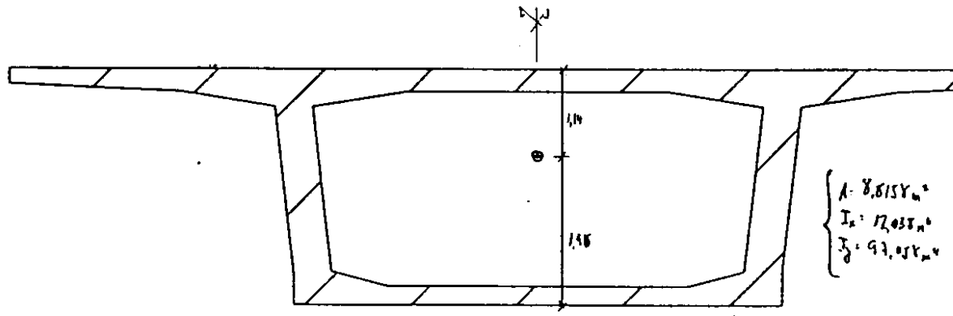


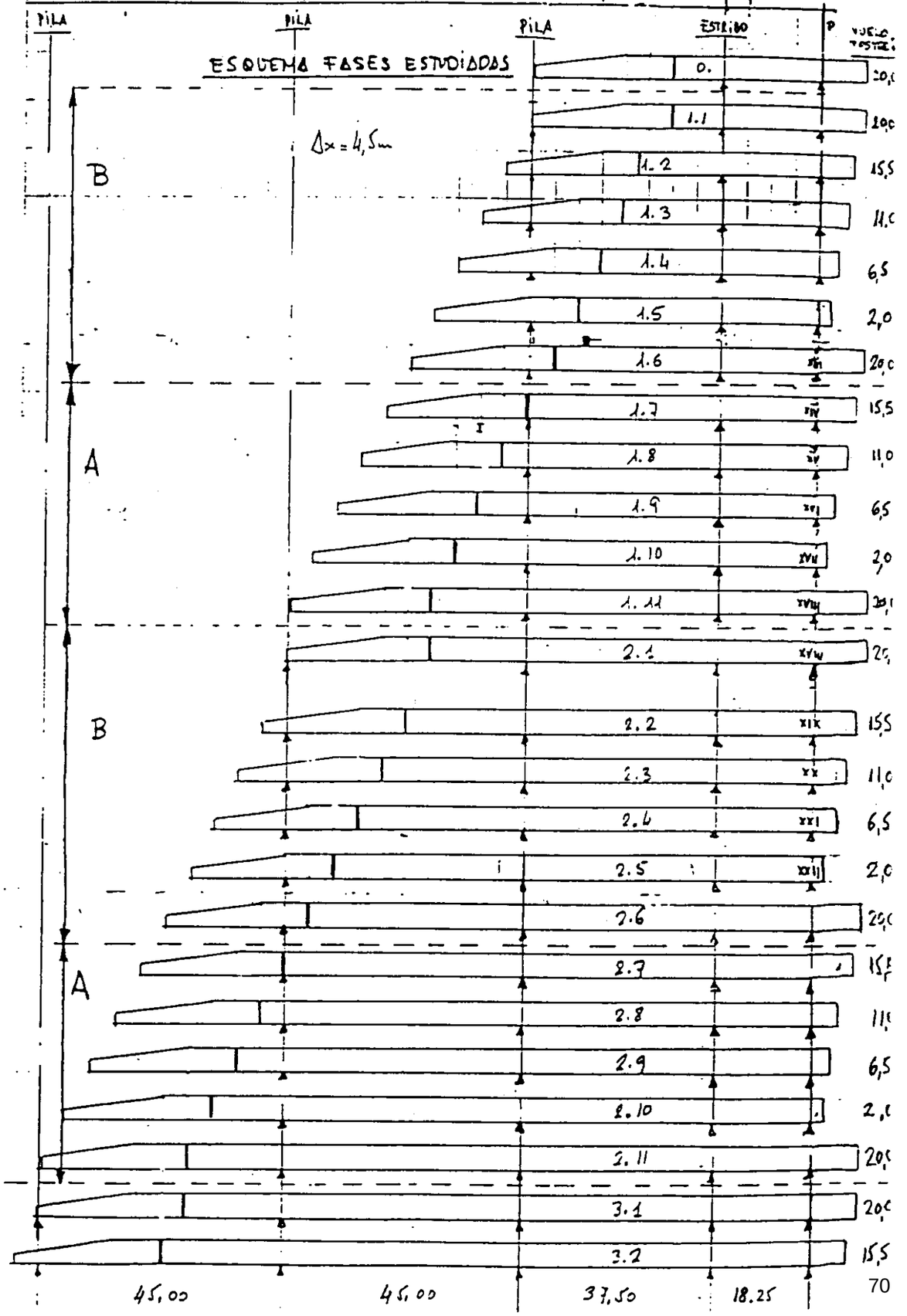
B) Cuando parte del pescante vuela y parte está a la derecha del apoyo.



El tramo de hormigón se considera de sección constante, con un módulo de elasticidad también constante e igual a 3×10^6 t/m².

Las características mecánicas del tablero son:



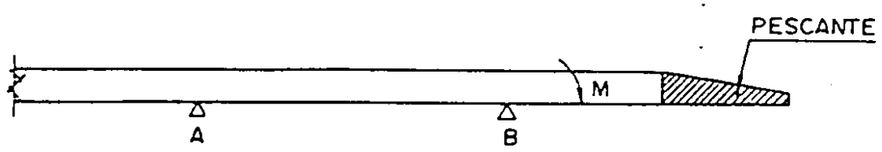


ESTUDIO DEL PROCESO DE LANZAMIENTO

El cálculo de la envolvente de esfuerzos que aparecen a lo largo del lanzamiento en la parte del puente delantera se realiza mediante el programa LANZA.

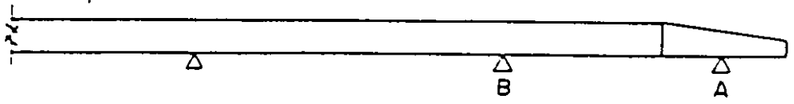
Hay que distinguir dos situaciones distintas de la estructura

1ª



La parte delantera de la estructura se encuentra en voladizo, - por lo que los esfuerzos se obtienen simplemente repartiendo el momento M y los de peso propio en la viga contínua correspondiente a la etapa de lanzamiento de que se trate.

2ª



El pescante se encuentra sobre el apoyo A. Se calcula como su-- perposición de dos estados: Uno idéntico al 1° con el vuelo total - medido desde B, y otro en el que se aplica a la estructura una carga unitaria en el punto A. El valor de la reacción en A y la consiguiente superposición de los dos estados de carga se hace anulando la flecha en A. Para esto es necesario conocer las características de flexibilidad del pescante, las cuales se obtienen mediante el -- programa "STAAD" introduciendo cargas puntuales de 100 Mp a lo largo de 5 posiciones distintas.

ESTUDIO ZONA PROXIMA AL PESCANTE

Para la determinación de los máximos momentos que se producen e esta zona, en el proceso de lanzamiento se emplea el programa "LANZ.

Este programa considera la estructura inicial, la cual es lanza da en avances en este caso de m, de esta manera las secciones de apoyo son siempre secciones de cálculo del programa y en ellas s registran los máximos momentos negativos.

Los datos de este programa son:

- Peso del pescante.
- Momento en la unión del pescante.
- Los resultados del estudio de flexibilidad.

  a) bajo su peso propio: desplazamientos.
  b) bajo carga unidad: desplazamientos bajo carga.

  - peso propio de la estructura por metro lineal.
  - E, I
  - Datos de longitudes iniciales, luces y final.

Los resultados:

- Bajo el título de geometría se dan los valores que definen l estados considerados.
  - Voladizo posterior.
  - Luces.
  - Voladizo anterior.
  - Longitud del pescante.
- Cuando el pescante se apoya en la siguiente pila'
  - Flecha de la estructura, sino existiera dicho apoyo en ese punto.
  - Flecha con una carga unidad, en el punto de apoyo.
  - Distancia a la unión del pescante, de dicho punto.
  - Reacción que se produce.

Finalmente la envolvente de todos los casos considerados es di jada e imprimida.

"PROGRAMA LANZA" (Archivo FLANZ)

Envolvente de Mtos. flectores en la fase de LANZAMIENTO

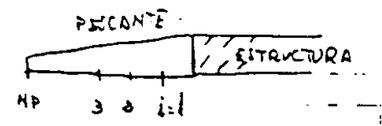
Calculo de la envolvente de momentos flectores que se producen en el proceso de lanzamiento de la estructura

El formato de lectura es (5, *)

Los datos a introducir son: (UNIDADES M, MP)

LINEA 1:
PP = peso del pescante + tercera unión
XMPP = Mf que produce el pescante en su unión a la estructura
NP = nº de partes en que se divide el pescante a efectos de sus flechas
PP, XMPP, NP (positivos)

LINEA 2:
FPP(I) = flecha en la sección I, del pescante, bajo su propio peso
FR(I) = flecha en la sección I, del pescante, bajo una carga unitaria aplicada en dicha sección



(FPP(I), I=1, NP), (FR(I), I=1, NP) (positivos)

LINEA 3
Q = sobrecarga a considerar que actua sobre la estructura (sin peso propio tablero)
E = modulo de elasticidad de la estructura (t/m²)
Y = inercia de la sección " " " (m⁴)
NL = nº de vanos final " " " "
Q, E, Y, NL

LINEA 4: XLØ = longitud inicial de la estructura (lanzón)
XLP = " del pescante
VPINI = voladizo posterior inicial
VPMIN = " " mínimo
DLT = incremento de la longitud de la estructura cuando el voladizo posterior fuese a ser menor que VPMIN
XL(J) = longitud o luz del vano J
XLTF = longitud final de la estructura
VPFIN = voladizo posterior final

XLØ	XLP	VPINI	VPMIN	DLT	(XL(J), J=1, NL)	XLTF	VPFIN
48.75	27.	20.	0.	22.5	18.25, 37.5, 45, 45, 45	190.75	0

UNIDADES: Todos los datos deben darse en Toneladas y metros

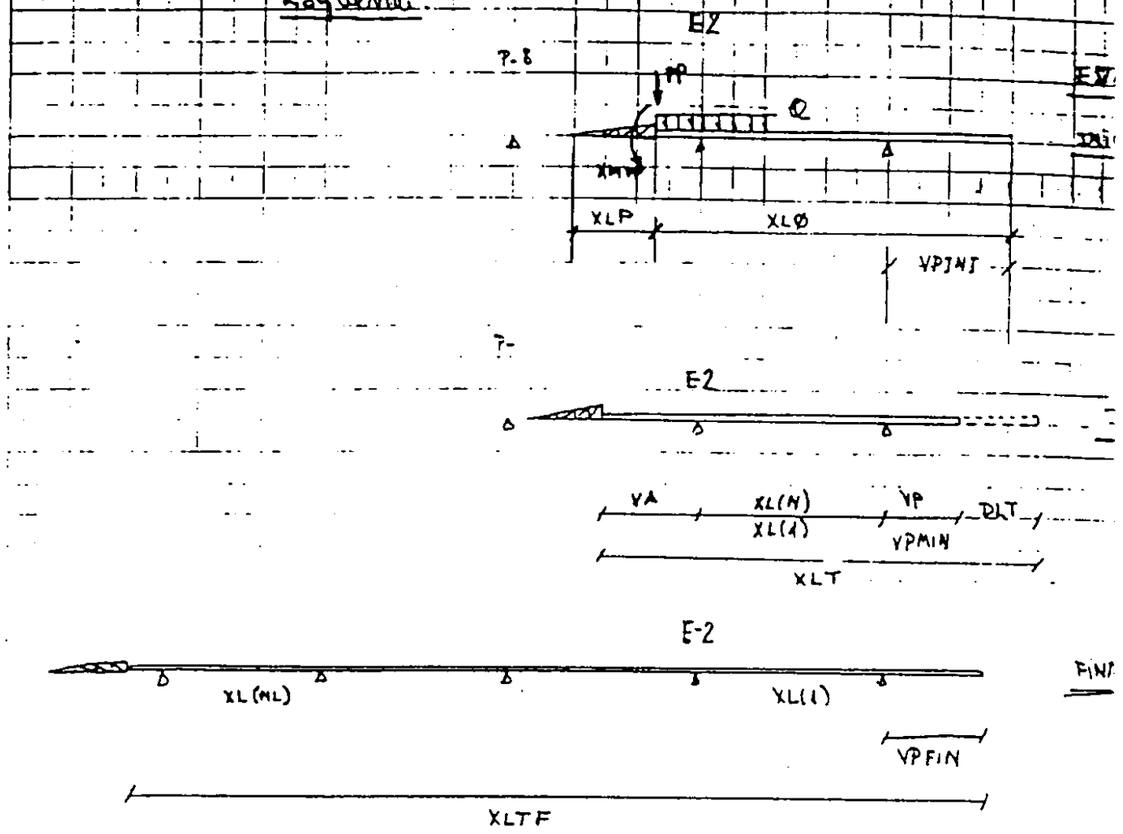
LÍNEA 5: AVAN = avance de la estructura en cada caso considerado en el lanzamiento
DX = intervalos a los que se obtienen los M_f comenzando por el extremo anterior.

AVAN	DX
4.5	4.5

Deben ser iguales y multiplos de la luz para que las secciones de apoyo (MAX M_f negativo) sean secciones de cálculo en todas las fases

LINEA 6: X = x inicial con la que se obtienen las secciones

Esquema:



Entrada de datos de LAITA:

c/ VIADUCTO ALTA VELOCIDAD

1/ 106 637,5 6

2/ 0,0013 0.0047 0.0095 0.0154 0.0218 0.0284 ↵

0.000007 0.000057 0.0001976 0.0004852 0.0009843 0.0017717

3/ 22.3 3500000 12.038 7 de línea

4/ 48,75 27.0 20.0 0.0 22.5 18.25, 37.5, 45, 45, 45, 45, 45 280,75 0

5/ 4.5 4.5

6/ 0.0

```
 0.0013 0.0047 0.0095 0.0154 0.0218 0.0284 0.000007 0.000057
*0.0001976 0.0004852 0.0009843 0.0017717
 22.3 3500000 12.038 7
 48.75 27 20 0 22.5 18.25 37.5 45 45 45 45 45 280.75 0
 4.5 4.5
 0
```

37.500
13.500
27.000

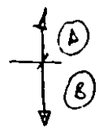
GEOMETRIA
20.000
18.250
37.500
18.000
27.000

1.11

GEOMETRIA
20.000
18.250
37.500
18.000
27.000

SIGUIENTE PILA

2.1



ECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.10574762 .00306496 27.000

REACCION= 34.502

GEOMETRIA
15.500
18.250
37.500
22.500
27.000

2.2

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.15735199 .00213056 22.500

REACCION= 73.855

GEOMETRIA
11.000
18.250
37.500
27.000
27.000

2.3

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.22265036 .00167454 18.000

REACCION= 132.962

GEOMETRIA
6.500
18.250
37.500
31.500
27.000

2.4

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.30317252 .00139921 13.500

REACCION= 216.673

GEOMETRIA
2.000
18.250
37.500
36.000
27.000

2.5

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.39855472 .00127191 9.000

REACCION= 313.351

GEOMETRIA
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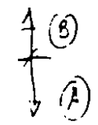
18.250
37.500
40.500
27.000

2.6



FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.50611345 .00122696 4.500

REACCION= 412.494

GEOMETRIA
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18.250
37.500
45.000
.000
27.000

2.7

GEOMETRIA
11.000
18.250
37.500
45.000
4.500
27.000

2.8

GEOMETRIA
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37.500
45.000
9.000
27.000

2.9

GEOMETRIA
2.000
18.250
37.500
45.000
13.500
27.000

2.10

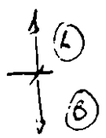
GEOMETRIA
20.000
18.250
37.500
45.000
18.000
27.000

2.11

SIGUIENTE PILA

GEOMETRIA
20.000
18.250
37.500
45.000
18.000
27.000

3.1



FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.10638474 .00317968 27.000

REACCION= 33.458

GEOMETRIA
15.500
18.250
37.500
45.000
22.500
27.000

3.2

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.16188007 .00224528 22.500

REACCION= 72.098

GEOMETRIA
11.000
18.250
37.500
45.000
27.000
27.000

3.3

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.23283870 .00178926 18.000

REACCION= 130.131

GEOMETRIA
6.500
18.250
37.500
45.000
31.500
27.000

3.4

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.32081727 .00151394 13.500

REACCION= 211.909

GEOMETRIA
2.000
18.250
37.500
45.000
36.000
27.000

3.5

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.42544615 .00138663 9.000

REACCION= 306.819

GEOMETRIA
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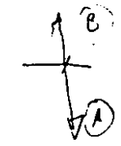
27.000

2.6



FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.55025486 .00134168 4.500

REACCION= 410.124

GEOMETRIA
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18.250
37.500
45.000
45.000
.000
27.000

3.7

GEOMETRIA
11.000
18.250
37.500
45.000
45.000

3.8

4.500
27.000

GEOMETRIA
6.500
18.250
37.500
45.000
45.000
9.000
27.000

3.9

GEOMETRIA
2.000
18.250
37.500
45.000
45.000
13.500
27.000

3.10

GEOMETRIA
20.000
18.250
37.500
45.000
45.000
18.000
27.000

3.11

GEOMETRIA
20.000
18.250
37.500
45.000
45.000
18.000
27.000

Siguiente hoja

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.10845712 .00318884 27.000

REACCION= 34.011

4.1

GEOMETRIA
15.500
18.250
37.500
45.000
45.000
22.500
27.000

4.2

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.16518745 .00225445 22.500

REACCION= 73.272

GEOMETRIA
11.000
18.250
37.500
45.000
45.000
27.000
27.000

4.3

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.23729293 .00179842 18.000

REACCION= 131.945

GEOMETRIA
6.500
18.250
37.500
45.000
45.000
31.500
27.000

4.4

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.32632520 .00152310 13.500

REACCION= 214.251

GEOMETRIA
2.000
18.250
37.500
45.000
45.000
36.000
27.000

4.5

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.43191464 .00139579 9.000

REACCION= 309.440

GEOMETRIA
20.000
18.250
37.500
45.000
45.000
40.500
27.000

4.6

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.55579600 .00135084 4.500

REACCION= 411.444

GEOMETRIA
15.500
18.250
37.500
45.000
45.000
45.000
.000
27.000

4.1

GEOMETRIA
11.000
18.250
37.500
45.000
45.000
45.000
4.500
27.000

4.8

GEOMETRIA
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18.250
37.500
45.000
45.000
45.000
9.000
27.000

4.9

GEOMETRIA
2.000
18.250
37.500
45.000
45.000
45.000
13.500
27.000

4.10

GEOMETRIA
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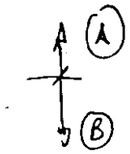
45.000
45.000
18.000
27.000

4.11



SIGUIENTE PILA

GEOMETRIA
20.000
18.250
37.500
45.000
45.000
45.000
18.000
27.000

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.10807013 .00318950 27.000

REACCION= 33.883

5.1

GEOMETRIA
15.500
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45.000
45.000
45.000
22.500
27.000

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.16463587 .00225511 22.500

REACCION= 73.006

5.2

GEOMETRIA
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18.250
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45.000
45.000
45.000
27.000
27.000

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.23663740 .00179908 18.000

REACCION= 131.532

5.3

GEOMETRIA
6.500
18.250
37.500
45.000
45.000
45.000
31.500
27.000

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.32562212 .00152376 13.500

5.4

REACCION= 213.697

GEOMETRIA
2.000
18.250
37.500
45.000
45.000
45.000
36.000
27.000

5.5

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.43122040 .00139646 9.000

REACCION= 308.796

GEOMETRIA
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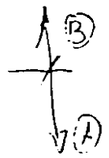
27.000

5.6



FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
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REACCION= 411.139

GEOMETRIA
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45.000
45.000
.000
27.000

5.7

GEOMETRIA
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5.8

GEOMETRIA
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5.9

GEOMETRIA
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5.10

GEOMETRIA
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5.11

GEOMETRIA
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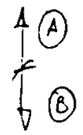
Siguiente pila

6.1



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.10818001 .00318955 27.000

REACCION= 33.917

GEOMETRIA
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45.000

6.2

45.000
45.000
45.000
22.500
27.000

6.2

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.16479411 .00225516 22.500

REACCION= 73.074

GEOMETRIA
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45.000
27.000
27.000

6.3

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.23685091 .00179913 18.000

REACCION= 131.647

GEOMETRIA
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45.000
45.000
45.000
31.500
27.000

6.4

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.32586481 .00152381 13.500

REACCION= 213.849

GEOMETRIA
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37.500
45.000
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45.000
45.000
36.000
27.000

6.5

FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
.43148637 .00139650 9.000

REACCION= 308.976

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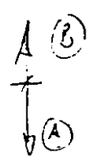
6.6



FLECHA EN VOLADIZO, FLECHA PARA REACCION UNITARIA XR
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REACCION= 411.223

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6.7

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6.8

GEOMETRIA
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6.9

GEOMETRIA

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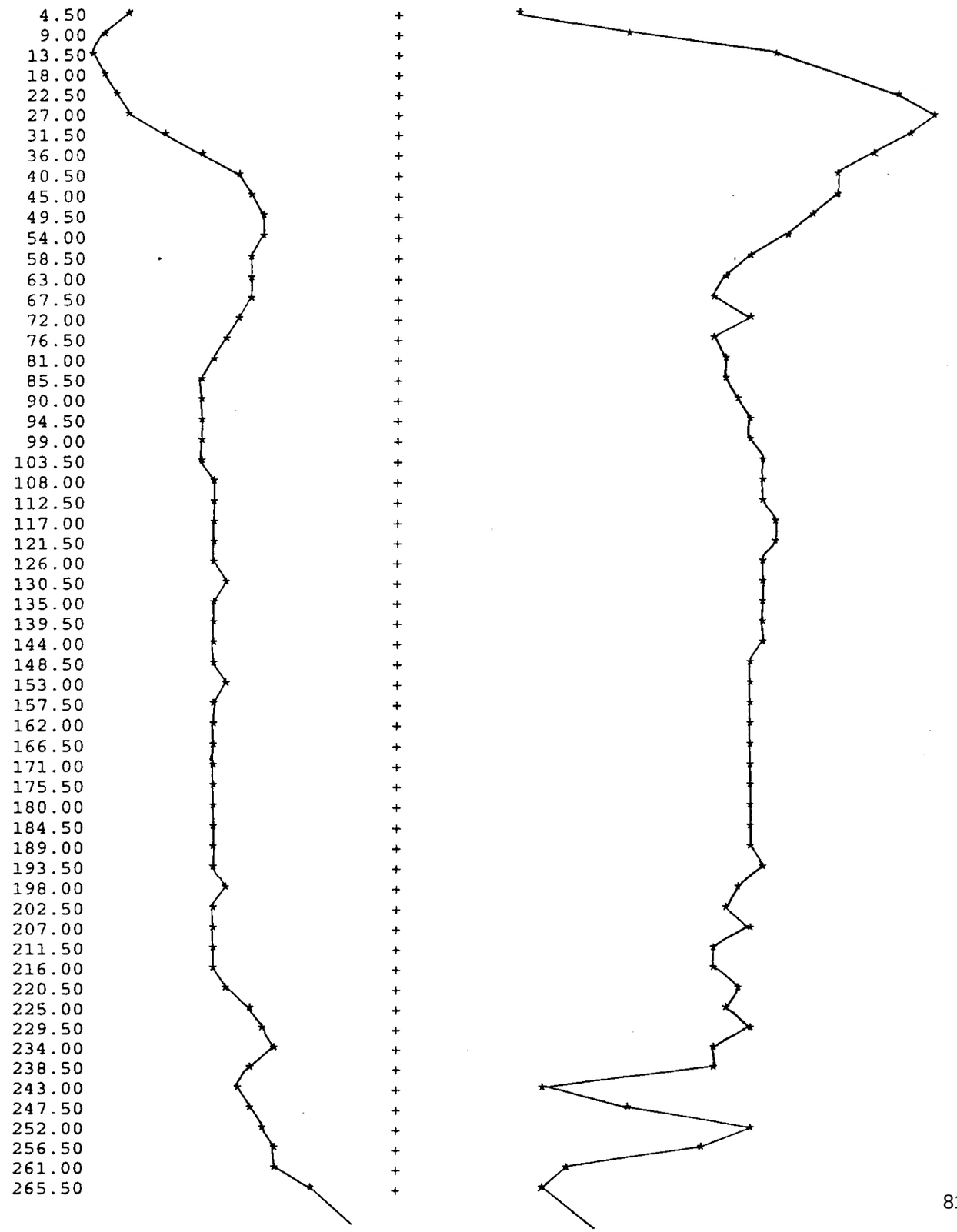
6.10

DIBUJO DE LA ENVOLVENTE

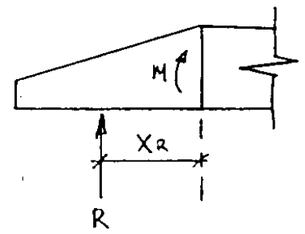


261.00	1336.26	-1812.57
265.50	927.53	-1528.77
270.00	108.38	-2442.20
74.50	.00	-3807.21
279.00	.00	-3317.82
283.50	.00	-1812.57
288.00	188.15	-758.90
292.50	108.38	-156.80

Envolvente de reacciones en el pescante

X_R	R_{max}	R_{min}	$M_{(R_{MÁX})}$
27	34,50	26,37	931,5
22,5	73,86	49,49	1661,9
18,0	132,96	89,36	2393,3
13,5	216,67	159,36	2925,1
9,0	313,35	252,13	2820,2
4,5	412,49	376,67	1856,2

(PILA SIGUIENTE A LA MÁS PRÓXIMA) (PILA ADYACENTE A ESTRIBO DE LANZAMIENTO)



El momento máximo positivo en la misma cuba pescante y tablero es:

$$M_{máx} = N(R_{máx}) - N_{pp} = 2925,1 - 637,5 = \underline{2287,6\ mt}$$

y el momento negativo debido al peso del pescante:

$$M_{pp}^{-} = -50 \times 12,75 = \underline{-637,5\ mt}\ (M.\ mínimo)$$

SERVICIO

PESO PROPIO

```
*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     1: 1: 1                       *
*                                                   *
*****************************************************
```

```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
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44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.9839543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
```

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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 1 PP + RCP CON SECCION DE BALASTO COMPLETA
131. SELFW Y -1
132. PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 105/ 104/ 10
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 1, TOTAL DEGREES OF FREEDOM = 589
SIZE OF STIFFNESS MATRIX = 7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE = 12.28 MEGA-BYTES

```
++ PROCESSING ELEMENT STIFFNESS MATRIX.          1: 1: 4
++ PROCESSING GLOBAL STIFFNESS MATRIX.           1: 1: 4
++ PROCESSING TRIANGULAR FACTORIZATION.          1: 1: 5
++ CALCULATING JOINT DISPLACEMENTS.              1: 1: 5
++ CALCULATING MEMBER  FORCES.                   1: 1: 5

133. PRINT JOINT COORDINATES
```


JOINT COORDINATES

COORDINATES ARE MET UNIT

JOINT	X	Y	Z
1	0.000	0.000	8000.000
2	0.800	0.000	8000.000
3	4.500	0.000	8000.000
4	9.250	0.000	7999.990
5	14.000	0.000	7999.990
6	18.750	0.000	7999.980
7	23.500	0.000	7999.970
8	28.250	0.000	7999.950
9	33.000	0.000	7999.931
10	36.700	0.000	7999.920
11	37.500	0.000	7999.911
12	38.300	0.000	7999.911
13	42.000	0.000	7999.890
14	46.500	0.000	7999.860
15	51.000	0.000	7999.840
16	55.500	0.000	7999.810
17	59.999	0.000	7999.770
18	64.499	0.000	7999.740
19	68.999	0.000	7999.700
20	73.499	0.000	7999.661
21	77.999	0.000	7999.620
22	81.699	0.000	7999.581
23	82.498	0.000	7999.570
24	83.299	0.000	7999.570
25	86.998	0.000	7999.530
26	91.498	0.000	7999.480
27	95.998	0.000	7999.420
28	100.497	0.000	7999.370
29	104.997	0.000	7999.311
30	109.497	0.000	7999.250
31	113.996	0.000	7999.190
32	118.496	0.000	7999.120
33	122.995	0.000	7999.050
34	126.695	0.000	7999.000
35	127.495	0.000	7998.980
36	128.294	0.000	7998.970
37	131.994	0.000	7998.911
38	136.493	0.000	7998.840
39	140.993	0.000	7998.760
40	145.492	0.000	7998.680
41	149.991	0.000	7998.590
42	154.490	0.000	7998.510
43	158.990	0.000	7998.420
44	163.489	0.000	7998.330
45	167.988	0.000	7998.241
46	171.687	0.000	7998.161
47	172.487	0.000	7998.141
48	173.286	0.000	7998.120

JOINT COORDINATES

COORDINATES ARE MET UNIT

JOINT	X	Y	Z
49	176.986	0.000	7998.040
50	181.484	0.000	7997.940
51	185.983	0.000	7997.840
52	190.482	0.000	7997.730
53	194.981	0.000	7997.620
54	199.479	0.000	7997.510
55	203.978	0.000	7997.400
56	208.476	0.000	7997.280
57	212.975	0.000	7997.160
58	216.674	0.000	7997.070
59	217.473	0.000	7997.041
60	218.273	0.000	7997.020
61	221.972	0.000	7996.920
62	226.470	0.000	7996.791
63	230.968	0.000	7996.670
64	235.466	0.000	7996.530
65	239.964	0.000	7996.400
66	244.462	0.000	7996.260
67	248.960	0.000	7996.130
68	253.458	0.000	7995.980
69	257.955	0.000	7995.840
70	261.653	0.000	7995.720
71	262.453	0.000	7995.690
72	263.252	0.000	7995.670
73	266.950	0.000	7995.540
74	271.448	0.000	7995.390
75	275.945	0.000	7995.240
76	280.443	0.000	7995.080
77	284.940	0.000	7994.920
78	289.437	0.000	7994.760
79	293.934	0.000	7994.601
80	298.431	0.000	7994.431
81	302.928	0.000	7994.260
82	306.625	0.000	7994.120
83	307.424	0.000	7994.090
84	308.224	0.000	7994.060
85	311.921	0.000	7993.920
86	316.417	0.000	7993.740
87	320.914	0.000	7993.560
88	325.410	0.000	7993.380
89	329.906	0.000	7993.190
90	334.403	0.000	7993.010
91	338.899	0.000	7992.820
92	343.394	0.000	7992.630
93	347.890	0.000	7992.430
94	351.587	0.000	7992.270
95	352.386	0.000	7992.241
96	353.185	0.000	7992.200

JOINT COORDINATES

COORDINATES ARE MET UNIT

JOINT	X	Y	Z
97	356.882	0.000	7992.040
98	361.777	0.000	7991.820
99	366.672	0.000	7991.590
100	371.566	0.000	7991.370
101	376.461	0.000	7991.141
102	381.355	0.000	7990.910
103	386.250	0.000	7990.670
104	389.945	0.000	7990.490
105	390.744	0.000	7990.451

********** END OF DATA FROM INTERNAL STORAGE **********

134. PRINT MEMBER INFORMATION

MEMBER INFORMATION

MEMBER	START JOINT	END JOINT	LENGTH (MET)	BETA (DEG)	RELEASES
1	1	2	0.800	0.00	
2	2	3	3.700	0.00	
3	3	4	4.750	0.00	
4	4	5	4.750	0.00	
5	5	6	4.750	0.00	
6	6	7	4.750	0.00	
7	7	8	4.750	0.00	
8	8	9	4.750	0.00	
9	9	10	3.700	0.00	
10	10	11	0.800	0.00	
11	11	12	0.800	0.00	
12	12	13	3.700	0.00	
13	13	14	4.500	0.00	
14	14	15	4.500	0.00	
15	15	16	4.500	0.00	
16	16	17	4.500	0.00	
17	17	18	4.500	0.00	
18	18	19	4.500	0.00	
19	19	20	4.500	0.00	
20	20	21	4.500	0.00	
21	21	22	3.700	0.00	
22	22	23	0.800	0.00	
23	23	24	0.800	0.00	
24	24	25	3.700	0.00	
25	25	26	4.500	0.00	
26	26	27	4.500	0.00	
27	27	28	4.500	0.00	
28	28	29	4.500	0.00	
29	29	30	4.500	0.00	
30	30	31	4.499	0.00	
31	31	32	4.501	0.00	
32	32	33	4.500	0.00	
33	33	34	3.700	0.00	
34	34	35	0.800	0.00	
35	35	36	0.799	0.00	
36	36	37	3.700	0.00	
37	37	38	4.500	0.00	
38	38	39	4.501	0.00	
39	39	40	4.500	0.00	
40	40	41	4.500	0.00	
41	41	42	4.500	0.00	
42	42	43	4.501	0.00	
43	43	44	4.500	0.00	
44	44	45	4.500	0.00	
45	45	46	3.700	0.00	
46	46	47	0.800	0.00	

MEMBER INFORMATION

MEMBER	START JOINT	END JOINT	LENGTH (MET)	BETA (DEG)	RELEASES
47	47	48	0.799	0.00	
48	48	49	3.701	0.00	
49	49	50	4.499	0.00	
50	50	51	4.500	0.00	
51	51	52	4.500	0.00	
52	52	53	4.500	0.00	
53	53	54	4.499	0.00	
54	54	55	4.500	0.00	
55	55	56	4.500	0.00	
56	56	57	4.501	0.00	
57	57	58	3.700	0.00	
58	58	59	0.800	0.00	
59	59	60	0.800	0.00	
60	60	61	3.700	0.00	
61	61	62	4.500	0.00	
62	62	63	4.500	0.00	
63	63	64	4.500	0.00	
64	64	65	4.500	0.00	
65	65	66	4.500	0.00	
66	66	67	4.500	0.00	
67	67	68	4.500	0.00	
68	68	69	4.499	0.00	
69	69	70	3.700	0.00	
70	70	71	0.801	0.00	
71	71	72	0.799	0.00	
72	72	73	3.700	0.00	
73	73	74	4.500	0.00	
74	74	75	4.500	0.00	
75	75	76	4.501	0.00	
76	76	77	4.500	0.00	
77	77	78	4.500	0.00	
78	78	79	4.500	0.00	
79	79	80	4.500	0.00	
80	80	81	4.500	0.00	
81	81	82	3.700	0.00	
82	82	83	0.800	0.00	
83	83	84	0.801	0.00	
84	84	85	3.700	0.00	
85	85	86	4.500	0.00	
86	86	87	4.501	0.00	
87	87	88	4.500	0.00	
88	88	89	4.500	0.00	
89	89	90	4.501	0.00	
90	90	91	4.500	0.00	
91	91	92	4.499	0.00	
92	92	93	4.500	0.00	

MEMBER INFORMATION

MEMBER	START JOINT	END JOINT	LENGTH (MET)	BETA (DEG)	RELEASES
93	93	94	3.700	0.00	
94	94	95	0.800	0.00	
95	95	96	0.800	0.00	
96	96	97	3.700	0.00	
97	97	98	4.900	0.00	
98	98	99	4.900	0.00	
99	99	100	4.899	0.00	
100	100	101	4.900	0.00	
101	101	102	4.899	0.00	
102	102	103	4.901	0.00	
103	103	104	3.699	0.00	
104	104	105	0.800	0.00	

********** END OF DATA FROM INTERNAL STORAGE **********

135. PRINT MEMBER PROPERTIES

MEMBER PROPERTIES. UNIT - CM

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
1	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
2	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
3	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
4	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
5	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
6	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
7	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
8	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
9	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
10	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
11	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
12	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
13	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
14	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
15	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
16	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
17	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
18	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
19	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
20	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
21	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
22	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
23	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
24	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	

MEMBER PROPERTIES. UNIT - CM

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
25	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
26	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
27	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
28	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
29	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
30	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
31	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
32	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
33	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
34	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
35	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
36	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
37	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
38	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
39	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
40	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
41	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
42	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
43	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
44	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
45	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
46	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
47	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
48	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	

MEMBER PROPERTIES. UNIT - CM

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
49	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
50	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
51	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
52	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
53	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
54	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
55	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
56	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
57	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
58	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
59	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
60	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
61	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
62	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
63	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
64	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
65	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
66	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
67	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
68	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
69	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
70	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
71	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
72	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	

MEMBER PROPERTIES. UNIT - CM

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
73	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
74	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
75	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
76	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
77	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
78	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
79	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
80	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
81	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
82	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
83	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
84	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
85	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
86	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
87	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
88	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
89	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
90	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
91	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
92	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
93	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
94	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
95	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	
96	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	

MEMBER PROPERTIES. UNIT - CM

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
97	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
98	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
99	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
100	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
101	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
102	PRISMATIC	87999.64	**********	**********	
		0.00	0.00	7758662.5013847057.00	
103	PRISMATIC	122349.49	**********	**********	
		0.00	0.00	10335421.0015822760.00	
104	PRISMATIC	219199.09	**********	**********	
		0.00	0.00	12987017.0019248454.00	

********** END OF DATA FROM INTERNAL STORAGE **********

136. PRINT MATERIAL PROPERTIES

MATERIAL PROPERTIES.

ALL UNITS ARE - MTON MET

MEMBER	E	G	DEN	ALPHA
1	3500000.0	1458333.1	2.50000024	0.00001000
2	3500000.0	1458333.1	2.50000024	0.00001000
3	3500000.0	1458333.1	2.50000024	0.00001000
4	3500000.0	1458333.1	2.50000024	0.00001000
5	3500000.0	1458333.1	2.50000024	0.00001000
6	3500000.0	1458333.1	2.50000024	0.00001000
7	3500000.0	1458333.1	2.50000024	0.00001000
8	3500000.0	1458333.1	2.50000024	0.00001000
9	3500000.0	1458333.1	2.50000024	0.00001000
10	3500000.0	1458333.1	2.50000024	0.00001000
11	3500000.0	1458333.1	2.50000024	0.00001000
12	3500000.0	1458333.1	2.50000024	0.00001000
13	3500000.0	1458333.1	2.50000024	0.00001000
14	3500000.0	1458333.1	2.50000024	0.00001000
15	3500000.0	1458333.1	2.50000024	0.00001000
16	3500000.0	1458333.1	2.50000024	0.00001000
17	3500000.0	1458333.1	2.50000024	0.00001000
18	3500000.0	1458333.1	2.50000024	0.00001000
19	3500000.0	1458333.1	2.50000024	0.00001000
20	3500000.0	1458333.1	2.50000024	0.00001000
21	3500000.0	1458333.1	2.50000024	0.00001000
22	3500000.0	1458333.1	2.50000024	0.00001000
23	3500000.0	1458333.1	2.50000024	0.00001000
24	3500000.0	1458333.1	2.50000024	0.00001000
25	3500000.0	1458333.1	2.50000024	0.00001000
26	3500000.0	1458333.1	2.50000024	0.00001000
27	3500000.0	1458333.1	2.50000024	0.00001000
28	3500000.0	1458333.1	2.50000024	0.00001000
29	3500000.0	1458333.1	2.50000024	0.00001000
30	3500000.0	1458333.1	2.50000024	0.00001000
31	3500000.0	1458333.1	2.50000024	0.00001000
32	3500000.0	1458333.1	2.50000024	0.00001000
33	3500000.0	1458333.1	2.50000024	0.00001000
34	3500000.0	1458333.1	2.50000024	0.00001000
35	3500000.0	1458333.1	2.50000024	0.00001000
36	3500000.0	1458333.1	2.50000024	0.00001000
37	3500000.0	1458333.1	2.50000024	0.00001000
38	3500000.0	1458333.1	2.50000024	0.00001000
39	3500000.0	1458333.1	2.50000024	0.00001000
40	3500000.0	1458333.1	2.50000024	0.00001000
41	3500000.0	1458333.1	2.50000024	0.00001000
42	3500000.0	1458333.1	2.50000024	0.00001000
43	3500000.0	1458333.1	2.50000024	0.00001000
44	3500000.0	1458333.1	2.50000024	0.00001000
45	3500000.0	1458333.1	2.50000024	0.00001000
46	3500000.0	1458333.1	2.50000024	0.00001000

MATERIAL PROPERTIES.

ALL UNITS ARE - MTON MET

MEMBER	E	G	DEN	ALPHA
47	3500000.0	1458333.1	2.50000024	0.00001000
48	3500000.0	1458333.1	2.50000024	0.00001000
49	3500000.0	1458333.1	2.50000024	0.00001000
50	3500000.0	1458333.1	2.50000024	0.00001000
51	3500000.0	1458333.1	2.50000024	0.00001000
52	3500000.0	1458333.1	2.50000024	0.00001000
53	3500000.0	1458333.1	2.50000024	0.00001000
54	3500000.0	1458333.1	2.50000024	0.00001000
55	3500000.0	1458333.1	2.50000024	0.00001000
56	3500000.0	1458333.1	2.50000024	0.00001000
57	3500000.0	1458333.1	2.50000024	0.00001000
58	3500000.0	1458333.1	2.50000024	0.00001000
59	3500000.0	1458333.1	2.50000024	0.00001000
60	3500000.0	1458333.1	2.50000024	0.00001000
61	3500000.0	1458333.1	2.50000024	0.00001000
62	3500000.0	1458333.1	2.50000024	0.00001000
63	3500000.0	1458333.1	2.50000024	0.00001000
64	3500000.0	1458333.1	2.50000024	0.00001000
65	3500000.0	1458333.1	2.50000024	0.00001000
66	3500000.0	1458333.1	2.50000024	0.00001000
67	3500000.0	1458333.1	2.50000024	0.00001000
68	3500000.0	1458333.1	2.50000024	0.00001000
69	3500000.0	1458333.1	2.50000024	0.00001000
70	3500000.0	1458333.1	2.50000024	0.00001000
71	3500000.0	1458333.1	2.50000024	0.00001000
72	3500000.0	1458333.1	2.50000024	0.00001000
73	3500000.0	1458333.1	2.50000024	0.00001000
74	3500000.0	1458333.1	2.50000024	0.00001000
75	3500000.0	1458333.1	2.50000024	0.00001000
76	3500000.0	1458333.1	2.50000024	0.00001000
77	3500000.0	1458333.1	2.50000024	0.00001000
78	3500000.0	1458333.1	2.50000024	0.00001000
79	3500000.0	1458333.1	2.50000024	0.00001000
80	3500000.0	1458333.1	2.50000024	0.00001000
81	3500000.0	1458333.1	2.50000024	0.00001000
82	3500000.0	1458333.1	2.50000024	0.00001000
83	3500000.0	1458333.1	2.50000024	0.00001000
84	3500000.0	1458333.1	2.50000024	0.00001000
85	3500000.0	1458333.1	2.50000024	0.00001000
86	3500000.0	1458333.1	2.50000024	0.00001000
87	3500000.0	1458333.1	2.50000024	0.00001000
88	3500000.0	1458333.1	2.50000024	0.00001000
89	3500000.0	1458333.1	2.50000024	0.00001000
90	3500000.0	1458333.1	2.50000024	0.00001000
91	3500000.0	1458333.1	2.50000024	0.00001000
92	3500000.0	1458333.1	2.50000024	0.00001000

MATERIAL PROPERTIES.

ALL UNITS ARE - MTON MET

MEMBER	E	G	DEN	ALPHA
93	3500000.0	1458333.1	2.50000024	0.00001000
94	3500000.0	1458333.1	2.50000024	0.00001000
95	3500000.0	1458333.1	2.50000024	0.00001000
96	3500000.0	1458333.1	2.50000024	0.00001000
97	3500000.0	1458333.1	2.50000024	0.00001000
98	3500000.0	1458333.1	2.50000024	0.00001000
99	3500000.0	1458333.1	2.50000024	0.00001000
100	3500000.0	1458333.1	2.50000024	0.00001000
101	3500000.0	1458333.1	2.50000024	0.00001000
102	3500000.0	1458333.1	2.50000024	0.00001000
103	3500000.0	1458333.1	2.50000024	0.00001000
104	3500000.0	1458333.1	2.50000024	0.00001000

********** END OF DATA FROM INTERNAL STORAGE **********

137. PRINT SUPPORTS INFORMATION

SUPPORT INFORMATION (1=FIXED, 0=RELEASED)

UNITS FOR SPRING CONSTANTS ARE MTON MET DEGREES

JOINT	FORCE-X/ KFX	FORCE-Y/ KFY	FORCE-Z/ KFZ	MOM-X/ KMX	MOM-Y/ KMY	MOM-Z/ KMZ
1	1	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
11	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
23	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
35	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
47	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
59	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
71	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
83	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
95	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0
105	0	1	1	1	1	0
	0.0	0.0	0.0	0.0	0.0	0.0

********** END OF DATA FROM INTERNAL STORAGE **********

138. PRINT MEMBER FORCES

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	0.00	360.43	0.00	-2.82	0.00	0.00
		2	0.00	-316.59	0.00	2.82	0.00	270.78
2	1	2	0.00	316.57	0.00	-2.82	0.00	-270.79
		3	0.00	-203.39	0.00	2.82	0.00	1232.72
3	1	3	0.00	203.39	0.00	-0.14	0.00	-1232.72
		4	0.00	-98.89	0.00	0.14	0.00	1950.65
4	1	4	0.00	98.90	0.00	-4.38	0.00	-1950.64
		5	0.00	5.60	0.00	4.38	0.00	2172.20
5	1	5	0.00	-5.61	0.00	-0.03	0.00	-2172.20
		6	0.00	110.11	0.00	0.03	0.00	1897.37
6	1	6	0.00	-110.11	0.00	0.29	0.00	-1897.38
		7	0.00	214.61	0.00	-0.29	0.00	1126.17
7	1	7	0.00	-214.61	0.00	2.55	0.00	-1126.17
		8	0.00	319.11	0.00	-2.55	0.00	-141.38
8	1	8	0.00	-319.11	0.00	2.55	0.00	141.38
		9	0.00	423.61	0.00	-2.55	0.00	-1905.35
9	1	9	0.00	-423.61	0.00	5.20	0.00	1905.34
		10	0.00	536.78	0.00	-5.20	0.00	-3682.07
10	1	10	0.00	-536.78	0.00	-28.37	0.00	3681.96
		11	0.00	580.62	0.00	28.37	0.00	-4128.96
11	1	11	0.00	557.73	0.00	19.35	0.00	4129.00
		12	0.00	-513.89	0.00	-19.35	0.00	-3700.35
12	1	12	0.00	513.89	0.00	-1.29	0.00	3700.41
		13	0.00	-400.71	0.00	1.29	0.00	-2008.41
13	1	13	0.00	400.71	0.00	-3.55	0.00	2008.41
		14	0.00	-301.71	0.00	3.55	0.00	-427.94
14	1	14	0.00	301.71	0.00	-2.56	0.00	427.95
		15	0.00	-202.71	0.00	2.56	0.00	707.02
15	1	15	0.00	202.71	0.00	-0.94	0.00	-707.03
		16	0.00	-103.71	0.00	0.94	0.00	1396.49
16	1	16	0.00	103.72	0.00	2.01	0.00	-1396.49
		17	0.00	-4.72	0.00	-2.01	0.00	1640.45

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	1	17	0.00	4.71	0.00	-1.46	0.00	-1640.45
		18	0.00	94.29	0.00	1.46	0.00	1438.91
18	1	18	0.00	-94.28	0.00	1.59	0.00	-1438.91
		19	0.00	193.28	0.00	-1.59	0.00	791.88
19	1	19	0.00	-193.29	0.00	1.59	0.00	-791.88
		20	0.00	292.29	0.00	-1.59	0.00	-300.67
20	1	20	0.00	-292.29	0.00	1.53	0.00	300.68
		21	0.00	391.29	0.00	-1.53	0.00	-1838.71
21	1	21	0.00	-391.29	0.00	-1.65	0.00	1838.71
		22	0.00	504.46	0.00	1.65	0.00	-3495.85
22	1	22	0.00	-504.46	0.00	-9.25	0.00	3495.84
		23	0.00	548.30	0.00	9.25	0.00	-3916.92
23	1	23	0.00	551.67	0.00	37.61	0.00	3916.71
		24	0.00	-507.83	0.00	-37.61	0.00	-3492.91
24	1	24	0.00	507.83	0.00	-0.61	0.00	3493.11
		25	0.00	-394.66	0.00	0.61	0.00	-1823.51
25	1	25	0.00	394.66	0.00	-0.60	0.00	1823.51
		26	0.00	-295.66	0.00	0.60	0.00	-270.31
26	1	26	0.00	295.66	0.00	-1.27	0.00	270.31
		27	0.00	-196.65	0.00	1.27	0.00	837.42
27	1	27	0.00	196.65	0.00	-3.18	0.00	-837.41
		28	0.00	-97.66	0.00	3.18	0.00	1499.57
28	1	28	0.00	97.67	0.00	-0.01	0.00	-1499.57
		29	0.00	1.34	0.00	0.01	0.00	1716.31
29	1	29	0.00	-1.34	0.00	0.29	0.00	-1716.31
		30	0.00	100.35	0.00	-0.29	0.00	1487.47
30	1	30	0.00	-100.36	0.00	0.29	0.00	-1487.47
		31	0.00	199.34	0.00	-0.29	0.00	813.24
31	1	31	0.00	-199.34	0.00	2.01	0.00	-813.24
		32	0.00	298.35	0.00	-2.01	0.00	-306.70
32	1	32	0.00	-298.35	0.00	2.01	0.00	306.70
		33	0.00	397.34	0.00	-2.01	0.00	-1871.85
33	1	33	0.00	-397.34	0.00	5.77	0.00	1871.84
		34	0.00	510.53	0.00	-5.77	0.00	-3551.56

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	1	34	0.00	-510.53	0.00	-34.31	0.00	3551.40
		35	0.00	554.38	0.00	34.31	0.00	-3977.49
35	1	35	0.00	553.33	0.00	10.10	0.00	3977.58
		36	0.00	-509.54	0.00	-10.10	0.00	-3552.92
36	1	36	0.00	509.54	0.00	-1.18	0.00	3552.93
		37	0.00	-396.35	0.00	1.18	0.00	-1876.80
37	1	37	0.00	396.36	0.00	-0.46	0.00	1876.80
		38	0.00	-297.37	0.00	0.46	0.00	-316.09
38	1	38	0.00	297.37	0.00	-1.12	0.00	316.09
		39	0.00	-198.35	0.00	1.12	0.00	799.44
39	1	39	0.00	198.35	0.00	-1.26	0.00	-799.44
		40	0.00	-99.35	0.00	1.26	0.00	1469.23
40	1	40	0.00	99.36	0.00	2.37	0.00	-1469.24
		41	0.00	-0.36	0.00	-2.37	0.00	1693.59
41	1	41	0.00	0.36	0.00	-1.52	0.00	-1693.58
		42	0.00	98.63	0.00	1.52	0.00	1472.48
42	1	42	0.00	-98.64	0.00	1.59	0.00	-1472.47
		43	0.00	197.66	0.00	-1.59	0.00	805.68
43	1	43	0.00	-197.66	0.00	1.60	0.00	-805.68
		44	0.00	296.65	0.00	-1.60	0.00	-306.48
44	1	44	0.00	-296.65	0.00	1.60	0.00	306.48
		45	0.00	395.65	0.00	-1.60	0.00	-1864.13
45	1	45	0.00	-395.65	0.00	-1.64	0.00	1864.13
		46	0.00	508.82	0.00	1.64	0.00	-3537.34
46	1	46	0.00	-508.82	0.00	-12.71	0.00	3537.32
		47	0.00	552.67	0.00	12.71	0.00	-3962.05
47	1	47	0.00	553.06	0.00	-15.39	0.00	3962.07
		48	0.00	-509.26	0.00	15.39	0.00	-3537.53
48	1	48	0.00	509.26	0.00	-0.68	0.00	3537.56
		49	0.00	-396.06	0.00	0.68	0.00	-1862.34
49	1	49	0.00	396.06	0.00	-1.73	0.00	1862.34
		50	0.00	-297.08	0.00	1.73	0.00	-303.10
50	1	50	0.00	297.08	0.00	-1.73	0.00	303.09
		51	0.00	-198.07	0.00	1.73	0.00	811.03

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	1	51	0.00	198.08	0.00	-0.01	0.00	-811.03
		52	0.00	-99.07	0.00	0.01	0.00	1479.65
52	1	52	0.00	99.07	0.00	0.25	0.00	-1479.65
		53	0.00	-0.06	0.00	-0.25	0.00	1702.70
53	1	53	0.00	0.06	0.00	0.26	0.00	-1702.70
		54	0.00	98.93	0.00	-0.26	0.00	1480.27
54	1	54	0.00	-98.93	0.00	-0.01	0.00	-1480.28
		55	0.00	197.93	0.00	0.01	0.00	812.30
55	1	55	0.00	-197.93	0.00	1.85	0.00	-812.30
		56	0.00	296.93	0.00	-1.85	0.00	-301.04
56	1	56	0.00	-296.93	0.00	1.85	0.00	301.04
		57	0.00	395.94	0.00	-1.85	0.00	-1860.19
57	1	57	0.00	-395.94	0.00	5.90	0.00	1860.19
		58	0.00	509.11	0.00	-5.90	0.00	-3534.57
58	1	58	0.00	-509.12	0.00	-37.51	0.00	3534.38
		59	0.00	552.93	0.00	37.51	0.00	-3958.96
59	1	59	0.00	552.43	0.00	4.74	0.00	3959.10
		60	0.00	-508.57	0.00	-4.74	0.00	-3534.57
60	1	60	0.00	508.58	0.00	0.36	0.00	3534.57
		61	0.00	-395.39	0.00	-0.36	0.00	-1862.07
61	1	61	0.00	395.39	0.00	-2.85	0.00	1862.07
		62	0.00	-296.39	0.00	2.85	0.00	-305.59
62	1	62	0.00	296.39	0.00	-2.26	0.00	305.59
		63	0.00	-197.40	0.00	2.26	0.00	805.36
63	1	63	0.00	197.41	0.00	1.15	0.00	-805.35
		64	0.00	-98.40	0.00	-1.15	0.00	1470.94
64	1	64	0.00	98.40	0.00	-1.97	0.00	-1470.94
		65	0.00	0.60	0.00	1.97	0.00	1690.99
65	1	65	0.00	-0.60	0.00	1.61	0.00	-1691.00
		66	0.00	99.60	0.00	-1.61	0.00	1465.53
66	1	66	0.00	-99.60	0.00	-1.49	0.00	-1465.53
		67	0.00	198.60	0.00	1.49	0.00	794.60
67	1	67	0.00	-198.60	0.00	2.01	0.00	-794.60
		68	0.00	297.61	0.00	-2.01	0.00	-321.99

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	1	68	0.00	-297.61	0.00	2.75	0.00	321.98
		69	0.00	396.59	0.00	-2.75	0.00	-1883.65
69	1	69	0.00	-396.59	0.00	0.22	0.00	1883.65
		70	0.00	509.76	0.00	-0.22	0.00	-3560.40
70	1	70	0.00	-509.77	0.00	-18.61	0.00	3560.35
		71	0.00	553.64	0.00	18.61	0.00	-3986.00
71	1	71	0.00	555.17	0.00	32.23	0.00	3985.90
		72	0.00	-511.37	0.00	-32.23	0.00	-3559.68
72	1	72	0.00	511.37	0.00	-4.64	0.00	3559.83
		73	0.00	-398.18	0.00	4.64	0.00	-1877.03
73	1	73	0.00	398.18	0.00	-1.17	0.00	1877.04
		74	0.00	-299.17	0.00	1.17	0.00	-307.82
74	1	74	0.00	299.17	0.00	-1.17	0.00	307.82
		75	0.00	-200.18	0.00	1.17	0.00	815.61
75	1	75	0.00	200.18	0.00	0.69	0.00	-815.61
		76	0.00	-101.16	0.00	-0.69	0.00	1493.77
76	1	76	0.00	101.16	0.00	0.44	0.00	-1493.77
		77	0.00	-2.17	0.00	-0.44	0.00	1726.26
77	1	77	0.00	2.17	0.00	0.75	0.00	-1726.26
		78	0.00	96.83	0.00	-0.75	0.00	1513.28
78	1	78	0.00	-96.83	0.00	0.48	0.00	-1513.27
		79	0.00	195.82	0.00	-0.48	0.00	854.84
79	1	79	0.00	-195.83	0.00	2.44	0.00	-854.83
		80	0.00	294.83	0.00	-2.44	0.00	-249.20
80	1	80	0.00	-294.83	0.00	2.39	0.00	249.20
		81	0.00	393.83	0.00	-2.39	0.00	-1798.78
81	1	81	0.00	-393.84	0.00	2.68	0.00	1798.78
		82	0.00	507.00	0.00	-2.68	0.00	-3465.15
82	1	82	0.00	-506.99	0.00	2.81	0.00	3465.16
		83	0.00	550.81	0.00	-2.81	0.00	-3888.06
83	1	83	0.00	545.46	0.00	0.30	0.00	3887.96
		84	0.00	-501.59	0.00	-0.30	0.00	-3468.85
84	1	84	0.00	501.59	0.00	0.01	0.00	3468.85
		85	0.00	-388.43	0.00	-0.01	0.00	-1822.48

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	1	85	0.00	388.43	0.00	-4.15	0.00	1822.48
		86	0.00	-289.44	0.00	4.15	0.00	-297.41
86	1	86	0.00	289.44	0.00	-4.15	0.00	297.41
		87	0.00	-190.42	0.00	4.15	0.00	782.41
87	1	87	0.00	190.42	0.00	-4.14	0.00	-782.41
		88	0.00	-91.43	0.00	4.14	0.00	1416.53
88	1	88	0.00	91.43	0.00	-1.14	0.00	-1416.53
		89	0.00	7.57	0.00	1.14	0.00	1605.23
89	1	89	0.00	-7.57	0.00	-4.55	0.00	-1605.21
		90	0.00	106.58	0.00	4.55	0.00	1348.34
90	1	90	0.00	-106.58	0.00	-1.69	0.00	-1348.34
		91	0.00	205.58	0.00	1.69	0.00	645.98
91	1	91	0.00	-205.58	0.00	-1.68	0.00	-645.97
		92	0.00	304.56	0.00	1.68	0.00	-501.60
92	1	92	0.00	-304.56	0.00	-2.83	0.00	501.59
		93	0.00	403.57	0.00	2.83	0.00	-2095.05
93	1	93	0.00	-403.57	0.00	-0.49	0.00	2095.05
		94	0.00	516.76	0.00	0.49	0.00	-3797.88
94	1	94	0.00	-516.76	0.00	24.58	0.00	3797.80
		95	0.00	560.57	0.00	-24.58	0.00	-4228.46
95	1	95	0.00	590.54	0.00	-0.22	0.00	4230.12
		96	0.00	-546.69	0.00	0.22	0.00	-3775.20
96	1	96	0.00	546.70	0.00	27.26	0.00	3775.10
		97	0.00	-433.51	0.00	-27.26	0.00	-1961.49
97	1	97	0.00	433.51	0.00	24.23	0.00	1961.53
		98	0.00	-325.71	0.00	-24.23	0.00	-101.46
98	1	98	0.00	325.71	0.00	24.01	0.00	101.51
		99	0.00	-217.90	0.00	-24.01	0.00	1230.45
99	1	99	0.00	217.90	0.00	21.44	0.00	-1230.49
		100	0.00	-110.12	0.00	-21.44	0.00	2033.98
100	1	100	0.00	110.12	0.00	25.37	0.00	-2033.93
		101	0.00	-2.32	0.00	-25.37	0.00	2309.44
101	1	101	0.00	2.31	0.00	25.76	0.00	-2309.43
		102	0.00	105.47	0.00	-25.76	0.00	2056.73

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	1	102	0.00	-105.47	0.00	30.07	0.00	-2056.67
		103	0.00	213.29	0.00	-30.07	0.00	1275.57
103	1	103	0.00	-213.29	0.00	29.32	0.00	-1275.58
		104	0.00	326.45	0.00	-29.32	0.00	277.25
104	1	104	0.00	-326.43	0.00	29.64	0.00	-277.20
		105	0.00	370.27	0.00	-29.64	0.00	-1.47

********** END OF LATEST ANALYSIS RESULT **********

139. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	0.00	360.43	0.00	-2.82	0.00	0.00
11	1	0.00	1138.35	0.00	-1.43	0.00	0.00
23	1	0.00	1099.97	0.00	-3.67	0.00	0.00
35	1	0.00	1107.71	0.00	-2.88	0.00	0.00
47	1	0.00	1105.73	0.00	1.38	0.00	0.00
59	1	0.00	1105.36	0.00	-1.10	0.00	0.00
71	1	0.00	1108.80	0.00	-0.40	0.00	0.00
83	1	0.00	1096.27	0.00	-2.69	0.00	0.00
95	1	0.00	1151.11	0.00	33.93	0.00	0.00
105	1	0.00	370.27	0.00	-29.67	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

140. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 1: 1:11 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 1: PP + BALASTO SECCIÓN COMPLETA + RCP (*)

(*) RCP concomitante con SC

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    23:53: 8                    *
*                                                *
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  1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
  2. UNIT MET MTON
  3. JOINT COORDINATES
  4. 1 0 0 8000
  5. 2 0.799999998666667 0 7999.99996
  6. 3 4.49999976269532 0 7999.99873437503
  7. 4 9.24999793892429 0 7999.99465234435
  8. 5 13.9999928541678 0 7999.98775000313
  9. 6 18.749982833867 0 7999.97802735381
 10. 7 23.4999662034651 0 7999.96548439982
 11. 8 28.2499412884074 0 7999.95012114558
 12. 9 32.9999064141421 0 7999.93193759651
 13. 10 36.6998712739297 0 7999.91581952263
 14. 11 37.4998626710493 0 7999.91210953593
 15. 12 38.2998536931703 0 7999.90831955011
 16. 13 41.9998070627659 0 7999.88975025323
 17. 14 46.4997381654814 0 7999.86485975548
 18. 15 50.9996545553895 0 7999.83743805055
 19. 16 55.4995548086885 0 7999.80748514713
 20. 17 59.999437501582 0 7999.77500105469
 21. 18 64.499301210279 0 7999.7399857835
 22. 19 68.9991445109945 0 7999.70243934465
 23. 20 73.49896597995 0 7999.66236175002
 24. 21 77.998764193374 0 7999.61975301228
 25. 22 81.6985798550281 0 7999.58282300081
 26. 23 82.4985377275021 0 7999.57461314493
 27. 24 83.2984947749906 0 7999.5663232933
 28. 25 86.9982851585779 0 7999.52694216223
 29. 26 91.4980050628533 0 7999.47674007929
 30. 27 95.9976960165887 0 7999.42400691197
 31. 28 100.497356596054 0 7999.36874267696
 32. 29 104.996985377528 0 7999.31094739176
 33. 30 109.496580937301 0 7999.25062107464
 34. 31 113.996141851672 0 7999.1877637447
 35. 32 118.495666696953 0 7999.12237542182
 36. 33 122.995154049465 0 7999.0544561267
 37. 34 126.694703448814 0 7998.99671534612
 38. 35 127.494602485542 0 7998.98400588081
 39. 36 128.294500247324 0 7998.97121642567
 40. 37 131.994010581532 0 7998.91102470646
 41. 38 136.493376913792 0 7998.83551262674
 42. 39 140.992700058696 0 7998.75746966553
 43. 40 145.49197859263 0 7998.67689584754
 44. 41 149.991211091994 0 7998.59379119825
 45. 42 154.490396133202 0 7998.50815574396
 46. 43 158.989532292685 0 7998.41998951176
 47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 1 PP + RCP CON SECCION DE BALASTO COMPLETA
131. SELFW Y -1
132. MEMBER LOAD
133. 1 TO 104 UNI GY -15.57
134. 1 TO 104 UMOM X 4.37
135. PERFORM ANALYSIS

                P R O B L E M   S T A T I S T I C S
                -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =    1/    1
   TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.          23:53:11
++ PROCESSING GLOBAL STIFFNESS MATRIX.          23:53:11
++ PROCESSING TRIANGULAR FACTORIZATION.         23:53:11
++ CALCULATING JOINT DISPLACEMENTS.             23:53:12
++ CALCULATING MEMBER  FORCES.                  23:53:12

 136. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	0.00	576.57	0.00	-86.68	0.00	0.02
		2	0.00	-520.28	0.00	83.18	0.00	438.73
2	1	2	0.00	520.26	0.00	-83.18	0.00	-438.72
		3	0.00	-349.47	0.00	67.01	0.00	2047.72
3	1	3	0.00	349.48	0.00	-62.57	0.00	-2047.86
		4	0.00	-171.02	0.00	41.81	0.00	3284.03
4	1	4	0.00	171.02	0.00	-48.94	0.00	-3283.92
		5	0.00	7.44	0.00	28.18	0.00	3672.43
5	1	5	0.00	-7.44	0.00	-20.82	0.00	-3672.47
		6	0.00	185.90	0.00	0.06	0.00	3213.28
6	1	6	0.00	-185.90	0.00	0.47	0.00	-3213.28
		7	0.00	364.36	0.00	-21.23	0.00	1906.43
7	1	7	0.00	-364.36	0.00	25.05	0.00	-1906.38
		8	0.00	542.81	0.00	-45.81	0.00	-248.13
8	1	8	0.00	-542.81	0.00	45.81	0.00	248.13
		9	0.00	721.27	0.00	-66.57	0.00	-3250.35
9	1	9	0.00	-721.27	0.00	71.08	0.00	3250.26
		10	0.00	892.05	0.00	-87.25	0.00	-6234.93
10	1	10	0.00	-892.06	0.00	30.41	0.00	6235.47
		11	0.00	948.36	0.00	-33.90	0.00	-6971.68
11	1	11	0.00	910.88	0.00	-65.57	0.00	6970.78
		12	0.00	-854.59	0.00	62.07	0.00	-6264.59
12	1	12	0.00	854.59	0.00	-97.01	0.00	6264.15
		13	0.00	-683.81	0.00	80.84	0.00	-3418.15
13	1	13	0.00	683.81	0.00	-84.69	0.00	3418.06
		14	0.00	-514.74	0.00	65.02	0.00	-721.32
14	1	14	0.00	514.74	0.00	-63.37	0.00	721.46
		15	0.00	-345.68	0.00	43.70	0.00	1214.50
15	1	15	0.00	345.68	0.00	-40.92	0.00	-1214.59
		16	0.00	-176.61	0.00	21.25	0.00	2389.74
16	1	16	0.00	176.61	0.00	-16.20	0.00	-2389.78
		17	0.00	-7.55	0.00	-3.47	0.00	2804.14

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	1	17	0.00	7.55	0.00	-2.47	0.00	-2804.13
		18	0.00	161.52	0.00	-17.20	0.00	2457.71
18	1	18	0.00	-161.52	0.00	22.40	0.00	-2457.66
		19	0.00	330.58	0.00	-42.07	0.00	1350.44
19	1	19	0.00	-330.58	0.00	42.07	0.00	-1350.45
		20	0.00	499.65	0.00	-61.73	0.00	-517.61
20	1	20	0.00	-499.65	0.00	61.64	0.00	517.62
		21	0.00	668.71	0.00	-81.30	0.00	-3146.43
21	1	21	0.00	-668.71	0.00	75.86	0.00	3146.57
		22	0.00	839.50	0.00	-92.03	0.00	-5936.77
22	1	22	0.00	-839.50	0.00	79.13	0.00	5936.96
		23	0.00	895.79	0.00	-82.62	0.00	-6631.04
23	1	23	0.00	901.13	0.00	-34.48	0.00	6629.42
		24	0.00	-844.83	0.00	30.98	0.00	-5931.04
24	1	24	0.00	844.83	0.00	-95.87	0.00	5930.35
		25	0.00	-674.04	0.00	79.70	0.00	-3120.42
25	1	25	0.00	674.04	0.00	-79.69	0.00	3120.42
		26	0.00	-504.98	0.00	60.02	0.00	-467.64
26	1	26	0.00	504.98	0.00	-61.17	0.00	467.49
		27	0.00	-335.91	0.00	41.51	0.00	1424.55
27	1	27	0.00	335.91	0.00	-44.77	0.00	-1424.46
		28	0.00	-166.86	0.00	25.11	0.00	2555.58
28	1	28	0.00	166.86	0.00	-19.71	0.00	-2555.63
		29	0.00	2.22	0.00	0.04	0.00	2926.11
29	1	29	0.00	-2.22	0.00	0.48	0.00	-2926.12
		30	0.00	171.30	0.00	-20.14	0.00	2535.65
30	1	30	0.00	-171.30	0.00	20.15	0.00	-2535.67
		31	0.00	340.34	0.00	-39.81	0.00	1384.62
31	1	31	0.00	-340.34	0.00	42.74	0.00	-1384.54
		32	0.00	509.43	0.00	-62.41	0.00	-527.68
32	1	32	0.00	-509.43	0.00	62.40	0.00	527.67
		33	0.00	678.48	0.00	-82.07	0.00	-3200.18
33	1	33	0.00	-678.47	0.00	88.50	0.00	3200.01
		34	0.00	849.27	0.00	-104.67	0.00	-6026.60

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	1	34	0.00	-849.27	0.00	36.65	0.00	6027.40
		35	0.00	905.58	0.00	-40.15	0.00	-6729.56
35	1	35	0.00	903.79	0.00	-81.20	0.00	6726.01
		36	0.00	-847.56	0.00	77.71	0.00	-6026.28
36	1	36	0.00	847.55	0.00	-96.84	0.00	6026.00
		37	0.00	-676.75	0.00	80.67	0.00	-3205.68
37	1	37	0.00	676.75	0.00	-79.43	0.00	3205.71
		38	0.00	-507.70	0.00	59.77	0.00	-540.98
38	1	38	0.00	507.70	0.00	-60.91	0.00	540.85
		39	0.00	-338.60	0.00	41.24	0.00	1363.63
39	1	39	0.00	338.61	0.00	-41.48	0.00	-1363.63
		40	0.00	-169.56	0.00	21.81	0.00	2506.92
40	1	40	0.00	169.55	0.00	-15.62	0.00	-2506.96
		41	0.00	-0.49	0.00	-4.04	0.00	2889.57
41	1	41	0.00	0.49	0.00	-2.58	0.00	-2889.56
		42	0.00	168.56	0.00	-17.08	0.00	2511.43
42	1	42	0.00	-168.56	0.00	22.38	0.00	-2511.39
		43	0.00	337.66	0.00	-42.05	0.00	1372.16
43	1	43	0.00	-337.66	0.00	42.06	0.00	-1372.15
		44	0.00	506.72	0.00	-61.72	0.00	-527.65
44	1	44	0.00	-506.72	0.00	61.72	0.00	527.66
		45	0.00	675.78	0.00	-81.39	0.00	-3188.23
45	1	45	0.00	-675.78	0.00	75.85	0.00	3188.37
		46	0.00	846.56	0.00	-92.02	0.00	-6004.59
46	1	46	0.00	-846.56	0.00	73.23	0.00	6004.85
		47	0.00	902.87	0.00	-76.73	0.00	-6704.84
47	1	47	0.00	903.32	0.00	-124.44	0.00	6699.90
		48	0.00	-847.07	0.00	120.95	0.00	-6000.39
48	1	48	0.00	847.07	0.00	-95.99	0.00	6000.84
		49	0.00	-676.25	0.00	79.81	0.00	-3182.03
49	1	49	0.00	676.25	0.00	-81.62	0.00	3181.98
		50	0.00	-507.22	0.00	61.96	0.00	-519.70
50	1	50	0.00	507.22	0.00	-61.96	0.00	519.70
		51	0.00	-338.15	0.00	42.29	0.00	1382.44

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	1	51	0.00	338.15	0.00	-39.36	0.00	-1382.52
		52	0.00	-169.07	0.00	19.70	0.00	2523.87
52	1	52	0.00	169.07	0.00	-19.25	0.00	-2523.87
		53	0.00	0.01	0.00	-0.41	0.00	2904.30
53	1	53	0.00	0.00	0.00	0.43	0.00	-2904.31
		54	0.00	169.04	0.00	-20.09	0.00	2523.98
54	1	54	0.00	-169.05	0.00	19.63	0.00	-2524.01
		55	0.00	338.12	0.00	-39.30	0.00	1382.79
55	1	55	0.00	-338.12	0.00	42.48	0.00	-1382.69
		56	0.00	507.17	0.00	-62.14	0.00	-519.05
56	1	56	0.00	-507.17	0.00	62.14	0.00	519.06
		57	0.00	676.26	0.00	-81.81	0.00	-3182.14
57	1	57	0.00	-676.26	0.00	88.74	0.00	3181.95
		58	0.00	847.05	0.00	-104.91	0.00	-6000.14
58	1	58	0.00	-847.05	0.00	31.21	0.00	6000.98
		59	0.00	903.31	0.00	-34.70	0.00	-6700.73
59	1	59	0.00	902.24	0.00	-90.27	0.00	6694.83
		60	0.00	-845.92	0.00	86.78	0.00	-5995.35
60	1	60	0.00	845.93	0.00	-94.21	0.00	5995.24
		61	0.00	-675.13	0.00	78.03	0.00	-3181.01
61	1	61	0.00	675.13	0.00	-83.52	0.00	3180.87
		62	0.00	-506.07	0.00	63.86	0.00	-523.25
62	1	62	0.00	506.07	0.00	-62.84	0.00	523.37
		63	0.00	-337.02	0.00	43.18	0.00	1373.40
63	1	63	0.00	337.02	0.00	-37.37	0.00	-1373.57
		64	0.00	-167.95	0.00	17.70	0.00	2509.79
64	1	64	0.00	167.95	0.00	-23.01	0.00	-2509.73
		65	0.00	1.11	0.00	3.35	0.00	2885.11
65	1	65	0.00	-1.12	0.00	2.76	0.00	-2885.11
		66	0.00	170.19	0.00	-22.42	0.00	2499.66
66	1	66	0.00	-170.19	0.00	17.13	0.00	-2499.70
		67	0.00	339.25	0.00	-36.80	0.00	1353.51
67	1	67	0.00	-339.25	0.00	42.76	0.00	-1353.34
		68	0.00	508.33	0.00	-62.43	0.00	-553.92

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	1	68	0.00	-508.33	0.00	63.70	0.00	553.77
		69	0.00	677.36	0.00	-83.36	0.00	-3221.09
69	1	69	0.00	-677.36	0.00	79.03	0.00	3221.19
		70	0.00	848.14	0.00	-95.20	0.00	-6043.37
70	1	70	0.00	-848.15	0.00	63.24	0.00	6043.79
		71	0.00	904.48	0.00	-66.74	0.00	-6745.32
71	1	71	0.00	906.73	0.00	-43.76	0.00	6739.00
		72	0.00	-850.49	0.00	40.26	0.00	-6036.77
72	1	72	0.00	850.49	0.00	-102.78	0.00	6036.03
		73	0.00	-679.69	0.00	86.61	0.00	-3204.98
73	1	73	0.00	679.69	0.00	-80.69	0.00	3205.14
		74	0.00	-510.61	0.00	61.03	0.00	-526.67
74	1	74	0.00	510.61	0.00	-61.03	0.00	526.67
		75	0.00	-341.56	0.00	41.37	0.00	1390.52
75	1	75	0.00	341.56	0.00	-38.19	0.00	-1390.60
		76	0.00	-172.47	0.00	18.52	0.00	2547.38
76	1	76	0.00	172.46	0.00	-18.95	0.00	-2547.37
		77	0.00	-3.40	0.00	-0.71	0.00	2943.08
77	1	77	0.00	3.41	0.00	1.23	0.00	-2943.08
		78	0.00	165.65	0.00	-20.90	0.00	2578.03
78	1	78	0.00	-165.65	0.00	20.44	0.00	-2578.01
		79	0.00	334.71	0.00	-40.11	0.00	1452.26
79	1	79	0.00	-334.71	0.00	43.43	0.00	-1452.16
		80	0.00	503.78	0.00	-63.10	0.00	-434.56
80	1	80	0.00	-503.79	0.00	63.02	0.00	434.57
		81	0.00	672.86	0.00	-82.69	0.00	-3082.16
81	1	81	0.00	-672.86	0.00	83.19	0.00	3082.14
		82	0.00	843.62	0.00	-99.35	0.00	-5887.36
82	1	82	0.00	-843.62	0.00	99.58	0.00	5887.36
		83	0.00	899.89	0.00	-103.07	0.00	-6584.40
83	1	83	0.00	890.74	0.00	-97.65	0.00	6576.82
		84	0.00	-834.40	0.00	94.15	0.00	-5886.29
84	1	84	0.00	834.40	0.00	-94.64	0.00	5886.28
		85	0.00	-663.64	0.00	78.47	0.00	-3115.18

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	1	85	0.00	663.64	0.00	-85.59	0.00	3114.99
		86	0.00	-494.59	0.00	65.93	0.00	-509.22
86	1	86	0.00	494.58	0.00	-65.92	0.00	509.21
		87	0.00	-325.50	0.00	46.25	0.00	1336.22
87	1	87	0.00	325.50	0.00	-46.24	0.00	-1336.23
		88	0.00	-156.45	0.00	26.58	0.00	2420.51
88	1	88	0.00	156.45	0.00	-21.46	0.00	-2420.58
		89	0.00	12.62	0.00	1.79	0.00	2744.17
89	1	89	0.00	-12.62	0.00	-7.62	0.00	-2744.17
		90	0.00	181.70	0.00	-12.05	0.00	2306.89
90	1	90	0.00	-181.70	0.00	16.95	0.00	-2306.85
		91	0.00	350.77	0.00	-36.61	0.00	1108.79
91	1	91	0.00	-350.77	0.00	36.62	0.00	-1108.79
		92	0.00	519.80	0.00	-56.28	0.00	-849.56
92	1	92	0.00	-519.80	0.00	54.34	0.00	849.69
		93	0.00	688.88	0.00	-74.01	0.00	-3569.49
93	1	93	0.00	-688.88	0.00	78.00	0.00	3569.40
		94	0.00	859.68	0.00	-94.17	0.00	-6434.61
94	1	94	0.00	-859.68	0.00	136.64	0.00	6433.85
		95	0.00	915.94	0.00	-140.13	0.00	-7143.66
95	1	95	0.00	965.09	0.00	-84.56	0.00	7138.55
		96	0.00	-908.79	0.00	81.06	0.00	-6388.96
96	1	96	0.00	908.81	0.00	-34.56	0.00	6389.38
		97	0.00	-738.00	0.00	18.39	0.00	-3342.39
97	1	97	0.00	738.00	0.00	-23.55	0.00	3342.36
		98	0.00	-553.91	0.00	2.14	0.00	-177.21
98	1	98	0.00	553.91	0.00	-2.51	0.00	177.20
		99	0.00	-369.80	0.00	-18.90	0.00	2086.08
99	1	99	0.00	369.81	0.00	14.53	0.00	-2086.11
		100	0.00	-185.75	0.00	-35.94	0.00	3446.92
100	1	100	0.00	185.75	0.00	42.61	0.00	-3446.84
		101	0.00	-1.64	0.00	-64.02	0.00	3905.99
101	1	101	0.00	1.64	0.00	64.69	0.00	-3905.98
		102	0.00	182.43	0.00	-86.10	0.00	3463.09

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	1	102	0.00	-182.43	0.00	93.35	0.00	-3462.91
		103	0.00	366.56	0.00	-114.77	0.00	2117.65
103	1	103	0.00	-366.55	0.00	113.53	0.00	-2117.71
		104	0.00	537.30	0.00	-129.70	0.00	445.86
104	1	104	0.00	-537.20	0.00	130.20	0.00	-445.66
		105	0.00	593.49	0.00	-133.69	0.00	-6.62

********** END OF LATEST ANALYSIS RESULT **********

137. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	0.00	576.57	0.00	-86.68	0.00	0.00
11	1	0.00	1859.24	0.00	-182.47	0.00	0.00
23	1	0.00	1796.92	0.00	-202.63	0.00	0.00
35	1	0.00	1809.37	0.00	-201.35	0.00	0.00
47	1	0.00	1806.19	0.00	-194.36	0.00	0.00
59	1	0.00	1805.55	0.00	-198.40	0.00	0.00
71	1	0.00	1811.21	0.00	-197.27	0.00	0.00
83	1	0.00	1790.63	0.00	-201.16	0.00	0.00
95	1	0.00	1881.03	0.00	-125.70	0.00	0.00
105	1	0.00	593.49	0.00	-133.86	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

138. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 23:53:16 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 2 : PP + BALASTO (-50% una vía, L compl.) + RCP(*)

(*) RCP CONCOMITANTES CON SC.

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    23:56:37                    *
*                                                *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 2
131. * PP + RCP CON 50% VIA DESBALASTADA EN TODA LONGITUD
132. SELFW Y -1
133. MEMBER LOAD
134. 1 TO 104 UNI GY -12.35
135. 1 TO 104 UMOM X 12.34
136. PERFORM ANALYSIS

                    P R O B L E M   S T A T I S T I C S
                    -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.                  23:56:40
++ PROCESSING GLOBAL STIFFNESS MATRIX.                   23:56:40
++ PROCESSING TRIANGULAR FACTORIZATION.                  23:56:40
++ CALCULATING JOINT DISPLACEMENTS.                      23:56:40
++ CALCULATING MEMBER  FORCES.                           23:56:41

137. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	2	1	0.00	531.87	0.00	-235.72	0.00	0.01
		2	0.00	-478.15	0.00	225.85	0.00	403.99
2	2	2	0.00	478.11	0.00	-225.85	0.00	-403.98
		3	0.00	-319.24	0.00	180.19	0.00	1879.06
3	2	3	0.00	319.24	0.00	-176.11	0.00	-1879.45
		4	0.00	-156.07	0.00	117.49	0.00	3008.33
4	2	4	0.00	156.07	0.00	-124.03	0.00	-3008.06
		5	0.00	7.09	0.00	65.41	0.00	3361.91
5	2	5	0.00	-7.09	0.00	-58.67	0.00	-3362.04
		6	0.00	170.25	0.00	0.06	0.00	2940.86
6	2	6	0.00	-170.25	0.00	0.44	0.00	-2940.87
		7	0.00	333.41	0.00	-59.05	0.00	1744.66
7	2	7	0.00	-333.41	0.00	62.55	0.00	-1744.55
		8	0.00	496.57	0.00	-121.16	0.00	-226.67
8	2	8	0.00	-496.57	0.00	121.16	0.00	226.66
		9	0.00	659.73	0.00	-179.78	0.00	-2972.91
9	2	9	0.00	-659.74	0.00	183.91	0.00	2972.66
		10	0.00	818.61	0.00	-229.57	0.00	-5707.61
10	2	10	0.00	-818.60	0.00	177.52	0.00	5709.46
		11	0.00	872.33	0.00	-187.39	0.00	-6385.89
11	2	11	0.00	837.78	0.00	-247.67	0.00	6383.20
		12	0.00	-784.06	0.00	237.80	0.00	-5734.46
12	2	12	0.00	784.06	0.00	-269.78	0.00	5733.05
		13	0.00	-625.20	0.00	224.12	0.00	-3125.94
13	2	13	0.00	625.20	0.00	-227.64	0.00	3125.69
		14	0.00	-470.62	0.00	172.11	0.00	-660.10
14	2	14	0.00	470.62	0.00	-170.59	0.00	660.49
		15	0.00	-316.05	0.00	115.06	0.00	1109.53
15	2	15	0.00	316.05	0.00	-112.52	0.00	-1109.79
		16	0.00	-161.47	0.00	56.99	0.00	2184.20
16	2	16	0.00	161.47	0.00	-52.36	0.00	-2184.32
		17	0.00	-6.90	0.00	-3.17	0.00	2563.15

VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	2	17	0.00	6.90	0.00	-2.26	0.00	-2563.15
		18	0.00	147.68	0.00	-53.27	0.00	2246.38
18	2	18	0.00	-147.68	0.00	58.03	0.00	-2246.26
		19	0.00	302.25	0.00	-113.56	0.00	1233.94
19	2	19	0.00	-302.25	0.00	113.56	0.00	-1233.93
		20	0.00	456.83	0.00	-169.09	0.00	-474.03
20	2	20	0.00	-456.83	0.00	169.00	0.00	474.06
		21	0.00	611.41	0.00	-224.53	0.00	-2877.58
21	2	21	0.00	-611.40	0.00	219.55	0.00	2877.97
		22	0.00	770.27	0.00	-265.21	0.00	-5434.08
22	2	22	0.00	-770.27	0.00	253.40	0.00	5434.65
		23	0.00	823.99	0.00	-263.27	0.00	-6072.33
23	2	23	0.00	828.74	0.00	-219.24	0.00	6068.42
		24	0.00	-775.02	0.00	209.37	0.00	-5426.92
24	2	24	0.00	775.02	0.00	-268.73	0.00	5424.30
		25	0.00	-616.15	0.00	223.07	0.00	-2850.64
25	2	25	0.00	616.15	0.00	-223.06	0.00	2850.64
		26	0.00	-461.57	0.00	167.53	0.00	-425.79
26	2	26	0.00	461.57	0.00	-168.58	0.00	425.37
		27	0.00	-306.99	0.00	113.05	0.00	1303.95
27	2	27	0.00	307.00	0.00	-116.04	0.00	-1303.69
		28	0.00	-152.44	0.00	60.51	0.00	2337.30
28	2	28	0.00	152.43	0.00	-55.57	0.00	-2337.42
		29	0.00	2.16	0.00	0.04	0.00	2675.58
29	2	29	0.00	-2.16	0.00	0.43	0.00	-2675.59
		30	0.00	156.74	0.00	-55.97	0.00	2318.03
30	2	30	0.00	-156.74	0.00	55.98	0.00	-2318.03
		31	0.00	311.29	0.00	-111.50	0.00	1265.08
31	2	31	0.00	-311.30	0.00	114.17	0.00	-1264.84
		32	0.00	465.89	0.00	-169.71	0.00	-484.05
32	2	32	0.00	-465.89	0.00	169.71	0.00	484.05
		33	0.00	620.45	0.00	-225.23	0.00	-2928.07
33	2	33	0.00	-620.45	0.00	231.12	0.00	2927.61
		34	0.00	779.33	0.00	-276.78	0.00	-5517.45

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	2	34	0.00	-779.33	0.00	214.50	0.00	5520.22
		35	0.00	833.07	0.00	-224.37	0.00	-6165.38
35	2	35	0.00	831.14	0.00	-261.99	0.00	6155.05
		36	0.00	-777.48	0.00	252.13	0.00	-5512.34
36	2	36	0.00	777.48	0.00	-269.63	0.00	5511.52
		37	0.00	-618.59	0.00	223.97	0.00	-2928.44
37	2	37	0.00	618.59	0.00	-222.83	0.00	2928.53
		38	0.00	-464.03	0.00	167.31	0.00	-492.87
38	2	38	0.00	464.04	0.00	-168.35	0.00	492.51
		39	0.00	-309.44	0.00	112.81	0.00	1248.07
39	2	39	0.00	309.44	0.00	-113.03	0.00	-1248.05
		40	0.00	-154.87	0.00	57.50	0.00	2292.67
40	2	40	0.00	154.87	0.00	-51.84	0.00	-2292.80
		41	0.00	-0.29	0.00	-3.69	0.00	2641.92
41	2	41	0.00	0.30	0.00	-2.37	0.00	-2641.93
		42	0.00	154.27	0.00	-53.16	0.00	2295.50
42	2	42	0.00	-154.27	0.00	58.01	0.00	-2295.40
		43	0.00	308.88	0.00	-113.55	0.00	1253.11
43	2	43	0.00	-308.88	0.00	113.55	0.00	-1253.13
		44	0.00	463.45	0.00	-169.08	0.00	-484.55
44	2	44	0.00	-463.45	0.00	169.08	0.00	484.55
		45	0.00	618.02	0.00	-224.61	0.00	-2917.78
45	2	45	0.00	-618.02	0.00	219.55	0.00	2918.17
		46	0.00	776.88	0.00	-265.20	0.00	-5498.63
46	2	46	0.00	-776.88	0.00	247.99	0.00	5499.43
		47	0.00	830.61	0.00	-257.87	0.00	-6142.63
47	2	47	0.00	830.67	0.00	-301.53	0.00	6128.60
		48	0.00	-777.00	0.00	291.67	0.00	-5486.13
48	2	48	0.00	776.99	0.00	-268.85	0.00	5487.30
		49	0.00	-618.09	0.00	223.18	0.00	-2905.79
49	2	49	0.00	618.09	0.00	-224.83	0.00	2905.66
		50	0.00	-463.54	0.00	169.31	0.00	-472.47
50	2	50	0.00	463.54	0.00	-169.31	0.00	472.46
		51	0.00	-308.97	0.00	113.78	0.00	1265.72

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	2	51	0.00	308.96	0.00	-111.10	0.00	-1265.96
		52	0.00	-154.38	0.00	55.56	0.00	2308.56
52	2	52	0.00	154.38	0.00	-55.16	0.00	-2308.57
		53	0.00	0.21	0.00	-0.38	0.00	2655.49
53	2	53	0.00	-0.21	0.00	0.39	0.00	-2655.48
		54	0.00	154.76	0.00	-55.91	0.00	2306.85
54	2	54	0.00	-154.76	0.00	55.50	0.00	-2306.86
		55	0.00	309.35	0.00	-111.03	0.00	1262.54
55	2	55	0.00	-309.35	0.00	113.93	0.00	-1262.28
		56	0.00	463.91	0.00	-169.46	0.00	-477.39
56	2	56	0.00	-463.91	0.00	169.46	0.00	477.39
		57	0.00	618.51	0.00	-225.00	0.00	-2913.15
57	2	57	0.00	-618.50	0.00	231.34	0.00	2912.65
		58	0.00	777.38	0.00	-276.99	0.00	-5495.10
58	2	58	0.00	-777.38	0.00	209.48	0.00	5498.09
		59	0.00	831.07	0.00	-219.35	0.00	-6141.10
59	2	59	0.00	829.63	0.00	-270.30	0.00	6123.96
		60	0.00	-775.89	0.00	260.43	0.00	-5481.56
60	2	60	0.00	775.90	0.00	-267.22	0.00	5481.23
		61	0.00	-617.01	0.00	221.56	0.00	-2904.10
61	2	61	0.00	617.01	0.00	-226.57	0.00	2903.72
		62	0.00	-462.44	0.00	171.04	0.00	-475.01
62	2	62	0.00	462.44	0.00	-170.12	0.00	475.34
		63	0.00	-307.88	0.00	114.59	0.00	1257.73
63	2	63	0.00	307.88	0.00	-109.27	0.00	-1258.20
		64	0.00	-153.30	0.00	53.74	0.00	2295.89
64	2	64	0.00	153.30	0.00	-58.59	0.00	-2295.78
		65	0.00	1.28	0.00	3.07	0.00	2637.82
65	2	65	0.00	-1.27	0.00	2.52	0.00	-2637.83
		66	0.00	155.85	0.00	-58.05	0.00	2284.28
66	2	66	0.00	-155.85	0.00	53.21	0.00	-2284.41
		67	0.00	310.43	0.00	-108.74	0.00	1235.30
67	2	67	0.00	-310.42	0.00	114.19	0.00	-1234.81
		68	0.00	465.01	0.00	-169.72	0.00	-510.11

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	2	68	0.00	-465.02	0.00	170.89	0.00	509.72
		69	0.00	619.56	0.00	-226.41	0.00	-2949.57
69	2	69	0.00	-619.56	0.00	222.44	0.00	2949.87
		70	0.00	778.43	0.00	-268.10	0.00	-5536.14
70	2	70	0.00	-778.43	0.00	238.83	0.00	5537.48
		71	0.00	832.19	0.00	-248.71	0.00	-6182.17
71	2	71	0.00	833.70	0.00	-227.76	0.00	6164.65
		72	0.00	-780.03	0.00	217.90	0.00	-5519.76
72	2	72	0.00	780.03	0.00	-275.05	0.00	5517.21
		73	0.00	-621.15	0.00	229.39	0.00	-2924.82
73	2	73	0.00	621.15	0.00	-223.99	0.00	2925.24
		74	0.00	-466.56	0.00	168.45	0.00	-477.62
74	2	74	0.00	466.56	0.00	-168.45	0.00	477.62
		75	0.00	-312.00	0.00	112.93	0.00	1273.95
75	2	75	0.00	312.00	0.00	-110.02	0.00	-1274.21
		76	0.00	-157.40	0.00	54.48	0.00	2330.55
76	2	76	0.00	157.40	0.00	-54.87	0.00	-2330.54
		77	0.00	-2.83	0.00	-0.66	0.00	2691.03
77	2	77	0.00	2.83	0.00	1.13	0.00	-2691.03
		78	0.00	151.74	0.00	-56.66	0.00	2355.98
78	2	78	0.00	-151.74	0.00	56.24	0.00	-2355.98
		79	0.00	306.31	0.00	-111.77	0.00	1325.42
79	2	79	0.00	-306.31	0.00	114.81	0.00	-1325.16
		80	0.00	460.89	0.00	-170.34	0.00	-401.15
80	2	80	0.00	-460.89	0.00	170.27	0.00	401.18
		81	0.00	615.47	0.00	-225.80	0.00	-2823.13
81	2	81	0.00	-615.48	0.00	226.26	0.00	2823.10
		82	0.00	774.33	0.00	-271.91	0.00	-5393.99
82	2	82	0.00	-774.33	0.00	272.11	0.00	5393.98
		83	0.00	828.02	0.00	-281.98	0.00	-6034.58
83	2	83	0.00	818.99	0.00	-277.07	0.00	6013.48
		84	0.00	-765.23	0.00	267.19	0.00	-5379.36
84	2	84	0.00	765.23	0.00	-267.64	0.00	5379.34
		85	0.00	-606.38	0.00	221.98	0.00	-2842.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	2	85	0.00	606.38	0.00	-228.48	0.00	2841.61
		86	0.00	-451.81	0.00	172.95	0.00	-460.88
86	2	86	0.00	451.81	0.00	-172.95	0.00	460.88
		87	0.00	-297.22	0.00	117.41	0.00	1224.66
87	2	87	0.00	297.22	0.00	-117.40	0.00	-1224.66
		88	0.00	-142.66	0.00	61.87	0.00	2214.29
88	2	88	0.00	142.66	0.00	-57.19	0.00	-2214.42
		89	0.00	11.92	0.00	1.66	0.00	2508.58
89	2	89	0.00	-11.92	0.00	-6.99	0.00	-2508.56
		90	0.00	166.52	0.00	-48.55	0.00	2107.04
90	2	90	0.00	-166.52	0.00	53.03	0.00	-2106.94
		91	0.00	321.09	0.00	-108.56	0.00	1009.83
91	2	91	0.00	-321.09	0.00	108.57	0.00	-1009.83
		92	0.00	475.63	0.00	-164.08	0.00	-782.40
92	2	92	0.00	-475.63	0.00	162.30	0.00	782.77
		93	0.00	630.22	0.00	-217.83	0.00	-3271.19
93	2	93	0.00	-630.22	0.00	221.49	0.00	3270.95
		94	0.00	789.11	0.00	-267.15	0.00	-5897.05
94	2	94	0.00	-789.11	0.00	306.07	0.00	5895.15
		95	0.00	842.80	0.00	-315.94	0.00	-6547.51
95	2	95	0.00	887.21	0.00	-237.44	0.00	6527.83
		96	0.00	-833.48	0.00	227.57	0.00	-5839.52
96	2	96	0.00	833.49	0.00	-185.06	0.00	5841.02
		97	0.00	-674.60	0.00	139.40	0.00	-3050.70
97	2	97	0.00	674.60	0.00	-144.11	0.00	3050.48
		98	0.00	-506.29	0.00	83.64	0.00	-157.34
98	2	98	0.00	506.29	0.00	-83.97	0.00	157.16
		99	0.00	-337.96	0.00	23.50	0.00	1911.41
99	2	99	0.00	337.96	0.00	-27.51	0.00	-1911.36
		100	0.00	-169.68	0.00	-32.95	0.00	3154.80
100	2	100	0.00	169.68	0.00	39.04	0.00	-3154.73
		101	0.00	-1.35	0.00	-99.51	0.00	3573.78
101	2	101	0.00	1.36	0.00	100.13	0.00	-3573.76
		102	0.00	166.94	0.00	-160.59	0.00	3168.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	2	102	0.00	-166.94	0.00	167.22	0.00	-3167.78
		103	0.00	335.29	0.00	-227.70	0.00	1937.07
103	2	103	0.00	-335.29	0.00	226.57	0.00	-1937.21
		104	0.00	494.13	0.00	-272.22	0.00	403.05
104	2	104	0.00	-494.16	0.00	272.67	0.00	-402.78
		105	0.00	547.88	0.00	-282.54	0.00	-14.06

********** END OF LATEST ANALYSIS RESULT **********

138. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	2	0.00	531.87	0.00	-235.72	0.00	0.00
11	2	0.00	1710.11	0.00	-511.08	0.00	0.00
23	2	0.00	1652.73	0.00	-560.82	0.00	0.00
35	2	0.00	1664.21	0.00	-559.68	0.00	0.00
47	2	0.00	1661.28	0.00	-553.30	0.00	0.00
59	2	0.00	1660.70	0.00	-557.06	0.00	0.00
71	2	0.00	1665.89	0.00	-556.09	0.00	0.00
83	2	0.00	1647.01	0.00	-559.72	0.00	0.00
95	2	0.00	1730.00	0.00	-463.07	0.00	0.00
105	2	0.00	547.88	0.00	-282.89	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

139. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 23:56:44 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 3: PP + BALASTO (-100% una vía en 15m) + RCP(*)

(*) (RCP concomit. con SC)

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*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    23:57: 0                    *
*                                                *
**************************************************

 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.6735009941 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 3
131. * PP + RCP CON 15 M SOBRE P-4 DESBALASTADA 1 VIA COMPLETA
132. SELFW Y -1
133. MEMBER LOAD
134. 1 TO 43 50 TO 104 UNI GY -15.57
135. 1 TO 43 50 TO 104 UMOM X 4.37
136. 44 TO 49 UNI GY 9.78
137. 44 TO 49 UMOM X 26.22
138. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
  ORIGINAL/FINAL BAND-WIDTH =     1/    1
  TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
  SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.                23:57: 3
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 23:57: 3
++ PROCESSING TRIANGULAR FACTORIZATION.                23:57: 3
++ CALCULATING JOINT DISPLACEMENTS.                    23:57: 4
++ CALCULATING MEMBER  FORCES.                         23:57: 4

139. PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	3	1	0.00	576.65	0.00	-86.68	0.00	0.02
		2	0.00	-520.35	0.00	83.18	0.00	438.82
2	3	2	0.00	520.37	0.00	-83.18	0.00	-438.81
		3	0.00	-349.58	0.00	67.01	0.00	2048.21
3	3	3	0.00	349.58	0.00	-62.56	0.00	-2048.36
		4	0.00	-171.13	0.00	41.81	0.00	3285.04
4	3	4	0.00	171.13	0.00	-48.94	0.00	-3284.94
		5	0.00	7.33	0.00	28.18	0.00	3673.96
5	3	5	0.00	-7.33	0.00	-20.82	0.00	-3674.00
		6	0.00	185.79	0.00	0.06	0.00	3215.34
6	3	6	0.00	-185.79	0.00	0.48	0.00	-3215.35
		7	0.00	364.25	0.00	-21.23	0.00	1909.00
7	3	7	0.00	-364.25	0.00	25.06	0.00	-1908.96
		8	0.00	542.70	0.00	-45.82	0.00	-245.04
8	3	8	0.00	-542.70	0.00	45.82	0.00	245.03
		9	0.00	721.16	0.00	-66.58	0.00	-3246.74
9	3	9	0.00	-721.16	0.00	71.09	0.00	3246.64
		10	0.00	891.95	0.00	-87.26	0.00	-6230.91
10	3	10	0.00	-891.95	0.00	30.45	0.00	6231.44
		11	0.00	948.25	0.00	-33.94	0.00	-6967.57
11	3	11	0.00	910.48	0.00	-65.61	0.00	6966.67
		12	0.00	-854.18	0.00	62.11	0.00	-6260.81
12	3	12	0.00	854.18	0.00	-97.03	0.00	6260.36
		13	0.00	-683.40	0.00	80.87	0.00	-3415.85
13	3	13	0.00	683.40	0.00	-84.71	0.00	3415.76
		14	0.00	-514.34	0.00	65.04	0.00	-720.84
14	3	14	0.00	514.34	0.00	-63.39	0.00	720.99
		15	0.00	-345.27	0.00	43.73	0.00	1213.17
15	3	15	0.00	345.28	0.00	-40.94	0.00	-1213.26
		16	0.00	-176.21	0.00	21.28	0.00	2386.59
16	3	16	0.00	176.21	0.00	-16.23	0.00	-2386.64
		17	0.00	-7.14	0.00	-3.44	0.00	2799.17

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	3	17	0.00	7.15	0.00	-2.49	0.00	-2799.16
		18	0.00	161.92	0.00	-17.18	0.00	2450.93
18	3	18	0.00	-161.92	0.00	22.37	0.00	-2450.88
		19	0.00	330.99	0.00	-42.03	0.00	1341.85
19	3	19	0.00	-330.99	0.00	42.03	0.00	-1341.85
		20	0.00	500.05	0.00	-61.70	0.00	-528.02
20	3	20	0.00	-500.05	0.00	61.60	0.00	528.03
		21	0.00	669.12	0.00	-81.27	0.00	-3158.66
21	3	21	0.00	-669.12	0.00	75.80	0.00	3158.79
		22	0.00	839.90	0.00	-91.97	0.00	-5950.48
22	3	22	0.00	-839.90	0.00	79.04	0.00	5950.67
		23	0.00	896.20	0.00	-82.54	0.00	-6645.08
23	3	23	0.00	902.52	0.00	-34.19	0.00	6643.46
		24	0.00	-846.22	0.00	30.69	0.00	-5943.97
24	3	24	0.00	846.22	0.00	-95.72	0.00	5943.28
		25	0.00	-675.43	0.00	79.55	0.00	-3128.21
25	3	25	0.00	675.43	0.00	-79.54	0.00	3128.21
		26	0.00	-506.37	0.00	59.88	0.00	-469.17
26	3	26	0.00	506.37	0.00	-61.03	0.00	469.01
		27	0.00	-337.30	0.00	41.37	0.00	1429.28
27	3	27	0.00	337.30	0.00	-44.64	0.00	-1429.19
		28	0.00	-168.25	0.00	24.98	0.00	2566.58
28	3	28	0.00	168.25	0.00	-19.55	0.00	-2566.63
		29	0.00	0.83	0.00	-0.11	0.00	2943.36
29	3	29	0.00	-0.83	0.00	0.63	0.00	-2943.36
		30	0.00	169.91	0.00	-20.30	0.00	2559.16
30	3	30	0.00	-169.91	0.00	20.31	0.00	-2559.16
		31	0.00	338.95	0.00	-39.97	0.00	1414.39
31	3	31	0.00	-338.95	0.00	42.96	0.00	-1414.29
		32	0.00	508.03	0.00	-62.63	0.00	-491.65
32	3	32	0.00	-508.04	0.00	62.62	0.00	491.66
		33	0.00	677.08	0.00	-82.29	0.00	-3157.90
33	3	33	0.00	-677.09	0.00	88.63	0.00	3157.73
		34	0.00	847.88	0.00	-104.80	0.00	-5979.17

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	3	34	0.00	-847.88	0.00	37.32	0.00	5979.98
		35	0.00	904.19	0.00	-40.82	0.00	-6681.02
35	3	35	0.00	898.57	0.00	-97.15	0.00	6677.26
		36	0.00	-842.34	0.00	93.65	0.00	-5981.70
36	3	36	0.00	842.34	0.00	-112.64	0.00	5981.37
		37	0.00	-671.54	0.00	96.47	0.00	-3180.34
37	3	37	0.00	671.53	0.00	-95.24	0.00	3180.38
		38	0.00	-502.49	0.00	75.58	0.00	-539.10
38	3	38	0.00	502.49	0.00	-76.71	0.00	538.94
		39	0.00	-333.39	0.00	57.05	0.00	1342.09
39	3	39	0.00	333.40	0.00	-57.28	0.00	-1342.07
		40	0.00	-164.35	0.00	37.61	0.00	2461.92
40	3	40	0.00	164.34	0.00	-31.53	0.00	-2461.99
		41	0.00	4.72	0.00	11.87	0.00	2821.13
41	3	41	0.00	-4.72	0.00	-18.34	0.00	-2821.10
		42	0.00	173.77	0.00	-1.33	0.00	2419.50
42	3	42	0.00	-173.78	0.00	6.44	0.00	-2419.51
		43	0.00	342.88	0.00	-26.10	0.00	1256.80
43	3	43	0.00	-342.87	0.00	26.11	0.00	-1256.81
		44	0.00	511.93	0.00	-45.77	0.00	-666.47
44	3	44	0.00	-511.94	0.00	45.77	0.00	666.46
		45	0.00	566.92	0.00	-163.76	0.00	-3093.84
45	3	45	0.00	-566.92	0.00	158.39	0.00	3094.12
		46	0.00	643.91	0.00	-255.40	0.00	-5334.07
46	3	46	0.00	-643.91	0.00	238.71	0.00	5334.85
		47	0.00	679.94	0.00	-259.69	0.00	-5864.55
47	3	47	0.00	680.16	0.00	-302.62	0.00	5850.44
		48	0.00	-644.18	0.00	281.66	0.00	-5321.19
48	3	48	0.00	644.18	0.00	-259.53	0.00	5322.32
		49	0.00	-567.18	0.00	162.49	0.00	-3080.78
49	3	49	0.00	567.18	0.00	-164.24	0.00	3080.69
		50	0.00	-512.20	0.00	46.27	0.00	-652.59
50	3	50	0.00	512.20	0.00	-46.27	0.00	652.58
		51	0.00	-343.13	0.00	26.60	0.00	1271.94

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	3	51	0.00	343.13	0.00	-23.91	0.00	-1271.99
		52	0.00	-174.05	0.00	4.24	0.00	2435.74
52	3	52	0.00	174.05	0.00	-3.81	0.00	-2435.73
		53	0.00	-4.97	0.00	-15.85	0.00	2838.56
53	3	53	0.00	4.97	0.00	15.87	0.00	-2838.55
		54	0.00	164.07	0.00	-35.53	0.00	2480.62
54	3	54	0.00	-164.07	0.00	35.08	0.00	-2480.63
		55	0.00	333.15	0.00	-54.75	0.00	1361.83
55	3	55	0.00	-333.15	0.00	57.88	0.00	-1361.69
		56	0.00	502.20	0.00	-77.54	0.00	-517.67
56	3	56	0.00	-502.20	0.00	77.54	0.00	517.67
		57	0.00	671.28	0.00	-97.21	0.00	-3158.36
57	3	57	0.00	-671.29	0.00	104.08	0.00	3158.14
		58	0.00	842.07	0.00	-120.25	0.00	-5957.92
58	3	58	0.00	-842.07	0.00	47.07	0.00	5958.95
		59	0.00	898.33	0.00	-50.56	0.00	-6654.72
59	3	59	0.00	900.91	0.00	-90.10	0.00	6648.26
		60	0.00	-844.59	0.00	86.61	0.00	-5949.84
60	3	60	0.00	844.59	0.00	-93.98	0.00	5949.73
		61	0.00	-673.79	0.00	77.81	0.00	-3140.44
61	3	61	0.00	673.80	0.00	-83.23	0.00	3140.31
		62	0.00	-504.73	0.00	63.56	0.00	-488.69
62	3	62	0.00	504.74	0.00	-62.61	0.00	488.81
		63	0.00	-335.68	0.00	42.95	0.00	1401.96
63	3	63	0.00	335.68	0.00	-37.02	0.00	-1402.14
		64	0.00	-166.61	0.00	17.35	0.00	2532.34
64	3	64	0.00	166.61	0.00	-22.71	0.00	-2532.30
		65	0.00	2.45	0.00	3.05	0.00	2901.66
65	3	65	0.00	-2.45	0.00	3.09	0.00	-2901.65
		66	0.00	171.52	0.00	-22.76	0.00	2510.23
66	3	66	0.00	-171.52	0.00	17.45	0.00	-2510.26
		67	0.00	340.58	0.00	-37.11	0.00	1358.05
67	3	67	0.00	-340.58	0.00	43.10	0.00	-1357.88
		68	0.00	509.66	0.00	-62.76	0.00	-555.37

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	3	68	0.00	-509.66	0.00	64.03	0.00	555.22
		69	0.00	678.70	0.00	-83.70	0.00	-3228.54
69	3	69	0.00	-678.70	0.00	79.36	0.00	3228.65
		70	0.00	849.48	0.00	-95.52	0.00	-6055.76
70	3	70	0.00	-849.48	0.00	63.51	0.00	6056.19
		71	0.00	905.81	0.00	-67.00	0.00	-6758.78
71	3	71	0.00	907.11	0.00	-43.73	0.00	6752.45
		72	0.00	-850.87	0.00	40.24	0.00	-6049.91
72	3	72	0.00	850.87	0.00	-102.90	0.00	6049.17
		73	0.00	-680.08	0.00	86.73	0.00	-3216.70
73	3	73	0.00	680.08	0.00	-80.78	0.00	3216.85
		74	0.00	-510.99	0.00	61.12	0.00	-536.65
74	3	74	0.00	510.99	0.00	-61.12	0.00	536.65
		75	0.00	-341.95	0.00	41.46	0.00	1382.26
75	3	75	0.00	341.94	0.00	-38.30	0.00	-1382.35
		76	0.00	-172.85	0.00	18.63	0.00	2540.87
76	3	76	0.00	172.85	0.00	-19.06	0.00	-2540.86
		77	0.00	-3.79	0.00	-0.60	0.00	2938.29
77	3	77	0.00	3.79	0.00	1.12	0.00	-2938.28
		78	0.00	165.27	0.00	-20.79	0.00	2574.98
78	3	78	0.00	-165.27	0.00	20.33	0.00	-2574.98
		79	0.00	334.33	0.00	-40.00	0.00	1450.94
79	3	79	0.00	-334.33	0.00	43.32	0.00	-1450.84
		80	0.00	503.40	0.00	-62.99	0.00	-434.13
80	3	80	0.00	-503.40	0.00	62.91	0.00	434.15
		81	0.00	672.47	0.00	-82.58	0.00	-3080.00
81	3	81	0.00	-672.47	0.00	83.07	0.00	3079.99
		82	0.00	843.24	0.00	-99.24	0.00	-5883.78
82	3	82	0.00	-843.24	0.00	99.46	0.00	5883.78
		83	0.00	899.51	0.00	-102.96	0.00	-6580.51
83	3	83	0.00	890.63	0.00	-97.62	0.00	6572.94
		84	0.00	-834.29	0.00	94.12	0.00	-5882.49
84	3	84	0.00	834.29	0.00	-94.61	0.00	5882.49
		85	0.00	-663.52	0.00	78.44	0.00	-3111.80

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	3	85	0.00	663.53	0.00	-85.55	0.00	3111.61
		86	0.00	-494.48	0.00	65.89	0.00	-506.33
86	3	86	0.00	494.47	0.00	-65.89	0.00	506.33
		87	0.00	-325.38	0.00	46.22	0.00	1338.60
87	3	87	0.00	325.39	0.00	-46.21	0.00	-1338.61
		88	0.00	-156.33	0.00	26.54	0.00	2422.39
88	3	88	0.00	156.33	0.00	-21.42	0.00	-2422.44
		89	0.00	12.73	0.00	1.76	0.00	2745.57
89	3	89	0.00	-12.73	0.00	-7.59	0.00	-2745.55
		90	0.00	181.81	0.00	-12.08	0.00	2307.76
90	3	90	0.00	-181.82	0.00	16.98	0.00	-2307.73
		91	0.00	350.88	0.00	-36.65	0.00	1109.18
91	3	91	0.00	-350.88	0.00	36.66	0.00	-1109.17
		92	0.00	519.91	0.00	-56.32	0.00	-849.69
92	3	92	0.00	-519.91	0.00	54.38	0.00	849.81
		93	0.00	688.99	0.00	-74.05	0.00	-3570.11
93	3	93	0.00	-688.99	0.00	78.04	0.00	3570.03
		94	0.00	859.80	0.00	-94.21	0.00	-6435.65
94	3	94	0.00	-859.80	0.00	136.68	0.00	6434.89
		95	0.00	916.06	0.00	-140.18	0.00	-7144.78
95	3	95	0.00	965.12	0.00	-84.58	0.00	7139.68
		96	0.00	-908.82	0.00	81.09	0.00	-6390.05
96	3	96	0.00	908.84	0.00	-34.57	0.00	6390.48
		97	0.00	-738.03	0.00	18.40	0.00	-3343.39
97	3	97	0.00	738.03	0.00	-23.57	0.00	3343.35
		98	0.00	-553.94	0.00	2.15	0.00	-178.06
98	3	98	0.00	553.94	0.00	-2.53	0.00	178.05
		99	0.00	-369.83	0.00	-18.89	0.00	2085.37
99	3	99	0.00	369.83	0.00	14.52	0.00	-2085.41
		100	0.00	-185.78	0.00	-35.93	0.00	3446.36
100	3	100	0.00	185.78	0.00	42.59	0.00	-3446.28
		101	0.00	-1.67	0.00	-64.00	0.00	3905.58
101	3	101	0.00	1.67	0.00	64.67	0.00	-3905.57
		102	0.00	182.40	0.00	-86.08	0.00	3462.82

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	3	102	0.00	-182.40	0.00	93.33	0.00	-3462.65
		103	0.00	366.53	0.00	-114.75	0.00	2117.51
103	3	103	0.00	-366.53	0.00	113.51	0.00	-2117.59
		104	0.00	537.28	0.00	-129.68	0.00	445.84
104	3	104	0.00	-537.18	0.00	130.18	0.00	-445.62
		105	0.00	593.47	0.00	-133.68	0.00	-6.60

********** END OF LATEST ANALYSIS RESULT **********

140. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	3	0.00	576.65	0.00	-86.68	0.00	0.00
11	3	0.00	1858.73	0.00	-182.50	0.00	0.00
23	3	0.00	1798.71	0.00	-202.44	0.00	0.00
35	3	0.00	1802.76	0.00	-217.39	0.00	0.00
47	3	0.00	1360.10	0.00	-556.49	0.00	0.00
59	3	0.00	1799.24	0.00	-213.59	0.00	0.00
71	3	0.00	1812.93	0.00	-197.68	0.00	0.00
83	3	0.00	1790.14	0.00	-201.02	0.00	0.00
95	3	0.00	1881.18	0.00	-125.75	0.00	0.00
105	3	0.00	593.47	0.00	-133.84	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

141. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 23:57: 8 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 4: PRETENSADO TOTAL

(CONTINUIDAD + LANZAMIENTO)

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=    11:15:29                    *
*                                                *
**************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 4 PRETENSADO DEL TABLERO EN SERVICIO
131. MEMBER LOAD
132. * PRETENSADO DE LANZAMIENTO
133. 1 CON X 2680 0.01
134. 1 CMOM Z -2465 0.01
135. 104 CON X -2680 0.79
136. 104 CMOM Z 2465 0.79
137. 1 CON X 1976 0.01
138. 1 CMOM Z 2588.6 0.01
139. 104 CON X -1976 0.79
140. 104 CMOM Z -2588.6 0.79
141. * PRETENSADO DE CONTINUIDAD
142. * S/PILAS
143. 7 CON X 3840 2.75
144. 7 CMOM Z -3801.6 2.75
145. 14 CON X -3840 2.25
146. 14 CMOM Z 3801.6 2.25
147. 19 CON X 3840 2.25
148. 19 CMOM Z -3801.6 2.25
149. 26 CON X -3840 2.25
150. 26 CMOM Z 3801.6 2.25
151. 31 CON X 3840 2.25
152. 31 CMOM Z -3801.6 2.25
153. 38 CON X -3840 2.25
154. 38 CMOM Z 3801.6 2.25
155. 43 CON X 1976 2.25
156. 43 CMOM Z -3801.6 2.25
157. 50 CON X -3840 2.25
158. 50 CMOM Z 3801.6 2.25
159. 55 CON X 3840 2.25
160. 55 CMOM Z -3801.6 2.25
161. 62 CON X -3840 2.25
162. 62 CMOM Z 3801.6 2.25
163. 67 CON X 3840 2.25
164. 67 CMOM Z -3801.6 2.25
165. 74 CON X -3840 2.25
166. 74 CMOM Z 3801.6 2.25
167. 79 CON X 3840 2.25
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168. 79 CMOM Z -3801.6 2.25
169. 86 CON X -3840 2.25
170. 86 CMOM Z 3801.6 2.25
171. 91 CON X 3840 2.25
172. 91 CMOM Z -3801.6 2.25
173. 98 CON X -3840 2
174. 98 CMOM Z 3801.6 2
175. * CDV
176. 1 CON X 2626 0.01
177. 1 CMOM Z 4818.7 0.01
178. 7 CON X -2626 2.75
179. 7 CMOM Z -4818.7 2.75
180. 14 CON X 2626 2.25
181. 14 CMOM Z 4818.7 2.25
182. 19 CON X -2626 2.25
183. 19 CMOM Z -4818.7 2.25
184. 26 CON X 2626 2.25
185. 26 CMOM Z 4818.7 2.25
186. 31 CON X -2626 2.25
187. 31 CMOM Z -4818.7 2.25
188. 38 CON X 2626 2.25
189. 38 CMOM Z 4818.7 2.25
190. 43 CON X -2626 2.25
191. 43 CMOM Z -4818.7 2.25
192. 50 CON X 2626 2.25
193. 50 CMOM Z 4818.7 2.25
194. 55 CON X -2626 2.25
195. 55 CMOM Z -4818.7 2.25
196. 62 CON X 2626 2.25
197. 62 CMOM Z 4818.7 2.25
198. 67 CON X -2626 2.25
199. 67 CMOM Z -4818.7 2.25
200. 74 CON X 2626 2.25
201. 74 CMOM Z 4818.7 2.25
202. 79 CON X -2626 2.25
203. 79 CMOM Z -4818.7 2.25
204. 86 CON X 2626 2.25
205. 86 CMOM Z 4818.7 2.25
206. 91 CON X -2626 2.25
207. 91 CMOM Z -4818.7 2.25
208. 98 CON X 2626 2
209. 98 CMOM Z 4818.7 2
210. 102 CON X -2626 4.15
211. 102 CMOM Z -4818.7 4.15
213. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.              11:15:32
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++ PROCESSING GLOBAL STIFFNESS MATRIX.               11:15:32
++ PROCESSING TRIANGULAR FACTORIZATION.              11:15:32
++ CALCULATING JOINT DISPLACEMENTS.                  11:15:33
++ CALCULATING MEMBER  FORCES.                       11:15:33

 214. PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	4	1	1854.19	28.37	-18.68	11.20	89.97	0.02
		2	-9136.19	-28.37	18.68	-11.20	-75.02	-4919.59
2	4	2	9136.19	28.38	-18.68	11.20	75.02	4919.59
		3	-9136.19	-28.38	18.68	-11.20	-5.89	-4814.58
3	4	3	9136.21	28.39	1.16	0.74	5.89	4814.59
		4	-9136.21	-28.39	-1.16	-0.74	-11.42	-4679.76
4	4	4	9136.19	28.39	-18.68	10.91	11.42	4679.75
		5	-9136.19	-28.39	18.68	-10.91	77.33	-4544.93
5	4	5	9136.20	28.38	-0.36	1.80	-77.33	4544.92
		6	-9136.20	-28.38	0.36	-1.80	79.05	-4410.13
6	4	6	9136.21	28.38	1.16	1.06	-79.05	4410.11
		7	-9136.21	-28.38	-1.16	-1.06	73.52	-4275.30
7	4	7	9136.19	28.39	19.48	-7.51	-73.52	4275.30
		8	-10350.19	-28.39	-19.48	7.51	-19.03	4479.84
8	4	8	10350.19	28.38	19.48	-7.52	19.03	-4479.83
		9	-10350.19	-28.38	-19.48	7.52	-111.58	4614.66
9	4	9	10350.21	28.38	5.11	-13.92	111.58	-4614.64
		10	-10350.21	-28.38	-5.11	13.92	-130.48	4719.66
10	4	10	10349.71	28.39	99.48	29.10	130.46	-4719.59
		11	-10349.71	-28.39	-99.48	-29.10	-210.06	4742.30
11	4	11	10350.15	-5.15	-69.65	-12.09	93.64	-4742.31
		12	-10350.15	5.15	69.65	12.09	-37.92	4738.19
12	4	12	10350.41	-5.15	-11.92	14.33	37.92	-4738.19
		13	-10350.41	5.15	11.92	-14.33	6.19	4719.13
13	4	13	10350.41	-5.15	-0.28	19.64	-6.19	-4719.12
		14	-10350.41	5.15	0.28	-19.64	7.44	4695.94
14	4	14	10350.39	-5.15	-24.01	8.87	-7.44	-4695.97
		15	-9136.39	5.15	24.01	-8.87	115.49	-3947.50
15	4	15	9136.41	-5.15	-3.06	-0.18	-115.49	3947.51
		16	-9136.41	5.15	3.06	0.18	129.27	-3970.68
16	4	16	9136.39	-5.15	16.28	-8.58	-129.27	3970.67
		17	-9136.39	5.15	-16.28	8.58	56.02	-3993.84

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	4	17	9136.41	-5.15	-3.06	-0.13	-56.02	3993.86
		18	-9136.41	5.15	3.06	0.13	69.79	-4017.02
18	4	18	9136.40	-5.15	16.28	-8.63	-69.79	4017.02
		19	-9136.40	5.15	-16.28	8.63	-3.46	-4040.19
19	4	19	9136.40	-5.15	16.28	-8.63	3.46	4040.19
		20	-10350.40	5.15	-16.28	8.63	-76.71	4556.94
20	4	20	10350.40	-5.15	18.10	-7.83	76.71	-4556.94
		21	-10350.40	5.15	-18.10	7.83	-158.17	4533.76
21	4	21	10350.33	-5.15	36.01	0.02	158.18	-4533.77
		22	-10350.33	5.15	-36.01	-0.02	-291.43	4514.72
22	4	22	10350.20	-5.15	58.62	9.83	291.41	-4514.71
		23	-10350.20	5.15	-58.62	-9.83	-338.21	4510.59
23	4	23	10350.08	1.48	-128.24	-56.54	94.53	-4510.34
		24	-10350.08	-1.48	128.24	56.54	8.07	4511.52
24	4	24	10350.93	1.48	-15.00	-7.17	-8.07	-4511.87
		25	-10350.93	-1.48	15.00	7.17	63.55	4517.34
25	4	25	10350.92	1.48	-15.04	-7.19	-63.55	-4517.34
		26	-10350.92	-1.48	15.04	7.19	131.24	4524.00
26	4	26	10350.94	1.48	10.52	3.98	-131.24	-4524.00
		27	-9136.94	-1.48	-10.52	-3.98	83.92	-4089.64
27	4	27	9136.93	1.48	-10.43	13.35	-83.92	4089.62
		28	-9136.93	-1.48	10.43	-13.35	130.83	-4082.97
28	4	28	9136.93	1.48	8.90	4.72	-130.83	4082.98
		29	-9136.93	-1.48	-8.90	-4.72	90.80	-4076.33
29	4	29	9136.95	1.49	10.51	4.00	-90.80	4076.34
		30	-9136.95	-1.49	-10.51	-4.00	43.50	-4069.67
30	4	30	9136.92	1.48	10.53	3.98	-43.51	4069.68
		31	-9136.92	-1.48	-10.53	-3.98	-3.89	-4063.03
31	4	31	9136.88	1.48	29.84	-4.60	3.90	4063.02
		32	-10350.88	-1.48	-29.84	4.60	-138.20	4563.94
32	4	32	10350.86	1.47	29.88	-4.59	138.21	-4563.94
		33	-10350.86	-1.47	-29.88	4.59	-272.64	4570.58
33	4	33	10350.95	1.48	9.07	-13.77	272.65	-4570.57
		34	-10350.95	-1.48	-9.07	13.77	-306.22	4576.04

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	4	34	10350.43	1.48	126.73	37.87	306.09	-4575.90
		35	-10350.43	-1.48	-126.73	-37.87	-407.30	4577.09
35	4	35	10351.63	-0.40	-47.35	-17.69	-4.13	-4577.23
		36	-10351.63	0.40	47.35	17.69	41.93	4576.91
36	4	36	10351.69	-0.40	-14.55	-3.16	-41.99	-4576.95
		37	-10351.69	0.40	14.55	3.16	95.83	4575.48
37	4	37	10351.69	-0.40	-18.56	-4.93	-95.84	-4575.48
		38	-10351.69	0.40	18.56	4.93	179.35	4573.70
38	4	38	10351.72	-0.39	3.31	4.73	-179.36	-4573.69
		39	-9137.72	0.39	-3.31	-4.73	164.48	-4048.38
39	4	39	9137.66	-0.40	1.73	5.43	-164.48	4048.38
		40	-9137.66	0.40	-1.73	-5.43	156.70	-4050.16
40	4	40	9137.63	-0.39	24.29	-4.57	-156.69	4050.18
		41	-9137.63	0.39	-24.29	4.57	47.39	-4051.95
41	4	41	9137.68	-0.40	3.34	4.72	-47.38	4051.94
		42	-9137.68	0.40	-3.34	-4.72	32.35	-4053.73
42	4	42	9137.67	-0.40	22.64	-3.85	-32.35	4053.73
		43	-9137.67	0.40	-22.64	3.85	-69.56	-4055.51
43	4	43	9137.66	-0.40	22.68	-3.86	69.55	4055.52
		44	-8487.66	0.40	-22.68	3.86	-171.62	4563.01
44	4	44	8487.67	-0.40	22.68	-3.86	171.61	-4563.00
		45	-8487.67	0.40	-22.68	3.86	-273.67	4561.22
45	4	45	8487.59	-0.40	37.41	4.05	273.66	-4561.22
		46	-8487.59	0.40	-37.41	-4.05	-412.10	4559.75
46	4	46	8487.53	-0.40	64.36	18.33	412.16	-4559.72
		47	-8487.53	0.40	-64.36	-18.33	-463.46	4559.40
47	4	47	8488.48	0.02	27.96	25.56	-142.97	-4559.32
		48	-8488.48	-0.02	-27.96	-25.56	120.71	4559.33
48	4	48	8488.54	0.02	-7.77	6.60	-120.83	-4559.40
		49	-8488.54	-0.02	7.77	-6.60	149.58	4559.48
49	4	49	8488.61	0.02	-2.95	9.18	-149.58	-4559.48
		50	-8488.61	-0.02	2.95	-9.18	162.86	4559.59
50	4	50	8488.62	0.03	-2.99	9.16	-162.87	-4559.58
		51	-7274.62	-0.03	2.99	-9.16	176.33	-4060.61

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	4	51	7274.56	0.03	12.40	0.57	-176.33	4060.63
		52	-7274.56	-0.03	-12.40	-0.57	120.55	-4060.52
52	4	52	7274.60	0.02	13.68	-0.15	-120.54	4060.52
		53	-7274.60	-0.02	-13.68	0.15	58.96	-4060.42
53	4	53	7274.64	0.03	13.73	-0.17	-58.98	4060.42
		54	-7274.64	-0.03	-13.73	0.17	-2.79	-4060.30
54	4	54	7274.56	0.02	12.40	0.57	2.77	4060.31
		55	-7274.56	-0.02	-12.40	-0.57	-58.57	-4060.22
55	4	55	7274.52	0.03	29.12	-8.76	58.58	4060.20
		56	-8488.52	-0.03	-29.12	8.76	-189.57	4560.21
56	4	56	8488.47	0.02	29.05	-8.79	189.62	-4560.20
		57	-8488.47	-0.02	-29.05	8.79	-320.37	4560.30
57	4	57	8488.58	0.02	10.60	-18.71	320.38	-4560.28
		58	-8488.58	-0.02	-10.60	18.71	-359.59	4560.36
58	4	58	8487.43	0.02	111.76	37.30	360.84	-4560.25
		59	-8487.43	-0.02	-111.76	-37.30	-450.26	4560.27
59	4	59	8489.29	0.33	-16.05	8.72	-185.86	-4559.85
		60	-8489.29	-0.33	16.05	-8.72	199.55	4560.11
60	4	60	8489.58	0.33	-5.69	14.38	-199.20	-4560.10
		61	-8489.58	-0.33	5.69	-14.38	220.24	4561.32
61	4	61	8489.57	0.33	8.95	22.24	-220.27	-4561.29
		62	-8489.57	-0.33	-8.95	-22.24	179.98	4562.78
62	4	62	8489.59	0.33	-7.51	13.39	-180.01	-4562.81
		63	-7275.59	-0.33	7.51	-13.39	213.78	-4055.99
63	4	63	7275.55	0.33	23.28	-3.77	-213.81	4056.02
		64	-7275.55	-0.33	-23.28	3.77	109.07	-4054.52
64	4	64	7275.55	0.32	7.87	4.81	-109.06	4054.52
		65	-7275.55	-0.32	-7.87	-4.81	73.62	-4053.03
65	4	65	7275.56	0.33	23.27	-3.77	-73.63	4053.02
		66	-7275.56	-0.33	-23.27	3.77	-31.13	-4051.57
66	4	66	7275.54	0.33	7.87	4.81	31.15	4051.55
		67	-7275.54	-0.33	-7.87	-4.81	-66.54	-4050.05
67	4	67	7275.45	0.33	39.95	-13.04	66.54	4050.05
		68	-8489.45	-0.33	-39.95	13.04	-246.36	4571.77

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	4	68	8489.49	0.33	20.55	-23.49	246.37	-4571.71
		69	-8489.49	-0.33	-20.55	23.49	-338.80	4573.20
69	4	69	8489.45	0.33	31.97	-17.34	338.82	-4573.23
		70	-8489.45	-0.33	-31.97	17.34	-457.05	4574.45
70	4	70	8489.09	0.33	76.24	6.84	457.38	-4574.48
		71	-8489.09	-0.33	-76.24	-6.84	-518.15	4574.74
71	4	71	8490.25	-1.18	-70.46	-30.55	-248.00	-4573.92
		72	-8490.25	1.18	70.46	30.55	304.87	4572.97
72	4	72	8490.72	-1.19	17.58	16.81	-304.54	-4573.05
		73	-8490.72	1.19	-17.58	-16.81	239.49	4568.66
73	4	73	8490.70	-1.19	1.90	8.37	-239.47	-4568.69
		74	-8490.70	1.19	-1.90	-8.37	230.90	4563.35
74	4	74	8490.75	-1.18	1.97	8.40	-230.92	-4563.35
		75	-7276.75	1.18	-1.97	-8.40	222.04	-4062.28
75	4	75	7276.69	-1.19	18.59	-0.88	-222.04	4062.29
		76	-7276.69	1.19	-18.59	0.88	138.41	-4067.62
76	4	76	7276.65	-1.19	17.35	-0.19	-138.39	4067.63
		77	-7276.65	1.19	-17.35	0.19	60.29	-4072.95
77	4	77	7276.72	-1.19	18.64	-0.91	-60.28	4072.95
		78	-7276.72	1.19	-18.64	0.91	-23.59	-4078.30
78	4	78	7276.66	-1.19	17.36	-0.19	23.61	4078.28
		79	-7276.66	1.19	-17.36	0.19	-101.73	-4083.62
79	4	79	7276.62	-1.19	34.03	-9.55	101.74	4083.60
		80	-8490.62	1.19	-34.03	9.55	-254.89	4531.36
80	4	80	8490.63	-1.18	35.55	-8.75	254.89	-4531.36
		81	-8490.63	1.18	-35.55	8.75	-414.81	4526.03
81	4	81	8490.69	-1.18	34.16	-9.48	414.80	-4526.03
		82	-8490.69	1.18	-34.16	9.48	-541.20	4521.65
82	4	82	8490.98	-1.18	32.26	-9.65	542.02	-4521.64
		83	-8490.98	1.18	-32.26	9.65	-568.44	4520.70
83	4	83	8492.06	4.18	-7.99	5.28	-302.59	-4520.53
		84	-8492.06	-4.18	7.99	5.28	307.74	4523.87
84	4	84	8492.19	4.18	-6.86	-4.91	-308.27	-4523.87
		85	-8492.19	-4.18	6.86	4.91	333.68	4539.34

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	4	85	8492.20	4.18	12.51	5.47	-333.76	-4539.34
		86	-8492.20	-4.18	-12.51	-5.47	277.38	4558.15
86	4	86	8492.17	4.18	12.44	5.43	-277.43	-4558.15
		87	-7278.17	-4.18	-12.44	-5.43	221.45	-4043.34
87	4	87	7278.22	4.18	12.50	5.39	-221.45	4043.32
		88	-7278.22	-4.18	-12.50	-5.39	165.22	-4024.53
88	4	88	7278.14	4.18	27.88	-3.12	-165.20	4024.53
		89	-7278.14	-4.18	-27.88	3.12	39.71	-4005.71
89	4	89	7278.17	4.18	12.44	5.39	-39.69	4005.70
		90	-7278.17	-4.18	-12.44	-5.39	-16.25	-3986.89
90	4	90	7278.14	4.18	27.90	-3.08	16.27	3986.90
		91	-7278.14	-4.18	-27.90	3.08	-141.79	-3968.07
91	4	91	7278.13	4.18	27.95	-3.12	141.79	3968.09
		92	-8492.13	-4.18	-27.95	3.12	-267.60	4671.03
92	4	92	8492.03	4.18	47.34	7.54	267.58	-4671.02
		93	-8492.03	-4.18	-47.34	-7.54	-480.65	4689.84
93	4	93	8492.04	4.18	37.86	2.30	480.58	-4689.84
		94	-8492.04	-4.18	-37.86	-2.30	-620.69	4705.31
94	4	94	8492.02	4.18	-21.97	-28.76	620.39	-4705.22
		95	-8492.02	-4.18	21.97	28.76	-606.58	4708.57
95	4	95	8493.65	-26.86	63.82	-24.80	-483.97	-4711.62
		96	-8493.65	26.86	-63.82	24.80	430.62	4690.14
96	4	96	8493.64	-26.85	3.87	-58.94	-431.02	-4689.84
		97	-8493.64	26.85	-3.87	58.94	416.79	4590.48
97	4	97	8493.54	-26.85	16.97	-51.85	-416.76	-4590.57
		98	-8493.54	26.85	-16.97	51.85	333.66	4459.01
98	4	98	8493.54	-26.85	34.84	-42.47	-333.67	-4459.10
		99	-7279.55	26.85	-34.84	42.47	162.92	-4292.77
99	4	99	7279.55	-26.85	19.59	-33.48	-162.95	4292.85
		100	-7279.55	26.85	-19.59	33.48	67.01	-4424.38
100	4	100	7279.51	-26.85	33.65	-42.03	-66.99	4424.30
		101	-7279.51	26.85	-33.65	42.03	-97.93	-4555.89
101	4	101	7279.55	-26.85	34.90	-42.81	97.94	4555.89
		102	-7279.55	26.85	-34.90	42.81	-268.97	-4687.41

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	4	102	7279.39	-26.85	50.13	-52.62	268.96	4687.32
		103	-4653.39	26.85	-50.13	52.62	-514.68	-0.20
103	4	103	4653.46	-26.85	47.47	-52.62	514.72	0.23
		104	-4653.46	26.85	-47.47	52.62	-690.19	-99.56
104	4	104	4653.78	-26.81	53.53	-52.73	689.34	99.51
		105	2.22	26.81	-53.53	52.73	-732.29	2.63

********** END OF LATEST ANALYSIS RESULT **********

215. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	4	1854.19	28.37	-18.68	11.20	89.97	0.00
11	4	0.00	-33.53	-45.91	15.26	-116.41	0.00
23	4	0.00	6.63	-53.35	-8.18	-243.68	0.00
35	4	0.00	-1.88	-51.05	-1.16	-411.43	0.00
47	4	0.00	0.42	-45.10	2.57	-606.43	0.00
59	4	0.00	0.31	-34.90	21.36	-636.11	0.00
71	4	0.00	-1.51	-37.58	21.42	-766.15	0.00
83	4	0.00	5.36	-39.88	4.58	-871.03	0.00
95	4	0.00	-31.04	-32.14	-61.47	-1090.55	0.00
105	4	0.00	26.81	-53.58	52.80	-732.29	0.00

********** END OF LATEST ANALYSIS RESULT **********

216. PLOT BENDING FILE
217. PLOT DISP FILE
218. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 11:15:39 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 5: PRETENSADO DE LANZAMIENTO.

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=    11:15:52                    *
*                                                *
**************************************************
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```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 4 PRETENSADO DEL TABLERO EN SERVICIO
131. MEMBER LOAD
132. * PRETENSADO DE LANZAMIENTO
133. 1 CON X 2680 0.01
134. 1 CMOM Z -2465 0.01
135. 104 CON X -2680 0.79
136. 104 CMOM Z 2465 0.79
137. 1 CON X 1976 0.01
138. 1 CMOM Z 2588.6 0.01
139. 104 CON X -1976 0.79
140. 104 CMOM Z -2588.6 0.79
141. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.                 11:15:54
++ PROCESSING GLOBAL STIFFNESS MATRIX.                  11:15:55
++ PROCESSING TRIANGULAR FACTORIZATION.                 11:15:55
++ CALCULATING JOINT DISPLACEMENTS.                     11:15:55
++ CALCULATING MEMBER  FORCES.                          11:15:55

142. PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	4	1	-5.73	4.17	-9.60	0.14	47.35	0.00
		2	-4650.27	-4.17	9.60	-0.14	-39.67	-120.26
2	4	2	4650.27	4.17	-9.60	0.14	39.67	120.26
		3	-4650.27	-4.17	9.60	-0.14	-4.15	-104.84
3	4	3	4650.28	4.17	0.50	-0.09	4.15	104.84
		4	-4650.28	-4.17	-0.50	0.09	-6.52	-85.03
4	4	4	4650.27	4.17	-9.60	0.09	6.52	85.03
		5	-4650.27	-4.17	9.60	-0.09	39.08	-65.23
5	4	5	4650.28	4.17	-0.28	-0.04	-39.08	65.23
		6	-4650.28	-4.17	0.28	0.04	40.40	-45.43
6	4	6	4650.28	4.17	0.50	-0.04	-40.40	45.43
		7	-4650.28	-4.17	-0.50	0.04	38.02	-25.62
7	4	7	4650.27	4.17	9.83	-0.10	-38.02	25.62
		8	-4650.27	-4.17	-9.83	0.10	-8.65	-5.82
8	4	8	4650.27	4.17	9.83	-0.10	8.65	5.82
		9	-4650.27	-4.17	-9.83	0.10	-55.32	13.99
9	4	9	4650.28	4.17	3.37	-0.12	55.32	-13.99
		10	-4650.28	-4.17	-3.37	0.12	-67.78	29.41
10	4	10	4650.04	4.17	45.72	0.15	67.79	-29.41
		11	-4650.04	-4.17	-45.72	-0.15	-104.38	32.75
11	4	11	4650.25	-0.94	-32.71	-0.16	53.51	-32.75
		12	-4650.25	0.94	32.71	0.16	-27.34	32.00
12	4	12	4650.38	-0.94	-6.78	0.02	27.34	-32.00
		13	-4650.38	0.94	6.78	-0.02	-2.27	28.53
13	4	13	4650.39	-0.94	-1.54	0.05	2.27	-28.53
		14	-4650.39	0.94	1.54	-0.05	4.68	24.31
14	4	14	4650.37	-0.94	-12.21	-0.01	-4.68	-24.31
		15	-4650.37	0.94	12.21	0.01	59.62	20.09
15	4	15	4650.39	-0.94	-1.54	0.04	-59.62	-20.09
		16	-4650.39	0.94	1.54	-0.04	66.57	15.87
16	4	16	4650.38	-0.94	8.30	0.07	-66.57	-15.87
		17	-4650.38	0.94	-8.30	-0.07	29.22	11.65

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	4	17	4650.39	-0.94	-1.54	0.05	-29.22	-11.65
		18	-4650.39	0.94	1.54	-0.05	36.17	7.43
18	4	18	4650.38	-0.94	8.30	0.06	-36.17	-7.43
		19	-4650.38	0.94	-8.30	-0.06	-1.18	3.21
19	4	19	4650.37	-0.94	8.30	0.06	1.18	-3.21
		20	-4650.37	0.94	-8.30	-0.06	-38.53	-1.01
20	4	20	4650.38	-0.94	9.12	0.06	38.53	1.01
		21	-4650.38	0.94	-9.12	-0.06	-79.57	-5.23
21	4	21	4650.35	-0.94	17.17	0.05	79.57	5.23
		22	-4650.35	0.94	-17.17	-0.05	-143.09	-8.69
22	4	22	4650.37	-0.94	27.35	0.04	143.05	8.69
		23	-4650.37	0.94	-27.35	-0.04	-164.94	-9.44
23	4	23	4650.27	0.27	-57.42	0.09	39.75	9.44
		24	-4650.27	-0.27	57.42	-0.09	6.19	-9.23
24	4	24	4650.62	0.27	-6.54	-0.01	-6.19	9.23
		25	-4650.62	-0.27	6.54	0.01	30.39	-8.23
25	4	25	4650.62	0.27	-6.56	-0.01	-30.39	8.23
		26	-4650.62	-0.27	6.56	0.01	59.91	-7.02
26	4	26	4650.62	0.27	4.92	-0.03	-59.91	7.02
		27	-4650.62	-0.27	-4.92	0.03	37.76	-5.81
27	4	27	4650.61	0.27	-5.74	-0.02	-37.76	5.81
		28	-4650.61	-0.27	5.74	0.02	63.57	-4.60
28	4	28	4650.62	0.27	4.10	-0.03	-63.57	4.60
		29	-4650.62	-0.27	-4.10	0.03	45.13	-3.39
29	4	29	4650.63	0.27	4.92	-0.03	-45.13	3.39
		30	-4650.63	-0.27	-4.92	0.03	23.00	-2.18
30	4	30	4650.62	0.27	4.93	-0.03	-23.00	2.18
		31	-4650.62	-0.27	-4.93	0.03	0.81	-0.97
31	4	31	4650.61	0.27	14.76	-0.03	-0.81	0.97
		32	-4650.61	-0.27	-14.76	0.03	-65.62	0.25
32	4	32	4650.60	0.27	14.78	-0.03	65.62	-0.25
		33	-4650.60	-0.27	-14.78	0.03	-132.11	1.46
33	4	33	4650.62	0.27	5.43	-0.03	132.11	-1.46
		34	-4650.62	-0.27	-5.43	0.03	-152.19	2.45

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	4	34	4650.24	0.27	58.09	-0.01	152.24	-2.45
		35	-4650.24	-0.27	-58.09	0.01	-198.37	2.67
35	4	35	4650.91	-0.07	-21.41	0.00	-9.16	-2.67
		36	-4650.91	0.07	21.41	0.00	26.21	2.61
36	4	36	4650.98	-0.07	-6.53	0.01	-26.19	-2.61
		37	-4650.98	0.07	6.53	-0.01	50.36	2.34
37	4	37	4650.97	-0.07	-8.33	0.01	-50.35	-2.34
		38	-4650.97	0.07	8.33	-0.01	87.85	2.02
38	4	38	4650.97	-0.07	1.49	0.01	-87.84	-2.02
		39	-4650.97	0.07	-1.49	-0.01	81.12	1.70
39	4	39	4650.98	-0.07	0.69	0.01	-81.11	-1.70
		40	-4650.98	0.07	-0.69	-0.01	78.00	1.38
40	4	40	4650.96	-0.07	12.18	0.01	-77.99	-1.38
		41	-4650.96	0.07	-12.18	-0.01	23.21	1.05
41	4	41	4650.98	-0.07	1.51	0.01	-23.20	-1.05
		42	-4650.98	0.07	-1.51	-0.01	16.40	0.73
42	4	42	4650.96	-0.07	11.34	0.01	-16.39	-0.73
		43	-4650.96	0.07	-11.34	-0.01	-34.63	0.41
43	4	43	4650.97	-0.07	11.36	0.01	34.63	-0.41
		44	-4650.97	0.07	-11.36	-0.01	-85.73	0.09
44	4	44	4650.95	-0.07	11.35	0.01	85.73	-0.09
		45	-4650.95	0.07	-11.35	-0.01	-136.83	-0.24
45	4	45	4650.93	-0.07	19.43	0.01	136.84	0.24
		46	-4650.93	0.07	-19.43	-0.01	-208.72	-0.50
46	4	46	4650.83	-0.07	34.01	0.01	208.77	0.50
		47	-4650.83	0.07	-34.01	-0.01	-235.86	-0.56
47	4	47	4651.37	0.00	14.35	-0.01	-76.90	0.56
		48	-4651.37	0.00	-14.35	0.01	65.66	-0.56
48	4	48	4651.46	0.00	-5.15	-0.01	-65.60	0.56
		49	-4651.46	0.00	5.15	0.01	84.67	-0.56
49	4	49	4651.48	0.00	-2.51	-0.01	-84.67	0.56
		50	-4651.48	0.00	2.51	0.01	95.97	-0.56
50	4	50	4651.48	0.00	-2.53	-0.01	-95.97	0.56
		51	-4651.48	0.00	2.53	0.01	107.38	-0.56

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	4	51	4651.45	0.00	7.30	-0.01	-107.37	0.56
		52	-4651.45	0.00	-7.30	0.01	74.50	-0.56
52	4	52	4651.45	0.00	8.13	-0.01	-74.49	0.56
		53	-4651.45	0.00	-8.13	0.01	37.92	-0.56
53	4	53	4651.45	0.00	8.15	-0.01	-37.91	0.56
		54	-4651.45	0.00	-8.15	0.01	1.24	-0.56
54	4	54	4651.47	0.00	7.31	-0.01	-1.23	0.56
		55	-4651.47	0.00	-7.31	0.01	-31.66	-0.57
55	4	55	4651.43	0.00	18.00	-0.01	31.66	0.57
		56	-4651.43	0.00	-18.00	0.01	-112.63	-0.57
56	4	56	4651.44	0.00	17.97	-0.01	112.63	0.57
		57	-4651.44	0.00	-17.97	0.01	-193.51	-0.57
57	4	57	4651.47	0.00	7.84	-0.01	193.50	0.57
		58	-4651.47	0.00	-7.84	0.01	-222.53	-0.57
58	4	58	4651.13	0.00	64.94	-0.02	222.34	0.57
		59	-4651.13	0.00	-64.94	0.02	-274.64	-0.57
59	4	59	4652.16	0.07	-10.19	0.02	-97.89	0.57
		60	-4652.16	-0.07	10.19	-0.02	105.96	-0.51
60	4	60	4652.04	0.07	-4.56	0.02	-106.03	0.51
		61	-4652.04	-0.07	4.56	-0.02	122.91	-0.24
61	4	61	4652.09	0.07	3.47	0.02	-122.89	0.24
		62	-4652.09	-0.07	-3.47	-0.02	107.26	0.08
62	4	62	4652.09	0.07	-5.55	0.02	-107.25	-0.08
		63	-4652.09	-0.07	5.55	-0.02	132.22	0.41
63	4	63	4652.08	0.07	14.14	0.02	-132.23	-0.41
		64	-4652.08	-0.07	-14.14	-0.02	68.59	0.74
64	4	64	4652.08	0.07	4.30	0.02	-68.59	-0.74
		65	-4652.08	-0.07	-4.30	-0.02	49.26	1.06
65	4	65	4652.08	0.07	14.14	0.02	-49.27	-1.06
		66	-4652.08	-0.07	-14.14	-0.02	-14.36	1.39
66	4	66	4652.10	0.07	4.29	0.02	14.37	-1.39
		67	-4652.10	-0.07	-4.29	-0.02	-33.68	1.71
67	4	67	4652.01	0.07	24.80	0.03	33.69	-1.71
		68	-4652.01	-0.07	-24.80	-0.03	-145.30	2.04

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	4	68	4652.07	0.07	14.16	0.02	145.31	-2.04
		69	-4652.07	-0.07	-14.16	-0.02	-209.04	2.37
69	4	69	4652.08	0.07	20.43	0.03	209.02	-2.37
		70	-4652.08	-0.07	-20.43	-0.03	-284.65	2.63
70	4	70	4651.85	0.07	44.00	0.04	284.36	-2.63
		71	-4651.85	-0.07	-44.00	-0.04	-320.65	2.69
71	4	71	4652.69	-0.27	-39.16	-0.10	-140.66	-2.69
		72	-4652.69	0.27	39.16	0.10	172.17	2.48
72	4	72	4652.82	-0.27	9.01	-0.07	-172.07	-2.48
		73	-4652.82	0.27	-9.01	0.07	138.72	1.47
73	4	73	4652.81	-0.27	0.41	-0.08	-138.73	-1.47
		74	-4652.81	0.27	-0.41	0.08	136.86	0.25
74	4	74	4652.83	-0.27	0.45	-0.08	-136.87	-0.25
		75	-4652.83	0.27	-0.45	0.08	134.86	-0.97
75	4	75	4652.79	-0.27	11.08	-0.08	-134.85	0.97
		76	-4652.79	0.27	-11.08	0.08	85.01	-2.20
76	4	76	4652.80	-0.27	10.29	-0.08	-84.99	2.20
		77	-4652.80	0.27	-10.29	0.08	38.69	-3.42
77	4	77	4652.79	-0.27	11.11	-0.08	-38.68	3.42
		78	-4652.79	0.27	-11.11	0.08	-11.31	-4.64
78	4	78	4652.81	-0.27	10.29	-0.08	11.33	4.64
		79	-4652.81	0.27	-10.29	0.08	-57.62	-5.86
79	4	79	4652.77	-0.27	20.95	-0.09	57.64	5.86
		80	-4652.77	0.27	-20.95	0.09	-151.93	-7.09
80	4	80	4652.77	-0.27	21.78	-0.09	151.94	7.09
		81	-4652.77	0.27	-21.78	0.09	-249.92	-8.31
81	4	81	4652.79	-0.27	21.03	-0.09	249.90	8.31
		82	-4652.79	0.27	-21.03	0.09	-327.74	-9.32
82	4	82	4652.80	-0.27	19.13	-0.09	327.77	9.31
		83	-4652.80	0.27	-19.13	0.09	-344.71	-9.53
83	4	83	4653.79	0.95	-2.50	0.32	-180.38	9.55
		84	-4653.79	-0.95	2.50	-0.32	182.37	-8.79
84	4	84	4653.71	0.95	-3.51	0.32	-182.94	8.79
		85	-4653.71	-0.95	3.51	-0.32	195.95	-5.28

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	4	85	4653.73	0.95	7.12	0.31	-195.97	5.29
		86	-4653.73	-0.95	-7.12	-0.31	163.94	-1.02
86	4	86	4653.72	0.95	7.07	0.31	-163.96	1.02
		87	-4653.72	-0.95	-7.07	-0.31	132.11	3.24
87	4	87	4653.74	0.95	7.11	0.31	-132.11	-3.24
		88	-4653.74	-0.95	-7.11	-0.31	100.10	7.50
88	4	88	4653.71	0.95	16.96	0.33	-100.10	-7.50
		89	-4653.71	-0.95	-16.96	-0.33	23.79	11.77
89	4	89	4653.71	0.95	7.08	0.30	-23.80	-11.77
		90	-4653.71	-0.95	-7.08	-0.30	-8.05	16.03
90	4	90	4653.70	0.95	16.96	0.33	8.05	-16.03
		91	-4653.70	-0.95	-16.96	-0.33	-84.33	20.29
91	4	91	4653.68	0.95	17.00	0.33	84.35	-20.29
		92	-4653.68	-0.95	-17.00	-0.33	-160.85	24.55
92	4	92	4653.64	0.95	27.61	0.39	160.84	-24.55
		93	-4653.64	-0.95	-27.61	-0.39	-285.11	28.82
93	4	93	4653.64	0.95	22.42	0.36	285.12	-28.82
		94	-4653.64	-0.95	-22.42	-0.36	-368.09	32.32
94	4	94	4653.65	0.95	-8.28	0.14	367.79	-32.33
		95	-4653.65	-0.95	8.28	-0.14	-362.20	33.08
95	4	95	4654.48	-4.08	39.31	-1.16	-316.84	-33.17
		96	-4654.48	4.08	-39.31	1.16	285.40	29.90
96	4	96	4654.41	-4.08	4.95	-1.38	-285.56	-29.89
		97	-4654.41	4.08	-4.95	1.38	267.29	14.79
97	4	97	4654.39	-4.08	12.13	-1.35	-267.26	-14.80
		98	-4654.39	4.08	-12.13	1.35	207.81	-5.20
98	4	98	4654.38	-4.08	21.92	-1.36	-207.80	5.19
		99	-4654.38	4.08	-21.92	1.36	100.32	-25.19
99	4	99	4654.41	-4.08	12.18	-1.31	-100.32	25.19
		100	-4654.41	4.08	-12.18	1.31	40.67	-45.18
100	4	100	4654.41	-4.08	21.18	-1.40	-40.69	45.18
		101	-4654.41	4.08	-21.18	1.40	-63.11	-65.17
101	4	101	4654.40	-4.08	21.98	-1.41	63.12	65.17
		102	-4654.40	4.08	-21.98	1.41	-170.76	-85.17

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	4	102	4654.28	-4.08	31.72	-1.59	170.79	85.16
		103	-4654.28	4.08	-31.72	1.59	-326.17	-105.16
103	4	103	4654.41	-4.08	29.04	-1.53	326.20	105.16
		104	-4654.41	4.08	-29.04	1.53	-433.52	-120.25
104	4	104	4654.65	-4.08	35.39	-1.66	433.21	120.25
		105	1.35	4.08	-35.39	1.66	-461.21	0.08

********** END OF LATEST ANALYSIS RESULT **********

143. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	4	-5.73	4.17	-9.60	0.14	47.35	0.00
11	4	0.00	-5.11	-23.07	0.08	-50.87	0.00
23	4	0.00	1.21	-24.78	-0.07	-125.19	0.00
35	4	0.00	-0.34	-24.22	0.04	-207.53	0.00
47	4	0.00	0.07	-24.42	-0.02	-312.76	0.00
59	4	0.00	0.07	-24.22	0.03	-372.53	0.00
71	4	0.00	-0.34	-23.36	-0.10	-461.30	0.00
83	4	0.00	1.22	-21.45	0.41	-525.09	0.00
95	4	0.00	-5.03	-17.03	-1.76	-679.04	0.00
105	4	0.00	4.08	-35.42	1.66	-461.21	0.00

********** END OF LATEST ANALYSIS RESULT **********

144. PLOT BENDING FILE
145. PLOT DISP FILE
146. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 11:16: 1 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC - IAPF : L. Influencia M^{+}_{max}, c.v. ⑤ . 1 vía

(LOAD 10)

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 *****************************************************
 *                                                   *
 *           S T A A D - III                         *
 *           Revision 17.0                           *
 *           Proprietary Program of                  *
 *           RESEARCH ENGINEERS, Inc.                *
 *           Date=    MAR 31, 1998                   *
 *           Time=     0:33:48                       *
 *                                                   *
 *****************************************************

  1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
  2. UNIT MET MTON
  3. JOINT COORDINATES
  4. 1 0 0 8000
  5. 2 0.799999998666667 0 7999.99996
  6. 3 4.49999976269532 0 7999.99873437503
  7. 4 9.24999793892429 0 7999.99465234435
  8. 5 13.9999928541678 0 7999.98775000313
  9. 6 18.749982833867 0 7999.97802735381
 10. 7 23.4999662034651 0 7999.96548439982
 11. 8 28.2499412884074 0 7999.95012114558
 12. 9 32.9999064141421 0 7999.93193759651
 13. 10 36.6998712739297 0 7999.91581952263
 14. 11 37.4998626710493 0 7999.91210953593
 15. 12 38.2998536931703 0 7999.90831955011
 16. 13 41.9998070627659 0 7999.88975025323
 17. 14 46.4997381654814 0 7999.86485975548
 18. 15 50.9996545553895 0 7999.83743805055
 19. 16 55.4995548086885 0 7999.80748514713
 20. 17 59.999437501582 0 7999.77500105469
 21. 18 64.499301210279 0 7999.7399857835
 22. 19 68.9991445109945 0 7999.70243934465
 23. 20 73.49896597995 0 7999.66236175002
 24. 21 77.998764193374 0 7999.61975301228
 25. 22 81.6985798550281 0 7999.58282300081
 26. 23 82.4985377275021 0 7999.57461314493
 27. 24 83.2984947749906 0 7999.5663232933
 28. 25 86.9982851585779 0 7999.52694216223
 29. 26 91.4980050628533 0 7999.47674007929
 30. 27 95.9976960165887 0 7999.42400691197
 31. 28 100.497356596054 0 7999.36874267696
 32. 29 104.996985377528 0 7999.31094739176
 33. 30 109.496580937301 0 7999.25062107464
 34. 31 113.996141851672 0 7999.1877637447
 35. 32 118.495666696953 0 7999.12237542182
 36. 33 122.995154049465 0 7999.0544561267
 37. 34 126.694703448814 0 7998.99671534612
 38. 35 127.494602485542 0 7998.98400588081
 39. 36 128.294500247324 0 7998.97121642567
 40. 37 131.994010581532 0 7998.91102470646
 41. 38 136.493376913792 0 7998.83551262674
 42. 39 140.992700058696 0 7998.75746966553
 43. 40 145.49197859263 0 7998.67689584754
 44. 41 149.991211091994 0 7998.59379119825
 45. 42 154.490396133202 0 7998.50815574396
 46. 43 158.989532292685 0 7998.41998951176
 47. 44 163.488618146887 0 7998.32929252956
 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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105 390.744470082394 0 7990.45172434575
MEMBER INCIDENCES
1 1 2 104
MEMBER PROPERTIES
* TRAVIESAS
1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
*PRE-TRAVIESAS
2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
*SECCION TIPO (CENTROS DE VANO)
3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
CONSTANTS
E 3500000 ALL
DENSITY 2.5 ALL
ALPHA 1E-5 ALL
POISSON .2 ALL
SUPPORTS
1 FIXED BUT MZ
11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
LOAD 10
MEMBER LOAD
*LOCOMOTORA
47 TO 53 UNI GY -12
47 TO 53 UMOM X 27
54 UNI GY -12 0 3
54 UMOM X 27 0 3
*VAGONES
54 UNI GY -10 3 4.5
54 UMOM X 27 3 4.5
55 TO 58 UNI GY -10
55 TO 58 UMOM X 22.5
58 TO 70 UNI GY -1
58 TO 70 UMOM X 2.25
71 TO 82 UNI GY -10
71 TO 82 UMOM X 22.5
83 TO 94 UNI GY -1
83 TO 94 UMOM X 2.25
95 TO 104 UNI GY -10
95 TO 104 UMOM X 22.5
*RIPADO + F.CENTRIFUGA
*LOCOMOTORA
47 TO 53 UMOM X 4.96
47 TO 53 UNI Z .47244
54 UMOM X 4.96  0 3
54 UNI Z .47244 0 3
*VAGONES
54 UMOM X 4.13386 3 4.5
54 UNI Z 0.3937 3 4.5
55 TO 58 UMOM X 4.13386
54 TO 58 UNI Z 0.3937
58 TO 70 UMOM X .413386
58 TO 70 UNI Z 0.04
71 TO 82 UMOM X 4.13386
71 TO 82 UNI Z 0.3937
83 TO 94 UMOM X .413386
83 TO 94 UNI Z 0.04
95 TO 104 UMOM X 4.13386
```



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95 TO 104 UNI Z 0.3937
PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 105/ 104/ 10
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 1, TOTAL DEGREES OF FREEDOM = 589
SIZE OF STIFFNESS MATRIX = 7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE = 12.28 MEGA-BYTES

```
++ PROCESSING ELEMENT STIFFNESS MATRIX.          0:33:50
++ PROCESSING GLOBAL STIFFNESS MATRIX.           0:33:51
++ PROCESSING TRIANGULAR FACTORIZATION.          0:33:51
++ CALCULATING JOINT DISPLACEMENTS.              0:33:51
++ CALCULATING MEMBER  FORCES.                   0:33:51

PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	10	1	-2.00	0.91	0.00	0.01	-0.02	0.00
		2	2.00	-0.91	0.00	-0.01	0.02	0.73
2	10	2	-2.00	0.91	0.00	0.01	-0.02	-0.73
		3	2.00	-0.91	0.00	-0.01	0.00	4.10
3	10	3	-2.00	0.91	0.00	0.02	0.00	-4.10
		4	2.00	-0.91	0.00	-0.02	0.00	8.42
4	10	4	-2.00	0.91	0.00	0.00	0.00	-8.42
		5	2.00	-0.91	0.00	0.00	-0.02	12.74
5	10	5	-2.00	0.91	0.00	0.02	0.02	-12.74
		6	2.00	-0.91	0.00	-0.02	-0.02	17.07
6	10	6	-2.00	0.91	0.00	0.03	0.02	-17.07
		7	2.00	-0.91	0.00	-0.03	-0.02	21.39
7	10	7	-2.00	0.91	0.00	0.07	0.02	-21.39
		8	2.00	-0.91	0.00	-0.07	0.00	25.72
8	10	8	-2.00	0.91	0.00	0.07	0.00	-25.72
		9	2.00	-0.91	0.00	-0.07	0.02	30.04
9	10	9	-2.00	0.91	0.00	0.03	-0.02	-30.04
		10	2.00	-0.91	0.00	-0.03	0.03	33.41
10	10	10	-2.00	0.91	-0.02	0.33	-0.03	-33.41
		11	2.00	-0.91	0.02	-0.33	0.04	34.14
11	10	11	-2.00	-3.35	0.01	-0.36	-0.02	-34.14
		12	2.00	3.35	-0.01	0.36	0.01	31.46
12	10	12	-2.00	-3.35	0.00	-0.19	-0.01	-31.46
		13	2.00	3.35	0.00	0.19	0.00	19.07
13	10	13	-2.00	-3.35	0.00	-0.16	0.00	-19.07
		14	2.00	3.35	0.00	0.16	0.00	4.00
14	10	14	-2.00	-3.35	0.01	-0.17	0.00	-4.00
		15	2.00	3.35	-0.01	0.17	-0.03	-11.07
15	10	15	-2.00	-3.35	0.00	-0.20	0.03	11.07
		16	2.00	3.35	0.00	0.20	-0.03	-26.14
16	10	16	-2.00	-3.35	0.00	-0.25	0.03	26.14
		17	2.00	3.35	0.00	0.25	-0.01	-41.21

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	10	17	-2.00	-3.35	0.00	-0.17	0.01	41.21
		18	2.00	3.35	0.00	0.17	-0.02	-56.29
18	10	18	-2.00	-3.35	0.00	-0.29	0.02	56.28
		19	2.00	3.35	0.00	0.29	0.00	-71.36
19	10	19	-2.00	-3.35	0.00	-0.29	0.00	71.36
		20	2.00	3.35	0.00	0.29	0.02	-86.43
20	10	20	-2.00	-3.35	0.00	-0.30	-0.02	86.43
		21	2.00	3.35	0.00	0.30	0.03	-101.50
21	10	21	-2.00	-3.35	-0.01	-0.48	-0.03	101.50
		22	2.00	3.35	0.01	0.48	0.06	-113.89
22	10	22	-2.00	-3.35	-0.01	-0.72	-0.06	113.89
		23	2.00	3.35	0.01	0.72	0.07	-116.57
23	10	23	-2.00	11.55	0.02	2.38	-0.02	116.57
		24	2.00	-11.55	-0.02	-2.38	0.00	-107.33
24	10	24	-2.00	11.55	0.00	1.20	0.00	107.35
		25	2.00	-11.55	0.00	-1.20	-0.01	-64.62
25	10	25	-2.00	11.55	0.00	1.20	0.01	64.62
		26	2.00	-11.55	0.00	-1.20	-0.03	-12.66
26	10	26	-2.00	11.55	0.00	1.17	0.03	12.67
		27	2.00	-11.55	0.00	-1.17	-0.02	39.30
27	10	27	-2.00	11.55	0.00	1.08	0.02	-39.30
		28	2.00	-11.55	0.00	-1.08	-0.03	91.26
28	10	28	-2.00	11.55	0.00	1.28	0.03	-91.26
		29	2.00	-11.55	0.00	-1.28	-0.02	143.22
29	10	29	-2.00	11.55	0.00	1.30	0.02	-143.22
		30	2.00	-11.55	0.00	-1.30	-0.01	195.19
30	10	30	-2.00	11.55	0.00	1.30	0.01	-195.19
		31	2.00	-11.55	0.00	-1.30	0.00	247.14
31	10	31	-2.00	11.55	-0.01	1.82	0.00	-247.14
		32	2.00	-11.55	0.01	-1.82	0.03	299.11
32	10	32	-2.00	11.55	-0.01	1.83	-0.03	-299.11
		33	2.00	-11.55	0.01	-1.83	0.06	351.06
33	10	33	-2.00	11.55	0.00	1.12	-0.06	-351.07
		34	2.00	-11.55	0.00	-1.12	0.07	393.80

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	10	34	-2.00	11.56	-0.03	5.56	-0.07	-393.76
		35	2.00	-11.56	0.03	-5.56	0.09	403.00
35	10	35	-2.00	-39.96	0.01	-7.09	0.00	-403.14
		36	2.00	39.96	-0.01	7.09	-0.01	371.20
36	10	36	-2.00	-39.96	0.00	-5.92	0.01	-371.23
		37	2.00	39.96	0.00	5.92	-0.02	223.35
37	10	37	-2.00	-39.96	0.00	-6.00	0.02	-223.35
		38	2.00	39.96	0.00	6.00	-0.04	43.54
38	10	38	-2.00	-39.96	0.00	-5.91	0.04	-43.55
		39	2.00	39.96	0.00	5.91	-0.03	-136.30
39	10	39	-2.00	-39.96	0.00	-5.89	0.03	136.30
		40	2.00	39.96	0.00	5.89	-0.03	-316.12
40	10	40	-2.00	-39.96	-0.01	-6.67	0.03	316.10
		41	2.00	39.96	0.01	6.67	-0.01	-495.92
41	10	41	-2.00	-39.96	0.00	-5.53	0.01	495.94
		42	2.00	39.96	0.00	5.53	-0.01	-675.75
42	10	42	-2.00	-39.96	0.00	-6.96	0.01	675.74
		43	2.00	39.96	0.00	6.96	0.01	-855.60
43	10	43	-2.00	-39.96	0.00	-6.96	-0.01	855.60
		44	2.00	39.96	0.00	6.96	0.04	-1035.42
44	10	44	-2.00	-39.96	0.00	-6.96	-0.04	1035.41
		45	2.00	39.96	0.00	6.96	0.06	-1215.24
45	10	45	-2.00	-39.96	-0.01	-9.07	-0.06	1215.22
		46	2.00	39.96	0.01	9.07	0.09	-1363.08
46	10	46	-2.00	-40.01	-0.01	-13.34	-0.09	1363.03
		47	2.00	40.01	0.01	13.34	0.10	-1395.02
47	10	47	-1.71	271.99	-11.02	-703.83	86.61	1377.21
		48	1.71	-262.40	10.65	678.28	-77.95	-1163.65
48	10	48	-1.76	262.39	-10.64	-673.44	77.95	1166.46
		49	1.76	-217.98	8.89	555.16	-41.82	-277.55
49	10	49	-1.75	217.98	-8.89	-555.32	41.82	277.24
		50	1.75	-163.99	6.77	411.52	-6.60	582.04
50	10	50	-1.75	163.99	-6.77	-411.53	6.60	-582.03
		51	1.75	-109.99	4.64	267.70	19.06	1198.52

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	10	51	-1.74	109.99	-4.64	-265.17	-19.06	-1199.08
		52	1.74	-55.99	2.52	121.34	35.17	1572.58
52	10	52	-1.74	55.98	-2.52	-121.06	-35.17	-1572.61
		53	1.74	-1.98	0.39	-22.77	41.72	1703.04
53	10	53	-1.74	1.98	-0.39	22.78	-41.72	-1703.05
		54	1.74	52.01	-1.73	-166.58	38.69	1590.51
54	10	54	-1.74	-52.01	1.74	166.29	-38.69	-1590.54
		55	1.74	103.01	-5.51	-308.87	22.20	1237.22
55	10	55	-1.75	-103.01	5.51	311.72	-22.20	-1236.52
		56	1.75	148.00	-7.28	-431.56	-6.58	671.78
56	10	56	-1.75	-148.00	7.28	431.55	6.58	-671.79
		57	1.75	193.01	-9.05	-551.42	-43.34	-95.60
57	10	57	-1.73	-193.01	9.06	551.63	43.34	94.40
		58	1.73	230.01	-10.51	-650.18	-79.55	-877.00
58	10	58	-1.86	-230.01	10.49	639.36	79.55	884.93
		59	1.86	238.81	-10.84	-662.78	-88.08	-1072.35
59	10	59	-1.44	24.91	-0.90	-72.06	6.94	1045.77
		60	1.44	-24.11	0.86	69.93	-6.24	-1026.15
60	10	60	-1.44	24.12	-0.87	-71.20	6.24	1026.06
		61	1.44	-20.42	0.72	61.35	-3.30	-943.67
61	10	61	-1.44	20.41	-0.72	-62.97	3.30	943.56
		62	1.44	-15.91	0.54	50.99	-0.46	-861.83
62	10	62	-1.44	15.91	-0.54	-49.32	0.46	861.92
		63	1.44	-11.41	0.36	37.33	1.55	-800.44
63	10	63	-1.44	11.41	-0.36	-40.72	-1.55	800.27
		64	1.44	-6.91	0.18	28.73	2.79	-759.03
64	10	64	-1.44	6.91	-0.18	-27.13	-2.79	759.09
		65	1.44	-2.41	0.00	15.14	3.20	-738.09
65	10	65	-1.44	2.41	0.00	-16.70	-3.20	738.06
		66	1.44	2.09	-0.18	4.72	2.81	-737.32
66	10	66	-1.44	-2.08	0.18	-3.16	-2.81	737.33
		67	1.44	6.58	-0.36	-8.83	1.60	-756.83
67	10	67	-1.44	-6.59	0.35	5.49	-1.60	756.86
		68	1.44	11.09	-0.53	-17.48	-0.39	-796.63

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	10	68	-1.44	-11.08	0.54	19.30	0.39	796.59
		69	1.44	15.58	-0.72	-31.28	-3.20	-856.58
69	10	69	-1.44	-15.58	0.71	30.13	3.20	856.62
		70	1.44	19.28	-0.86	-39.98	-6.12	-921.13
70	10	70	-1.44	-19.27	0.85	35.11	6.12	921.32
		71	1.44	20.08	-0.89	-37.25	-6.81	-937.08
71	10	71	-1.19	221.97	-8.85	-576.19	68.06	921.00
		72	1.19	-213.98	8.53	554.90	-61.11	-746.78
72	10	72	-1.10	213.99	-8.55	-562.61	61.11	740.99
		73	1.10	-176.99	7.09	464.06	-32.19	-17.63
73	10	73	-1.11	176.99	-7.09	-464.02	32.19	18.49
		74	1.11	-131.98	5.31	344.16	-4.28	676.77
74	10	74	-1.11	131.98	-5.31	-344.15	4.28	-676.77
		75	1.11	-86.99	3.54	224.31	15.65	1169.40
75	10	75	-1.11	86.98	-3.55	-221.64	-15.65	-1169.90
		76	1.11	-41.98	1.77	101.77	27.62	1460.12
76	10	76	-1.11	41.98	-1.77	-102.01	-27.62	-1460.11
		77	1.11	3.02	0.00	-17.84	31.62	1547.75
77	10	77	-1.11	-3.02	0.00	18.11	-31.62	-1547.76
		78	1.11	48.02	-1.77	-137.96	27.64	1432.91
78	10	78	-1.11	-48.02	1.77	137.70	-27.64	-1432.93
		79	1.11	93.01	-3.54	-257.55	15.69	1115.63
79	10	79	-1.11	-93.02	3.54	260.11	-15.69	-1115.03
		80	1.11	138.02	-5.31	-379.97	-4.22	595.17
80	10	80	-1.11	-138.02	5.31	380.07	4.22	-595.10
		81	1.11	183.02	-7.08	-499.93	-32.10	-127.29
81	10	81	-1.11	-183.02	7.08	499.95	32.10	127.21
		82	1.11	220.02	-8.54	-598.49	-60.99	-872.75
82	10	82	-1.11	-220.03	8.54	598.52	60.99	872.72
		83	1.11	228.02	-8.85	-619.81	-67.95	-1051.88
83	10	83	-0.75	28.39	-0.90	-76.20	6.94	1025.60
		84	0.75	-27.58	0.87	74.07	-6.23	-1003.17
84	10	84	-0.75	27.59	-0.87	-74.15	6.23	1003.17
		85	0.75	-23.89	0.72	64.30	-3.30	-907.95

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	10	85	-0.74	23.89	-0.72	-66.37	3.30	907.80
		86	0.74	-19.39	0.54	54.39	-0.46	-810.43
86	10	86	-0.74	19.39	-0.54	-54.38	0.46	810.43
		87	0.74	-14.89	0.36	42.40	1.57	-733.31
87	10	87	-0.74	14.89	-0.36	-42.40	-1.57	733.30
		88	0.74	-10.39	0.18	30.42	2.79	-676.44
88	10	88	-0.74	10.39	-0.18	-31.85	-2.79	676.37
		89	0.74	-5.89	0.00	19.86	3.21	-639.75
89	10	89	-0.74	5.89	0.00	-18.50	-3.21	639.78
		90	0.74	-1.39	-0.18	6.52	2.81	-623.42
90	10	90	-0.74	1.39	0.18	-7.84	-2.81	623.40
		91	0.74	3.11	-0.36	-4.14	1.61	-627.28
91	10	91	-0.74	-3.11	0.36	4.14	-1.61	627.28
		92	0.74	7.61	-0.54	-16.12	-0.41	-651.40
92	10	92	-0.74	-7.61	0.54	14.63	0.41	651.44
		93	0.74	12.11	-0.72	-26.62	-3.22	-695.82
93	10	93	-0.74	-12.11	0.72	27.40	3.22	695.79
		94	0.74	15.81	-0.86	-37.25	-6.15	-747.45
94	10	94	-0.74	-15.83	0.87	42.19	6.15	747.19
		95	0.74	16.63	-0.90	-44.32	-6.85	-760.14
95	10	95	-0.32	210.52	-7.56	-489.59	49.70	734.19
		96	0.32	-202.52	7.25	468.28	-43.78	-568.96
96	10	96	-0.38	202.51	-7.24	-464.13	43.78	572.36
		97	0.38	-165.51	5.79	365.57	-19.66	108.56
97	10	97	-0.37	165.51	-5.79	-365.40	19.66	-109.12
		98	0.37	-116.51	3.86	234.90	3.97	800.05
98	10	98	-0.36	116.51	-3.86	-233.21	-3.97	-800.53
		99	0.36	-67.50	1.93	102.70	18.16	1251.40
99	10	99	-0.36	67.50	-1.93	-105.32	-18.16	-1251.18
		100	0.36	-18.51	0.00	-25.16	22.89	1461.87
100	10	100	-0.36	18.51	0.00	27.99	-22.89	-1461.81
		101	0.36	30.49	-1.93	-158.50	18.17	1432.47
101	10	101	-0.36	-30.49	1.93	158.75	-18.17	-1432.44
		102	0.36	79.48	-3.86	-289.24	4.00	1163.04

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	10	102	-0.37	-79.48	3.86	291.67	-4.00	-1162.42
		103	0.37	128.49	-5.79	-422.20	-19.62	652.79
103	10	103	-0.37	-128.49	5.79	421.82	19.63	-653.03
		104	0.37	165.49	-7.24	-520.35	-43.72	109.26
104	10	104	-0.38	-165.49	7.24	520.47	43.72	-108.67
		105	0.38	173.49	-7.56	-541.78	-49.64	-26.91

********** END OF LATEST ANALYSIS RESULT **********

172. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	10	-2.00	0.91	0.00	0.01	-0.02	0.00
11	10	0.00	-4.26	0.01	-0.29	0.02	0.00
23	10	0.00	14.90	0.01	1.60	0.05	0.00
35	10	0.00	-51.52	0.01	-7.87	0.09	0.00
47	10	0.00	312.01	-11.01	-689.29	86.71	0.00
59	10	0.00	263.71	-11.76	-746.79	-81.14	0.00
71	10	0.00	242.04	-9.76	-625.67	61.25	0.00
83	10	0.00	256.41	-9.76	-696.56	-61.01	0.00
95	10	0.00	227.15	-8.46	-524.02	42.84	0.00
105	10	0.00	173.49	-7.57	-542.45	-49.64	0.00

********** END OF LATEST ANALYSIS RESULT **********

173. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:33:55 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC - IAPF : L.INFLUENCIA $M^{+}_{C.VANO\ ⑨}$ - LÍNEA

(LOAD 11)

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:25: 5                       *
*                                                   *
*****************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 11
131. MEMBER LOAD
132. * LOCOMOTORA
133. 98 TO 104 UNI GY -12
134. 97 UNI GY -12 3.9 4.9
135. * VAGONES
136. 97 UNI GY -10 0 3.9
137. 95 96 UNI GY -10
138. 83 TO 94 UNI GY -1
139. 71 TO 82 UNI GY -10
140. 59 TO 70 UNI GY -1
141. 47 TO 58 UNI GY -10
142. 35 TO 46 UNI GY -1
143. 23 TO 34 UNI GY -10
144. 11 TO 22 UNI GY -1
145. 1 TO 10 UNI GY -10
146. *RIPADO + F.CENTRIFUGA + TORSOR POR BRAZO DEL TREN DE 2.25 M
147. * LOCOMOTORA
148. 98 TO 104 UMOM X 31.96
149. 98 TO 104 UNI Z .47244
150. 97 UMOM X 31.96 3.9 4.9
151. 97 UNI Z .47244 3.9 4.9
152. * VAGONES
153. 97 UMOM X 26.6338 0 3.9
154. 97 UNI Z 0.3937 0 3.9
155. 95 96 UMOM X 26.6338
156. 95 96 UNI Z 0.3937
157. 83 TO 94 UMOM X 22.913386
158. 83 TO 94 UNI Z 0.04
159. 71 TO 82 UMOM X 26.6338
160. 71 TO 82 UNI Z 0.3937
161. 59 TO 70 UMOM X 22.913386
162. 59 TO 70 UNI Z 0.04
163. 47 TO 58 UMOM X 26.6338
164. 47 TO 58 UNI Z 0.3937
165. 35 TO 46 UMOM X 22.913386
166. 35 TO 46 UNI Z 0.04
167. 23 TO 34 UMOM X 26.6338
168. 23 TO 34 UNI Z 0.3937
169. 11 TO 22 UMOM X 22.913386
170. 11 TO 22 UNI Z 0.04
171. 1 TO 10 UMOM X 26.6338
172. 1 TO 10 UNI Z 0.3937
174. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
  ORIGINAL/FINAL BAND-WIDTH =    1/    1
  TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
  SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      97

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      97

++ PROCESSING ELEMENT STIFFNESS MATRIX.                  0:25: 8
++ PROCESSING GLOBAL STIFFNESS MATRIX.                   0:25: 8
++ PROCESSING TRIANGULAR FACTORIZATION.                  0:25: 9
++ CALCULATING JOINT DISPLACEMENTS.                      0:25: 9
++ CALCULATING MEMBER  FORCES.                           0:25: 9

 175. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	11	1	-2.32	168.92	-7.38	-500.34	47.37	0.01
		2	2.32	-160.92	7.06	479.04	-41.60	131.94
2	11	2	-2.32	160.92	-7.06	-479.04	41.60	-131.94
		3	2.32	-123.92	5.61	380.49	-18.16	658.89
3	11	3	-2.31	123.92	-5.61	-379.06	18.16	-659.71
		4	2.31	-76.42	3.74	252.55	4.05	1135.52
4	11	4	-2.32	76.42	-3.74	-255.01	-4.05	-1134.96
		5	2.32	-28.92	1.87	128.50	17.35	1385.15
5	11	5	-2.31	28.92	-1.87	-125.73	-17.35	-1385.40
		6	2.31	18.58	0.00	-0.79	21.79	1409.96
6	11	6	-2.31	-18.58	0.00	1.02	-21.79	-1409.96
		7	2.31	66.08	-1.87	-127.53	17.35	1208.89
7	11	7	-2.32	-66.08	1.87	129.96	-17.35	-1208.63
		8	2.32	113.58	-3.74	-256.46	4.05	781.94
8	11	8	-2.32	-113.58	3.74	256.46	-4.05	-781.94
		9	2.32	161.08	-5.61	-382.98	-18.13	129.62
9	11	9	-2.31	-161.08	5.61	382.80	18.13	-130.15
		10	2.31	198.08	-7.07	-481.34	-41.58	-534.30
10	11	10	-2.37	-198.10	7.04	476.45	41.58	538.66
		11	2.37	206.10	-7.36	-497.76	-47.34	-700.36
11	11	11	-2.29	14.47	-0.88	-514.00	6.89	694.36
		12	2.29	-13.67	0.85	495.67	-6.19	-683.11
12	11	12	-2.28	13.67	-0.86	-499.47	6.19	680.34
		13	2.28	-9.97	0.72	414.69	-3.27	-636.62
13	11	13	-2.28	9.97	-0.72	-415.41	3.27	636.15
		14	2.28	-5.47	0.54	312.30	-0.43	-601.43
14	11	14	-2.28	5.46	-0.53	-310.92	0.43	602.15
		15	2.28	-0.96	0.35	207.80	1.56	-587.67
15	11	15	-2.28	0.97	-0.36	-209.15	-1.56	587.20
		16	2.28	3.53	0.18	106.04	2.78	-592.97
16	11	16	-2.28	-3.54	-0.18	-107.30	-2.78	592.75
		17	2.28	8.04	0.00	4.19	3.20	-618.78

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	11	17	-2.28	-8.03	0.00	-2.88	-3.20	618.79
		18	2.28	12.53	-0.18	-100.23	2.79	-665.06
18	11	18	-2.28	-12.53	0.18	98.83	-2.79	665.28
		19	2.28	17.03	-0.36	-201.94	1.59	-731.80
19	11	19	-2.28	-17.04	0.36	201.94	-1.59	731.80
		20	2.28	21.54	-0.54	-305.05	-0.41	-818.58
20	11	20	-2.28	-21.53	0.54	304.90	0.41	818.63
		21	2.28	26.03	-0.72	-408.01	-3.23	-925.66
21	11	21	-2.28	-26.03	0.71	406.41	3.23	926.36
		22	2.28	29.73	-0.86	-491.19	-6.13	-1029.54
22	11	22	-2.28	-29.74	0.85	488.95	6.13	1030.62
		23	2.28	30.54	-0.89	-507.28	-6.83	-1054.69
23	11	23	-2.27	226.95	-8.83	-585.19	68.01	1048.08
		24	2.27	-218.95	8.52	563.88	-61.07	-869.73
24	11	24	-2.18	218.94	-8.54	-573.37	61.07	863.50
		25	2.18	-181.94	7.08	474.82	-32.17	-121.87
25	11	25	-2.18	181.94	-7.08	-474.82	32.17	121.87
		26	2.18	-136.94	5.31	354.97	-4.28	595.60
26	11	26	-2.17	136.94	-5.32	-353.50	4.28	-596.48
		27	2.17	-91.94	3.55	233.64	15.66	1111.47
27	11	27	-2.17	91.94	-3.54	-236.19	-15.66	-1110.93
		28	2.17	-46.94	1.77	116.35	27.61	1423.39
28	11	28	-2.17	46.94	-1.77	-113.34	-27.61	-1423.63
		29	2.17	-1.94	0.00	-6.52	31.61	1533.64
29	11	29	-2.17	1.94	0.00	6.80	-31.61	-1533.63
		30	2.17	43.06	-1.77	-126.66	27.63	1441.10
30	11	30	-2.17	-43.07	1.77	126.66	-27.63	-1441.09
		31	2.17	88.06	-3.54	-246.50	15.68	1146.11
31	11	31	-2.18	-88.06	3.54	248.92	-15.68	-1145.58
		32	2.18	133.06	-5.31	-368.79	-4.22	648.00
32	11	32	-2.18	-133.06	5.31	368.79	4.22	-648.00
		33	2.18	178.06	-7.08	-488.63	-32.09	-51.95
33	11	33	-2.16	-178.06	7.08	488.73	32.09	50.98
		34	2.16	215.06	-8.54	-587.29	-61.00	-778.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	11	34	-2.26	-215.07	8.52	578.47	61.00	784.90
		35	2.26	223.07	-8.83	-599.78	-67.94	-960.21
35	11	35	-2.03	21.40	-0.89	-520.22	6.92	938.38
		36	2.03	-20.60	0.86	501.91	-6.22	-921.62
36	11	36	-2.03	20.60	-0.87	-504.84	6.22	920.01
		37	2.03	-16.90	0.72	420.05	-3.29	-850.65
37	11	37	-2.03	16.89	-0.72	-419.72	3.29	850.81
		38	2.03	-12.40	0.54	316.62	-0.47	-784.92
38	11	38	-2.03	12.40	-0.54	-318.27	0.47	784.24
		39	2.03	-7.90	0.36	215.15	1.56	-738.59
39	11	39	-2.03	7.90	-0.36	-215.02	-1.56	738.63
		40	2.03	-3.40	0.18	111.92	2.77	-713.21
40	11	40	-2.03	3.40	-0.19	-113.68	-2.77	712.94
		41	2.03	1.10	0.01	10.57	3.20	-707.79
41	11	41	-2.03	-1.10	0.00	-8.95	-3.20	707.82
		42	2.03	5.60	-0.18	-94.16	2.80	-722.91
42	11	42	-2.03	-5.61	0.18	92.63	-2.80	723.10
		43	2.03	10.11	-0.36	-195.76	1.61	-758.46
43	11	43	-2.03	-10.11	0.36	195.76	-1.61	758.46
		44	2.03	14.61	-0.54	-298.86	-0.39	-814.06
44	11	44	-2.03	-14.60	0.54	298.86	0.39	814.06
		45	2.03	19.10	-0.72	-401.97	-3.21	-889.91
45	11	45	-2.03	-19.11	0.71	400.43	3.21	890.60
		46	2.03	22.81	-0.86	-485.20	-6.11	-968.13
46	11	46	-2.03	-22.78	0.85	482.17	6.11	969.67
		47	2.03	23.58	-0.89	-500.51	-6.81	-988.21
47	11	47	-1.78	224.54	-8.86	-592.45	68.06	960.52
		48	1.78	-216.55	8.55	571.16	-61.10	-784.25
48	11	48	-1.81	216.55	-8.54	-567.89	61.10	786.62
		49	1.81	-179.54	7.08	469.32	-32.18	-53.68
49	11	49	-1.81	179.54	-7.09	-469.36	32.18	53.41
		50	1.81	-134.55	5.31	349.53	-4.29	653.16
50	11	50	-1.81	134.55	-5.31	-349.53	4.29	-653.16
		51	1.81	-89.55	3.54	229.67	15.64	1157.40

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	11	51	-1.80	89.55	-3.55	-227.23	-15.64	-1157.88
		52	1.80	-44.55	1.77	107.36	27.61	1459.63
52	11	52	-1.80	44.54	-1.77	-107.11	-27.61	-1459.64
		53	1.80	0.46	0.00	-12.75	31.61	1558.84
53	11	53	-1.80	-0.46	0.00	12.76	-31.61	-1558.85
		54	1.80	45.45	-1.77	-132.60	27.64	1455.58
54	11	54	-1.80	-45.45	1.77	132.33	-27.64	-1455.59
		55	1.80	90.45	-3.54	-252.19	15.69	1149.79
55	11	55	-1.81	-90.46	3.54	254.84	-15.69	-1149.21
		56	1.81	135.45	-5.31	-374.68	-4.20	640.96
56	11	56	-1.81	-135.45	5.31	374.67	4.20	-640.96
		57	1.81	180.46	-7.08	-494.54	-32.08	-69.92
57	11	57	-1.79	-180.46	7.08	494.69	32.08	68.84
		58	1.79	217.46	-8.54	-593.24	-60.98	-805.00
58	11	58	-1.90	-217.44	8.52	583.31	60.98	812.22
		59	1.90	225.43	-8.83	-604.60	-67.92	-989.28
59	11	59	-1.55	21.83	-0.90	-527.50	6.94	953.13
		60	1.55	-21.03	0.86	509.17	-6.24	-935.99
60	11	60	-1.55	21.03	-0.87	-510.33	6.24	935.35
		61	1.55	-17.33	0.72	425.54	-3.31	-864.39
61	11	61	-1.55	17.33	-0.72	-427.03	3.31	863.66
		62	1.55	-12.83	0.54	323.92	-0.47	-795.82
62	11	62	-1.55	12.83	-0.54	-322.38	0.47	796.45
		63	1.55	-8.33	0.36	219.28	1.55	-748.86
63	11	63	-1.55	8.33	-0.36	-222.44	-1.55	747.93
		64	1.55	-3.83	0.18	119.33	2.79	-720.59
64	11	64	-1.55	3.82	-0.18	-117.80	-2.79	720.84
		65	1.55	0.68	0.00	14.70	3.20	-713.75
65	11	65	-1.55	-0.68	0.00	-16.21	-3.20	713.71
		66	1.55	5.18	-0.18	-86.91	2.81	-726.88
66	11	66	-1.55	-5.18	0.18	88.45	-2.81	726.69
		67	1.55	9.68	-0.36	-191.55	1.60	-760.11
67	11	67	-1.55	-9.67	0.35	188.20	-1.60	760.94
		68	1.55	14.17	-0.53	-291.32	-0.38	-814.61

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	11	68	-1.55	-14.18	0.54	293.18	0.38	813.94
		69	1.55	18.68	-0.72	-396.27	-3.20	-887.84
69	11	69	-1.55	-18.67	0.71	395.08	3.20	888.37
		70	1.55	22.37	-0.86	-479.86	-6.11	-964.31
70	11	70	-1.55	-22.32	0.85	474.75	6.11	966.85
		71	1.55	23.12	-0.88	-493.10	-6.81	-985.06
71	11	71	-1.30	223.72	-8.85	-575.72	68.06	951.79
		72	1.30	-215.73	8.53	554.43	-61.12	-776.16
72	11	72	-1.21	215.73	-8.55	-562.44	61.12	770.39
		73	1.21	-178.73	7.09	463.89	-32.19	-40.60
73	11	73	-1.23	178.72	-7.09	-463.81	32.19	41.45
		74	1.23	-133.72	5.31	343.94	-4.28	661.62
74	11	74	-1.23	133.72	-5.31	-343.94	4.28	-661.63
		75	1.23	-88.72	3.54	224.10	15.65	1162.08
75	11	75	-1.22	88.72	-3.55	-221.45	-15.65	-1162.59
		76	1.22	-43.71	1.77	101.57	27.62	1460.63
76	11	76	-1.22	43.72	-1.77	-101.82	-27.62	-1460.61
		77	1.22	1.28	0.00	-18.03	31.62	1556.09
77	11	77	-1.22	-1.28	0.00	18.31	-31.62	-1556.09
		78	1.22	46.28	-1.77	-138.15	27.64	1449.06
78	11	78	-1.22	-46.29	1.77	137.90	-27.64	-1449.10
		79	1.22	91.28	-3.54	-257.74	15.70	1139.60
79	11	79	-1.23	-91.28	3.54	260.36	-15.70	-1139.01
		80	1.23	136.28	-5.31	-380.21	-4.21	626.97
80	11	80	-1.23	-136.28	5.31	380.32	4.21	-626.90
		81	1.23	181.28	-7.08	-500.18	-32.09	-87.65
81	11	81	-1.23	-181.28	7.08	500.20	32.09	87.58
		82	1.23	218.28	-8.54	-598.73	-60.99	-826.69
82	11	82	-1.22	-218.26	8.54	598.76	60.99	826.67
		83	1.22	226.26	-8.85	-620.06	-67.94	-1004.41
83	11	83	-0.86	22.89	-0.90	-533.46	6.94	960.87
		84	0.86	-22.09	0.87	515.12	-6.24	-942.88
84	11	84	-0.86	22.07	-0.87	-515.19	6.24	942.84
		85	0.86	-18.37	0.72	430.42	-3.30	-868.02

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	11	85	-0.86	18.38	-0.72	-432.40	3.30	867.04
		86	0.86	-13.88	0.54	329.30	-0.46	-794.47
86	11	86	-0.86	13.87	-0.54	-329.30	0.46	794.48
		87	0.86	-9.37	0.36	226.17	1.57	-742.16
87	11	87	-0.86	9.38	-0.36	-226.18	-1.57	742.17
		88	0.86	-4.88	0.18	123.08	2.79	-710.10
88	11	88	-0.85	4.88	-0.18	-124.58	-2.79	709.84
		89	0.85	-0.38	0.00	21.47	3.21	-698.03
89	11	89	-0.85	0.37	0.00	-19.99	-3.21	698.07
		90	0.85	4.13	-0.18	-83.14	2.81	-706.51
90	11	90	-0.86	-4.13	0.18	81.64	-2.81	706.69
		91	0.86	8.63	-0.36	-184.75	1.61	-735.38
91	11	91	-0.86	-8.62	0.36	184.74	-1.61	735.39
		92	0.86	13.12	-0.54	-287.83	-0.40	-784.31
92	11	92	-0.86	-13.12	0.53	286.04	0.40	784.96
		93	0.86	17.63	-0.71	-389.16	-3.21	-854.16
93	11	93	-0.86	-17.63	0.72	390.11	3.21	853.72
		94	0.86	21.33	-0.86	-474.90	-6.14	-925.79
94	11	94	-0.85	-21.31	0.87	481.00	6.14	922.66
		95	0.85	22.11	-0.90	-499.32	-6.85	-939.98
95	11	95	-0.39	238.00	-8.44	-547.78	57.54	894.45
		96	0.39	-230.00	8.12	526.47	-50.91	-707.24
96	11	96	-0.45	230.00	-8.12	-521.31	50.91	711.06
		97	0.45	-193.00	6.66	422.75	-23.56	71.58
97	11	97	-0.44	192.99	-6.66	-422.64	23.56	-72.23
		98	0.44	-141.99	4.66	286.81	4.33	896.84
98	11	98	-0.43	142.00	-4.66	-284.92	-4.33	-897.44
		99	0.43	-83.19	2.34	128.31	21.49	1449.20
99	11	99	-0.43	83.19	-2.34	-131.34	-21.49	-1448.92
		100	0.43	-24.41	0.03	-25.23	27.29	1712.47
100	11	100	-0.43	24.40	-0.03	28.54	-27.29	-1712.42
		101	0.43	34.40	-2.29	-185.15	21.75	1687.91
101	11	101	-0.43	-34.40	2.29	185.44	-21.75	-1687.89
		102	0.43	93.20	-4.60	-342.03	4.88	1375.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	11	102	-0.44	-93.19	4.60	344.91	-4.88	-1374.60
		103	0.44	152.01	-6.92	-501.54	-23.35	773.75
103	11	103	-0.44	-152.01	6.92	501.09	23.35	-774.04
		104	0.44	196.40	-8.66	-619.32	-52.17	129.61
104	11	104	-0.45	-196.43	8.66	619.47	52.17	-128.92
		105	0.45	206.03	-9.04	-645.03	-59.25	-32.06

********** END OF LATEST ANALYSIS RESULT **********

176. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	11	-2.32	168.92	-7.38	-500.34	47.37	0.00
11	11	0.00	220.57	-8.27	-1020.06	-40.46	0.00
23	11	0.00	257.49	-9.75	-1106.04	61.18	0.00
35	11	0.00	244.47	-9.75	-1131.47	-61.02	0.00
47	11	0.00	248.12	-9.75	-1092.31	61.25	0.00
59	11	0.00	247.26	-9.75	-1143.28	-60.98	0.00
71	11	0.00	246.84	-9.76	-1081.77	61.26	0.00
83	11	0.00	249.14	-9.76	-1154.38	-60.99	0.00
95	11	0.00	260.11	-9.34	-1035.34	50.69	0.00
105	11	0.00	206.03	-9.05	-645.83	-59.25	0.00

********** END OF LATEST ANALYSIS RESULT **********

177. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:25:12 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC-IAPF - L.I. $\bar{M}_{MIN}$ PILA P-4. (1 vía)

(LOAD 12)

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:34: 7                       *
*                                                   *
*****************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.1575510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 12
131. MEMBER LOAD
132. 35 TO 41 UNI GY -12
133. 42 UNI GY -12 0 3.8
134. 42 UNI GY -10 3.8 4.5
135. 43 TO 58 UNI GY -10
136. 59 TO 70 UNI GY -1
137. 71 TO 82 UNI GY -10
138. 83 TO 94 UNI GY -1
139. 95 TO 104 UNI GY -10
140. *RIPADO + F.CENTRIFUGA+ TORSOR POR EXCENTRICIDAD DE SC DE 2.25 M
141. 35 TO 41 UMOM X 31.96
142. 35 TO 41 UNI Z .47244
143. 42 UMOM X 31.96 0 3.8
144. 42 UNI Z .47244 0 3.8
145. 42 UMOM X 26.6338 3.8 4.5
146. 42 UNI Z 0.3937 3.8 4.5
147. 43 TO 58 UMOM X 26.6338
148. 43 TO 58 UNI Z 0.3937
149. 59 TO 70 UMOM X 22.913386
150. 59 TO 70 UNI Z 0.04
151. 71 TO 82 UMOM X 26.6338
152. 71 TO 82 UNI Z 0.3937
153. 83 TO 94 UMOM X 22.913386
154. 83 TO 94 UNI Z 0.04
155. 95 TO 104 UMOM X 26.6338
156. 95 TO 104 UNI Z 0.3937
158. PERFORM ANALYSIS
```


P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 105/ 104/ 10
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 1, TOTAL DEGREES OF FREEDOM = 589
SIZE OF STIFFNESS MATRIX = 7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE = 12.28 MEGA-BYTES

```
++ PROCESSING ELEMENT STIFFNESS MATRIX.        0:34: 9
++ PROCESSING GLOBAL STIFFNESS MATRIX.         0:34:10
++ PROCESSING TRIANGULAR FACTORIZATION.        0:34:10
++ CALCULATING JOINT DISPLACEMENTS.            0:34:10
++ CALCULATING MEMBER  FORCES.                 0:34:10

159. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	12	1	-2.27	-2.22	0.00	-0.02	-0.02	0.00
		2	2.27	2.22	0.00	0.02	0.02	-1.78
2	12	2	-2.27	-2.22	0.00	-0.02	-0.02	1.78
		3	2.27	2.22	0.00	0.02	0.00	-10.00
3	12	3	-2.27	-2.22	0.00	-0.04	0.00	10.00
		4	2.27	2.22	0.00	0.04	0.00	-20.55
4	12	4	-2.27	-2.22	0.00	0.00	0.00	20.55
		5	2.27	2.22	0.00	0.00	-0.02	-31.10
5	12	5	-2.27	-2.22	0.00	-0.06	0.02	31.10
		6	2.27	2.22	0.00	0.06	-0.02	-41.65
6	12	6	-2.27	-2.22	0.00	-0.07	0.02	41.65
		7	2.27	2.22	0.00	0.07	-0.02	-52.20
7	12	7	-2.27	-2.22	0.00	-0.17	0.02	52.20
		8	2.27	2.22	0.00	0.17	0.00	-62.75
8	12	8	-2.27	-2.22	0.00	-0.17	0.00	62.75
		9	2.27	2.22	0.00	0.17	0.03	-73.31
9	12	9	-2.27	-2.22	0.00	-0.07	-0.03	73.31
		10	2.27	2.22	0.00	0.07	0.03	-81.53
10	12	10	-2.27	-2.22	-0.02	-0.81	-0.03	81.52
		11	2.27	2.22	0.02	0.81	0.05	-83.30
11	12	11	-2.27	8.17	0.02	0.88	-0.03	83.30
		12	2.27	-8.17	-0.02	-0.88	0.01	-76.77
12	12	12	-2.27	8.17	0.00	0.45	-0.01	76.77
		13	2.27	-8.17	0.00	-0.45	0.00	-46.53
13	12	13	-2.27	8.17	0.00	0.40	0.00	46.53
		14	2.27	-8.17	0.00	-0.40	0.00	-9.76
14	12	14	-2.27	8.17	0.01	0.42	0.00	9.75
		15	2.27	-8.17	-0.01	-0.42	-0.03	27.02
15	12	15	-2.27	8.17	0.00	0.48	0.03	-27.02
		16	2.27	-8.17	0.00	-0.48	-0.03	63.80
16	12	16	-2.27	8.17	0.00	0.62	0.03	-63.80
		17	2.27	-8.17	0.00	-0.62	-0.01	100.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	12	17	-2.27	8.17	0.00	0.41	0.01	-100.57
		18	2.27	-8.17	0.00	-0.41	-0.02	137.35
18	12	18	-2.27	8.17	0.00	0.70	0.02	-137.35
		19	2.27	-8.17	0.00	-0.70	0.00	174.12
19	12	19	-2.27	8.17	0.00	0.70	0.00	-174.12
		20	2.27	-8.17	0.00	-0.70	0.02	210.90
20	12	20	-2.27	8.17	0.00	0.73	-0.02	-210.90
		21	2.27	-8.17	0.00	-0.73	0.04	247.68
21	12	21	-2.27	8.17	-0.01	1.16	-0.04	-247.67
		22	2.27	-8.17	0.01	-1.16	0.07	277.91
22	12	22	-2.27	8.17	-0.01	1.77	-0.07	-277.91
		23	2.27	-8.17	0.01	-1.77	0.08	284.45
23	12	23	-2.27	-28.18	0.03	-5.80	-0.02	-284.45
		24	2.27	28.18	-0.03	5.80	0.00	261.90
24	12	24	-2.27	-28.18	0.00	-2.94	0.00	-261.95
		25	2.27	28.18	0.00	2.94	-0.01	157.70
25	12	25	-2.27	-28.18	0.00	-2.94	0.01	-157.70
		26	2.27	28.18	0.00	2.94	-0.03	30.90
26	12	26	-2.27	-28.18	0.00	-2.86	0.03	-30.91
		27	2.27	28.18	0.00	2.86	-0.02	-95.89
27	12	27	-2.27	-28.18	0.00	-2.64	0.02	95.90
		28	2.27	28.18	0.00	2.64	-0.03	-222.69
28	12	28	-2.27	-28.18	0.00	-3.11	0.03	222.68
		29	2.27	28.18	0.00	3.11	-0.02	-349.49
29	12	29	-2.27	-28.18	0.00	-3.18	0.02	349.49
		30	2.27	28.18	0.00	3.18	-0.01	-476.29
30	12	30	-2.27	-28.18	0.00	-3.18	0.01	476.30
		31	2.27	28.18	0.00	3.18	0.00	-603.08
31	12	31	-2.27	-28.18	-0.01	-4.45	0.00	603.07
		32	2.27	28.18	0.01	4.45	0.03	-729.88
32	12	32	-2.27	-28.18	-0.01	-4.45	-0.03	729.88
		33	2.27	28.18	0.01	4.45	0.06	-856.67
33	12	33	-2.27	-28.18	0.00	-2.73	-0.06	856.67
		34	2.27	28.18	0.00	2.73	0.07	-960.94

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	12	34	-2.27	-28.17	-0.03	-13.58	-0.07	960.85
		35	2.27	28.17	0.03	13.58	0.10	-983.39
35	12	35	-2.13	231.46	-10.53	-704.92	80.39	974.41
		36	2.13	-221.87	10.15	679.38	-72.13	-793.28
36	12	36	-2.10	221.89	-10.16	-681.89	72.13	791.11
		37	2.10	-177.48	8.41	563.62	-37.77	-52.19
37	12	37	-2.10	177.48	-8.41	-563.60	37.77	52.40
		38	2.10	-123.49	6.29	419.80	-4.70	624.70
38	12	38	-2.09	123.49	-6.29	-418.48	4.70	-625.59
		39	2.09	-69.48	4.16	274.64	18.82	1059.82
39	12	39	-2.09	69.48	-4.16	-274.82	-18.82	-1059.78
		40	2.09	-15.48	2.04	131.01	32.77	1250.92
40	12	40	-2.09	15.48	-2.04	-127.92	-32.77	-1251.24
		41	2.09	38.51	-0.08	-15.90	37.17	1199.42
41	12	41	-2.09	-38.52	0.09	13.15	-37.17	-1199.44
		42	2.09	92.51	-2.21	-156.96	31.99	904.64
42	12	42	-2.09	-92.52	2.21	158.87	-31.99	-904.31
		43	2.09	145.12	-4.28	-298.96	17.28	366.85
43	12	43	-2.09	-145.11	4.28	298.96	-17.28	-366.85
		44	2.09	190.11	-6.05	-418.81	-5.97	-387.39
44	12	44	-2.09	-190.11	6.05	418.81	5.97	387.39
		45	2.09	235.11	-7.82	-538.66	-37.19	-1344.13
45	12	45	-2.11	-235.11	7.82	536.33	37.19	1345.06
		46	2.11	272.11	-9.28	-634.87	-68.82	-2283.39
46	12	46	-2.13	-272.11	9.27	627.72	68.82	2285.36
		47	2.13	280.11	-9.59	-649.03	-76.36	-2506.32
47	12	47	-1.67	267.83	-8.86	-604.36	68.05	2474.67
		48	1.67	-259.84	8.55	583.07	-61.10	-2263.80
48	12	48	-1.70	259.84	-8.54	-573.65	61.10	2266.20
		49	1.70	-222.83	7.08	475.08	-32.18	-1373.05
49	12	49	-1.70	222.83	-7.09	-475.86	32.18	1372.78
		50	1.70	-177.84	5.31	356.03	-4.29	-471.44
50	12	50	-1.70	177.84	-5.31	-356.03	4.29	471.44
		51	1.70	-132.84	3.54	236.18	15.64	227.61

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	12	51	-1.69	132.84	-3.55	-235.69	-15.64	-228.11
		52	1.69	-87.84	1.77	115.83	27.61	724.67
52	12	52	-1.69	87.84	-1.77	-115.70	-27.61	-724.69
		53	1.69	-42.83	0.00	-4.16	31.61	1018.73
53	12	53	-1.69	42.83	0.00	4.16	-31.61	-1018.72
		54	1.69	2.16	-1.77	-124.00	27.64	1110.22
54	12	54	-1.69	-2.16	1.77	123.80	-27.64	-1110.25
		55	1.69	47.16	-3.54	-243.66	15.69	999.26
55	12	55	-1.70	-47.17	3.54	245.95	-15.69	-998.71
		56	1.70	92.16	-5.31	-365.79	-4.21	685.25
56	12	56	-1.70	-92.16	5.31	365.79	4.21	-685.25
		57	1.70	137.17	-7.08	-485.66	-32.08	169.21
57	12	57	-1.68	-137.17	7.08	485.29	32.08	-170.26
		58	1.68	174.17	-8.54	-583.84	-60.99	-405.72
58	12	58	-1.79	-174.21	8.52	578.81	60.99	412.84
		59	1.79	182.20	-8.83	-600.10	-67.93	-555.32
59	12	59	-1.44	9.69	-0.90	-525.81	6.94	519.50
		60	1.44	-8.89	0.86	507.48	-6.24	-512.07
60	12	60	-1.44	8.89	-0.87	-508.11	6.24	511.44
		61	1.44	-5.19	0.72	423.33	-3.30	-485.39
61	12	61	-1.44	5.19	-0.72	-424.16	3.30	484.66
		62	1.44	-0.69	0.54	321.05	-0.46	-471.43
62	12	62	-1.44	0.69	-0.54	-320.14	0.46	472.06
		63	1.44	3.81	0.36	217.04	1.55	-479.07
63	12	63	-1.44	-3.81	-0.36	-219.06	-1.55	478.15
		64	1.44	8.31	0.18	115.95	2.79	-505.42
64	12	64	-1.44	-8.31	-0.18	-114.88	-2.79	505.67
		65	1.44	12.81	0.00	11.77	3.20	-553.18
65	12	65	-1.44	-12.81	0.00	-12.94	-3.20	553.16
		66	1.44	17.31	-0.18	-90.17	2.81	-620.93
66	12	66	-1.44	-17.31	0.18	91.49	-2.81	620.74
		67	1.44	21.81	-0.36	-194.59	1.60	-708.76
67	12	67	-1.44	-21.81	0.35	191.47	-1.60	709.60
		68	1.44	26.31	-0.53	-294.59	-0.39	-817.89

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	12	68	-1.44	-26.31	0.54	296.46	0.39	817.21
		69	1.44	30.81	-0.72	-399.55	-3.20	-945.71
69	12	69	-1.44	-30.81	0.71	398.28	3.20	946.24
		70	1.44	34.51	-0.86	-483.05	-6.12	-1067.09
70	12	70	-1.44	-34.50	0.85	477.41	6.12	1069.63
		71	1.44	35.30	-0.89	-495.75	-6.81	-1097.57
71	12	71	-1.19	225.94	-8.85	-576.01	68.06	1064.14
		72	1.19	-217.94	8.53	554.73	-61.11	-886.75
72	12	72	-1.10	217.96	-8.55	-563.88	61.11	880.95
		73	1.10	-180.95	7.09	465.33	-32.19	-142.91
73	12	73	-1.11	180.95	-7.09	-465.06	32.19	143.77
		74	1.11	-135.95	5.31	345.20	-4.28	569.34
74	12	74	-1.11	135.95	-5.31	-345.19	4.28	-569.34
		75	1.11	-90.95	3.54	225.35	15.65	1079.81
75	12	75	-1.11	90.95	-3.55	-222.89	-15.65	-1080.32
		76	1.11	-45.95	1.77	103.01	27.62	1388.41
76	12	76	-1.11	45.94	-1.77	-103.25	-27.62	-1388.38
		77	1.11	-0.94	0.00	-16.60	31.62	1493.89
77	12	77	-1.11	0.95	0.00	16.87	-31.62	-1493.88
		78	1.11	44.05	-1.77	-136.71	27.64	1396.92
78	12	78	-1.11	-44.05	1.77	136.47	-27.64	-1396.93
		79	1.11	89.05	-3.54	-256.31	15.69	1097.45
79	12	79	-1.11	-89.05	3.54	258.83	-15.69	-1096.87
		80	1.11	134.05	-5.31	-378.69	-4.22	594.87
80	12	80	-1.11	-134.05	5.31	378.79	4.22	-594.80
		81	1.11	179.06	-7.08	-498.65	-32.10	-109.73
81	12	81	-1.11	-179.05	7.08	498.67	32.10	109.65
		82	1.11	216.05	-8.54	-597.20	-60.99	-840.52
82	12	82	-1.11	-216.02	8.54	597.23	60.99	840.48
		83	1.11	224.02	-8.85	-618.53	-67.95	-1016.45
83	12	83	-0.75	26.66	-0.90	-531.57	6.94	973.05
		84	0.75	-25.86	0.87	513.23	-6.23	-952.05
84	12	84	-0.75	25.85	-0.87	-513.31	6.23	951.99
		85	0.75	-22.15	0.72	428.54	-3.30	-863.20

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	12	85	-0.74	22.15	-0.72	-430.51	3.30	862.22
		86	0.74	-17.65	0.54	327.41	-0.46	-772.67
86	12	86	-0.74	17.65	-0.54	-327.40	0.46	772.67
		87	0.74	-13.15	0.36	224.27	1.57	-703.36
87	12	87	-0.74	13.15	-0.36	-224.28	-1.57	703.36
		88	0.74	-8.65	0.18	121.18	2.79	-654.30
88	12	88	-0.74	8.65	-0.18	-122.56	-2.79	654.05
		89	0.74	-4.15	0.00	19.45	3.21	-625.23
89	12	89	-0.74	4.15	0.00	-18.12	-3.21	625.28
		90	0.74	0.35	-0.18	-85.00	2.81	-616.72
90	12	90	-0.74	-0.35	0.18	83.69	-2.81	616.90
		91	0.74	4.85	-0.36	-186.80	1.61	-628.59
91	12	91	-0.74	-4.85	0.36	186.79	-1.61	628.60
		92	0.74	9.35	-0.54	-289.88	-0.41	-660.53
92	12	92	-0.74	-9.35	0.54	288.37	0.41	661.19
		93	0.74	13.85	-0.72	-391.49	-3.22	-713.39
93	12	93	-0.74	-13.85	0.72	392.29	3.22	712.95
		94	0.74	17.55	-0.86	-477.08	-6.15	-771.04
94	12	94	-0.74	-17.51	0.87	482.16	6.15	767.89
		95	0.74	18.31	-0.90	-500.48	-6.85	-782.22
95	12	95	-0.32	210.64	-7.56	-489.69	49.70	739.49
		96	0.32	-202.64	7.25	468.38	-43.78	-574.15
96	12	96	-0.38	202.65	-7.24	-464.19	43.78	577.55
		97	0.38	-165.65	5.79	365.63	-19.66	103.88
97	12	97	-0.37	165.64	-5.79	-365.47	19.66	-104.44
		98	0.37	-116.64	3.86	234.97	3.97	796.04
98	12	98	-0.36	116.64	-3.86	-233.29	-3.97	-796.54
		99	0.36	-67.64	1.93	102.78	18.16	1248.06
99	12	99	-0.36	67.64	-1.93	-105.39	-18.16	-1247.84
		100	0.36	-18.65	0.00	-25.09	22.89	1459.23
100	12	100	-0.36	18.65	0.00	27.91	-22.89	-1459.17
		101	0.36	30.35	-1.93	-158.42	18.17	1430.50
101	12	101	-0.36	-30.35	1.93	158.67	-18.17	-1430.47
		102	0.36	79.35	-3.86	-289.16	4.00	1161.74

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	12	102	-0.37	-79.35	3.86	291.59	-4.00	-1161.13
		103	0.37	128.36	-5.79	-422.12	-19.62	652.16
103	12	103	-0.37	-128.36	5.79	421.74	19.63	-652.41
		104	0.37	165.35	-7.24	-520.27	-43.72	109.15
104	12	104	-0.38	-165.32	7.24	520.39	43.72	-108.57
		105	0.38	173.32	-7.56	-541.69	-49.64	-26.89

********** END OF LATEST ANALYSIS RESULT **********

160. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	12	-2.27	-2.22	0.00	-0.02	-0.02	0.00
11	12	0.00	10.40	0.01	0.70	0.02	0.00
23	12	0.00	-36.35	0.01	-3.90	0.06	0.00
35	12	0.00	259.62	-10.53	-703.09	80.49	0.00
47	12	0.00	547.95	-18.45	-1251.24	-8.31	0.00
59	12	0.00	191.89	-9.75	-1132.34	-60.99	0.00
71	12	0.00	261.24	-9.76	-1086.17	61.25	0.00
83	12	0.00	250.68	-9.76	-1150.97	-61.01	0.00
95	12	0.00	228.96	-8.46	-980.52	42.85	0.00
105	12	0.00	173.32	-7.57	-542.36	-49.64	0.00

********** END OF LATEST ANALYSIS RESULT **********

161. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:34:13 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC-IAPF.- L.I. Qmax PILA P-4. (1 vía)

(LOAD 13)

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*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:34:26                       *
*                                                   *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
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34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
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40. 37 131.994010581532 0 7998.91102470646
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43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
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53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
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59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
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77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
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81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
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85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
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90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
```

```
108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 13
131. MEMBER LOAD
132. 51 UNI GY -12 1.5 4.5
133. 52 TO 58 UNI GY -12
134. 51 UNI GY -10 0 1.5
135. 35 TO 50 UNI GY -10
136. 23 TO 34 UNI GY -1
137. 11 TO 22 UNI GY -10
138. *RIPADO + F.CENTRIFUGA + EXCENTRICIDAD DE SC DE 2,25 M.
139. 51 UMOM X 31.96 1.5 4.5
140. 51 UNI Z .47244 1.5 4.5
141. 52 TO 58 UMOM X 31.96
142. 52 TO 58 UNI Z .47244
143. 51 UMOM X 26.6338 0 1.5
144. 51 UNI Z 0.3937 0 1.5
145. 35 TO 50 UMOM X 26.6338
146. 35 TO 50 UNI Z 0.3937
147. 23 TO 34 UMOM X 22.913386
148. 23 TO 34 UNI Z 0.04
149. 11 TO 22 UMOM X 26.6338
150. 11 TO 22 UNI Z 0.3937
152. PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

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 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
 ORIGINAL/FINAL BAND-WIDTH =    1/    1
 TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
 SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.              0:34:29
++ PROCESSING GLOBAL STIFFNESS MATRIX.               0:34:29
```



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++ PROCESSING TRIANGULAR FACTORIZATION.              0:34:30
++ CALCULATING JOINT DISPLACEMENTS.                  0:34:30
++ CALCULATING MEMBER  FORCES.                       0:34:30

153. PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	13	68	0.00	27.82	0.00	-7.03	0.00	-30.37
		69	0.00	-27.82	0.00	7.03	0.00	155.54
69	13	69	0.00	27.82	0.00	-6.82	0.00	-155.55
		70	0.00	-27.82	0.00	6.82	0.00	258.49
70	13	70	0.00	27.82	0.00	-5.46	0.00	-258.53
		71	0.00	-27.82	0.00	5.46	0.00	280.79
71	13	71	0.00	-8.04	0.00	-0.48	0.00	-280.49
		72	0.00	8.04	0.00	0.48	0.00	274.06
72	13	72	0.00	-8.03	0.00	2.36	0.00	-274.06
		73	0.00	8.03	0.00	-2.36	0.00	244.32
73	13	73	0.00	-8.04	0.00	1.91	0.00	-244.33
		74	0.00	8.04	0.00	-1.91	0.00	208.17
74	13	74	0.00	-8.04	0.00	1.91	0.00	-208.17
		75	0.00	8.04	0.00	-1.91	0.00	172.01
75	13	75	0.00	-8.04	0.00	2.30	0.00	-172.01
		76	0.00	8.04	0.00	-2.30	0.00	135.84
76	13	76	0.00	-8.04	0.00	2.28	0.00	-135.84
		77	0.00	8.04	0.00	-2.28	0.00	99.68
77	13	77	0.00	-8.04	0.00	2.30	0.00	-99.68
		78	0.00	8.04	0.00	-2.30	0.00	63.53
78	13	78	0.00	-8.04	0.00	2.29	0.00	-63.53
		79	0.00	8.04	0.00	-2.29	0.00	27.37
79	13	79	0.00	-8.04	0.00	2.35	0.00	-27.37
		80	0.00	8.04	0.00	-2.35	0.00	-8.79
80	13	80	0.00	-8.04	0.00	2.35	0.00	8.80
		81	0.00	8.04	0.00	-2.35	0.00	-44.96
81	13	81	0.00	-8.04	0.00	2.36	0.00	44.95
		82	0.00	8.04	0.00	-2.36	0.00	-74.68
82	13	82	0.00	-8.04	0.00	2.36	0.00	74.68
		83	0.00	8.04	0.00	-2.36	0.00	-81.11
83	13	83	0.00	2.32	0.00	-0.55	0.00	81.00
		84	0.00	-2.32	0.00	0.55	0.00	-79.14
84	13	84	0.00	2.32	0.00	-0.56	0.00	79.14
		85	0.00	-2.32	0.00	0.56	0.00	-70.55

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	13	85	0.00	2.32	0.00	-0.72	0.00	70.55
		86	0.00	-2.32	0.00	0.72	0.00	-60.10
86	13	86	0.00	2.32	0.00	-0.72	0.00	60.10
		87	0.00	-2.32	0.00	0.72	0.00	-49.66
87	13	87	0.00	2.32	0.00	-0.72	0.00	49.66
		88	0.00	-2.32	0.00	0.72	0.00	-39.21
88	13	88	0.00	2.32	0.00	-0.80	0.00	39.21
		89	0.00	-2.32	0.00	0.80	0.00	-28.76
89	13	89	0.00	2.32	0.00	-0.74	0.00	28.76
		90	0.00	-2.32	0.00	0.74	0.00	-18.32
90	13	90	0.00	2.32	0.00	-0.78	0.00	18.31
		91	0.00	-2.32	0.00	0.78	0.00	-7.87
91	13	91	0.00	2.32	0.00	-0.78	0.00	7.87
		92	0.00	-2.32	0.00	0.78	0.00	2.58
92	13	92	0.00	2.32	0.00	-0.78	0.00	-2.58
		93	0.00	-2.32	0.00	0.78	0.00	13.02
93	13	93	0.00	2.32	0.00	-0.79	0.00	-13.02
		94	0.00	-2.32	0.00	0.79	0.00	21.61
94	13	94	0.00	2.32	0.00	-0.93	0.00	-21.61
		95	0.00	-2.32	0.00	0.93	0.00	23.46
95	13	95	0.00	-0.61	0.00	0.46	0.00	-23.42
		96	0.00	0.61	0.00	-0.46	0.00	22.93
96	13	96	0.00	-0.61	0.00	0.30	0.00	-22.94
		97	0.00	0.61	0.00	-0.30	0.00	20.68
97	13	97	0.00	-0.61	0.00	0.33	0.00	-20.68
		98	0.00	0.61	0.00	-0.33	0.00	17.69
98	13	98	0.00	-0.61	0.00	0.37	0.00	-17.68
		99	0.00	0.61	0.00	-0.37	0.00	14.69
99	13	99	0.00	-0.61	0.00	0.33	0.00	-14.69
		100	0.00	0.61	0.00	-0.33	0.00	11.70
100	13	100	0.00	-0.61	0.00	0.36	0.00	-11.70
		101	0.00	0.61	0.00	-0.36	0.00	8.71
101	13	101	0.00	-0.61	0.00	0.36	0.00	-8.71
		102	0.00	0.61	0.00	-0.36	0.00	5.72

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	13	102	0.00	-0.61	0.00	0.37	0.00	-5.72
		103	0.00	0.61	0.00	-0.37	0.00	2.73
103	13	103	0.00	-0.61	0.00	0.37	0.00	-2.73
		104	0.00	0.61	0.00	-0.37	0.00	0.47
104	13	104	0.00	-0.61	0.00	0.37	0.00	-0.47
		105	0.00	0.61	0.00	-0.37	0.00	-0.02

********** END OF LATEST ANALYSIS RESULT **********

154. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	13	-0.98	-31.58	0.00	-0.29	-0.01	0.00
11	13	0.00	259.94	-8.85	-594.76	68.04	0.00
23	13	0.00	254.24	-9.75	-1123.79	-61.09	0.00
35	13	0.00	193.99	-9.76	-1108.17	61.15	0.00
47	13	0.00	546.20	-18.41	-1247.01	8.04	0.00
59	13	0.00	260.01	-10.53	-719.11	-80.17	0.00
71	13	0.00	-35.85	0.00	8.59	0.00	0.00
83	13	0.00	10.36	0.00	-2.92	0.00	0.00
95	13	0.00	-2.93	0.00	1.07	0.00	0.00
105	13	0.00	0.61	0.00	-0.37	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

155. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:34:33 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

ENVOLVENTE DE SC - IAPF. 1 vía

(Casos 10 a 13)

	6	-.98	-31.58	.00	-.85	.01	-592.03
12	5	-2.31	28.92	1.87	-125.73	-17.35	1385.40

C A S O 7

SELECCION DE MAXIMOS DE CARGAS NORMALES

ARCHIVO	NO. HIPOTESIS	HIPOTESIS
SC10-17.ANL	4	10 11 12 13

HIPOTESIS	ENVOLVENTE
1	N .MIN
2	N .MAX
3	QY.MIN
4	QY.MAX
5	QZ.MIN
6	QZ.MAX
7	MT.MIN
8	MT.MAX
9	MY.MIN
10	MY.MAX
11	MZ.MIN
12	MZ.MAX

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
1	11	1	-2.32	168.92	7.38	-500.34	47.37	-.01
		2	-.98	-31.58	.00	-.29	-.01	-25.26
	12	1	.00	.00	.00	.00	.00	.00
		2	-2.32	160.92	7.06	-479.04	41.60	131.94
2	11	2	-.98	-31.57	.00	-.29	-.01	-25.26
		3	-.98	-31.57	.00	-.29	.00	-142.09
	12	2	-2.32	160.92	7.06	-479.04	41.60	131.94
		3	-2.32	123.92	5.61	-380.49	18.16	658.89
3	11	3	-.98	-31.57	.00	-.60	.00	-142.09
		4	-.98	-31.57	.00	-.60	.00	-292.07
	12	3	-2.31	123.92	5.61	-379.06	18.16	659.71
		4	-2.31	76.42	3.74	-252.55	-4.05	1135.52
4	11	4	-.98	-31.58	.00	.04	.00	-292.07
		5	-.98	-31.58	.00	.04	.01	-442.05
	12	4	-2.32	76.42	3.74	-255.01	-4.05	1134.96
		5	-2.32	28.92	1.87	-128.50	-17.35	1385.15
5	11	5	-.98	-31.58	.00	-.85	.01	-442.05

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		6	-2.31	-18.58	.00	.79	-21.79	1409.96
6	11	6	-.98	-31.58	.00	-.95	.01	-592.03
		7	-.98	-31.58	.00	-.95	.01	-742.02
	12	6	-2.31	-18.58	.00	1.02	-21.79	1409.96
		7	-2.31	-66.08	-1.87	127.53	-17.35	1208.89
7	11	7	-.98	-31.58	.00	-2.43	.01	-742.01
		8	-.98	-31.58	.00	-2.43	.00	-891.99
	12	7	-2.32	-66.08	-1.87	129.96	-17.35	1208.63
		8	-2.32	-113.58	-3.74	256.46	-4.05	781.94
8	11	8	-.98	-31.57	.00	-2.43	.00	-891.99
		9	-.98	-31.57	.00	-2.43	-.01	-1041.97
	12	8	-2.32	-113.58	-3.74	256.46	-4.05	781.94
		9	-2.32	-161.08	-5.61	382.98	18.13	129.62
9	11	9	-.98	-31.58	.00	-.99	-.01	-1041.97
		10	-.98	-31.58	.00	-.99	-.01	-1158.81
	12	9	-2.31	-161.08	-5.61	382.80	18.13	130.15
		10	-2.00	.91	.00	.03	-.03	33.41
10	11	10	-.98	-31.54	.01	-11.55	-.01	-1158.75
		11	-.98	-31.54	.01	-11.55	-.02	-1184.00
	12	10	-2.00	.91	.02	.33	-.03	33.41
		11	-2.00	.91	.02	.33	-.04	34.14
11	11	11	-.98	228.40	8.85	-592.21	68.02	-1184.06
		12	-.98	220.40	8.54	-570.91	61.06	-1004.54
	12	11	-2.00	-3.35	-.01	-.36	-.02	34.14
		12	-2.00	-3.35	-.01	-.36	-.01	31.46
12	11	12	-.93	220.40	8.54	-576.50	61.06	-1001.35
		13	-2.28	9.97	.72	-414.69	3.27	-636.62
	12	12	-2.00	-3.35	.00	-.19	-.01	31.46
		13	-2.00	-3.35	.00	-.19	.00	19.07
13	11	13	-2.28	9.97	.72	-415.41	3.27	-636.15
		14	-2.28	5.47	.54	-312.30	.43	-601.43
	12	13	-2.00	-3.35	.00	-.16	.00	19.07
		14	-.93	138.40	5.31	-358.39	4.25	470.23
14	11	14	-2.28	5.46	.53	-310.92	.43	-602.15
		15	-2.28	.96	.35	-207.80	-1.56	-587.67
	12	14	-.94	138.39	5.31	-359.47	4.25	469.41
		15	-.94	93.39	3.54	-239.61	-15.67	990.94
15	11	15	-2.28	.97	.36	-209.15	-1.56	-587.20
		16	-2.28	-3.53	.18	-106.04	-2.78	-592.97
	12	15	-.93	93.39	3.54	-237.34	-15.67	991.49
		16	-.93	48.39	1.77	-117.49	-27.63	1310.51

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
16	11	16	-2.28	-3.54	.18	-107.30	-2.78	-592.75
		17	-2.28	-8.04	.00	-4.19	-3.20	-618.78
	12	16	-.93	48.40	1.77	-114.72	-27.63	1310.76
		17	-.93	3.40	.00	5.14	-31.62	1427.29
17	11	17	-2.28	-8.03	.00	-2.88	-3.20	-618.79
		18	-2.28	-12.53	-.18	100.23	-2.79	-665.06
	12	17	-.93	3.39	.00	2.11	-31.62	1427.30
		18	-.93	-41.61	-1.77	121.97	-27.63	1341.33
18	11	18	-2.28	-12.53	-.18	98.83	-2.79	-665.28
		19	-2.28	-17.03	-.36	201.94	-1.59	-731.80
	12	18	-.93	-41.61	-1.77	124.81	-27.63	1341.07
		19	-.93	-86.61	-3.54	244.66	-15.68	1052.60
19	11	19	-2.28	-17.04	-.36	201.94	-1.59	-731.80
		20	-2.28	-21.54	-.54	305.05	.41	-818.58
	12	19	-.93	-86.60	-3.54	244.66	-15.68	1052.60
		20	-.93	-131.60	-5.31	364.51	4.24	561.62
20	11	20	-2.28	-21.53	-.54	304.90	.41	-818.63
		21	-2.28	-26.03	-.72	408.01	3.23	-925.66
	12	20	-.93	-131.60	-5.31	364.61	4.24	561.56
		21	-2.27	8.17	.00	.73	-.04	247.68
21	11	21	-2.28	-26.03	-.71	406.41	3.23	-926.36
		22	-2.28	-29.73	-.86	491.19	6.13	-1029.54
	12	21	-2.27	8.17	.01	1.16	-.04	247.67
		22	-2.27	8.17	.01	1.16	-.07	277.91
22	11	22	-2.28	-29.74	-.85	488.95	6.13	-1030.62
		23	-2.28	-30.54	-.89	507.28	6.83	-1054.69
	12	22	-2.27	8.17	.01	1.77	-.07	277.91
		23	-2.27	8.17	.01	1.77	-.08	284.45
23	11	23	-2.27	226.95	8.83	-585.19	68.01	-1048.08
		24	-.85	31.87	.86	-490.00	6.21	-996.31
	12	23	-2.27	-28.18	-.03	-5.80	-.02	284.45
		24	-2.27	-28.18	-.03	-5.80	.00	261.90
24	11	24	-.84	31.87	.87	-500.87	6.21	-990.89
		25	-.84	28.17	.72	-416.09	3.27	-879.83
	12	24	-2.27	-28.18	.00	-2.94	.00	261.95
		25	-2.27	-28.18	.00	-2.94	.01	157.70
25	11	25	-.84	28.17	.72	-416.09	3.27	-879.83
		26	-.84	23.67	.54	-312.98	.44	-763.21
	12	25	-2.27	-28.18	.00	-2.94	.01	157.70
		26	-2.18	136.94	5.31	-354.97	4.28	595.60

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
26	11	26	-.84	23.67	.54	-314.86	.44	-762.43
		27	-.84	19.17	.36	-211.75	-1.59	-666.05
	12	26	-2.17	136.94	5.32	-353.50	4.28	596.48
		27	-2.17	91.94	3.55	-233.64	-15.66	1111.47
27	11	27	-.84	19.16	.36	-210.22	-1.59	-666.53
		28	-.84	14.66	.18	-107.12	-2.80	-590.42
	12	27	-2.17	91.94	3.54	-236.19	-15.66	1110.93
		28	-2.17	46.94	1.77	-116.35	-27.61	1423.39
28	11	28	-.84	14.67	.18	-108.37	-2.80	-590.19
		29	-.84	10.17	.00	-5.25	-3.21	-534.31
	12	28	-2.17	46.94	1.77	-113.34	-27.61	1423.63
		29	-2.17	1.94	.00	6.52	-31.61	1533.64
29	11	29	-.84	10.17	.00	-5.34	-3.21	-534.31
		30	-.84	5.67	-.18	97.78	-2.80	-498.68
	12	29	-2.17	1.94	.00	6.80	-31.61	1533.63
		30	-2.17	-43.06	-1.77	126.66	-27.63	1441.10
30	11	30	-.84	5.67	-.18	97.78	-2.80	-498.68
		31	-2.27	-28.18	.00	-3.18	.00	-603.08
	12	30	-2.17	-43.07	-1.77	126.66	-27.63	1441.09
		31	-2.17	-88.06	-3.54	246.50	-15.68	1146.11
31	11	31	-2.27	-28.18	.01	-4.45	.00	-603.07
		32	-2.27	-28.18	.01	-4.45	-.03	-729.88
	12	31	-2.18	-88.06	-3.54	248.92	-15.68	1145.58
		32	-2.18	-133.06	-5.31	368.79	4.22	648.00
32	11	32	-2.27	-28.18	.01	-4.45	-.03	-729.88
		33	-2.27	-28.18	.01	-4.45	-.06	-856.67
	12	32	-2.18	-133.06	-5.31	368.79	4.22	648.00
		33	-2.00	11.55	.01	1.83	-.06	351.06
33	11	33	-2.27	-28.18	.00	-2.73	-.06	-856.67
		34	-2.27	-28.18	.00	-2.73	-.07	-960.94
	12	33	-2.00	11.55	.00	1.12	-.06	351.07
		34	-2.00	11.55	.00	1.12	-.07	393.80
34	11	34	-2.27	-28.17	.03	-13.58	-.07	-960.85
		35	-2.27	-28.17	.03	-13.58	-.10	-983.39
	12	34	-2.00	11.56	.03	5.56	-.07	393.76
		35	-2.00	11.56	.03	5.56	-.09	403.00
35	11	35	-2.13	231.46	10.53	-704.92	80.39	-974.41
		36	-2.03	20.60	.86	-501.91	6.22	-921.62
	12	35	-2.00	-39.96	-.01	-7.09	.00	403.14
		36	-2.00	-39.96	-.01	-7.09	.01	371.20
36	11	36	-2.03	20.60	.87	-504.84	6.22	-920.01

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		37	-2.03	16.90	.72	-420.05	3.29	-850.65
	12	36	-2.00	-39.96	.00	-5.92	.01	371.23
		37	-2.00	-39.96	.00	-5.92	.02	223.35
37	11	37	-2.03	16.89	.72	-419.72	3.29	-850.81
		38	-2.03	12.40	.54	-316.62	.47	-784.92
	12	37	-2.00	-39.96	.00	-6.00	.02	223.35
		38	-.69	91.62	5.31	-359.07	4.27	687.58
38	11	38	-2.03	12.40	.54	-318.27	.47	-784.24
		39	-2.03	7.90	.36	-215.15	-1.56	-738.59
	12	38	-.67	91.62	5.32	-357.62	4.27	688.34
		39	-2.09	69.48	4.16	-274.64	-18.82	1059.82
39	11	39	-2.03	7.90	.36	-215.02	-1.56	-738.63
		40	-2.03	3.40	.18	-111.92	-2.77	-713.21
	12	39	-2.09	69.48	4.16	-274.82	-18.82	1059.78
		40	-2.09	15.48	2.04	-131.01	-32.77	1250.92
40	11	40	-2.03	3.40	.19	-113.68	-2.77	-712.94
		41	-2.03	-1.10	.01	-10.57	-3.20	-707.79
	12	40	-2.09	15.48	2.04	-127.92	-32.77	1251.24
		41	-2.09	-38.51	-.08	15.90	-37.17	1199.42
41	11	41	-2.03	-1.10	.00	-8.95	-3.20	-707.82
		42	-2.03	-5.60	-.18	94.16	-2.80	-722.91
	12	41	-2.09	-38.52	-.09	13.15	-37.17	1199.44
		42	-2.09	-92.51	-2.21	156.96	-31.99	904.64
42	11	42	-2.03	-5.61	-.18	92.63	-2.80	-723.10
		43	-2.00	-39.96	.00	-6.96	-.01	-855.60
	12	42	-2.09	-92.52	-2.21	158.87	-31.99	904.31
		43	-2.09	-145.12	-4.28	298.96	-17.28	366.85
43	11	43	-2.00	-39.96	.00	-6.96	-.01	-855.60
		44	-2.00	-39.96	.00	-6.96	-.04	-1035.42
	12	43	-2.09	-145.11	-4.28	298.96	-17.28	366.85
		44	.00	.00	.00	.00	.00	.00
44	11	44	-2.00	-39.96	.00	-6.96	-.04	-1035.41
		45	-.67	-223.39	-7.08	483.12	32.13	-1387.07
	12	44	.00	.00	.00	.00	.00	.00
		45	.00	.00	.00	.00	.00	.00
45	11	45	-.69	-223.39	-7.08	480.71	32.13	-1387.91
		46	-2.11	-272.11	-9.28	634.87	68.82	-2283.39
	12	45	.00	.00	.00	.00	.00	.00
		46	.00	.00	.00	.00	.00	.00
46	11	46	-2.13	-272.11	-9.27	627.72	68.82	-2285.36
		47	-2.13	-280.11	-9.59	649.03	76.36	-2506.32

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	46	.00	.00	.00	.00	.00	.00
		47	.00	.00	.00	.00	.00	.00
47	11	47	-1.67	267.83	8.86	-604.36	68.05	-2474.67
		48	-1.67	259.84	8.55	-583.07	61.10	-2263.80
	12	47	.00	.00	.00	.00	.00	.00
		48	.00	.00	.00	.00	.00	.00
48	11	48	-1.70	259.84	8.54	-573.65	61.10	-2266.20
		49	-1.70	222.83	7.08	-475.08	32.18	-1373.05
	12	48	.00	.00	.00	.00	.00	.00
		49	.00	.00	.00	.00	.00	.00
49	11	49	-1.70	222.83	7.09	-475.86	32.18	-1372.78
		50	-1.70	177.84	5.31	-356.03	4.29	-471.44
	12	49	.00	.00	.00	.00	.00	.00
		50	-1.81	134.55	5.31	-349.53	4.29	653.16
50	11	50	-1.70	177.84	5.31	-356.03	4.29	-471.44
		51	.00	.00	.00	.00	.00	.00
	12	50	-1.81	134.55	5.31	-349.53	4.29	653.16
		51	-1.75	109.99	4.64	-267.70	-19.06	1198.52
51	11	51	.00	.00	.00	.00	.00	.00
		52	.00	.00	.00	.00	.00	.00
	12	51	-1.74	109.99	4.64	-265.17	-19.06	1199.08
		52	-1.74	55.99	2.52	-121.34	-35.17	1572.58
52	11	52	.00	.00	.00	.00	.00	.00
		53	.00	.00	.00	.00	.00	.00
	12	52	-1.74	55.98	2.52	-121.06	-35.17	1572.61
		53	-1.74	1.98	.39	22.77	-41.72	1703.04
53	11	53	.00	.00	.00	.00	.00	.00
		54	.00	.00	.00	.00	.00	.00
	12	53	-1.74	1.98	.39	22.78	-41.72	1703.05
		54	-1.74	-52.01	-1.73	166.58	-38.69	1590.51
54	11	54	.00	.00	.00	.00	.00	.00
		55	.00	.00	.00	.00	.00	.00
	12	54	-1.74	-52.01	-1.74	166.29	-38.69	1590.54
		55	-1.74	-103.01	-5.51	308.87	-22.20	1237.22
55	11	55	.00	.00	.00	.00	.00	.00
		56	.00	.00	.00	.00	.00	.00
	12	55	-1.75	-103.01	-5.51	311.72	-22.20	1236.52
		56	-1.70	-92.16	-5.31	365.79	4.21	685.25
56	11	56	.00	.00	.00	.00	.00	.00
		57	-1.75	-193.01	-9.05	551.42	43.34	-95.60
	12	56	-1.70	-92.16	-5.31	365.79	4.21	685.25

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		57	-1.70	-137.17	-7.08	485.66	32.08	169.21
57	11	57	-1.73	-193.01	-9.06	551.63	43.34	-94.40
		58	-1.73	-230.01	-10.51	650.18	79.55	-877.00
	12	57	-1.68	-137.17	-7.08	485.29	32.08	170.26
		58	.00	.00	.00	.00	.00	.00
58	11	58	-1.86	-230.01	-10.49	639.36	79.55	-884.93
		59	-1.86	-238.81	-10.84	662.78	88.08	-1072.35
	12	58	.00	.00	.00	.00	.00	.00
		59	.00	.00	.00	.00	.00	.00
59	11	59	-1.44	24.91	.90	-72.06	6.94	-1045.77
		60	-1.44	24.11	.86	-69.93	6.24	-1026.15
	12	59	.00	.00	.00	.00	.00	.00
		60	.00	.00	.00	.00	.00	.00
60	11	60	-1.44	24.12	.87	-71.20	6.24	-1026.06
		61	-1.44	20.42	.72	-61.35	3.30	-943.67
	12	60	.00	.00	.00	.00	.00	.00
		61	.00	.00	.00	.00	.00	.00
61	11	61	-1.44	20.41	.72	-62.97	3.30	-943.56
		62	-1.44	15.91	.54	-50.99	.46	-861.83
	12	61	.00	.00	.00	.00	.00	.00
		62	.00	.00	.00	.00	.00	.00
62	11	62	-1.44	15.91	.54	-49.32	.46	-861.92
		63	-1.44	11.41	.36	-37.33	-1.55	-800.44
	12	62	.00	.00	.00	.00	.00	.00
		63	.00	.00	.00	.00	.00	.00
63	11	63	-1.44	11.41	.36	-40.72	-1.55	-800.27
		64	-1.44	6.91	.18	-28.73	-2.79	-759.03
	12	63	.00	.00	.00	.00	.00	.00
		64	.00	.00	.00	.00	.00	.00
64	11	64	-1.44	6.91	.18	-27.13	-2.79	-759.09
		65	-1.44	2.41	.00	-15.14	-3.20	-738.09
	12	64	.00	.00	.00	.00	.00	.00
		65	.00	.00	.00	.00	.00	.00
65	11	65	-1.44	2.41	.00	-16.70	-3.20	-738.06
		66	-1.44	-2.09	-.18	-4.72	-2.81	-737.32
	12	65	.00	.00	.00	.00	.00	.00
		66	.00	.00	.00	.00	.00	.00
66	11	66	-1.44	-2.08	-.18	-3.16	-2.81	-737.33
		67	-1.55	-9.68	-.36	191.55	-1.60	-760.11
	12	66	.00	.00	.00	.00	.00	.00
		67	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
67	11	67	-1.55	-9.67	-.35	188.20	-1.60	-760.94
		68	-1.44	-26.31	-.53	294.59	.39	-817.89
	12	67	.00	.00	.00	.00	.00	.00
		68	.00	27.82	.00	-6.96	.00	30.39
68	11	68	-1.44	-26.31	-.54	296.46	.39	-817.21
		69	-1.44	-30.81	-.72	399.55	3.20	-945.71
	12	68	.00	27.82	.00	-7.03	.00	30.37
		69	.00	27.82	.00	-7.03	.00	155.54
69	11	69	-1.44	-30.81	-.71	398.28	3.20	-946.24
		70	-1.44	-34.51	-.86	483.05	6.12	-1067.09
	12	69	.00	27.82	.00	-6.82	.00	155.55
		70	.00	27.82	.00	-6.82	.00	258.49
70	11	70	-1.44	-34.50	-.85	477.41	6.12	-1069.63
		71	-1.44	-35.30	-.89	495.75	6.81	-1097.57
	12	70	.00	27.82	.00	-5.46	.00	258.53
		71	.00	27.82	.00	-5.46	.00	280.79
71	11	71	-1.19	225.94	8.85	-576.01	68.06	-1064.14
		72	-1.19	217.94	8.53	-554.73	61.11	-886.75
	12	71	.00	-8.04	.00	-.48	.00	280.49
		72	.00	-8.04	.00	-.48	.00	274.06
72	11	72	-1.10	217.96	8.55	-563.88	61.11	-880.95
		73	-1.10	180.95	7.09	-465.33	32.19	-142.91
	12	72	.00	-8.03	.00	2.36	.00	274.06
		73	.00	-8.03	.00	2.36	.00	244.32
73	11	73	-1.11	180.95	7.09	-465.06	32.19	-143.77
		74	.00	.00	.00	.00	.00	.00
	12	73	.00	-8.04	.00	1.91	.00	244.33
		74	-1.11	131.98	5.31	-344.16	4.28	676.77
74	11	74	.00	.00	.00	.00	.00	.00
		75	.00	.00	.00	.00	.00	.00
	12	74	-1.11	131.98	5.31	-344.15	4.28	676.77
		75	-1.11	86.99	3.54	-224.31	-15.65	1169.40
75	11	75	.00	.00	.00	.00	.00	.00
		76	.00	.00	.00	.00	.00	.00
	12	75	-1.11	86.98	3.55	-221.64	-15.65	1169.90
		76	-1.22	43.71	1.77	-101.57	-27.62	1460.63
76	11	76	.00	.00	.00	.00	.00	.00
		77	.00	.00	.00	.00	.00	.00
	12	76	-1.22	43.72	1.77	-101.82	-27.62	1460.61
		77	-1.22	-1.28	.00	18.03	-31.62	1556.09

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
77	11	77	.00	.00	.00	.00	.00	.00
		78	.00	.00	.00	.00	.00	.00
	12	77	-1.22	-1.28	.00	18.31	-31.62	1556.09
		78	-1.22	-46.28	-1.77	138.15	-27.64	1449.06
78	11	78	.00	.00	.00	.00	.00	.00
		79	.00	.00	.00	.00	.00	.00
	12	78	-1.22	-46.29	-1.77	137.90	-27.64	1449.10
		79	-1.22	-91.28	-3.54	257.74	-15.70	1139.60
79	11	79	.00	.00	.00	.00	.00	.00
		80	.00	-8.04	.00	2.35	.00	-8.79
	12	79	-1.23	-91.28	-3.54	260.36	-15.70	1139.01
		80	-1.23	-136.28	-5.31	380.21	4.21	626.97
80	11	80	.00	-8.04	.00	2.35	.00	-8.80
		81	-1.11	-183.02	-7.08	499.93	32.10	-127.29
	12	80	-1.23	-136.28	-5.31	380.32	4.21	626.90
		81	.00	.00	.00	.00	.00	.00
81	11	81	-1.11	-183.02	-7.08	499.95	32.10	-127.21
		82	-1.11	-220.02	-8.54	598.49	60.99	-872.75
	12	81	.00	.00	.00	.00	.00	.00
		82	.00	.00	.00	.00	.00	.00
82	11	82	-1.11	-220.03	-8.54	598.52	60.99	-872.72
		83	-1.11	-228.02	-8.85	619.81	67.95	-1051.88
	12	82	.00	.00	.00	.00	.00	.00
		83	.00	.00	.00	.00	.00	.00
83	11	83	-.75	28.39	.90	-76.20	6.94	-1025.60
		84	-.75	27.58	.87	-74.07	6.23	-1003.17
	12	83	.00	.00	.00	.00	.00	.00
		84	.00	.00	.00	.00	.00	.00
84	11	84	-.75	27.59	.87	-74.15	6.23	-1003.17
		85	-.75	23.89	.72	-64.30	3.30	-907.95
	12	84	.00	.00	.00	.00	.00	.00
		85	.00	.00	.00	.00	.00	.00
85	11	85	-.74	23.89	.72	-66.37	3.30	-907.80
		86	-.74	19.39	.54	-54.39	.46	-810.43
	12	85	.00	.00	.00	.00	.00	.00
		86	.00	.00	.00	.00	.00	.00
86	11	86	-.74	19.39	.54	-54.38	.46	-810.43
		87	-.86	9.37	.36	-226.17	-1.57	-742.16
	12	86	.00	.00	.00	.00	.00	.00
		87	.00	.00	.00	.00	.00	.00
87	11	87	-.86	9.38	.36	-226.18	-1.57	-742.17

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		88	-.86	4.88	.18	-123.08	-2.79	-710.10
	12	87	.00	.00	.00	.00	.00	.00
		88	.00	.00	.00	.00	.00	.00
88	11	88	-.85	4.88	.18	-124.58	-2.79	-709.84
		89	-.85	.38	.00	-21.47	-3.21	-698.03
	12	88	.00	.00	.00	.00	.00	.00
		89	.00	.00	.00	.00	.00	.00
89	11	89	-.85	.37	.00	-19.99	-3.21	-698.07
		90	-.85	-4.13	-.18	83.14	-2.81	-706.51
	12	89	.00	.00	.00	.00	.00	.00
		90	.00	.00	.00	.00	.00	.00
90	11	90	-.86	-4.13	-.18	81.64	-2.81	-706.69
		91	-.86	-8.63	-.36	184.75	-1.61	-735.38
	12	90	.00	.00	.00	.00	.00	.00
		91	.00	.00	.00	.00	.00	.00
91	11	91	-.86	-8.62	-.36	184.74	-1.61	-735.39
		92	-.86	-13.12	-.54	287.83	.40	-784.31
	12	91	.00	.00	.00	.00	.00	.00
		92	.00	2.32	.00	-.78	.00	2.58
92	11	92	-.86	-13.12	-.53	286.04	.40	-784.96
		93	-.86	-17.63	-.71	389.16	3.21	-854.16
	12	92	.00	2.32	.00	-.78	.00	2.58
		93	.00	2.32	.00	-.78	.00	13.02
93	11	93	-.86	-17.63	-.72	390.11	3.21	-853.72
		94	-.86	-21.33	-.86	474.90	6.14	-925.79
	12	93	.00	2.32	.00	-.79	.00	13.02
		94	.00	2.32	.00	-.79	.00	21.61
94	11	94	-.85	-21.31	-.87	481.00	6.14	-922.66
		95	-.85	-22.11	-.90	499.32	6.85	-939.98
	12	94	.00	2.32	.00	-.93	.00	21.61
		95	.00	2.32	.00	-.93	.00	23.46
95	11	95	-.39	238.00	8.44	-547.78	57.54	-894.45
		96	-.39	230.00	8.12	-526.47	50.91	-707.24
	12	95	.00	-.61	.00	.46	.00	23.42
		96	.00	-.61	.00	.46	.00	22.93
96	11	96	-.45	230.00	8.12	-521.31	50.91	-711.06
		97	.00	.00	.00	.00	.00	.00
	12	96	.00	-.61	.00	.30	.00	22.94
		97	-.38	165.51	5.79	-365.57	19.66	108.56
97	11	97	.00	.00	.00	.00	.00	.00
		98	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	97	-.37	165.51	5.79	-365.40	19.66	109.12
		98	-.44	141.99	4.66	-286.81	-4.33	896.84
98	11	98	.00	.00	.00	.00	.00	.00
		99	.00	.00	.00	.00	.00	.00
	12	98	-.43	142.00	4.66	-284.92	-4.33	897.44
		99	-.43	83.19	2.34	-128.31	-21.49	1449.20
99	11	99	.00	.00	.00	.00	.00	.00
		100	.00	.00	.00	.00	.00	.00
	12	99	-.43	83.19	2.34	-131.34	-21.49	1448.92
		100	-.43	24.41	.03	25.23	-27.29	1712.47
100	11	100	.00	.00	.00	.00	.00	.00
		101	.00	.00	.00	.00	.00	.00
	12	100	-.43	24.40	.03	28.54	-27.29	1712.42
		101	-.43	-34.40	-2.29	185.15	-21.75	1687.91
101	11	101	.00	.00	.00	.00	.00	.00
		102	.00	.00	.00	.00	.00	.00
	12	101	-.43	-34.40	-2.29	185.44	-21.75	1687.89
		102	-.43	-93.20	-4.60	342.03	-4.88	1375.31
102	11	102	.00	.00	.00	.00	.00	.00
		103	.00	.00	.00	.00	.00	.00
	12	102	-.44	-93.19	-4.60	344.91	-4.88	1374.60
		103	-.44	-152.01	-6.92	501.54	23.35	773.75
103	11	103	.00	.00	.00	.00	.00	.00
		104	.00	.00	.00	.00	.00	.00
	12	103	-.44	-152.01	-6.92	501.09	23.35	774.04
		104	-.44	-196.40	-8.66	619.32	52.17	129.61
104	11	104	.00	.00	.00	.00	.00	.00
		105	-.45	-206.03	-9.04	645.03	59.25	-32.06
	12	104	-.45	-196.43	-8.66	619.47	52.17	128.92
		105	.00	.00	.00	.00	.00	.00

SC- iAPF - LI $M^{+}_{máx}$ en c. vano ⑤. (2 UTAs)

(LOAD 1ª)

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:41:27                       *
*                                                   *
*****************************************************
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```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 14
131. * POR LA CUASI SIMETRIA SE TOMARA EL DOBLE DEL TREN UNICO, AUNQUE
132. * VAYAN EN SENTIDOS OPUESTOS REALMENTE
133. MEMBER LOAD
134. *LOCOMOTORA 1
135. 47 TO 53 UNI GY -24
136. 54 UNI GY -24 0 3
137. *VAGONES 1
138. 54 UNI GY -20 3 4.5
139. 55 TO 58 UNI GY -20
140. 58 TO 70 UNI GY -2
141. 71 TO 82 UNI GY -20
142. 83 TO 94 UNI GY -2
143. 95 TO 104 UNI GY -20
144. *RIPADO + F.CENTRIFUGA
145. *LOCOMOTORA 1
146. 47 TO 53 UMOM X 9.92
147. 47 TO 53 UNI Z .9449
148. 54 UMOM X 9.92126 0 3
149. 54 UNI Z 0.9449 0 3
150. *VAGONES 1
151. 54 UMOM X 8.26772 3 4.5
152. 54 UNI Z 0.7874 3 4.5
153. 55 TO 58 UMOM X 8.2677
154. 55 TO 58 UNI Z 0.7874
155. 58 TO 70 UMOM X .82677
156. 58 TO 70 UNI Z 0.08
157. 71 TO 82 UMOM X 8.2677
158. 71 TO 82 UNI Z 0.7874
159. 83 TO 94 UMOM X .82677
160. 83 TO 94 UNI Z 0.08
161. 95 TO 104 UMOM X 8.2677
162. 95 TO 104 UNI Z .7874
163. PERFORM ANALYSIS
```


P R O B L E M S T A T I S T I C S

```
NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                0:41:30
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 0:41:30
++ PROCESSING TRIANGULAR FACTORIZATION.                0:41:30
++ CALCULATING JOINT DISPLACEMENTS.                    0:41:31
++ CALCULATING MEMBER  FORCES.                         0:41:31

 164. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	14	1	-3.90	1.81	0.01	0.02	-0.04	0.00
		2	3.90	-1.81	-0.01	-0.02	0.03	1.45
2	14	2	-3.90	1.81	0.01	0.02	-0.03	-1.45
		3	3.90	-1.81	-0.01	-0.02	0.00	8.16
3	14	3	-3.90	1.81	0.00	0.03	0.00	-8.16
		4	3.90	-1.81	0.00	-0.03	0.01	16.77
4	14	4	-3.90	1.81	0.01	0.00	-0.01	-16.77
		5	3.90	-1.81	-0.01	0.00	-0.03	25.39
5	14	5	-3.90	1.81	0.00	0.05	0.03	-25.39
		6	3.90	-1.81	0.00	-0.05	-0.03	34.00
6	14	6	-3.90	1.81	0.00	0.05	0.03	-34.00
		7	3.90	-1.81	0.00	-0.05	-0.03	42.62
7	14	7	-3.90	1.81	-0.01	0.14	0.03	-42.62
		8	3.90	-1.81	0.01	-0.14	0.01	51.23
8	14	8	-3.90	1.81	-0.01	0.14	-0.01	-51.23
		9	3.90	-1.81	0.01	-0.14	0.05	59.84
9	14	9	-3.90	1.81	0.00	0.06	-0.05	-59.84
		10	3.90	-1.81	0.00	-0.06	0.06	66.55
10	14	10	-3.90	1.81	-0.04	0.66	-0.06	-66.55
		11	3.90	-1.81	0.04	-0.66	0.09	68.00
11	14	11	-3.90	-6.67	0.03	-0.72	-0.04	-68.00
		12	3.90	6.67	-0.03	0.72	0.02	62.67
12	14	12	-3.90	-6.67	0.01	-0.37	-0.02	-62.67
		13	3.90	6.67	-0.01	0.37	0.00	37.98
13	14	13	-3.90	-6.67	0.00	-0.33	0.00	-37.99
		14	3.90	6.67	0.00	0.33	0.00	7.96
14	14	14	-3.90	-6.67	0.01	-0.34	0.00	-7.96
		15	3.90	6.67	-0.01	0.34	-0.05	-22.06
15	14	15	-3.90	-6.67	0.00	-0.39	0.05	22.06
		16	3.90	6.67	0.00	0.39	-0.06	-52.08
16	14	16	-3.90	-6.67	-0.01	-0.50	0.06	52.08
		17	3.90	6.67	0.01	0.50	-0.02	-82.10

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	14	17	-3.90	-6.67	0.00	-0.33	0.02	82.10
		18	3.90	6.67	0.00	0.33	-0.03	-112.12
18	14	18	-3.90	-6.67	-0.01	-0.57	0.03	112.12
		19	3.90	6.67	0.01	0.57	0.00	-142.14
19	14	19	-3.90	-6.67	-0.01	-0.57	0.00	142.14
		20	3.90	6.67	0.01	0.57	0.03	-172.16
20	14	20	-3.90	-6.67	-0.01	-0.60	-0.03	172.16
		21	3.90	6.67	0.01	0.60	0.07	-202.19
21	14	21	-3.90	-6.67	-0.01	-0.95	-0.07	202.18
		22	3.90	6.67	0.01	0.95	0.12	-226.87
22	14	22	-3.90	-6.67	-0.02	-1.44	-0.12	226.86
		23	3.90	6.67	0.02	1.44	0.14	-232.20
23	14	23	-3.90	23.00	0.05	4.74	-0.03	232.20
		24	3.90	-23.00	-0.05	-4.74	-0.01	-213.80
24	14	24	-3.91	23.00	0.01	2.40	0.01	213.84
		25	3.91	-23.00	-0.01	-2.40	-0.03	-128.73
25	14	25	-3.91	23.00	0.01	2.40	0.03	128.73
		26	3.91	-23.00	-0.01	-2.40	-0.05	-25.22
26	14	26	-3.91	23.00	0.00	2.34	0.05	25.23
		27	3.91	-23.00	0.00	-2.34	-0.03	78.28
27	14	27	-3.91	23.00	0.00	2.16	0.03	-78.28
		28	3.91	-23.00	0.00	-2.16	-0.05	181.79
28	14	28	-3.91	23.00	0.00	2.54	0.05	-181.78
		29	3.91	-23.00	0.00	-2.54	-0.04	285.30
29	14	29	-3.91	23.00	0.00	2.59	0.04	-285.30
		30	3.91	-23.00	0.00	-2.59	-0.02	388.82
30	14	30	-3.91	23.00	0.00	2.59	0.02	-388.82
		31	3.91	-23.00	0.00	-2.59	0.00	492.31
31	14	31	-3.91	23.00	-0.01	3.63	0.00	-492.30
		32	3.91	-23.00	0.01	-3.63	0.06	595.82
32	14	32	-3.91	23.00	-0.01	3.64	-0.06	-595.82
		33	3.91	-23.00	0.01	-3.64	0.11	699.32
33	14	33	-3.91	23.00	0.00	2.23	-0.11	-699.33
		34	3.91	-23.00	0.00	-2.23	0.13	784.44

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	14	34	-3.90	23.01	-0.05	11.08	-0.13	-784.36
		35	3.90	-23.01	0.05	-11.08	0.17	802.78
35	14	35	-3.91	-79.61	0.02	-14.13	0.01	-803.05
		36	3.91	79.61	-0.02	14.13	-0.02	739.45
36	14	36	-3.91	-79.60	0.01	-11.78	0.02	-739.48
		37	3.91	79.60	-0.01	11.78	-0.04	444.91
37	14	37	-3.91	-79.60	0.01	-11.96	0.04	-444.91
		38	3.91	79.60	-0.01	11.96	-0.07	86.73
38	14	38	-3.91	-79.60	0.00	-11.77	0.07	-86.76
		39	3.91	79.60	0.00	11.77	-0.07	-271.51
39	14	39	-3.91	-79.60	0.00	-11.73	0.07	271.51
		40	3.91	79.60	0.00	11.73	-0.07	-629.70
40	14	40	-3.91	-79.60	-0.01	-13.28	0.07	629.67
		41	3.91	79.60	0.01	13.28	-0.02	-987.88
41	14	41	-3.91	-79.60	0.00	-11.02	0.02	987.90
		42	3.91	79.60	0.00	11.02	-0.01	-1346.10
42	14	42	-3.91	-79.60	-0.01	-13.86	0.01	1346.07
		43	3.91	79.60	0.01	13.86	0.03	-1704.36
43	14	43	-3.91	-79.60	-0.01	-13.87	-0.03	1704.36
		44	3.91	79.60	0.01	13.87	0.07	-2062.56
44	14	44	-3.91	-79.60	-0.01	-13.87	-0.07	2062.57
		45	3.91	79.60	0.01	13.87	0.11	-2420.76
45	14	45	-3.91	-79.60	-0.02	-18.07	-0.11	2420.73
		46	3.91	79.60	0.02	18.07	0.18	-2715.26
46	14	46	-3.91	-79.59	-0.03	-26.57	-0.18	2715.19
		47	3.91	79.59	0.03	26.57	0.20	-2778.84
47	14	47	-3.36	544.69	-21.06	-208.63	160.43	2774.24
		48	3.36	-525.51	20.31	200.70	-143.90	-2346.51
48	14	48	-3.45	525.51	-20.29	-190.94	143.90	2347.36
		49	3.45	-436.69	16.79	154.22	-75.28	-566.85
49	14	49	-3.44	436.69	-16.80	-154.55	75.28	566.76
		50	3.44	-328.72	12.55	109.91	-9.27	1155.07
50	14	50	-3.44	328.71	-12.55	-109.92	9.27	-1155.07
		51	3.44	-220.71	8.29	65.28	37.62	2391.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	14	51	-3.42	220.71	-8.30	-60.22	-37.62	-2391.44
		52	3.42	-112.71	4.05	15.58	65.41	3141.70
52	14	52	-3.42	112.71	-4.05	-15.02	-65.41	-3141.69
		53	3.42	-4.70	-0.20	-29.62	74.06	3405.86
53	14	53	-3.42	4.69	0.20	29.64	-74.06	-3405.88
		54	3.42	103.29	-4.45	-74.27	63.58	3184.05
54	14	54	-3.42	-103.28	4.46	73.70	-63.58	-3184.07
		55	3.42	205.28	-8.47	-115.86	34.14	2480.71
55	14	55	-3.44	-205.28	8.46	121.56	-34.14	-2480.43
		56	3.44	295.27	-12.01	-158.76	-11.92	1354.27
56	14	56	-3.44	-295.28	12.01	158.75	11.92	-1354.26
		57	3.44	385.29	-15.55	-195.96	-73.93	-177.25
57	14	57	-3.40	-385.30	15.56	196.35	73.93	176.81
		58	3.40	459.30	-18.47	-226.94	-136.88	-1739.34
58	14	58	-3.63	-459.33	18.43	205.56	136.88	1742.00
		59	3.63	476.92	-19.12	-212.83	-151.89	-2116.27
59	14	59	-2.88	50.52	-1.79	-42.81	13.88	2106.61
		60	2.88	-48.92	1.73	42.15	-12.47	-2066.78
60	14	60	-2.88	48.96	-1.73	-44.71	12.47	2066.73
		61	2.88	-41.56	1.44	41.65	-6.61	-1899.24
61	14	61	-2.88	41.56	-1.44	-44.92	6.61	1899.17
		62	2.88	-32.56	1.08	41.20	-0.93	-1732.40
62	14	62	-2.88	32.56	-1.08	-37.84	0.93	1732.46
		63	2.88	-23.56	0.72	34.12	3.10	-1606.20
63	14	63	-2.87	23.56	-0.73	-40.92	-3.10	1606.04
		64	2.87	-14.56	0.37	37.20	5.57	-1520.26
64	14	64	-2.88	14.57	-0.36	-33.98	-5.57	1520.34
		65	2.88	-5.57	0.00	30.26	6.40	-1475.04
65	14	65	-2.88	5.56	-0.01	-33.38	-6.40	1474.98
		66	2.88	3.44	-0.35	29.66	5.63	-1470.19
66	14	66	-2.87	-3.44	0.36	-26.55	-5.63	1470.26
		67	2.87	12.44	-0.72	22.83	3.21	-1505.97
67	14	67	-2.88	-12.44	0.70	-29.47	-3.21	1505.86
		68	2.88	21.44	-1.06	25.75	-0.77	-1582.09

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	14	68	-2.88	-21.44	1.07	-22.13	0.77	1582.14
		69	2.88	30.43	-1.43	18.41	-6.40	-1698.84
69	14	69	-2.88	-30.43	1.43	-20.70	6.40	1698.82
		70	2.88	37.83	-1.72	17.64	-12.23	-1825.11
70	14	70	-2.89	-37.81	1.71	-27.29	12.23	1825.01
		71	2.89	39.41	-1.77	26.63	-13.63	-1855.93
71	14	71	-2.38	444.96	-17.70	-139.74	136.12	1852.71
		72	2.38	-428.98	17.07	133.13	-122.22	-1503.50
72	14	72	-2.20	428.93	-17.09	-148.70	122.22	1502.05
		73	2.20	-354.92	14.18	118.10	-64.37	-51.82
73	14	73	-2.23	354.92	-14.17	-118.01	64.37	52.03
		74	2.23	-264.91	10.63	80.80	-8.56	1342.76
74	14	74	-2.23	264.91	-10.63	-80.79	8.56	-1342.76
		75	2.23	-174.92	7.09	43.59	31.30	2332.29
75	14	75	-2.21	174.92	-7.09	-38.26	-31.30	-2332.38
		76	2.21	-84.91	3.55	1.05	55.24	2917.11
76	14	76	-2.21	84.91	-3.55	-1.54	-55.24	-2917.10
		77	2.21	5.09	0.00	-35.66	63.23	3096.69
77	14	77	-2.21	-5.09	0.00	36.21	-63.23	-3096.67
		78	2.21	95.09	-3.54	-73.41	55.28	2871.30
78	14	78	-2.21	-95.09	3.54	72.91	-55.28	-2871.29
		79	2.21	185.09	-7.08	-110.11	31.39	2240.95
79	14	79	-2.23	-185.08	7.08	115.24	-31.39	-2240.68
		80	2.23	275.09	-10.62	-152.45	-8.43	1205.25
80	14	80	-2.23	-275.09	10.62	152.66	8.43	-1205.22
		81	2.23	365.10	-14.16	-189.87	-64.20	-235.27
81	14	81	-2.23	-365.09	14.16	189.91	64.20	235.24
		82	2.23	439.08	-17.08	-220.49	-121.99	-1722.81
82	14	82	-2.23	-439.00	17.08	220.56	121.99	1722.81
		83	2.23	454.99	-17.71	-227.17	-135.89	-2080.30
83	14	83	-1.49	57.55	-1.80	-51.15	13.88	2069.79
		84	1.49	-55.95	1.73	50.49	-12.47	-2024.34
84	14	84	-1.49	55.94	-1.73	-50.66	12.47	2024.35
		85	1.49	-48.54	1.44	47.60	-6.60	-1831.06

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	14	85	-1.49	48.54	-1.44	-51.78	6.60	1830.94
		86	1.49	-39.54	1.08	48.06	-0.92	-1632.76
86	14	86	-1.49	39.54	-1.08	-48.05	0.92	1632.77
		87	1.49	-30.54	0.72	44.33	3.14	-1475.04
87	14	87	-1.49	30.55	-0.72	-44.34	-3.14	1475.05
		88	1.49	-21.55	0.36	40.62	5.58	-1357.84
88	14	88	-1.49	21.54	-0.37	-43.49	-5.58	1357.76
		89	1.49	-12.54	0.01	39.77	6.42	-1281.07
89	14	89	-1.49	12.55	0.00	-37.05	-6.42	1281.14
		90	1.49	-3.54	-0.36	33.33	5.62	-1244.93
90	14	90	-1.49	3.54	0.35	-35.97	-5.62	1244.85
		91	1.49	5.46	-0.71	32.25	3.21	-1249.17
91	14	91	-1.49	-5.46	0.71	-32.26	-3.21	1249.16
		92	1.49	14.45	-1.07	28.55	-0.81	-1293.94
92	14	92	-1.49	-14.45	1.07	-31.50	0.81	1293.88
		93	1.49	23.45	-1.43	27.78	-6.44	-1379.18
93	14	93	-1.49	-23.46	1.43	-26.23	6.44	1379.21
		94	1.49	30.86	-1.73	23.18	-12.29	-1479.70
94	14	94	-1.48	-30.84	1.74	-13.41	12.29	1479.83
		95	1.48	32.44	-1.80	12.75	-13.71	-1505.12
95	14	95	-0.64	422.82	-15.12	-115.15	99.40	1500.69
		96	0.64	-406.82	14.49	108.53	-87.55	-1168.80
96	14	96	-0.75	406.82	-14.49	-100.03	87.55	1169.56
		97	0.75	-332.81	11.57	69.43	-39.33	198.94
97	14	97	-0.73	332.81	-11.58	-69.12	39.33	-199.05
		98	0.73	-234.81	7.72	28.61	7.94	1589.71
98	14	98	-0.72	234.81	-7.72	-25.27	-7.94	-1589.77
		99	0.72	-136.80	3.86	-15.25	36.32	2500.32
99	14	99	-0.72	136.80	-3.86	10.01	-36.32	-2500.35
		100	0.72	-38.82	0.00	-50.51	45.78	2930.56
100	14	100	-0.72	38.82	0.00	56.18	-45.78	-2930.46
		101	0.72	59.18	-3.86	-96.69	36.34	2880.57
101	14	101	-0.73	-59.18	3.86	97.19	-36.34	-2880.56
		102	0.73	157.17	-7.71	-137.69	8.00	2350.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	14	102	-0.74	-157.17	7.71	142.61	-8.00	-2350.28
		103	0.74	255.19	-11.57	-183.13	-39.25	1339.82
103	14	103	-0.73	-255.19	11.57	182.35	39.25	-1339.94
		104	0.73	329.18	-14.48	-212.94	-87.44	259.03
104	14	104	-0.75	-329.18	14.48	213.23	87.44	-258.80
		105	0.75	345.18	-15.11	-219.84	-99.28	-10.88

********** END OF LATEST ANALYSIS RESULT **********

165. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	14	-3.90	1.81	0.01	0.02	-0.04	0.00
11	14	0.00	-8.48	0.02	-0.57	0.04	0.00
23	14	0.00	29.67	0.02	3.19	0.11	0.00
35	14	0.00	-102.61	0.02	-15.67	0.17	0.00
47	14	0.00	624.29	-21.04	-179.27	160.63	0.00
59	14	0.00	527.44	-20.96	-278.89	-138.01	0.00
71	14	0.00	484.37	-19.51	-137.02	122.49	0.00
83	14	0.00	512.54	-19.52	-278.61	-122.01	0.00
95	14	0.00	455.26	-16.93	-81.62	85.69	0.00
105	14	0.00	345.18	-15.13	-220.11	-99.28	0.00

********** END OF LATEST ANALYSIS RESULT **********

166. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:41:35 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC - iAPF - L.I. $M^{+}_{máx}$ c.v⑨ - (2 vías)

(LOAD IS)

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:41:47                       *
*                                                   *
*****************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
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61. 58 216.67350099441 0 7997.06524882515
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63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 15
131. MEMBER LOAD
132. * LOCOMOTORA 1
133. 98 TO 104 UNI GY -12
134. 97 UNI GY -12 3.9 4.9
135. * VAGONES 1
136. 97 UNI GY -10 0 3.9
137. 95 96 UNI GY -10
138. 83 TO 94 UNI GY -1
139. 71 TO 82 UNI GY -10
140. 59 TO 70 UNI GY -1
141. 47 TO 58 UNI GY -10
142. 35 TO 46 UNI GY -1
143. 23 TO 34 UNI GY -10
144. 11 TO 22 UNI GY -1
145. 1 TO 10 UNI GY -10
146. * LOCOMOTORA 2
147. 95 TO 101 UNI GY -12
148. 102 UNI GY -12 0 3.9
149. 102 UNI GY -10 3.9 4.9
150. 103 104 UNI GY -10
151. *RIPADO + F.CENTRIFUGA
152. * LOCOMOTORA 1
153. 98 TO 104 UMOM X 4.96
154. 98 TO 104 UNI Z .47244
155. 97 UMOM X 4.96 3.9 4.9
156. 97 UNI Z .47244 3.9 4.9
157. * VAGONES 1
158. 97 UMOM X 4.13386 0 3.9
159. 97 UNI Z 0.3937 0 3.9
160. 95 96 UMOM X 4.13386
161. 95 96 UNI Z 0.3937
162. 83 TO 94 UMOM X .413386
163. 83 TO 94 UNI Z 0.04
164. 71 TO 82 UMOM X 4.13386
165. 71 TO 82 UNI Z 0.3937
166. 59 TO 70 UMOM X .413386
167. 59 TO 70 UNI Z 0.04
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168. 47 TO 58 UMOM X 4.13386
169. 47 TO 58 UNI Z 0.3937
170. 35 TO 46 UMOM X .413386
171. 35 TO 46 UNI Z 0.04
172. 23 TO 34 UMOM X 4.13386
173. 23 TO 34 UNI Z 0.3937
174. 11 TO 22 UMOM X .413386
175. 11 TO 22 UNI Z 0.04
176. 1 TO 10 UMOM X 4.13386
177. 1 TO 10 UNI Z 0.3937
178. * LOCOMOTORA 2
179. 95 TO 101 UMOM X 4.96
180. 95 TO 101 UNI Z .47244
181. 102 UMOM X 4.96 0 3.9
182. 102 UNI Z .47244 0 3.9
183. 102 UMOM X 4.13386 3.9 4.9
184. 102 UNI Z 0.3937 3.9 4.9
185. 103 104 UMOM X 4.13386
186. 103 104 UNI Z 0.3937
188. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =    589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      97

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      97

++ PROCESSING ELEMENT STIFFNESS MATRIX.                  0:41:50
++ PROCESSING GLOBAL STIFFNESS MATRIX.                   0:41:50
++ PROCESSING TRIANGULAR FACTORIZATION.                  0:41:51
++ CALCULATING JOINT DISPLACEMENTS.                      0:41:51
++ CALCULATING MEMBER  FORCES.                           0:41:51

 189. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	15	1	-3.15	168.97	-7.38	-78.47	47.36	0.00
		2	3.15	-160.97	7.06	75.16	-41.59	131.99
2	15	2	-3.15	160.99	-7.06	-75.16	41.59	-131.99
		3	3.15	-123.99	5.60	59.87	-18.16	659.19
3	15	3	-3.13	123.99	-5.61	-58.43	18.16	-659.32
		4	3.13	-76.49	3.74	38.80	4.05	1135.45
4	15	4	-3.14	76.49	-3.73	-41.26	-4.05	-1135.36
		5	3.14	-28.99	1.86	21.63	17.34	1385.86
5	15	5	-3.14	28.99	-1.87	-18.85	-17.34	-1385.90
		6	3.14	18.51	0.00	-0.79	21.78	1410.77
6	15	6	-3.14	-18.51	0.00	1.02	-21.78	-1410.78
		7	3.14	66.01	-1.87	-20.66	17.34	1210.02
7	15	7	-3.14	-66.01	1.86	23.08	-17.34	-1209.99
		8	3.14	113.51	-3.73	-42.72	4.05	783.61
8	15	8	-3.14	-113.51	3.73	42.72	-4.05	-783.62
		9	3.14	161.01	-5.60	-62.36	-18.12	131.61
9	15	9	-3.13	-161.01	5.61	62.17	18.12	-131.70
		10	3.13	198.01	-7.06	-77.47	-41.57	-532.50
10	15	10	-3.20	-198.00	7.04	72.61	41.57	533.18
		11	3.20	206.00	-7.35	-75.92	-47.32	-694.81
11	15	11	-3.11	14.62	-0.88	-7.74	6.88	693.86
		12	3.11	-13.82	0.85	7.41	-6.19	-682.48
12	15	12	-3.11	13.81	-0.86	-11.22	6.19	682.43
		13	3.11	-10.11	0.72	9.69	-3.27	-638.18
13	15	13	-3.11	10.11	-0.72	-10.40	3.27	638.17
		14	3.11	-5.61	0.54	8.54	-0.43	-602.80
14	15	14	-3.11	5.61	-0.53	-7.16	0.43	602.82
		15	3.11	-1.11	0.35	5.30	1.55	-587.69
15	15	15	-3.11	1.11	-0.36	-6.65	-1.55	587.68
		16	3.11	3.39	0.18	4.79	2.76	-592.81
16	15	16	-3.11	-3.39	-0.19	-6.04	-2.76	592.80
		17	3.11	7.89	0.01	4.18	3.19	-618.18

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	15	17	-3.11	-7.89	0.00	-2.88	-3.19	618.19
		18	3.11	12.39	-0.18	1.02	2.78	-663.82
18	15	18	-3.11	-12.39	0.17	-2.42	-2.78	663.81
		19	3.11	16.89	-0.35	0.56	1.59	-729.69
19	15	19	-3.11	-16.89	0.35	-0.56	-1.59	729.69
		20	3.11	21.39	-0.53	-1.30	-0.41	-815.82
20	15	20	-3.11	-21.39	0.53	1.16	0.41	815.82
		21	3.11	25.89	-0.71	-3.02	-3.21	-922.20
21	15	21	-3.11	-25.89	0.71	1.42	3.21	922.20
		22	3.11	29.59	-0.86	-2.95	-6.11	-1024.84
22	15	22	-3.11	-29.59	0.85	0.72	6.11	1024.85
		23	3.11	30.39	-0.88	-1.05	-6.80	-1048.84
23	15	23	-3.10	227.30	-8.82	-78.89	68.00	1048.73
		24	3.10	-219.30	8.51	75.58	-61.07	-870.09
24	15	24	-3.00	219.30	-8.54	-85.10	61.07	869.21
		25	3.00	-182.30	7.08	69.80	-32.17	-126.24
25	15	25	-3.00	182.30	-7.08	-69.80	32.17	126.24
		26	3.00	-137.31	5.31	51.20	-4.29	592.88
26	15	26	-2.99	137.30	-5.32	-49.74	4.29	-593.00
		27	2.99	-92.30	3.55	31.13	15.66	1109.63
27	15	27	-3.00	92.30	-3.54	-33.68	-15.66	-1109.55
		28	3.00	-47.31	1.77	15.08	27.60	1423.65
28	15	28	-3.00	47.31	-1.77	-12.06	-27.60	-1423.68
		29	3.00	-2.30	0.00	-6.54	31.60	1535.31
29	15	29	-3.00	2.30	0.00	6.81	-31.60	-1535.31
		30	3.00	42.70	-1.77	-25.41	27.63	1444.40
30	15	30	-3.00	-42.70	1.77	25.42	-27.63	-1444.41
		31	3.00	87.69	-3.54	-44.02	15.68	1151.06
31	15	31	-3.00	-87.69	3.53	46.45	-15.68	-1150.95
		32	3.00	132.70	-5.31	-65.06	-4.21	655.01
32	15	32	-3.00	-132.70	5.31	65.06	4.21	-655.01
		33	3.00	177.70	-7.08	-83.66	-32.07	-43.31
33	15	33	-2.99	-177.70	7.08	83.74	32.07	43.14
		34	2.99	214.70	-8.54	-99.04	-60.97	-769.14

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	15	34	-3.09	-214.75	8.51	90.36	60.97	770.21
		35	3.09	222.76	-8.82	-93.66	-67.90	-945.23
35	15	35	-2.85	21.57	-0.89	-13.99	6.92	942.51
		36	2.85	-20.77	0.85	13.65	-6.22	-925.57
36	15	36	-2.85	20.78	-0.86	-16.59	6.22	925.53
		37	2.85	-17.08	0.72	15.06	-3.30	-855.47
37	15	37	-2.85	17.08	-0.71	-14.73	3.30	855.48
		38	2.85	-12.58	0.53	12.87	-0.49	-788.73
38	15	38	-2.85	12.58	-0.54	-14.54	0.49	788.71
		39	2.85	-8.08	0.36	12.68	1.54	-742.20
39	15	39	-2.85	8.08	-0.36	-12.55	-1.54	742.20
		40	2.85	-3.58	0.18	10.69	2.76	-715.96
40	15	40	-2.85	3.58	-0.19	-12.46	-2.76	715.93
		41	2.85	0.92	0.01	10.60	3.20	-709.93
41	15	41	-2.85	-0.92	0.00	-8.97	-3.20	709.95
		42	2.85	5.42	-0.18	7.11	2.80	-724.21
42	15	42	-2.85	-5.42	0.17	-8.64	-2.80	724.19
		43	2.85	9.92	-0.35	6.78	1.61	-758.70
43	15	43	-2.85	-9.92	0.35	-6.78	-1.61	758.70
		44	2.85	14.42	-0.53	4.92	-0.38	-813.45
44	15	44	-2.85	-14.42	0.53	-4.92	0.38	813.45
		45	2.85	18.92	-0.71	3.06	-3.18	-888.45
45	15	45	-2.85	-18.92	0.71	-4.60	3.18	888.44
		46	2.85	22.62	-0.86	3.07	-6.08	-965.29
46	15	46	-2.85	-22.62	0.85	-6.09	6.08	965.28
		47	2.85	23.42	-0.88	5.76	-6.77	-983.69
47	15	47	-2.60	225.93	-8.87	-86.10	68.07	981.63
		48	2.60	-217.94	8.55	82.80	-61.11	-804.27
48	15	48	-2.64	217.91	-8.54	-79.45	61.11	804.61
		49	2.64	-180.91	7.08	64.15	-32.20	-66.62
49	15	49	-2.64	180.90	-7.09	-64.19	32.20	66.58
		50	2.64	-135.91	5.31	45.59	-4.31	646.11
50	15	50	-2.64	135.91	-5.31	-45.60	4.31	-646.11
		51	2.64	-90.91	3.54	26.99	15.62	1156.48

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	15	51	-2.63	90.91	-3.55	-24.55	-15.62	-1156.53
		52	2.63	-45.91	1.78	5.94	27.60	1464.40
52	15	52	-2.63	45.91	-1.78	-5.68	-27.60	-1464.41
		53	2.63	-0.91	0.00	-12.92	31.60	1569.74
53	15	53	-2.63	0.90	0.00	12.93	-31.61	-1569.74
		54	2.63	44.09	-1.77	-31.53	27.64	1472.59
54	15	54	-2.63	-44.09	1.77	31.26	-27.64	-1472.60
		55	2.63	89.09	-3.54	-49.86	15.70	1172.92
55	15	55	-2.64	-89.09	3.53	52.56	-15.70	-1172.80
		56	2.64	134.09	-5.30	-71.16	-4.18	670.69
56	15	56	-2.64	-134.09	5.30	71.16	4.18	-670.69
		57	2.64	179.09	-7.08	-89.76	-32.05	-34.06
57	15	57	-2.62	-179.09	7.08	89.84	32.05	33.87
		58	2.62	216.09	-8.54	-105.13	-60.95	-764.98
58	15	58	-2.72	-216.09	8.51	95.73	60.95	766.23
		59	2.72	224.08	-8.82	-99.03	-67.87	-942.18
59	15	59	-2.38	19.71	-0.89	-21.92	6.96	937.66
		60	2.38	-18.91	0.86	21.59	-6.26	-922.23
60	15	60	-2.38	18.88	-0.87	-22.73	6.26	922.20
		61	2.38	-15.18	0.72	21.20	-3.33	-859.18
61	15	61	-2.37	15.18	-0.72	-22.68	3.33	859.14
		62	2.37	-10.68	0.54	20.82	-0.49	-800.94
62	15	62	-2.37	10.68	-0.54	-19.27	0.49	800.98
		63	2.37	-6.18	0.36	17.41	1.53	-763.03
63	15	63	-2.37	6.18	-0.37	-20.64	-1.53	762.95
		64	2.37	-1.68	0.19	18.78	2.77	-745.25
64	15	64	-2.37	1.68	-0.18	-17.20	-2.77	745.28
		65	2.37	2.82	0.00	15.34	3.19	-747.84
65	15	65	-2.37	-2.82	-0.01	-16.92	-3.19	747.81
		66	2.37	7.32	-0.17	15.06	2.82	-770.60
66	15	66	-2.37	-7.31	0.18	-13.43	-2.82	770.63
		67	2.37	11.81	-0.36	11.57	1.61	-813.68
67	15	67	-2.37	-11.82	0.35	-15.16	-1.61	813.62
		68	2.37	16.32	-0.53	13.30	-0.36	-876.93

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	15	68	-2.37	-16.32	0.53	-11.30	0.36	876.96
		69	2.37	20.82	-0.71	9.44	-3.16	-960.49
69	15	69	-2.37	-20.81	0.71	-10.73	3.16	960.48
		70	2.37	24.51	-0.86	9.20	-6.06	-1044.34
70	15	70	-2.38	-24.52	0.85	-14.72	6.06	1044.27
		71	2.38	25.32	-0.88	14.39	-6.75	-1064.22
71	15	71	-2.13	234.27	-8.84	-65.74	68.09	1062.71
		72	2.13	-226.28	8.53	62.44	-61.15	-878.65
72	15	72	-2.04	226.29	-8.55	-71.54	61.15	877.96
		73	2.04	-189.28	7.09	56.24	-32.21	-109.10
73	15	73	-2.05	189.28	-7.09	-56.04	32.21	109.20
		74	2.05	-144.28	5.31	37.43	-4.31	641.40
74	15	74	-2.05	144.28	-5.31	-37.43	4.31	-641.39
		75	2.05	-99.28	3.54	18.83	15.62	1189.35
75	15	75	-2.04	99.28	-3.55	-16.11	-15.62	-1189.39
		76	2.04	-54.28	1.78	-2.49	27.60	1534.96
76	15	76	-2.04	54.28	-1.78	2.24	-27.60	-1534.96
		77	2.04	-9.28	0.00	-20.84	31.61	1677.95
77	15	77	-2.04	9.28	0.00	21.13	-31.61	-1677.94
		78	2.04	35.72	-1.77	-39.73	27.64	1618.44
78	15	78	-2.04	-35.72	1.77	39.45	-27.64	-1618.44
		79	2.04	80.72	-3.54	-58.05	15.71	1356.46
79	15	79	-2.05	-80.72	3.53	61.16	-15.71	-1356.32
		80	2.05	125.72	-5.31	-79.76	-4.19	891.80
80	15	80	-2.05	-125.72	5.31	79.92	4.19	-891.79
		81	2.05	170.73	-7.08	-98.52	-32.05	224.75
81	15	81	-2.05	-170.72	7.08	98.49	32.05	-224.77
		82	2.05	207.72	-8.53	-113.78	-60.93	-475.30
82	15	82	-2.05	-207.76	8.53	113.80	60.93	475.26
		83	2.05	215.76	-8.85	-117.10	-67.88	-644.59
83	15	83	-1.68	-9.98	-0.90	-38.63	6.98	638.71
		84	1.68	10.78	0.87	38.30	-6.27	-647.02
84	15	84	-1.68	-10.79	-0.87	-38.35	6.27	647.02
		85	1.68	14.49	0.72	36.82	-3.34	-693.79

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	15	85	-1.68	-14.49	-0.72	-38.41	3.34	693.71
		86	1.68	18.99	0.54	36.55	-0.49	-769.04
86	15	86	-1.68	-18.99	-0.54	-36.54	0.49	769.04
		87	1.68	23.49	0.36	34.68	1.55	-864.65
87	15	87	-1.68	-23.49	-0.36	-34.69	-1.55	864.65
		88	1.68	27.99	0.18	32.83	2.77	-980.49
88	15	88	-1.68	-27.99	-0.19	-34.90	-2.77	980.41
		89	1.68	32.49	0.01	33.04	3.20	-1116.51
89	15	89	-1.68	-32.49	0.00	-30.67	-3.20	1116.58
		90	1.68	36.99	-0.18	28.81	2.81	-1272.95
90	15	90	-1.68	-36.99	0.17	-31.51	-2.81	1272.89
		91	1.68	41.49	-0.35	29.65	1.62	-1449.48
91	15	91	-1.68	-41.49	0.35	-29.67	-1.62	1449.48
		92	1.68	45.99	-0.53	27.81	-0.37	-1646.28
92	15	92	-1.68	-45.99	0.53	-31.56	0.37	1646.22
		93	1.68	50.49	-0.71	29.70	-3.16	-1863.32
93	15	93	-1.68	-50.49	0.71	-27.62	3.16	1863.37
		94	1.68	54.19	-0.86	26.09	-6.07	-2057.06
94	15	94	-1.68	-54.18	0.87	-12.51	6.07	2057.17
		95	1.68	54.98	-0.90	12.18	-6.78	-2100.83
95	15	95	-0.76	499.35	-17.51	-138.70	117.08	2095.53
		96	0.76	-481.75	16.81	131.42	-103.35	-1703.10
96	15	96	-0.88	481.73	-16.81	-119.03	103.35	1704.00
		97	0.88	-400.32	13.60	85.37	-47.09	-72.02
97	15	97	-0.86	400.31	-13.60	-85.49	47.09	71.89
		98	0.86	-290.51	9.28	40.10	9.12	1624.51
98	15	98	-0.84	290.51	-9.28	-36.68	-9.12	-1624.60
		99	0.84	-172.90	4.65	-11.93	43.26	2760.05
99	15	99	-0.85	172.90	-4.65	6.15	-43.26	-2760.08
		100	0.85	-55.33	0.02	-54.75	54.70	3319.14
100	15	100	-0.85	55.33	-0.02	61.16	-54.70	-3319.02
		101	0.85	62.28	-4.61	-109.77	43.47	3302.00
101	15	101	-0.85	-62.28	4.61	110.34	-43.47	-3301.96
		102	0.85	179.86	-9.24	-158.94	9.55	2708.79

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	15	102	-0.87	-179.87	9.24	164.61	-9.55	-2708.46
		103	0.87	295.48	-13.79	-212.40	-47.01	1539.71
103	15	103	-0.86	-295.48	13.79	211.50	47.01	-1539.86
		104	0.86	376.86	-16.99	-245.14	-103.95	296.23
104	15	104	-0.88	-376.87	16.99	245.47	103.94	-295.99
		105	0.88	394.47	-17.69	-252.75	-117.82	-12.57

********** END OF LATEST ANALYSIS RESULT **********

190. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	15	-3.15	168.97	-7.38	-78.47	47.36	0.00
11	15	0.00	220.62	-8.27	-91.92	-40.45	0.00
23	15	0.00	257.69	-9.74	-93.47	61.20	0.00
35	15	0.00	244.33	-9.74	-118.89	-60.99	0.00
47	15	0.00	249.35	-9.75	-79.36	61.30	0.00
59	15	0.00	243.79	-9.75	-131.31	-60.91	0.00
71	15	0.00	259.59	-9.75	-65.06	61.34	0.00
83	15	0.00	205.78	-9.76	-155.87	-60.90	0.00
95	15	0.00	554.34	-18.41	-97.49	110.30	0.00
105	15	0.00	394.47	-17.71	-253.06	-117.82	0.00

********** END OF LATEST ANALYSIS RESULT **********

191. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:41:55 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC-IAPF.- L.I. MIN PILA P-4. (2 VIAS)

(LOAD 16)

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*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     0:42: 8                       *
*                                                   *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 16
131. * POR LA CUASI SIMETRIA SE TOMARA EL DOBLE DEL TREN UNICO, AUNQUE
132. * VAYAN EN SENTIDOS OPUESTOS REALMENTE
133. MEMBER LOAD
134. 35 TO 41 UNI GY -24
135. 42 UNI GY -24 0 3.8
136. 42 UNI GY -20 3.8 4.5
137. 43 TO 58 UNI GY -20
138. 59 TO 70 UNI GY -2
139. 71 TO 82 UNI GY -20
140. 83 TO 94 UNI GY -2
141. 95 TO 104 UNI GY -20
142. *RIPADO + F.CENTRIFUGA
143. 35 TO 41 UMOM X 9.92
144. 35 TO 41 UNI Z 0.9449
145. 42 UMOM X 9.92126 0 3.8
146. 42 UNI Z 0.9449 0 3.8
147. 42 UMOM X 8.2677 3.8 4.5
148. 42 UNI Z 0.7874 3.8 4.5
149. 43 TO 58 UMOM X 8.2677
150. 43 TO 58 UNI Z .7874
151. 59 TO 70 UMOM X .82677
152. 59 TO 70 UNI Z .08
153. 71 TO 82 UMOM X 8.2677
154. 71 TO 82 UNI Z .7874
155. 83 TO 94 UMOM X .82677
156. 83 TO 94 UNI Z 0.08
157. 95 TO 104 UMOM X 8.2677
158. 95 TO 104 UNI Z .7874
160. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =    589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                0:42:11
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 0:42:11
++ PROCESSING TRIANGULAR FACTORIZATION.                0:42:12
++ CALCULATING JOINT DISPLACEMENTS.                    0:42:12
++ CALCULATING MEMBER  FORCES.                         0:42:12

161. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	16	1	-4.54	-4.43	0.01	-0.04	-0.05	0.00
		2	4.54	4.43	-0.01	0.04	0.04	-3.54
2	16	2	-4.54	-4.43	0.01	-0.04	-0.04	3.54
		3	4.54	4.43	-0.01	0.04	0.00	-19.93
3	16	3	-4.54	-4.43	0.00	-0.08	0.00	19.93
		4	4.54	4.43	0.00	0.08	0.01	-40.97
4	16	4	-4.54	-4.43	0.01	0.01	-0.01	40.97
		5	4.54	4.43	-0.01	-0.01	-0.04	-62.01
5	16	5	-4.54	-4.43	0.00	-0.12	0.04	62.01
		6	4.54	4.43	0.00	0.12	-0.04	-83.05
6	16	6	-4.54	-4.43	0.00	-0.13	0.04	83.05
		7	4.54	4.43	0.00	0.13	-0.04	-104.09
7	16	7	-4.54	-4.43	-0.01	-0.34	0.04	104.09
		8	4.54	4.43	0.01	0.34	0.01	-125.13
8	16	8	-4.54	-4.43	-0.01	-0.34	-0.01	125.13
		9	4.54	4.43	0.01	0.34	0.05	-146.17
9	16	9	-4.54	-4.43	0.00	-0.14	-0.05	146.17
		10	4.54	4.43	0.00	0.14	0.07	-162.56
10	16	10	-4.54	-4.43	-0.04	-1.62	-0.07	162.55
		11	4.54	4.43	0.04	1.62	0.10	-166.09
11	16	11	-4.54	16.30	0.03	1.75	-0.05	166.10
		12	4.54	-16.30	-0.03	-1.75	0.03	-153.07
12	16	12	-4.54	16.30	0.01	0.90	-0.03	153.07
		13	4.54	-16.30	-0.01	-0.90	0.00	-92.78
13	16	13	-4.54	16.30	0.00	0.80	0.00	92.78
		14	4.54	-16.30	0.00	-0.80	0.00	-19.45
14	16	14	-4.54	16.30	0.01	0.84	0.00	19.45
		15	4.54	-16.30	-0.01	-0.84	-0.06	53.88
15	16	15	-4.54	16.30	0.00	0.96	0.06	-53.88
		16	4.54	-16.30	0.00	-0.96	-0.06	127.21
16	16	16	-4.54	16.30	-0.01	1.23	0.06	-127.20
		17	4.54	-16.30	0.01	-1.23	-0.03	200.53

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	16	17	-4.54	16.30	0.00	0.81	0.03	-200.54
		18	4.54	-16.30	0.00	-0.81	-0.04	273.87
18	16	18	-4.54	16.30	-0.01	1.39	0.04	-273.86
		19	4.54	-16.30	0.01	-1.39	0.00	347.19
19	16	19	-4.54	16.30	-0.01	1.39	0.00	-347.19
		20	4.54	-16.30	0.01	-1.39	0.04	420.53
20	16	20	-4.54	16.30	-0.01	1.46	-0.04	-420.52
		21	4.54	-16.30	0.01	-1.46	0.08	493.85
21	16	21	-4.54	16.29	-0.02	2.32	-0.08	-493.85
		22	4.54	-16.29	0.02	-2.32	0.14	554.15
22	16	22	-4.54	16.28	-0.03	3.52	-0.14	-554.14
		23	4.54	-16.28	0.03	-3.52	0.16	567.18
23	16	23	-4.54	-56.18	0.06	-11.57	-0.04	-567.17
		24	4.54	56.18	-0.06	11.57	-0.01	522.23
24	16	24	-4.54	-56.18	0.01	-5.86	0.01	-522.32
		25	4.54	56.18	-0.01	5.86	-0.03	314.44
25	16	25	-4.54	-56.18	0.01	-5.86	0.03	-314.44
		26	4.54	56.18	-0.01	5.86	-0.06	61.61
26	16	26	-4.54	-56.18	0.00	-5.71	0.06	-61.63
		27	4.54	56.18	0.00	5.71	-0.04	-191.21
27	16	27	-4.54	-56.18	0.01	-5.27	0.04	191.22
		28	4.54	56.18	-0.01	5.27	-0.06	-444.03
28	16	28	-4.54	-56.18	0.00	-6.21	0.06	444.02
		29	4.54	56.18	0.00	6.21	-0.04	-696.86
29	16	29	-4.54	-56.18	0.00	-6.33	0.04	696.86
		30	4.54	56.18	0.00	6.33	-0.02	-949.72
30	16	30	-4.54	-56.19	0.00	-6.34	0.02	949.71
		31	4.54	56.19	0.00	6.34	0.00	-1202.50
31	16	31	-4.54	-56.18	-0.01	-8.88	0.00	1202.50
		32	4.54	56.18	0.01	8.88	0.06	-1455.34
32	16	32	-4.54	-56.19	-0.01	-8.88	-0.06	1455.35
		33	4.54	56.19	0.01	8.88	0.13	-1708.15
33	16	33	-4.54	-56.18	-0.01	-5.45	-0.13	1708.17
		34	4.54	56.18	0.01	5.45	0.15	-1916.07

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	16	34	-4.54	-56.17	-0.06	-27.07	-0.15	1915.92
		35	4.54	56.17	0.06	27.07	0.19	-1960.82
35	16	35	-4.27	463.75	-21.06	-212.55	160.79	1958.35
		36	4.27	-444.57	20.31	204.62	-144.26	-1595.41
36	16	36	-4.20	444.56	-20.32	-209.68	144.26	1594.77
		37	4.20	-355.75	16.82	172.98	-75.53	-114.00
37	16	37	-4.21	355.75	-16.82	-172.93	75.53	114.07
		38	4.21	-247.76	12.57	128.30	-9.41	1243.68
38	16	38	-4.18	247.76	-12.58	-125.67	9.41	-1243.95
		39	4.18	-139.74	8.33	81.02	37.64	2115.98
39	16	39	-4.18	139.75	-8.33	-81.39	-37.64	-2115.96
		40	4.18	-31.75	4.07	36.75	65.54	2501.79
40	16	40	-4.17	31.75	-4.08	-30.57	-65.54	-2501.88
		41	4.17	76.25	-0.17	-14.07	74.35	2401.75
41	16	41	-4.17	-76.25	0.18	8.56	-74.35	-2401.78
		42	4.17	184.24	-4.43	-53.20	63.99	1815.72
42	16	42	-4.18	-184.24	4.42	57.03	-63.99	-1815.60
		43	4.18	289.44	-8.56	-100.52	34.56	744.24
43	16	43	-4.18	-289.44	8.56	100.52	-34.56	-744.24
		44	4.18	379.44	-12.10	-137.73	-11.94	-760.71
44	16	44	-4.18	-379.44	12.10	137.73	11.94	760.70
		45	4.18	469.44	-15.65	-174.93	-74.38	-2670.63
45	16	45	-4.21	-469.44	15.64	170.30	74.38	2670.93
		46	4.21	543.43	-18.55	-200.88	-137.64	-4544.67
46	16	46	-4.27	-543.44	18.54	186.66	137.64	4545.28
		47	4.27	559.44	-19.17	-193.28	-152.73	-4986.57
47	16	47	-3.34	536.81	-17.73	-196.30	136.11	4976.83
		48	3.34	-520.83	17.10	189.69	-122.19	-4554.17
48	16	48	-3.41	520.83	-17.08	-170.74	122.19	4554.91
		49	3.41	-446.81	14.17	140.14	-64.36	-2764.36
49	16	49	-3.40	446.81	-14.17	-141.71	64.36	2764.27
		50	3.40	-356.83	10.63	104.52	-8.57	-956.44
50	16	50	-3.40	356.83	-10.63	-104.51	8.57	956.44
		51	3.40	-266.83	7.09	67.30	31.28	446.83

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	16	51	-3.38	266.83	-7.09	-66.36	-31.28	-446.97
		52	3.38	-176.82	3.55	29.15	55.23	1445.26
52	16	52	-3.38	176.82	-3.55	-28.90	-55.23	-1445.27
		53	3.38	-86.81	0.01	-8.31	63.23	2038.48
53	16	53	-3.38	86.81	-0.01	8.32	-63.23	-2038.49
		54	3.38	3.18	-3.54	-45.52	55.28	2226.65
54	16	54	-3.38	-3.17	3.54	45.12	-55.28	-2226.65
		55	3.38	93.18	-7.08	-82.32	31.39	2009.86
55	16	55	-3.40	-93.18	7.07	86.94	-31.39	-2009.66
		56	3.40	183.17	-10.62	-124.14	-8.41	1387.92
56	16	56	-3.40	-183.17	10.62	124.14	8.41	-1387.92
		57	3.40	273.18	-14.16	-161.34	-64.17	360.98
57	16	57	-3.37	-273.19	14.17	160.56	64.17	-361.33
		58	3.37	347.19	-17.08	-191.15	-121.98	-786.37
58	16	58	-3.58	-347.17	17.04	181.48	121.98	788.66
		59	3.58	363.16	-17.67	-188.09	-135.85	-1072.67
59	16	59	-2.88	20.70	-1.79	-39.03	13.88	1064.37
		60	2.88	-19.10	1.73	38.37	-12.47	-1048.43
60	16	60	-2.88	19.11	-1.73	-39.67	12.47	1048.38
		61	2.88	-11.71	1.44	36.61	-6.61	-991.37
61	16	61	-2.88	11.71	-1.44	-38.32	6.61	991.30
		62	2.88	-2.71	1.08	34.60	-0.93	-958.88
62	16	62	-2.88	2.71	-1.08	-32.74	0.93	958.94
		63	2.88	6.29	0.72	29.02	3.10	-967.01
63	16	63	-2.87	-6.29	-0.73	-33.11	-3.10	966.88
		64	2.87	15.29	0.37	29.39	5.57	-1015.45
64	16	64	-2.88	-15.29	-0.36	-27.24	-5.57	1015.50
		65	2.88	24.29	0.00	23.52	6.40	-1104.56
65	16	65	-2.88	-24.29	-0.01	-25.86	-6.40	1104.51
		66	2.88	33.29	-0.35	22.14	5.63	-1234.09
66	16	66	-2.87	-33.29	0.36	-19.53	-5.63	1234.12
		67	2.87	42.29	-0.72	15.81	3.21	-1404.19
67	16	67	-2.88	-42.29	0.70	-22.00	-3.21	1404.10
		68	2.88	51.30	-1.06	18.28	-0.77	-1614.69

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	16	68	-2.88	-51.29	1.07	-14.59	0.77	1614.72
		69	2.88	60.29	-1.43	10.87	-6.40	-1865.76
69	16	69	-2.88	-60.29	1.43	-13.38	6.40	1865.74
		70	2.88	67.69	-1.72	10.32	-12.23	-2102.50
70	16	70	-2.89	-67.61	1.71	-21.43	12.23	2102.44
		71	2.89	69.21	-1.77	20.77	-13.63	-2157.22
71	16	71	-2.38	453.49	-17.70	-139.23	136.12	2153.69
		72	2.38	-437.50	17.07	132.62	-122.22	-1797.61
72	16	72	-2.20	437.55	-17.09	-151.23	122.22	1796.13
		73	2.20	-363.55	14.18	120.64	-64.37	-313.99
73	16	73	-2.23	363.55	-14.17	-120.06	64.37	314.22
		74	2.23	-273.54	10.63	82.85	-8.56	1119.39
74	16	74	-2.23	273.53	-10.63	-82.84	8.56	-1119.38
		75	2.23	-183.54	7.09	45.64	31.30	2147.71
75	16	75	-2.21	183.54	-7.09	-40.73	-31.30	-2147.80
		76	2.21	-93.53	3.55	3.52	55.24	2771.34
76	16	76	-2.21	93.52	-3.55	-3.99	-55.24	-2771.33
		77	2.21	-3.53	0.00	-33.21	63.23	2989.72
77	16	77	-2.21	3.54	0.00	33.74	-63.23	-2989.69
		78	2.21	86.46	-3.54	-70.94	55.28	2803.13
78	16	78	-2.21	-86.47	3.54	70.45	-55.28	-2803.13
		79	2.21	176.47	-7.08	-107.65	31.39	2211.57
79	16	79	-2.23	-176.46	7.08	112.72	-31.39	-2211.32
		80	2.23	266.47	-10.62	-149.93	-8.43	1214.67
80	16	80	-2.23	-266.47	10.62	150.14	8.43	-1214.66
		81	2.23	356.47	-14.16	-187.35	-64.20	-187.03
81	16	81	-2.23	-356.47	14.16	187.38	64.20	187.00
		82	2.23	430.46	-17.08	-217.97	-121.99	-1642.67
82	16	82	-2.23	-430.51	17.08	218.03	121.99	1642.65
		83	2.23	446.51	-17.71	-224.64	-135.89	-1993.28
83	16	83	-1.49	55.06	-1.80	-50.56	13.88	1982.85
		84	1.49	-53.46	1.73	49.90	-12.47	-1939.43
84	16	84	-1.49	53.45	-1.73	-50.06	12.47	1939.42
		85	1.49	-46.05	1.44	47.00	-6.60	-1755.36

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	16	85	-1.49	46.05	-1.44	-51.01	6.60	1755.25
		86	1.49	-37.06	1.08	47.29	-0.92	-1568.26
86	16	86	-1.49	37.06	-1.08	-47.28	0.92	1568.26
		87	1.49	-28.06	0.72	43.55	3.14	-1421.76
87	16	87	-1.49	28.06	-0.72	-43.57	-3.14	1421.76
		88	1.49	-19.06	0.36	39.85	5.58	-1315.77
88	16	88	-1.49	19.05	-0.37	-42.63	-5.58	1315.67
		89	1.49	-10.05	0.01	38.91	6.42	-1250.19
89	16	89	-1.49	10.05	0.00	-36.25	-6.42	1250.25
		90	1.49	-1.05	-0.36	32.53	5.62	-1225.28
90	16	90	-1.49	1.05	0.35	-35.14	-5.62	1225.21
		91	1.49	7.95	-0.71	31.42	3.21	-1240.71
91	16	91	-1.49	-7.95	0.71	-31.43	-3.21	1240.70
		92	1.49	16.95	-1.07	27.71	-0.81	-1296.72
92	16	92	-1.49	-16.94	1.07	-30.66	0.81	1296.64
		93	1.49	25.95	-1.43	26.94	-6.44	-1393.16
93	16	93	-1.49	-25.95	1.43	-25.39	6.44	1393.18
		94	1.49	33.35	-1.73	22.33	-12.29	-1502.89
94	16	94	-1.48	-33.26	1.74	-12.41	12.29	1503.01
		95	1.48	34.85	-1.80	11.75	-13.71	-1530.29
95	16	95	-0.64	423.49	-15.12	-115.65	99.40	1525.82
		96	0.64	-407.49	14.49	109.03	-87.55	-1193.39
96	16	96	-0.75	407.48	-14.49	-100.34	87.55	1194.17
		97	0.75	-333.47	11.57	69.75	-39.33	176.75
97	16	97	-0.73	333.47	-11.58	-69.48	39.33	-176.86
		98	0.73	-235.47	7.72	28.96	7.94	1570.74
98	16	98	-0.72	235.47	-7.72	-25.66	-7.94	-1570.80
		99	0.72	-137.46	3.86	-14.86	36.32	2484.55
99	16	99	-0.72	137.46	-3.86	9.65	-36.32	-2484.57
		100	0.72	-39.48	0.00	-50.15	45.78	2918.00
100	16	100	-0.72	39.48	0.00	55.79	-45.78	-2917.90
		101	0.72	58.53	-3.86	-96.31	36.34	2871.24
101	16	101	-0.73	-58.52	3.86	96.80	-36.34	-2871.22
		102	0.73	156.51	-7.71	-137.31	8.00	2344.43

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	16	102	-0.74	-156.51	7.71	142.22	-8.00	-2344.14
		103	0.74	254.53	-11.57	-182.74	-39.25	1336.89
103	16	103	-0.73	-254.53	11.57	181.96	39.25	-1337.00
		104	0.73	328.52	-14.48	-212.54	-87.44	258.55
104	16	104	-0.75	-328.55	14.48	212.83	87.44	-258.29
		105	0.75	344.54	-15.11	-219.44	-99.28	-10.88

********** END OF LATEST ANALYSIS RESULT **********

162. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	16	-4.54	-4.43	0.01	-0.04	-0.05	0.00
11	16	0.00	20.73	0.02	1.40	0.05	0.00
23	16	0.00	-72.46	0.02	-7.78	0.12	0.00
35	16	0.00	519.92	-21.06	-208.80	160.98	0.00
47	16	0.00	1096.26	-36.91	-384.59	-16.62	0.00
59	16	0.00	383.86	-19.51	-238.93	-121.97	0.00
71	16	0.00	522.70	-19.51	-146.24	122.49	0.00
83	16	0.00	501.57	-19.52	-275.48	-122.01	0.00
95	16	0.00	458.34	-16.93	-82.77	85.69	0.00
105	16	0.00	344.54	-15.13	-219.71	-99.28	0.00

********** END OF LATEST ANALYSIS RESULT **********

163. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:42:16 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC - iAPF - L.I. $Q^{+}_{MÁX}$ PILA P-4. (2 vías)

(LOAD 17)

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 *****************************************************
 *                                                   *
 *           S T A A D - III                         *
 *           Revision 17.0                           *
 *           Proprietary Program of                  *
 *           RESEARCH ENGINEERS, Inc.                *
 *           Date=    MAR 31, 1998                   *
 *           Time=     0:42:28                       *
 *                                                   *
 *****************************************************

  1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
  2. UNIT MET MTON
  3. JOINT COORDINATES
  4. 1 0 0 8000
  5. 2 0.799999998666667 0 7999.99996
  6. 3 4.49999976269532 0 7999.99873437503
  7. 4 9.24999793892429 0 7999.99465234435
  8. 5 13.9999928541678 0 7999.98775000313
  9. 6 18.749982833867 0 7999.97802735381
 10. 7 23.4999662034651 0 7999.96548439982
 11. 8 28.2499412884074 0 7999.95012114558
 12. 9 32.9999064141421 0 7999.93193759651
 13. 10 36.6998712739297 0 7999.91581952263
 14. 11 37.4998626710493 0 7999.91210953593
 15. 12 38.2998536931703 0 7999.90831955011
 16. 13 41.9998070627659 0 7999.88975025323
 17. 14 46.4997381654814 0 7999.86485975548
 18. 15 50.9996545553895 0 7999.83743805055
 19. 16 55.4995548086885 0 7999.80748514713
 20. 17 59.999437501582 0 7999.77500105469
 21. 18 64.499301210279 0 7999.7399857835
 22. 19 68.9991445109945 0 7999.70243934465
 23. 20 73.49896597995 0 7999.66236175002
 24. 21 77.998764193374 0 7999.61975301228
 25. 22 81.6985798550281 0 7999.58282300081
 26. 23 82.4985377275021 0 7999.57461314493
 27. 24 83.2984947749906 0 7999.5663232933
 28. 25 86.9982851585779 0 7999.52694216223
 29. 26 91.4980050628533 0 7999.47674007929
 30. 27 95.9976960165887 0 7999.42400691197
 31. 28 100.497356596054 0 7999.36874267696
 32. 29 104.996985377528 0 7999.31094739176
 33. 30 109.496580937301 0 7999.25062107464
 34. 31 113.996141851672 0 7999.1877637447
 35. 32 118.495666696953 0 7999.12237542182
 36. 33 122.995154049465 0 7999.0544561267
 37. 34 126.694703448814 0 7998.99671534612
 38. 35 127.494602485542 0 7998.98400588081
 39. 36 128.294500247324 0 7998.97121642567
 40. 37 131.994010581532 0 7998.91102470646
 41. 38 136.493376913792 0 7998.83551262674
 42. 39 140.992700058696 0 7998.75746966553
 43. 40 145.49197859263 0 7998.67689584754
 44. 41 149.991211091994 0 7998.59379119825
 45. 42 154.490396133202 0 7998.50815574396
 46. 43 158.989532292685 0 7998.41998951176
 47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 17
131. MEMBER LOAD
132. *TREN 1
133. 47 TO 53 UNI GY -12
134. 54 UNI GY -12 0 3
135. 54 UNI GY -10 3 4.5
136. 55 TO 58 UNI GY -10
137. 59 TO 70 UNI GY -1
138. 71 TO 82 UNI GY -10
139. 83 TO 94 UNI GY -1
140. 95 TO 104 UNI GY -10
141. *TREN OPUESTO
142. 51 UNI GY -12 1.5 4.5
143. 52 TO 58 UNI GY -12
144. 51 UNI GY -10 0 1.5
145. 35 TO 50 UNI GY -10
146. 23 TO 34 UNI GY -1
147. 11 TO 22 UNI GY -10
148. *RIPADO + F.CENTRIFUGA
149. *TREN 1
150. 47 TO 53 UMOM X 4.96
151. 47 TO 53 UNI Z .47244
152. 54 UMOM X 4.96 0 3
153. 54 UNI Z .47244 0 3
154. 54 UMOM X 4.13386 3 4.5
155. 54 UNI Z 0.3937 3 4.5
156. 55 TO 58 UMOM X 4.13386
157. 55 TO 58 UNI Z 0.3937
158. 59 TO 70 UMOM X .413386
159. 59 TO 70 UNI Z 0.04
160. 71 TO 82 UMOM X 4.13386
161. 71 TO 82 UNI Z 0.3937
162. 83 TO 94 UMOM X .413386
163. 83 TO 94 UNI Z 0.04
164. 95 TO 104 UMOM X 4.13386
165. 95 TO 104 UNI Z 0.3937
166. *TREN OPUESTO
167. 51 UMOM X 4.96 1.5 4.5
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168. 51 UNI Z .47244 1.5 4.5
169. 52 TO 58 UMOM X 4.96
170. 52 TO 58 UNI Z .47244
171. 51 UMOM X 4.13386 0 1.5
172. 51 UNI Z 0.3937 0 1.5
173. 35 TO 50 UMOM X 4.13386
174. 35 TO 50 UNI Z 0.3937
175. 23 TO 34 UMOM X .413386
176. 23 TO 34 UNI Z 0.04
177. 11 TO 22 UMOM X 4.13386
178. 11 TO 22 UNI Z 0.3937
180. PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

```
NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                0:42:31
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 0:42:31
++ PROCESSING TRIANGULAR FACTORIZATION.                0:42:32
++ CALCULATING JOINT DISPLACEMENTS.                    0:42:32
++ CALCULATING MEMBER  FORCES.                         0:42:32
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181. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	17	1	-2.93	-30.65	0.01	-0.28	-0.03	0.00
		2	2.93	30.65	-0.01	0.28	0.03	-24.52
2	17	2	-2.93	-30.65	0.01	-0.28	-0.03	24.52
		3	2.93	30.65	-0.01	0.28	0.00	-137.93
3	17	3	-2.93	-30.65	0.00	-0.58	0.00	137.92
		4	2.93	30.65	0.00	0.58	0.00	-283.51
4	17	4	-2.93	-30.65	0.01	0.04	0.00	283.51
		5	2.93	30.65	-0.01	-0.04	-0.02	-429.10
5	17	5	-2.93	-30.65	0.00	-0.82	0.02	429.10
		6	2.93	30.65	0.00	0.82	-0.03	-574.69
6	17	6	-2.93	-30.65	0.00	-0.92	0.03	574.69
		7	2.93	30.65	0.00	0.92	-0.02	-720.28
7	17	7	-2,93	-30.65	-0.01	-2.36	0.02	720.27
		8	2.93	30.65	0.01	2.36	0.01	-865.86
8	17	8	-2.93	-30.65	-0.01	-2.36	-0.01	865.86
		9	2.93	30.65	0.01	2.36	0.03	-1011.45
9	17	9	-2.93	-30.65	0.00	-0.96	-0.03	1011.45
		10	2.93	30.65	0.00	0.96	0.04	-1124.86
10	17	10	-2.93	-30.63	-0.03	-11.21	-0.04	1124.80
		11	2.93	30.63	0.03	11.21	0.07	-1149.33
11	17	11	-2.93	225.21	-8.84	-86.32	67.99	1149.37
		12	2.93	-217.21	8.52	83.01	-61.05	-972.40
12	17	12	-2.89	217.22	-8.54	-88.43	61.05	971.92
		13	2.89	-180.22	7.08	73.14	-32.15	-236.69
13	17	13	-2.88	180.21	-7.09	-73.40	32.15	236.60
		14	2.88	-135.21	5.31	54.80	-4.25	473.11
14	17	14	-2.89	135.22	-5.31	-55.89	4.25	-472.99
		15	2.89	-90.22	3.54	37.28	15.65	980.22
15	17	15	-2.88	90.22	-3.54	-35.04	-15.65	-980.30
		16	2.88	-45.22	1.77	16.43	27.60	1285.01
16	17	16	-2.88	45.21	-1.78	-13.71	-27.60	-1285.05
		17	2.88	-0.21	0.01	-4.89	31.61	1387.27

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	17	17	-2.88	0.22	0.00	1.95	-31.61	-1387.27
		18	2.88	44.78	-1.77	-20.55	27.62	1287.00
18	17	18	-2.88	-44.78	1.77	23.28	-27.62	-1286.95
		19	2.88	89.78	-3.54	-41.88	15.68	984.17
19	17	19	-2.88	-89.79	3.54	41.88	-15.68	-984.17
		20	2.88	134.79	-5.31	-60.48	-4.23	478.88
20	17	20	-2.88	-134.78	5.31	60.57	4.23	-478.87
		21	2.88	179.78	-7.08	-79.17	-32.10	-228.91
21	17	21	-2.89	-179.79	7.08	78.77	32.10	229.04
		22	2.89	216.79	-8.53	-94.07	-60.98	-962.70
22	17	22	-2.91	-216.79	8.53	91.98	60.98	962.91
		23	2.91	224.79	-8.84	-95.28	-67.93	-1139.52
23	17	23	-2.80	44.45	-0.87	0.33	6.89	1138.20
		24	2.80	-43.65	0.83	-0.66	-6.21	-1102.95
24	17	24	-2.79	43.65	-0.86	-11.41	6.21	1102.89
		25	2.79	-39.95	0.72	9.88	-3.28	-948.22
25	17	25	-2.79	39.95	-0.72	-9.88	3.28	948.22
		26	2.79	-35.45	0.54	8.02	-0.47	-778.55
26	17	26	-2.79	35.45	-0.54	-9.94	0.47	778.53
		27	2.79	-30.95	0.36	8.08	1.57	-629.10
27	17	27	-2.79	30.96	-0.36	-6.64	-1.57	629.11
		28	2.79	-26.46	0.18	4.78	2.77	-499.95
28	17	28	-2.79	26.45	-0.18	-5.83	-2.77	499.94
		29	2.79	-21.95	0.00	3.97	3.19	-391.01
29	17	29	-2.79	21.96	0.00	-4.04	-3.19	391.01
		30	2.79	-17.46	-0.18	2.18	2.79	-302.33
30	17	30	-2.79	17.45	0.18	-2.18	-2.79	302.33
		31	2.79	-12.96	-0.36	0.32	1.59	-233.92
31	17	31	-2.79	12.96	0.35	-0.82	-1.59	233.92
		32	2.79	-8.46	-0.53	-1.04	-0.39	-185.74
32	17	32	-2.79	8.45	0.53	1.04	0.39	185.74
		33	2.79	-3.95	-0.71	-2.90	-3.19	-157.82
33	17	33	-2.79	3.96	0.72	3.22	3.19	157.81
		34	2.79	-0.26	-0.86	-4.75	-6.11	-150.02

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	17	34	-2.80	0.25	0.83	3.06	6.11	150.07
		35	2.80	0.55	-0.87	-3.39	-6.79	-150.18
35	17	35	-2.66	142.27	-8.85	-98.19	68.03	148.80
		36	2.66	-134.28	8.53	94.89	-61.09	-38.31
36	17	36	-2.63	134.28	-8.54	-95.01	61.09	38.01
		37	2.63	-97.27	7.08	79.71	-32.18	390.42
37	17	37	-2.64	97.27	-7.08	-79.86	32.18	-390.39
		38	2.64	-52.28	5.31	61.26	-4.30	726.85
38	17	38	-2.63	52.28	-5.32	-59.73	4.30	-726.98
		39	2.63	-7.27	3.54	41.12	15.64	860.99
39	17	39	-2.63	7.27	-3.54	-41.27	-15.64	-860.98
		40	2.63	37.73	1.77	22.67	27.60	792.47
40	17	40	-2.62	-37.72	-1.78	-20.71	-27.60	-792.52
		41	2.62	82.72	0.01	2.11	31.61	521.52
41	17	41	-2.62	-82.72	0.00	-3.31	-31.61	-521.51
		42	2.62	127.72	-1.77	-15.29	27.63	48.04
42	17	42	-2.63	-127.72	1.76	15.40	-27.63	-48.00
		43	2.63	172.73	-3.54	-34.00	15.70	-628.15
43	17	43	-2.63	-172.73	3.54	34.00	-15.70	628.15
		44	2.63	217.73	-5.31	-52.60	-4.20	-1506.66
44	17	44	-2.63	-217.73	5.31	52.60	4.20	1506.66
		45	2.63	262.73	-7.08	-71.20	-32.08	-2587.67
45	17	45	-2.64	-262.73	7.08	66.71	32.08	2587.79
		46	2.64	299.73	-8.53	-82.01	-60.95	-3628.29
46	17	46	-2.66	-299.73	8.52	70.65	60.95	3628.54
		47	2.66	307.73	-8.84	-73.96	-67.90	-3871.56
47	17	47	-1.93	550.66	-20.08	-210.09	156.25	3864.42
		48	1.93	-533.08	19.39	202.82	-140.48	-3431.34
48	17	48	-2.01	533.06	-19.38	-188.54	140.48	3432.16
		49	2.01	-451.64	16.18	154.89	-74.67	-1610.05
49	17	49	-2.00	451.64	-16.18	-155.80	74.67	1609.96
		50	2.00	-352.66	12.28	114.89	-10.64	199.34
50	17	50	-2.00	352.66	-12.28	-114.89	10.64	-199.33
		51	2.00	-253.66	8.38	73.97	35.86	1563.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	17	51	-1.98	253.65	-8.39	-70.66	-35.86	-1563.72
		52	1.98	-148.65	4.26	27.26	64.49	2473.47
52	17	52	-1.98	148.65	-4.26	-26.82	-64.49	-2473.47
		53	1.98	-40.64	0.00	-17.82	74.07	2899.42
53	17	53	-1.98	40.64	0.00	17.84	-74.07	-2899.41
		54	1.98	67.34	-4.25	-62.47	64.52	2839.35
54	17	54	-1.98	-67.35	4.25	61.96	-64.52	-2839.36
		55	1.98	172.35	-8.38	-105.36	35.92	2295.53
55	17	55	-2.00	-172.35	8.38	110.63	-35.92	-2295.27
		56	2.00	271.34	-12.28	-151.55	-10.54	1297.06
56	17	56	-2.00	-271.34	12.28	151.55	10.54	-1297.06
		57	2.00	370.35	-16.17	-192.47	-74.56	-146.93
57	17	57	-1.96	-370.35	16.18	192.79	74.56	146.52
		58	1.96	451.75	-19.38	-226.44	-140.35	-1667.43
58	17	58	-2.20	-451.76	19.36	205.95	140.35	1670.11
		59	2.20	469.35	-20.05	-213.22	-156.10	-2038.33
59	17	59	-1.44	53.25	-0.90	-24.94	6.94	2029.16
		60	1.44	-52.45	0.86	24.61	-6.24	-1986.89
60	17	60	-1.44	52.43	-0.87	-27.07	6.24	1986.84
		61	1.44	-48.73	0.72	25.54	-3.30	-1799.67
61	17	61	-1.44	48.73	-0.72	-28.64	3.30	1799.62
		62	1.44	-44.23	0.54	26.78	-0.46	-1590.44
62	17	62	-1.44	44.23	-0.54	-23.70	0.46	1590.50
		63	1.44	-39.73	0.36	21.84	1.55	-1401.57
63	17	63	-1.44	39.73	-0.36	-27.77	-1.55	1401.48
		64	1.44	-35.23	0.18	25.91	2.79	-1232.78
64	17	64	-1.44	35.23	-0.18	-23.30	-2.79	1232.84
		65	1.44	-30.73	0.00	21.44	3.20	-1084.41
65	17	65	-1.44	30.74	0.00	-23.74	-3.20	1084.37
		66	1.44	-26.24	-0.18	21.88	2.81	-956.17
66	17	66	-1.44	26.23	0.18	-19.85	-2.81	956.22
		67	1.44	-21.73	-0.36	17.99	1.60	-848.30
67	17	67	-1.44	21.74	0.35	-21.73	-1.60	848.21
		68	1.44	-17.24	-0.53	19.87	-0.39	-760.51

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	17	68	-1.44	17.23	0.54	-18.13	0.39	760.56
		69	1.44	-12.73	-0.72	16.27	-3.20	-693.14
69	17	69	-1.44	12.74	0.71	-17.20	3.20	693.12
		70	1.44	-9.04	-0.86	15.67	-6.12	-652.84
70	17	70	-1.44	8.98	0.85	-19.13	6.12	652.75
		71	1.44	-8.18	-0.89	18.80	-6.81	-645.86
71	17	71	-1.19	214.37	-8.85	-70.35	68.06	644.54
		72	1.19	-206.38	8.53	67.05	-61.11	-476.40
72	17	72	-1.10	206.39	-8.55	-71.98	61.11	475.67
		73	1.10	-169.39	7.09	56.68	-32.19	219.58
73	17	73	-1.11	169.39	-7.09	-57.09	32.19	-219.47
		74	1.11	-124.38	5.31	38.48	-4.28	880.53
74	17	74	-1.11	124.38	-5.31	-38.48	4.28	-880.53
		75	1.11	-79.39	3.54	19.87	15.65	1338.97
75	17	75	-1.11	79.39	-3.55	-16.82	-15.65	-1339.02
		76	1.11	-34.38	1.77	-1.79	27.62	1595.04
76	17	76	-1.11	34.38	-1.77	1.52	-27.62	-1595.03
		77	1.11	10.62	0.00	-20.12	31.62	1648.51
77	17	77	-1.11	-10.62	0.00	20.41	-31.62	-1648.50
		78	1.11	55.62	-1.77	-39.01	27.64	1499.47
78	17	78	-1.11	-55.62	1.77	38.75	-27.64	-1499.48
		79	1.11	100.62	-3.54	-57.35	15.69	1147.97
79	17	79	-1.11	-100.61	3.54	59.98	-15.69	-1147.83
		80	1.11	145.61	-5.31	-78.59	-4.22	593.79
80	17	80	-1.11	-145.62	5.31	78.69	4.22	-593.78
		81	1.11	190.62	-7.08	-97.29	-32.10	-162.80
81	17	81	-1.11	-190.62	7.08	97.32	32.10	162.79
		82	1.11	227.62	-8.54	-112.61	-60.99	-936.44
82	17	82	-1.11	-227.63	8.54	112.65	60.99	936.45
		83	1.11	235.63	-8.85	-115.95	-67.95	-1121.63
83	17	83	-0.75	31.11	-0.90	-26.13	6.94	1116.26
		84	0.75	-30.31	0.87	25.80	-6.23	-1091.69
84	17	84	-0.75	30.30	-0.87	-25.89	6.23	1091.69
		85	0.75	-26.61	0.72	24.36	-3.30	-986.41

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	17	85	-0.74	26.61	-0.72	-26.62	3.30	986.36
		86	0.74	-22.11	0.54	24.76	-0.46	-876.77
86	17	86	-0.74	22.10	-0.54	-24.75	0.46	876.77
		87	0.74	-17.60	0.36	22.89	1.57	-787.41
87	17	87	-0.74	17.60	-0.36	-22.89	-1.57	787.41
		88	0.74	-13.10	0.18	21.03	2.79	-718.32
88	17	88	-0.74	13.11	-0.18	-22.55	-2.79	718.27
		89	0.74	-8.61	0.00	20.69	3.21	-669.43
89	17	89	-0.74	8.61	0.00	-19.27	-3.21	669.47
		90	0.74	-4.11	-0.18	17.41	2.81	-640.86
90	17	90	-0.74	4.10	0.18	-18.77	-2.81	640.83
		91	0.74	0.40	-0.36	16.91	1.61	-632.49
91	17	91	-0.74	-0.40	0.36	-16.92	-1.61	632.48
		92	0.74	4.90	-0.54	15.06	-0.41	-644.39
92	17	92	-0.74	-4.89	0.54	-16.53	0.41	644.35
		93	0.74	9.39	-0.72	14.67	-3.22	-676.50
93	17	93	-0.74	-9.39	0.72	-13.91	3.22	676.52
		94	0.74	13.10	-0.86	12.38	-6.15	-718.13
94	17	94	-0.74	-13.13	0.87	-7.64	6.15	718.18
		95	0.74	13.92	-0.90	7.31	-6.85	-729.00
95	17	95	-0.32	210.81	-7.56	-57.11	49.70	726.82
		96	0.32	-202.81	7.25	53.80	-43.78	-561.36
96	17	96	-0.38	202.80	-7.24	-49.72	43.78	561.73
		97	0.38	-165.79	5.79	34.42	-19.66	120.24
97	17	97	-0.37	165.79	-5.79	-34.23	19.66	-120.30
		98	0.37	-116.79	3.86	13.98	3.97	812.63
98	17	98	-0.36	116.79	-3.86	-12.27	-3.97	-812.66
		99	0.36	-67.79	1.93	-7.99	18.16	1264.92
99	17	99	-0.36	67.79	-1.93	5.34	-18.16	-1264.94
		100	0.36	-18.80	0.00	-25.59	22.89	1477.04
100	17	100	-0.36	18.80	0.00	28.45	-22.89	-1476.98
		101	0.36	30.20	-1.93	-48.70	18.17	1449.04
101	17	101	-0.36	-30.20	1.93	48.95	-18.17	-1449.03
		102	0.36	79.20	-3.86	-69.21	4.00	1181.03

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	17	102	-0.37	-79.20	3.86	71.68	-4.00	-1180.89
		103	0.37	128.21	-5.79	-91.94	-19.63	672.65
103	17	103	-0.37	-128.21	5.79	91.55	19.63	-672.71
		104	0.37	165.20	-7.24	-106.84	-43.72	130.00
104	17	104	-0.38	-165.20	7.24	106.98	43.72	-129.89
		105	0.38	173.20	-7.56	-110.29	-49.64	-5.51

********** END OF LATEST ANALYSIS RESULT **********

182. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	17	-2.93	-30.65	0.01	-0.28	-0.03	0.00
11	17	0.00	255.84	-8.84	-88.79	68.06	0.00
23	17	0.00	269.24	-9.74	-109.65	-61.04	0.00
35	17	0.00	142.83	-9.75	-103.37	61.24	0.00
47	17	0.00	858.40	-28.93	-280.17	88.36	0.00
59	17	0.00	522.60	-20.98	-260.54	-149.16	0.00
71	17	0.00	206.19	-9.76	-59.88	61.25	0.00
83	17	0.00	266.73	-9.76	-142.24	-61.01	0.00
95	17	0.00	224.74	-8.46	-39.73	42.85	0.00
105	17	0.00	173.20	-7.57	-110.43	-49.64	0.00

********** END OF LATEST ANALYSIS RESULT **********

183. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 0:42:36 ****

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*  FOR  QUESTIONS REGARDING THIS VERSION OF PROGRAM    *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
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ENVOLVENTES DE SC - IAPF . 2 VIAS

(CASOS 10 a 17)

		6	-.98	-31.58	.00	-.85	.01	-592.03
	12	5	-3.14	28.99	1.87	-18.85	-17.34	1385.90

C A S O 7

SELECCION DE MAXIMOS DE CARGAS NORMALES

ARCHIVO	NO. HIPOTESIS	HIPOTESIS
SC10-17.ANL	8	10 11 12 13 14 15 16

HIPOTESIS	ENVOLVENTE
1	N .MIN
2	N .MAX
3	QY.MIN
4	QY.MAX
5	QZ.MIN
6	QZ.MAX
7	MT.MIN
8	MT.MAX
9	MY.MIN
10	MY.MAX
11	MZ.MIN
12	MZ.MAX

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
1	11	1	-2.32	168.92	7.38	-500.34	47.37	-.01
		2	-.98	-31.58	.00	-.29	-.01	-25.26
	12	1	.00	.00	.00	.00	.00	.00
		2	-3.15	160.97	7.06	-75.16	41.59	131.99
2	11	2	-.98	-31.57	.00	-.29	-.01	-25.26
		3	-.98	-31.57	.00	-.29	.00	-142.09
	12	2	-3.15	160.99	7.06	-75.16	41.59	131.99
		3	-3.15	123.99	5.60	-59.87	18.16	659.19
3	11	3	-.98	-31.57	.00	-.60	.00	-142.09
		4	-.98	-31.57	.00	-.60	.00	-292.07
	12	3	-2.31	123.92	5.61	-379.06	18.16	659.71
		4	-2.31	76.42	3.74	-252.55	-4.05	1135.52
4	11	4	-.98	-31.58	.00	.04	.00	-292.07
		5	-.98	-31.58	.00	.04	.01	-442.05
	12	4	-3.14	76.49	3.73	-41.26	-4.05	1135.36
		5	-3.14	28.99	1.86	-21.63	-17.34	1385.86
5	11	5	-.98	-31.58	.00	-.85	.01	-442.05

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		6	-3.14	-18.51	.00	.79	-21.78	1410.77
6	11	6	-.98	-31.58	.00	-.95	.01	-592.03
		7	-.98	-31.58	.00	-.95	.01	-742.02
	12	6	-3.14	-18.51	.00	1.02	-21.78	1410.78
		7	-3.14	-66.01	-1.87	20.66	-17.34	1210.02
7	11	7	-.98	-31.58	.00	-2.43	.01	-742.01
		8	-.98	-31.58	.00	-2.43	.00	-891.99
	12	7	-3.14	-66.01	-1.86	23.08	-17.34	1209.99
		8	-3.14	-113.51	-3.73	42.72	-4.05	783.61
8	11	8	-.98	-31.57	.00	-2.43	.00	-891.99
		9	-.98	-31.57	.00	-2.43	-.01	-1041.97
	12	8	-3.14	-113.51	-3.73	42.72	-4.05	783.62
		9	-3.14	-161.01	-5.60	62.36	18.12	131.61
9	11	9	-.98	-31.58	.00	-.99	-.01	-1041.97
		10	-.98	-31.58	.00	-.99	-.01	-1158.81
	12	9	-3.13	-161.01	-5.61	62.17	18.12	131.70
		10	-3.90	1.81	.00	.06	-.06	66.55
10	11	10	-.98	-31.54	.01	-11.55	-.01	-1158.75
		11	-.98	-31.54	.01	-11.55	-.02	-1184.00
	12	10	-3.90	1.81	.04	.66	-.06	66.55
		11	-3.90	1.81	.04	.66	-.09	68.00
11	11	11	-.98	228.40	8.85	-592.21	68.02	-1184.06
		12	-.98	220.40	8.54	-570.91	61.06	-1004.54
	12	11	-3.90	-6.67	-.03	-.72	-.04	68.00
		12	-3.90	-6.67	-.03	-.72	-.02	62.67
12	11	12	-.93	220.40	8.54	-576.50	61.06	-1001.35
		13	-3.11	10.11	.72	-9.69	3.27	-638.18
	12	12	-3.90	-6.67	-.01	-.37	-.02	62.67
		13	-3.90	-6.67	-.01	-.37	.00	37.98
13	11	13	-3.11	10.11	.72	-10.40	3.27	-638.17
		14	-3.11	5.61	.54	-8.54	.43	-602.80
	12	13	-3.90	-6.67	.00	-.33	.00	37.99
		14	-2.88	135.21	5.31	-54.80	4.25	473.11
14	11	14	-3.11	5.61	.53	-7.16	.43	-602.82
		15	-3.11	1.11	.35	-5.30	-1.55	-587.69
	12	14	-2.89	135.22	5.31	-55.89	4.25	472.99
		15	-.94	93.39	3.54	-239.61	-15.67	990.94
15	11	15	-3.11	1.11	.36	-6.65	-1.55	-587.68
		16	-2.28	-3.53	.18	-106.04	-2.78	-592.97
	12	15	-.93	93.39	3.54	-237.34	-15.67	991.49
		16	-.93	48.39	1.77	-117.49	-27.63	1310.51

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
16	11	16	-3.11	-3.39	.19	-6.04	-2.76	-592.80
		17	-2.28	-8.04	.00	-4.19	-3.20	-618.78
	12	16	-.93	48.40	1.77	-114.72	-27.63	1310.76
		17	-.93	3.40	.00	5.14	-31.62	1427.29
17	11	17	-2.28	-8.03	.00	-2.88	-3.20	-618.79
		18	-2.28	-12.53	-.18	100.23	-2.79	-665.06
	12	17	-.93	3.39	.00	2.11	-31.62	1427.30
		18	-.93	-41.61	-1.77	121.97	-27.63	1341.33
18	11	18	-2.28	-12.53	-.18	98.83	-2.79	-665.28
		19	-2.28	-17.03	-.36	201.94	-1.59	-731.80
	12	18	-.93	-41.61	-1.77	124.81	-27.63	1341.07
		19	-.93	-86.61	-3.54	244.66	-15.68	1052.60
19	11	19	-2.28	-17.04	-.36	201.94	-1.59	-731.80
		20	-2.28	-21.54	-.54	305.05	.41	-818.58
	12	19	-.93	-86.60	-3.54	244.66	-15.68	1052.60
		20	-.93	-131.60	-5.31	364.51	4.24	561.62
20	11	20	-2.28	-21.53	-.54	304.90	.41	-818.63
		21	-2.28	-26.03	-.72	408.01	3.23	-925.66
	12	20	-.93	-131.60	-5.31	364.61	4.24	561.56
		21	-4.54	16.30	.01	1.46	-.08	493.85
21	11	21	-2.28	-26.03	-.71	406.41	3.23	-926.36
		22	-2.28	-29.73	-.86	491.19	6.13	-1029.54
	12	21	-4.54	16.29	.02	2.32	-.08	493.85
		22	-4.54	16.29	.02	2.32	-.14	554.15
22	11	22	-2.28	-29.74	-.85	488.95	6.13	-1030.62
		23	-2.91	-224.79	-8.84	95.28	67.93	-1139.52
	12	22	-4.54	16.28	.03	3.52	-.14	554.14
		23	-4.54	16.28	.03	3.52	-.16	567.18
23	11	23	-2.80	44.45	.87	.33	6.89	-1138.20
		24	-2.80	43.65	.83	.66	6.21	-1102.95
	12	23	-4.54	-56.18	-.06	-11.57	-.04	567.17
		24	-4.54	-56.18	-.06	-11.57	.01	522.23
24	11	24	-2.79	43.65	.86	-11.41	6.21	-1102.89
		25	-2.79	39.95	.72	-9.88	3.28	-948.22
	12	24	-4.54	-56.18	-.01	-5.86	.01	522.32
		25	-4.54	-56.18	-.01	-5.86	.03	314.44
25	11	25	-2.79	39.95	.72	-9.88	3.28	-948.22
		26	-2.79	35.45	.54	-8.02	.47	-778.55
	12	25	-4.54	-56.18	-.01	-5.86	.03	314.44
		26	-2.18	136.94	5.31	-354.97	4.28	595.60

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
26	11	26	-2.79	35.45	.54	-9.94	.47	-778.53
		27	-.84	19.17	.36	-211.75	-1.59	-666.05
	12	26	-2.17	136.94	5.32	-353.50	4.28	596.48
		27	-2.17	91.94	3.55	-233.64	-15.66	1111.47
27	11	27	-.84	19.16	.36	-210.22	-1.59	-666.53
		28	-.84	14.66	.18	-107.12	-2.80	-590.42
	12	27	-2.17	91.94	3.54	-236.19	-15.66	1110.93
		28	-3.00	47.31	1.77	-15.08	-27.60	1423.65
28	11	28	-.84	14.67	.18	-108.37	-2.80	-590.19
		29	-4.54	-56.18	.00	-6.21	.04	-696.86
	12	28	-3.00	47.31	1.77	-12.06	-27.60	1423.68
		29	-3.00	2.30	.00	6.54	-31.60	1535.31
29	11	29	-4.54	-56.18	.00	-6.33	.04	-696.86
		30	-4.54	-56.18	.00	-6.33	.02	-949.72
	12	29	-3.00	2.30	.00	6.81	-31.60	1535.31
		30	-3.00	-42.70	-1.77	25.41	-27.63	1444.40
30	11	30	-4.54	-56.19	.00	-6.34	.02	-949.71
		31	-4.54	-56.19	.00	-6.34	.00	-1202.50
	12	30	-3.00	-42.70	-1.77	25.42	-27.63	1444.41
		31	-3.00	-87.69	-3.54	44.02	-15.68	1151.06
31	11	31	-4.54	-56.18	.01	-8.88	.00	-1202.50
		32	-4.54	-56.18	.01	-8.88	-.06	-1455.34
	12	31	-3.00	-87.69	-3.53	46.45	-15.68	1150.95
		32	-3.00	-132.70	-5.31	65.06	4.21	655.01
32	11	32	-4.54	-56.19	.01	-8.88	-.06	-1455.35
		33	-4.54	-56.19	.01	-8.88	-.13	-1708.15
	12	32	-3.00	-132.70	-5.31	65.06	4.21	655.01
		33	-3.91	23.00	.01	3.64	-.11	699.32
33	11	33	-4.54	-56.18	.01	-5.45	-.13	-1708.17
		34	-4.54	-56.18	.01	-5.45	-.15	-1916.07
	12	33	-3.91	23.00	.00	2.23	-.11	699.33
		34	-3.91	23.00	.00	2.23	-.13	784.44
34	11	34	-4.54	-56.17	.06	-27.07	-.15	-1915.92
		35	-4.54	-56.17	.06	-27.07	-.19	-1960.82
	12	34	-3.90	23.01	.05	11.08	-.13	784.36
		35	-3.90	23.01	.05	11.08	-.17	802.78
35	11	35	-4.27	463.75	21.06	-212.55	160.79	-1958.35
		36	-4.27	444.57	20.31	-204.62	144.26	-1595.41
	12	35	-3.91	-79.61	-.02	-14.13	.01	803.05
		36	-3.91	-79.61	-.02	-14.13	.02	739.45
36	11	36	-4.20	444.56	20.32	-209.68	144.26	-1594.77

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		37	-2.85	17.08	.72	-15.06	3.30	-855.47
	12	36	-3.91	-79.60	-.01	-11.78	.02	739.48
		37	-3.91	-79.60	-.01	-11.78	.04	444.91
37	11	37	-2.85	17.08	.71	-14.73	3.30	-855.48
		38	-2.85	12.58	.53	-12.87	.49	-788.73
	12	37	-3.91	-79.60	-.01	-11.96	.04	444.91
		38	-4.21	247.76	12.57	-128.30	9.41	1243.68
38	11	38	-2.85	12.58	.54	-14.54	.49	-788.71
		39	-2.85	8.08	.36	-12.68	-1.54	-742.20
	12	38	-4.18	247.76	12.58	-125.67	9.41	1243.95
		39	-4.18	139.74	8.33	-81.02	-37.64	2115.98
39	11	39	-2.85	8.08	.36	-12.55	-1.54	-742.20
		40	-2.85	3.58	.18	-10.69	-2.76	-715.96
	12	39	-4.18	139.75	8.33	-81.39	-37.64	2115.96
		40	-4.18	31.75	4.07	-36.75	-65.54	2501.79
40	11	40	-2.85	3.58	.19	-12.46	-2.76	-715.93
		41	-3.91	-79.60	.01	-13.28	.02	-987.88
	12	40	-4.17	31.75	4.08	-30.57	-65.54	2501.88
		41	-4.17	-76.25	-.17	14.07	-74.35	2401.75
41	11	41	-3.91	-79.60	.00	-11.02	.02	-987.90
		42	-3.91	-79.60	.00	-11.02	.01	-1346.10
	12	41	-4.17	-76.25	-.18	8.56	-74.35	2401.78
		42	-4.17	-184.24	-4.43	53.20	-63.99	1815.72
42	11	42	-3.91	-79.60	.01	-13.86	.01	-1346.07
		43	-3.91	-79.60	.01	-13.86	-.03	-1704.36
	12	42	-4.18	-184.24	-4.42	57.03	-63.99	1815.60
		43	-4.18	-289.44	-8.56	100.52	-34.56	744.24
43	11	43	-3.91	-79.60	.01	-13.87	-.03	-1704.36
		44	-3.91	-79.60	.01	-13.87	-.07	-2062.56
	12	43	-4.18	-289.44	-8.56	100.52	-34.56	744.24
		44	.00	.00	.00	.00	.00	.00
44	11	44	-3.91	-79.60	.01	-13.87	-.07	-2062.57
		45	-4.18	-469.44	-15.65	174.93	74.38	-2670.63
	12	44	.00	.00	.00	.00	.00	.00
		45	.00	.00	.00	.00	.00	.00
45	11	45	-4.21	-469.44	-15.64	170.30	74.38	-2670.93
		46	-4.21	-543.43	-18.55	200.88	137.64	-4544.67
	12	45	.00	.00	.00	.00	.00	.00
		46	.00	.00	.00	.00	.00	.00
46	11	46	-4.27	-543.44	-18.54	186.66	137.64	-4545.28
		47	-4.27	-559.44	-19.17	193.28	152.73	-4986.57

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	46	.00	.00	.00	.00	.00	.00
		47	.00	.00	.00	.00	.00	.00
47	11	47	-3.34	536.81	17.73	-196.30	136.11	-4976.83
		48	-3.34	520.83	17.10	-189.69	122.19	-4554.17
	12	47	.00	.00	.00	.00	.00	.00
		48	.00	.00	.00	.00	.00	.00
48	11	48	-3.41	520.83	17.08	-170.74	122.19	-4554.91
		49	-3.41	446.81	14.17	-140.14	64.36	-2764.36
	12	48	.00	.00	.00	.00	.00	.00
		49	.00	.00	.00	.00	.00	.00
49	11	49	-3.40	446.81	14.17	-141.71	64.36	-2764.27
		50	-3.40	356.83	10.63	-104.52	8.57	-956.44
	12	49	.00	.00	.00	.00	.00	.00
		50	-3.44	328.72	12.55	-109.91	9.27	1155.07
50	11	50	-3.40	356.83	10.63	-104.51	8.57	-956.44
		51	.00	.00	.00	.00	.00	.00
	12	50	-3.44	328.71	12.55	-109.92	9.27	1155.07
		51	-3.44	220.71	8.29	-65.28	-37.62	2391.31
51	11	51	.00	.00	.00	.00	.00	.00
		52	.00	.00	.00	.00	.00	.00
	12	51	-3.42	220.71	8.30	-60.22	-37.62	2391.44
		52	-3.42	112.71	4.05	-15.58	-65.41	3141.70
52	11	52	.00	.00	.00	.00	.00	.00
		53	.00	.00	.00	.00	.00	.00
	12	52	-3.42	112.71	4.05	-15.02	-65.41	3141.69
		53	-3.42	4.70	-.20	29.62	-74.06	3405.86
53	11	53	.00	.00	.00	.00	.00	.00
		54	.00	.00	.00	.00	.00	.00
	12	53	-3.42	4.69	-.20	29.64	-74.06	3405.88
		54	-3.42	-103.29	-4.45	74.27	-63.58	3184.05
54	11	54	.00	.00	.00	.00	.00	.00
		55	.00	.00	.00	.00	.00	.00
	12	54	-3.42	-103.28	-4.46	73.70	-63.58	3184.07
		55	-3.42	-205.28	-8.47	115.86	-34.14	2480.71
55	11	55	.00	.00	.00	.00	.00	.00
		56	.00	.00	.00	.00	.00	.00
	12	55	-3.44	-205.28	-8.46	121.56	-34.14	2480.43
		56	-3.40	-183.17	-10.62	124.14	8.41	1387.92
56	11	56	.00	.00	.00	.00	.00	.00
		57	-3.44	-385.29	-15.55	195.96	73.93	-177.25
	12	56	-3.40	-183.17	-10.62	124.14	8.41	1387.92

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		57	-3.40	-273.18	-14.16	161.34	64.17	360.98
57	11	57	-3.40	-385.30	-15.56	196.35	73.93	-176.81
		58	-3.40	-459.30	-18.47	226.94	136.88	-1739.34
	12	57	-3.37	-273.19	-14.17	160.56	64.17	361.33
		58	.00	.00	.00	.00	.00	.00
58	11	58	-3.63	-459.33	-18.43	205.56	136.88	-1742.00
		59	-3.63	-476.92	-19.12	212.83	151.89	-2116.27
	12	58	.00	.00	.00	.00	.00	.00
		59	.00	.00	.00	.00	.00	.00
59	11	59	-2.88	50.52	1.79	-42.81	13.88	-2106.61
		60	-2.88	48.92	1.73	-42.15	12.47	-2066.78
	12	59	.00	.00	.00	.00	.00	.00
		60	.00	.00	.00	.00	.00	.00
60	11	60	-2.88	48.96	1.73	-44.71	12.47	-2066.73
		61	-2.88	41.56	1.44	-41.65	6.61	-1899.24
	12	60	.00	.00	.00	.00	.00	.00
		61	.00	.00	.00	.00	.00	.00
61	11	61	-2.88	41.56	1.44	-44.92	6.61	-1899.17
		62	-2.88	32.56	1.08	-41.20	.93	-1732.40
	12	61	.00	.00	.00	.00	.00	.00
		62	.00	.00	.00	.00	.00	.00
62	11	62	-2.88	32.56	1.08	-37.84	.93	-1732.46
		63	-2.88	23.56	.72	-34.12	-3.10	-1606.20
	12	62	.00	.00	.00	.00	.00	.00
		63	.00	.00	.00	.00	.00	.00
63	11	63	-2.87	23.56	.73	-40.92	-3.10	-1606.04
		64	-2.87	14.56	.37	-37.20	-5.57	-1520.26
	12	63	.00	.00	.00	.00	.00	.00
		64	.00	.00	.00	.00	.00	.00
64	11	64	-2.88	14.57	.36	-33.98	-5.57	-1520.34
		65	-2.88	5.57	.00	-30.26	-6.40	-1475.04
	12	64	.00	.00	.00	.00	.00	.00
		65	.00	.00	.00	.00	.00	.00
65	11	65	-2.88	5.56	.01	-33.38	-6.40	-1474.98
		66	-2.88	-3.44	-.35	-29.66	-5.63	-1470.19
	12	65	.00	.00	.00	.00	.00	.00
		66	.00	.00	.00	.00	.00	.00
66	11	66	-2.87	-3.44	-.36	-26.55	-5.63	-1470.26
		67	-2.87	-12.44	-.72	-22.83	-3.21	-1505.97
	12	66	.00	.00	.00	.00	.00	.00
		67	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
67	11	67	-2.88	-12.44	-.70	-29.47	-3.21	-1505.86
		68	-2.88	-51.30	-1.06	-18.28	.77	-1614.69
	12	67	.00	.00	.00	.00	.00	.00
		68	.00	27.82	.00	-6.96	.00	30.39
68	11	68	-2.88	-51.29	-1.07	-14.59	.77	-1614.72
		69	-2.88	-60.29	-1.43	-10.87	6.40	-1865.76
	12	68	.00	27.82	.00	-7.03	.00	30.37
		69	.00	27.82	.00	-7.03	.00	155.54
69	11	69	-2.88	-60.29	-1.43	-13.38	6.40	-1865.74
		70	-2.88	-67.69	-1.72	-10.32	12.23	-2102.50
	12	69	.00	27.82	.00	-6.82	.00	155.55
		70	.00	27.82	.00	-6.82	.00	258.49
70	11	70	-2.89	-67.61	-1.71	-21.43	12.23	-2102.44
		71	-2.89	-69.21	-1.77	-20.77	13.63	-2157.22
	12	70	.00	27.82	.00	-5.46	.00	258.53
		71	.00	27.82	.00	-5.46	.00	280.79
71	11	71	-2.38	453.49	17.70	-139.23	136.12	-2153.69
		72	-2.38	437.50	17.07	-132.62	122.22	-1797.61
	12	71	.00	-8.04	.00	-.48	.00	280.49
		72	.00	-8.04	.00	-.48	.00	274.06
72	11	72	-2.20	437.55	17.09	-151.23	122.22	-1796.13
		73	-2.20	363.55	14.18	-120.64	64.37	-313.99
	12	72	.00	-8.03	.00	2.36	.00	274.06
		73	.00	-8.03	.00	2.36	.00	244.32
73	11	73	-2.23	363.55	14.17	-120.06	64.37	-314.22
		74	.00	.00	.00	.00	.00	.00
	12	73	.00	-8.04	.00	1.91	.00	244.33
		74	-2.23	264.91	10.63	-80.80	8.56	1342.76
74	11	74	.00	.00	.00	.00	.00	.00
		75	.00	.00	.00	.00	.00	.00
	12	74	-2.23	264.91	10.63	-80.79	8.56	1342.76
		75	-2.23	174.92	7.09	-43.59	-31.30	2332.29
75	11	75	.00	.00	.00	.00	.00	.00
		76	.00	.00	.00	.00	.00	.00
	12	75	-2.21	174.92	7.09	-38.26	-31.30	2332.38
		76	-2.21	84.91	3.55	-1.05	-55.24	2917.11
76	11	76	.00	.00	.00	.00	.00	.00
		77	.00	.00	.00	.00	.00	.00
	12	76	-2.21	84.91	3.55	-1.54	-55.24	2917.10
		77	-2.21	-5.09	.00	35.66	-63.23	3096.69

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
77	11	77	.00	.00	.00	.00	.00	.00
		78	.00	.00	.00	.00	.00	.00
	12	77	-2.21	-5.09	.00	36.21	-63.23	3096.67
		78	-2.21	-95.09	-3.54	73.41	-55.28	2871.30
78	11	78	.00	.00	.00	.00	.00	.00
		79	.00	.00	.00	.00	.00	.00
	12	78	-2.21	-95.09	-3.54	72.91	-55.28	2871.29
		79	-2.21	-185.09	-7.08	110.11	-31.39	2240.95
79	11	79	.00	.00	.00	.00	.00	.00
		80	.00	-8.04	.00	2.35	.00	-8.79
	12	79	-2.23	-185.08	-7.08	115.24	-31.39	2240.68
		80	-2.23	-266.47	-10.62	149.93	8.43	1214.67
80	11	80	.00	-8.04	.00	2.35	.00	-8.80
		81	-2.23	-365.10	-14.16	189.87	64.20	-235.27
	12	80	-2.23	-266.47	-10.62	150.14	8.43	1214.66
		81	-2.05	-170.73	-7.08	98.52	32.05	224.75
81	11	81	-2.23	-365.09	-14.16	189.91	64.20	-235.24
		82	-2.23	-439.08	-17.08	220.49	121.99	-1722.81
	12	81	-2.05	-170.72	-7.08	98.49	32.05	224.77
		82	.00	.00	.00	.00	.00	.00
82	11	82	-2.23	-439.00	-17.08	220.56	121.99	-1722.81
		83	-2.23	-454.99	-17.71	227.17	135.89	-2080.30
	12	82	.00	.00	.00	.00	.00	.00
		83	.00	.00	.00	.00	.00	.00
83	11	83	-1.49	57.55	1.80	-51.15	13.88	-2069.79
		84	-1.49	55.95	1.73	-50.49	12.47	-2024.34
	12	83	.00	.00	.00	.00	.00	.00
		84	.00	.00	.00	.00	.00	.00
84	11	84	-1.49	55.94	1.73	-50.66	12.47	-2024.35
		85	-1.49	48.54	1.44	-47.60	6.60	-1831.06
	12	84	.00	.00	.00	.00	.00	.00
		85	.00	.00	.00	.00	.00	.00
85	11	85	-1.49	48.54	1.44	-51.78	6.60	-1830.94
		86	-1.49	39.54	1.08	-48.06	.92	-1632.76
	12	85	.00	.00	.00	.00	.00	.00
		86	.00	.00	.00	.00	.00	.00
86	11	86	-1.49	39.54	1.08	-48.05	.92	-1632.77
		87	-1.49	30.54	.72	-44.33	-3.14	-1475.04
	12	86	.00	.00	.00	.00	.00	.00
		87	.00	.00	.00	.00	.00	.00
87	11	87	-1.49	30.55	.72	-44.34	-3.14	-1475.05

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		88	-1.49	21.55	.36	-40.62	-5.58	-1357.84
	12	87	.00	.00	.00	.00	.00	.00
		88	.00	.00	.00	.00	.00	.00
88	11	88	-1.49	21.54	.37	-43.49	-5.58	-1357.76
		89	-1.49	12.54	.01	-39.77	-6.42	-1281.07
	12	88	.00	.00	.00	.00	.00	.00
		89	.00	.00	.00	.00	.00	.00
89	11	89	-1.49	12.55	.00	-37.05	-6.42	-1281.14
		90	-1.68	-36.99	-.18	-28.81	-2.81	-1272.95
	12	89	.00	.00	.00	.00	.00	.00
		90	.00	.00	.00	.00	.00	.00
90	11	90	-1.68	-36.99	-.17	-31.51	-2.81	-1272.89
		91	-1.68	-41.49	-.35	-29.65	-1.62	-1449.48
	12	90	.00	.00	.00	.00	.00	.00
		91	.00	.00	.00	.00	.00	.00
91	11	91	-1.68	-41.49	-.35	-29.67	-1.62	-1449.48
		92	-1.68	-45.99	-.53	-27.81	.37	-1646.28
	12	91	.00	.00	.00	.00	.00	.00
		92	.00	2.32	.00	-.78	.00	2.58
92	11	92	-1.68	-45.99	-.53	-31.56	.37	-1646.22
		93	-1.68	-50.49	-.71	-29.70	3.16	-1863.32
	12	92	.00	2.32	.00	-.78	.00	2.58
		93	.00	2.32	.00	-.78	.00	13.02
93	11	93	-1.68	-50.49	-.71	-27.62	3.16	-1863.37
		94	-1.68	-54.19	-.86	-26.09	6.07	-2057.06
	12	93	.00	2.32	.00	-.79	.00	13.02
		94	.00	2.32	.00	-.79	.00	21.61
94	11	94	-1.68	-54.18	-.87	-12.51	6.07	-2057.17
		95	-1.68	-54.98	-.90	-12.18	6.78	-2100.83
	12	94	.00	2.32	.00	-.93	.00	21.61
		95	.00	2.32	.00	-.93	.00	23.46
95	11	95	-.76	499.35	17.51	-138.70	117.08	-2095.53
		96	-.76	481.75	16.81	-131.42	103.35	-1703.10
	12	95	.00	-.61	.00	.46	.00	23.42
		96	.00	-.61	.00	.46	.00	22.93
96	11	96	-.88	481.73	16.81	-119.03	103.35	-1704.00
		97	-.88	400.32	13.60	-85.37	47.09	-72.02
	12	96	.00	-.61	.00	.30	.00	22.94
		97	-.75	332.81	11.57	-69.43	39.33	198.94
97	11	97	-.86	400.31	13.60	-85.49	47.09	-71.89
		98	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	97	-.73	332.81	11.58	-69.12	39.33	199.05
		98	-.86	290.51	9.28	-40.10	-9.12	1624.51
98	11	98	.00	.00	.00	.00	.00	.00
		99	.00	.00	.00	.00	.00	.00
	12	98	-.84	290.51	9.28	-36.68	-9.12	1624.60
		99	-.84	172.90	4.65	11.93	-43.26	2760.05
99	11	99	.00	.00	.00	.00	.00	.00
		100	.00	.00	.00	.00	.00	.00
	12	99	-.85	172.90	4.65	6.15	-43.26	2760.08
		100	-.85	55.33	.02	54.75	-54.70	3319.14
100	11	100	.00	.00	.00	.00	.00	.00
		101	.00	.00	.00	.00	.00	.00
	12	100	-.85	55.33	.02	61.16	-54.70	3319.02
		101	-.85	-62.28	-4.61	109.77	-43.47	3302.00
101	11	101	.00	.00	.00	.00	.00	.00
		102	.00	.00	.00	.00	.00	.00
	12	101	-.85	-62.28	-4.61	110.34	-43.47	3301.96
		102	-.85	-179.86	-9.24	158.94	-9.55	2708.79
102	11	102	.00	.00	.00	.00	.00	.00
		103	.00	.00	.00	.00	.00	.00
	12	102	-.87	-179.87	-9.24	164.61	-9.55	2708.46
		103	-.87	-295.48	-13.79	212.40	47.01	1539.71
103	11	103	.00	.00	.00	.00	.00	.00
		104	.00	.00	.00	.00	.00	.00
	12	103	-.86	-295.48	-13.79	211.50	47.01	1539.86
		104	-.86	-376.86	-16.99	245.14	103.95	296.23
104	11	104	.00	.00	.00	.00	.00	.00
		105	-.45	-206.03	-9.04	645.03	59.25	-32.06
	12	104	-.88	-376.87	-16.99	245.47	103.94	295.99
		105	.00	.00	.00	.00	.00	.00

LOAD 18: EMPUJE BARANDILLAS + EFECTO LAZO

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    15:17:24                    *
*                                                *
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```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 18
131. MEMBER LOAD
132. 1 TO 104 UNI Z .186
133. 1 TO 104 UMOM X .4
134. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
ORIGINAL/FINAL BAND-WIDTH =     1/    1
TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.                15:17:26
++ PROCESSING GLOBAL STIFFNESS MATRIX.                 15:17:26
++ PROCESSING TRIANGULAR FACTORIZATION.                15:17:27
++ CALCULATING JOINT DISPLACEMENTS.                    15:17:27
++ CALCULATING MEMBER  FORCES.                         15:17:27

135. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	18	1	-1.78	0.00	-3.48	-7.50	22.37	0.00
		2	1.78	0.00	3.34	7.18	-19.65	0.00
2	18	2	-1.78	0.00	-3.34	-7.18	19.65	0.00
		3	1.78	0.00	2.65	5.70	-8.58	0.00
3	18	3	-1.77	0.00	-2.65	-5.70	8.58	-0.01
		4	1.77	0.00	1.77	3.80	1.91	0.00
4	18	4	-1.77	0.00	-1.76	-3.80	-1.91	0.01
		5	1.77	0.00	0.88	1.90	8.19	-0.01
5	18	5	-1.77	0.00	-0.88	-1.90	-8.19	0.01
		6	1.77	0.00	0.00	0.00	10.29	-0.01
6	18	6	-1.77	0.00	0.00	0.00	-10.29	0.01
		7	1.77	0.00	-0.88	-1.90	8.19	-0.02
7	18	7	-1.77	0.00	0.88	1.90	-8.19	0.02
		8	1.77	0.00	-1.76	-3.80	1.91	-0.03
8	18	8	-1.77	0.00	1.76	3.80	-1.91	0.03
		9	1.77	0.00	-2.65	-5.70	-8.56	-0.03
9	18	9	-1.77	0.00	2.65	5.70	8.56	0.02
		10	1.77	0.00	-3.34	-7.18	-19.63	-0.03
10	18	10	-1.80	0.00	3.32	7.18	19.63	0.09
		11	1.80	0.00	-3.47	-7.50	-22.35	-0.09
11	18	11	-1.76	0.00	-4.17	-9.00	32.12	0.01
		12	1.76	0.00	4.02	8.68	-28.84	-0.01
12	18	12	-1.74	0.00	-4.03	-8.68	28.84	-0.04
		13	1.74	0.00	3.35	7.20	-15.19	0.03
13	18	13	-1.73	0.00	-3.35	-7.20	15.19	-0.04
		14	1.73	0.00	2.51	5.40	-2.01	0.02
14	18	14	-1.74	0.00	-2.51	-5.40	2.01	-0.01
		15	1.74	0.00	1.67	3.60	7.39	0.00
15	18	15	-1.74	0.00	-1.67	-3.60	-7.39	-0.01
		16	1.74	0.00	0.84	1.80	13.03	-0.01
16	18	16	-1.73	0.00	-0.84	-1.80	-13.03	0.00
		17	1.73	0.00	0.00	0.00	14.93	-0.01

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	18	17	-1.73	0.00	0.00	0.00	-14.93	0.01
		18	1.73	0.00	-0.84	-1.80	13.05	-0.03
18	18	18	-1.74	0.00	0.83	1.80	-13.05	0.03
		19	1.74	0.00	-1.67	-3.60	7.41	-0.04
19	18	19	-1.74	0.00	1.67	3.60	-7.41	0.04
		20	1.74	0.00	-2.51	-5.40	-1.99	-0.06
20	18	20	-1.74	0.00	2.51	5.40	1.99	0.06
		21	1.74	0.00	-3.34	-7.20	-15.16	-0.07
21	18	21	-1.74	0.00	3.34	7.20	15.16	0.08
		22	1.74	0.00	-4.03	-8.68	-28.80	-0.10
22	18	22	-1.75	0.00	4.03	8.68	28.80	0.11
		23	1.75	0.00	-4.17	-9.00	-32.08	-0.12
23	18	23	-1.70	-0.01	-4.16	-9.00	32.13	0.00
		24	1.70	0.01	4.02	8.68	-28.85	0.00
24	18	24	-1.65	-0.01	-4.03	-8.68	28.85	-0.09
		25	1.65	0.01	3.35	7.20	-15.20	0.07
25	18	25	-1.65	-0.01	-3.35	-7.20	15.20	-0.07
		26	1.65	0.01	2.51	5.40	-2.03	0.05
26	18	26	-1.65	-0.01	-2.51	-5.40	2.03	-0.06
		27	1.65	0.01	1.68	3.60	7.40	0.04
27	18	27	-1.65	-0.01	-1.67	-3.60	-7.40	-0.03
		28	1.65	0.01	0.84	1.80	13.04	0.00
28	18	28	-1.65	-0.01	-0.84	-1.80	-13.04	-0.01
		29	1.65	0.01	0.00	0.00	14.93	-0.01
29	18	29	-1.65	-0.01	0.00	0.00	-14.93	0.01
		30	1.65	0.01	-0.84	-1.80	13.05	-0.04
30	18	30	-1.65	-0.01	0.84	1.80	-13.05	0.04
		31	1.65	0.01	-1.67	-3.60	7.41	-0.06
31	18	31	-1.65	-0.01	1.67	3.60	-7.41	0.07
		32	1.65	0.01	-2.51	-5.40	-1.98	-0.09
32	18	32	-1.65	-0.01	2.51	5.40	1.98	0.09
		33	1.65	0.01	-3.34	-7.20	-15.14	-0.12
33	18	33	-1.64	-0.01	3.35	7.20	15.14	0.10
		34	1.64	0.01	-4.03	-8.68	-28.80	-0.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	18	34	-1.69	-0.01	4.02	8.68	28.80	0.22
		35	1.69	0.01	-4.16	-9.00	-32.07	-0.22
35	18	35	-1.53	-0.01	-4.18	-9.00	32.14	-0.12
		36	1.53	0.01	4.03	8.68	-28.86	0.11
36	18	36	-1.52	-0.01	-4.03	-8.68	28.86	-0.14
		37	1.52	0.01	3.35	7.20	-15.21	0.11
37	18	37	-1.52	-0.01	-3.35	-7.20	15.21	-0.11
		38	1.52	0.01	2.51	5.40	-2.04	0.07
38	18	38	-1.52	-0.01	-2.51	-5.40	2.04	-0.08
		39	1.52	0.01	1.67	3.60	7.38	0.05
39	18	39	-1.52	-0.01	-1.67	-3.60	-7.38	-0.05
		40	1.52	0.01	0.84	1.80	13.03	0.02
40	18	40	-1.51	-0.01	-0.84	-1.80	-13.03	-0.02
		41	1.51	0.01	0.00	0.00	14.93	-0.01
41	18	41	-1.51	-0.01	0.00	0.00	-14.93	0.01
		42	1.51	0.01	-0.84	-1.80	13.05	-0.05
42	18	42	-1.52	-0.01	0.83	1.80	-13.05	0.05
		43	1.52	0.01	-1.67	-3.60	7.42	-0.09
43	18	43	-1.52	-0.01	1.67	3.60	-7.42	0.09
		44	1.52	0.01	-2.51	-5.40	-1.98	-0.12
44	18	44	-1.52	-0.01	2.51	5.40	1.98	0.12
		45	1.52	0.01	-3.34	-7.20	-15.15	-0.15
45	18	45	-1.52	-0.01	3.34	7.20	15.15	0.17
		46	1.52	0.01	-4.03	-8.68	-28.78	-0.19
46	18	46	-1.53	-0.01	4.03	8.68	28.78	0.22
		47	1.53	0.01	-4.17	-9.00	-32.06	-0.23
47	18	47	-1.32	-0.01	-4.19	-9.00	32.16	-0.23
		48	1.32	0.01	4.04	8.68	-28.87	0.22
48	18	48	-1.34	-0.01	-4.03	-8.68	28.87	-0.19
		49	1.34	0.01	3.35	7.20	-15.21	0.15
49	18	49	-1.34	-0.01	-3.35	-7.20	15.21	-0.15
		50	1.34	0.01	2.51	5.40	-2.04	0.11
50	18	50	-1.34	-0.01	-2.51	-5.40	2.04	-0.11
		51	1.34	0.01	1.67	3.60	7.38	0.07

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	18	51	-1.33	-0.01	-1.68	-3.60	-7.38	-0.07
		52	1.33	0.01	0.84	1.80	13.04	0.03
52	18	52	-1.33	-0.01	-0.84	-1.80	-13.04	-0.03
		53	1.33	0.01	0.00	0.00	14.93	-0.01
53	18	53	-1.33	-0.01	0.00	0.00	-14.93	0.01
		54	1.33	0.01	-0.83	-1.80	13.06	-0.06
54	18	54	-1.33	-0.01	0.83	1.80	-13.06	0.06
		55	1.33	0.01	-1.67	-3.60	7.42	-0.10
55	18	55	-1.34	-0.01	1.67	3.60	-7.42	0.11
		56	1.34	0.01	-2.51	-5.40	-1.97	-0.15
56	18	56	-1.34	-0.01	2.51	5.40	1.97	0.15
		57	1.34	0.01	-3.34	-7.20	-15.14	-0.20
57	18	57	-1.33	-0.01	3.35	7.20	15.14	0.18
		58	1.33	0.01	-4.03	-8.68	-28.79	-0.22
58	18	58	-1.38	-0.01	4.02	8.68	28.79	0.33
		59	1.38	0.01	-4.17	-9.00	-32.06	-0.33
59	18	59	-1.12	-0.01	-4.18	-9.00	32.16	-0.23
		60	1.12	0.01	4.03	8.68	-28.88	0.22
60	18	60	-1.11	-0.01	-4.04	-8.68	28.88	-0.23
		61	1.11	0.01	3.35	7.20	-15.22	0.19
61	18	61	-1.11	-0.01	-3.35	-7.20	15.22	-0.20
		62	1.11	0.01	2.51	5.40	-2.03	0.15
62	18	62	-1.11	-0.01	-2.51	-5.40	2.03	-0.14
		63	1.11	0.01	1.67	3.60	7.38	0.08
63	18	63	-1.11	-0.01	-1.68	-3.60	-7.38	-0.10
		64	1.11	0.01	0.84	1.80	13.04	0.04
64	18	64	-1.11	-0.01	-0.84	-1.80	-13.04	-0.04
		65	1.11	0.01	0.00	0.00	14.93	-0.01
65	18	65	-1.11	-0.01	0.00	0.00	-14.93	0.01
		66	1.11	0.01	-0.83	-1.80	13.06	-0.07
66	18	66	-1.11	-0.01	0.84	1.80	-13.06	0.06
		67	1.11	0.01	-1.67	-3.60	7.42	-0.12
67	18	67	-1.11	-0.01	1.67	3.60	-7.42	0.13
		68	1.11	0.01	-2.51	-5.40	-1.97	-0.19

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	18	68	-1.11	-0.01	2.51	5.40	1.97	0.18
		69	1.11	0.01	-3.34	-7.20	-15.14	-0.23
69	18	69	-1.11	-0.01	3.34	7.20	15.14	0.24
		70	1.11	0.01	-4.03	-8.68	-28.78	-0.28
70	18	70	-1.13	-0.01	4.03	8.68	28.78	0.33
		71	1.13	0.01	-4.17	-9.00	-32.06	-0.34
71	18	71	-0.87	-0.01	-4.18	-9.00	32.16	-0.22
		72	0.87	0.01	4.03	8.68	-28.88	0.21
72	18	72	-0.83	-0.01	-4.04	-8.68	28.88	-0.30
		73	0.83	0.01	3.35	7.20	-15.22	0.25
73	18	73	-0.84	-0.01	-3.35	-7.20	15.22	-0.24
		74	0.84	0.01	2.51	5.40	-2.03	0.17
74	18	74	-0.84	-0.01	-2.51	-5.40	2.03	-0.17
		75	0.84	0.01	1.67	3.60	7.38	0.11
75	18	75	-0.83	-0.01	-1.68	-3.60	-7.38	-0.11
		76	0.83	0.01	0.84	1.80	13.04	0.05
76	18	76	-0.83	-0.01	-0.84	-1.80	-13.04	-0.05
		77	0.83	0.01	0.00	0.00	14.93	-0.02
77	18	77	-0.83	-0.01	0.00	0.00	-14.93	0.02
		78	0.83	0.01	-0.84	-1.80	13.06	-0.08
78	18	78	-0.83	-0.01	0.84	1.80	-13.06	0.08
		79	0.83	0.01	-1.67	-3.60	7.42	-0.15
79	18	79	-0.84	-0.01	1.67	3.60	-7.42	0.16
		80	0.84	0.01	-2.51	-5.40	-1.98	-0.22
80	18	80	-0.84	-0.01	2.51	5.40	1.98	0.22
		81	0.84	0.01	-3.34	-7.20	-15.15	-0.29
81	18	81	-0.84	-0.01	3.34	7.20	15.15	0.29
		82	0.84	0.01	-4.03	-8.68	-28.79	-0.34
82	18	82	-0.84	-0.01	4.03	8.68	28.79	0.34
		83	0.84	0.01	-4.18	-9.00	-32.08	-0.35
83	18	83	-0.52	-0.02	-4.18	-9.00	32.16	-0.33
		84	0.52	0.02	4.04	8.68	-28.87	0.31
84	18	84	-0.52	-0.02	-4.04	-8.68	28.87	-0.32
		85	0.52	0.02	3.35	7.20	-15.21	0.26

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	18	85	-0.51	-0.02	-3.35	-7.20	15.21	-0.27
		86	0.51	0.02	2.51	5.40	-2.03	0.20
86	18	86	-0.51	-0.02	-2.51	-5.40	2.03	-0.20
		87	0.51	0.02	1.67	3.60	7.40	0.13
87	18	87	-0.51	-0.02	-1.67	-3.60	-7.40	-0.13
		88	0.51	0.02	0.84	1.80	13.05	0.06
88	18	88	-0.51	-0.02	-0.84	-1.80	-13.05	-0.07
		89	0.51	0.02	0.00	0.00	14.94	0.00
89	18	89	-0.51	-0.02	0.00	0.00	-14.94	0.00
		90	0.51	0.02	-0.84	-1.80	13.06	-0.07
90	18	90	-0.51	-0.02	0.84	1.80	-13.06	0.08
		91	0.51	0.02	-1.67	-3.60	7.42	-0.15
91	18	91	-0.51	-0.02	1.67	3.60	-7.42	0.15
		92	0.51	0.02	-2.51	-5.40	-1.99	-0.22
92	18	92	-0.52	-0.02	2.51	5.40	1.99	0.23
		93	0.52	0.02	-3.34	-7.20	-15.16	-0.30
93	18	93	-0.51	-0.02	3.35	7.20	15.16	0.29
		94	0.51	0.02	-4.03	-8.68	-28.81	-0.35
94	18	94	-0.49	-0.02	4.04	8.68	28.81	0.29
		95	0.49	0.02	-4.19	-9.00	-32.10	-0.30
95	18	95	-0.15	-0.02	-3.57	-7.68	23.48	-0.42
		96	0.15	0.02	3.42	7.36	-20.68	0.40
96	18	96	-0.18	-0.02	-3.42	-7.36	20.68	-0.35
		97	0.18	0.02	2.73	5.88	-9.29	0.28
97	18	97	-0.17	-0.02	-2.73	-5.88	9.29	-0.28
		98	0.17	0.02	1.82	3.92	1.88	0.19
98	18	98	-0.17	-0.02	-1.82	-3.92	-1.88	-0.20
		99	0.17	0.02	0.91	1.96	8.58	0.10
99	18	99	-0.17	-0.02	-0.91	-1.96	-8.58	-0.10
		100	0.17	0.02	0.00	0.00	10.81	0.00
100	18	100	-0.17	-0.02	0.00	0.00	-10.81	0.00
		101	0.17	0.02	-0.91	-1.96	8.58	-0.09
101	18	101	-0.17	-0.02	0.91	1.96	-8.58	0.09
		102	0.17	0.02	-1.82	-3.92	1.89	-0.19

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	18	102	-0.18	-0.02	1.82	3.92	-1.89	0.19
		103	0.18	0.02	-2.73	-5.88	-9.27	-0.29
103	18	103	-0.17	-0.02	2.73	5.88	9.27	0.29
		104	0.17	0.02	-3.42	-7.36	-20.66	-0.36
104	18	104	-0.18	-0.02	3.42	7.36	20.66	0.37
		105	0.18	0.02	-3.57	-7.68	-23.45	-0.38

********** END OF LATEST ANALYSIS RESULT **********

136. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	18	-1.78	0.00	-3.48	-7.50	22.37	0.00
11	18	0.00	0.00	-7.66	-16.50	9.77	0.00
23	18	0.00	0.00	-8.36	-18.00	0.05	0.00
35	18	0.00	0.00	-8.36	-18.00	0.07	0.00
47	18	0.00	0.00	-8.36	-18.00	0.10	0.00
59	18	0.00	0.00	-8.37	-18.01	0.10	0.00
71	18	0.00	0.00	-8.37	-18.01	0.10	0.00
83	18	0.00	0.00	-8.37	-18.01	0.08	0.00
95	18	0.00	0.00	-7.76	-16.70	-8.62	0.00
105	18	0.00	0.02	-3.57	-7.69	-23.45	0.00

********** END OF LATEST ANALYSIS RESULT **********

137. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 15:17:31 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 19: REDUCCIÓN RCP PARA SER CONCOMIT. CON SC

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*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    15: 3: 8                    *
*                                                *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 350.0000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 19   REDUCCION DE CP EN PASEOS POR SC (SE PONE YA VALOR NEGATIVO)
131. MEMBER LOAD
132. 1 TO 104 UNI GY .25
134. PERFORM ANALYSIS

                P R O B L E M   S T A T I S T I C S
                -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              15: 3:11
++ PROCESSING GLOBAL STIFFNESS MATRIX.               15: 3:11
++ PROCESSING TRIANGULAR FACTORIZATION.              15: 3:11
++ CALCULATING JOINT DISPLACEMENTS.                  15: 3:12
++ CALCULATING MEMBER  FORCES.                       15: 3:12

 135. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	19	1	0.00	-3.47	0.00	0.03	0.00	0.00
		2	0.00	3.27	0.00	-0.03	0.00	-2.70
2	19	2	0.00	-3.27	0.00	0.03	0.00	2.70
		3	0.00	2.35	0.00	-0.03	0.00	-13.09
3	19	3	0.00	-2.35	0.00	0.00	0.00	13.09
		4	0.00	1.16	0.00	0.00	0.00	-21.41
4	19	4	0.00	-1.16	0.00	0.05	0.00	21.41
		5	0.00	-0.03	0.00	-0.05	0.00	-24.09
5	19	5	0.00	0.03	0.00	0.00	0.00	24.09
		6	0.00	-1.22	0.00	0.00	0.00	-21.13
6	19	6	0.00	1.22	0.00	0.00	0.00	21.13
		7	0.00	-2.40	0.00	0.00	0.00	-12.53
7	19	7	0.00	2.40	0.00	-0.03	0.00	12.53
		8	0.00	-3.59	0.00	0.03	0.00	1.71
8	19	8	0.00	3.59	0.00	-0.03	0.00	-1.71
		9	0.00	-4.78	0.00	0.03	0.00	21.59
9	19	9	0.00	4.78	0.00	-0.06	0.00	-21.59
		10	0.00	-5.70	0.00	0.06	0.00	40.99
10	19	10	0.00	5.70	0.00	0.32	0.00	-40.98
		11	0.00	-5.90	0.00	-0.32	0.00	45.63
11	19	11	0.00	-5.67	0.00	-0.22	0.00	-45.63
		12	0.00	5.47	0.00	0.22	0.00	41.17
12	19	12	0.00	-5.47	0.00	0.01	0.00	-41.17
		13	0.00	4.55	0.00	-0.01	0.00	22.64
13	19	13	0.00	-4.55	0.00	0.04	0.00	-22.64
		14	0.00	3.42	0.00	-0.04	0.00	4.71
14	19	14	0.00	-3.42	0.00	0.03	0.00	-4.72
		15	0.00	2.30	0.00	-0.03	0.00	-8.15
15	19	15	0.00	-2.30	0.00	0.01	0.00	8.15
		16	0.00	1.17	0.00	-0.01	0.00	-15.95
16	19	16	0.00	-1.17	0.00	-0.02	0.00	15.95
		17	0.00	0.05	0.00	0.02	0.00	-18.69

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	19	17	0.00	-0.05	0.00	0.02	0.00	18.69
		18	0.00	-1.08	0.00	-0.02	0.00	-16.36
18	19	18	0.00	1.08	0.00	-0.02	0.00	16.36
		19	0.00	-2.20	0.00	0.02	0.00	-8.98
19	19	19	0.00	2.20	0.00	-0.02	0.00	8.98
		20	0.00	-3.33	0.00	0.02	0.00	3.47
20	19	20	0.00	3.33	0.00	-0.02	0.00	-3.47
		21	0.00	-4.45	0.00	0.02	0.00	20.98
21	19	21	0.00	4.45	0.00	0.02	0.00	-20.98
		22	0.00	-5.38	0.00	-0.02	0.00	39.18
22	19	22	0.00	5.38	0.00	0.10	0.00	-39.18
		23	0.00	-5.58	0.00	-0.10	0.00	43.56
23	19	23	0.00	-5.61	0.00	-0.42	0.00	-43.56
		24	0.00	5.41	0.00	0.42	0.00	39.15
24	19	24	0.00	-5.41	0.00	0.01	0.00	-39.15
		25	0.00	4.49	0.00	-0.01	0.00	20.84
25	19	25	0.00	-4.49	0.00	0.01	0.00	-20.84
		26	0.00	3.36	0.00	-0.01	0.00	3.18
26	19	26	0.00	-3.36	0.00	0.01	0.00	-3.18
		27	0.00	2.24	0.00	-0.01	0.00	-9.42
27	19	27	0.00	-2.24	0.00	0.04	0.00	9.42
		28	0.00	1.11	0.00	-0.04	0.00	-16.96
28	19	28	0.00	-1.11	0.00	0.00	0.00	16.96
		29	0.00	-0.01	0.00	0.00	0.00	-19.43
29	19	29	0.00	0.01	0.00	0.00	0.00	19.43
		30	0.00	-1.14	0.00	0.00	0.00	-16.84
30	19	30	0.00	1.14	0.00	0.00	0.00	16.84
		31	0.00	-2.26	0.00	0.00	0.00	-9.19
31	19	31	0.00	2.26	0.00	-0.02	0.00	9.19
		32	0.00	-3.39	0.00	0.02	0.00	3.53
32	19	32	0.00	3.39	0.00	-0.02	0.00	-3.53
		33	0.00	-4.51	0.00	0.02	0.00	21.31
33	19	33	0.00	4.51	0.00	-0.07	0.00	-21.31
		34	0.00	-5.44	0.00	0.07	0.00	39.72

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	19	34	0.00	5.44	0.00	0.38	0.00	-39.72
		35	0.00	-5.64	0.00	-0.38	0.00	44.15
35	19	35	0.00	-5.63	0.00	-0.11	0.00	-44.15
		36	0.00	5.43	0.00	0.11	0.00	39.73
36	19	36	0.00	-5.43	0.00	0.01	0.00	-39.73
		37	0.00	4.50	0.00	-0.01	0.00	21.36
37	19	37	0.00	-4.50	0.00	0.00	0.00	-21.36
		38	0.00	3.38	0.00	0.00	0.00	3.62
38	19	38	0.00	-3.38	0.00	0.01	0.00	-3.62
		39	0.00	2.25	0.00	-0.01	0.00	-9.05
39	19	39	0.00	-2.25	0.00	0.01	0.00	9.05
		40	0.00	1.13	0.00	-0.01	0.00	-16.66
40	19	40	0.00	-1.13	0.00	-0.03	0.00	16.66
		41	0.00	0.00	0.00	0.03	0.00	-19.21
41	19	41	0.00	0.00	0.00	0.02	0.00	19.21
		42	0.00	-1.12	0.00	-0.02	0.00	-16.69
42	19	42	0.00	1.12	0.00	-0.02	0.00	16.69
		43	0.00	-2.25	0.00	0.02	0.00	-9.11
43	19	43	0.00	2.25	0.00	-0.02	0.00	9.11
		44	0.00	-3.37	0.00	0.02	0.00	3.53
44	19	44	0.00	3.37	0.00	-0.02	0.00	-3.53
		45	0.00	-4.50	0.00	0.02	0.00	21.23
45	19	45	0.00	4.50	0.00	0.02	0.00	-21.23
		46	0.00	-5.42	0.00	-0.02	0.00	39.58
46	19	46	0.00	5.42	0.00	0.14	0.00	-39.58
		47	0.00	-5.62	0.00	-0.14	0.00	44.00
47	19	47	0.00	-5.63	0.00	0.17	0.00	-44.00
		48	0.00	5.43	0.00	-0.17	0.00	39.58
48	19	48	0.00	-5.43	0.00	0.01	0.00	-39.58
		49	0.00	4.50	0.00	-0.01	0.00	21.22
49	19	49	0.00	-4.50	0.00	0.02	0.00	-21.22
		50	0.00	3.38	0.00	-0.02	0.00	3.50
50	19	50	0.00	-3.38	0.00	0.02	0.00	-3.50
		51	0.00	2.25	0.00	-0.02	0.00	-9.16

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	19	51	0.00	-2.25	0.00	0.00	0.00	9.16
		52	0.00	1.13	0.00	0.00	0.00	-16.76
52	19	52	0.00	-1.13	0.00	0.00	0.00	16.76
		53	0.00	0.00	0.00	0.00	0.00	-19.30
53	19	53	0.00	0.00	0.00	0.00	0.00	19.30
		54	0.00	-1.12	0.00	0.00	0.00	-16.77
54	19	54	0.00	1.12	0.00	0.00	0.00	16.77
		55	0.00	-2.25	0.00	0.00	0.00	-9.18
55	19	55	0.00	2.25	0.00	-0.02	0.00	9.18
		56	0.00	-3.37	0.00	0.02	0.00	3.47
56	19	56	0.00	3.37	0.00	-0.02	0.00	-3.47
		57	0.00	-4.50	0.00	0.02	0.00	21.19
57	19	57	0.00	4.50	0.00	-0.07	0.00	-21.19
		58	0.00	-5.42	0.00	0.07	0.00	39.55
58	19	58	0.00	5.42	0.00	0.42	0.00	-39.55
		59	0.00	-5.62	0.00	-0.42	0.00	43.96
59	19	59	0.00	-5.62	0.00	-0.05	0.00	-43.97
		60	0.00	5.42	0.00	0.05	0.00	39.55
60	19	60	0.00	-5.42	0.00	0.00	0.00	-39.55
		61	0.00	4.49	0.00	0.00	0.00	21.21
61	19	61	0.00	-4.49	0.00	0.03	0.00	-21.21
		62	0.00	3.37	0.00	-0.03	0.00	3.52
62	19	62	0.00	-3.37	0.00	0.03	0.00	-3.52
		63	0.00	2.24	0.00	-0.03	0.00	-9.11
63	19	63	0.00	-2.24	0.00	-0.01	0.00	9.11
		64	0.00	1.12	0.00	0.01	0.00	-16.67
64	19	64	0.00	-1.12	0.00	0.02	0.00	16.67
		65	0.00	-0.01	0.00	-0.02	0.00	-19.18
65	19	65	0.00	0.01	0.00	-0.02	0.00	19.18
		66	0.00	-1.13	0.00	0.02	0.00	-16.62
66	19	66	0.00	1.13	0.00	0.02	0.00	16.62
		67	0.00	-2.26	0.00	-0.02	0.00	-8.99
67	19	67	0.00	2.26	0.00	-0.02	0.00	8.99
		68	0.00	-3.38	0.00	0.02	0.00	3.69

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	19	68	0.00	3.38	0.00	-0.03	0.00	-3.69
		69	0.00	-4.51	0.00	0.03	0.00	21.43
69	19	69	0.00	4.51	0.00	0.00	0.00	-21.43
		70	0.00	-5.43	0.00	0.00	0.00	39.82
70	19	70	0.00	5.43	0.00	0.21	0.00	-39.82
		71	0.00	-5.63	0.00	-0.21	0.00	44.25
71	19	71	0.00	-5.65	0.00	-0.36	0.00	-44.24
		72	0.00	5.45	0.00	0.36	0.00	39.81
72	19	72	0.00	-5.45	0.00	0.05	0.00	-39.81
		73	0.00	4.52	0.00	-0.05	0.00	21.37
73	19	73	0.00	-4.52	0.00	0.01	0.00	-21.37
		74	0.00	3.40	0.00	-0.01	0.00	3.54
74	19	74	0.00	-3.40	0.00	0.01	0.00	-3.54
		75	0.00	2.27	0.00	-0.01	0.00	-9.21
75	19	75	0.00	-2.27	0.00	-0.01	0.00	9.21
		76	0.00	1.15	0.00	0.01	0.00	-16.91
76	19	76	0.00	-1.15	0.00	0.00	0.00	16.91
		77	0.00	0.02	0.00	0.00	0.00	-19.54
77	19	77	0.00	-0.02	0.00	-0.01	0.00	19.54
		78	0.00	-1.10	0.00	0.01	0.00	-17.11
78	19	78	0.00	1.10	0.00	0.00	0.00	17.11
		79	0.00	-2.23	0.00	0.00	0.00	-9.62
79	19	79	0.00	2.23	0.00	-0.03	0.00	9.62
		80	0.00	-3.35	0.00	0.03	0.00	2.94
80	19	80	0.00	3.35	0.00	-0.03	0.00	-2.94
		81	0.00	-4.48	0.00	0.03	0.00	20.56
81	19	81	0.00	4.48	0.00	-0.03	0.00	-20.56
		82	0.00	-5.40	0.00	0.03	0.00	38.83
82	19	82	0.00	5.40	0.00	-0.03	0.00	-38.83
		83	0.00	-5.60	0.00	0.03	0.00	43.23
83	19	83	0.00	-5.55	0.00	-0.01	0.00	-43.23
		84	0.00	5.35	0.00	0.01	0.00	38.87
84	19	84	0.00	-5.35	0.00	0.00	0.00	-38.87
		85	0.00	4.42	0.00	0.00	0.00	20.80

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	19	85	0.00	-4.42	0.00	0.04	0.00	-20.80
		86	0.00	3.30	0.00	-0.04	0.00	3.44
86	19	86	0.00	-3.30	0.00	0.04	0.00	-3.44
		87	0.00	2.17	0.00	-0.04	0.00	-8.87
87	19	87	0.00	-2.17	0.00	0.04	0.00	8.87
		88	0.00	1.05	0.00	-0.04	0.00	-16.11
88	19	88	0.00	-1.05	0.00	0.01	0.00	16.11
		89	0.00	-0.08	0.00	-0.01	0.00	-18.29
89	19	89	0.00	0.08	0.00	0.05	0.00	18.29
		90	0.00	-1.20	0.00	-0.05	0.00	-15.40
90	19	90	0.00	1.20	0.00	0.02	0.00	15.40
		91	0.00	-2.33	0.00	-0.02	0.00	-7.46
91	19	91	0.00	2.33	0.00	0.02	0.00	7.46
		92	0.00	-3.45	0.00	-0.02	0.00	5.55
92	19	92	0.00	3.45	0.00	0.03	0.00	-5.55
		93	0.00	-4.58	0.00	-0.03	0.00	23.62
93	19	93	0.00	4.58	0.00	0.00	0.00	-23.62
		94	0.00	-5.50	0.00	0.00	0.00	42.28
94	19	94	0.00	5.50	0.00	-0.28	0.00	-42.27
		95	0.00	-5.70	0.00	0.28	0.00	46.75
95	19	95	0.00	-6.02	0.00	0.01	0.00	-46.77
		96	0.00	5.82	0.00	-0.01	0.00	42.04
96	19	96	0.00	-5.82	0.00	-0.30	0.00	-42.04
		97	0.00	4.89	0.00	0.30	0.00	22.22
97	19	97	0.00	-4.89	0.00	-0.26	0.00	-22.22
		98	0.00	3.67	0.00	0.26	0.00	1.25
98	19	98	0.00	-3.67	0.00	-0.26	0.00	-1.25
		99	0.00	2.44	0.00	0.26	0.00	-13.72
99	19	99	0.00	-2.44	0.00	-0.23	0.00	13.72
		100	0.00	1.22	0.00	0.23	0.00	-22.69
100	19	100	0.00	-1.22	0.00	-0.28	0.00	22.69
		101	0.00	-0.01	0.00	0.28	0.00	-25.65
101	19	101	0.00	0.01	0.00	-0.28	0.00	25.65
		102	0.00	-1.23	0.00	0.28	0.00	-22.61

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	19	102	0.00	1.23	0.00	-0.33	0.00	22.61
		103	0.00	-2.46	0.00	0.33	0.00	-13.57
103	19	103	0.00	2.46	0.00	-0.32	0.00	13.57
		104	0.00	-3.38	0.00	0.32	0.00	-2.77
104	19	104	0.00	3.38	0.00	-0.32	0.00	2.77
		105	0.00	-3.58	0.00	0.32	0.00	0.02

********** END OF LATEST ANALYSIS RESULT **********

136. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	19	0.00	-3.47	0.00	0.03	0.00	0.00
11	19	0.00	-11.58	0.00	0.01	0.00	0.00
23	19	0.00	-11.19	0.00	0.04	0.00	0.00
35	19	0.00	-11.27	0.00	0.03	0.00	0.00
47	19	0.00	-11.25	0.00	-0.02	0.00	0.00
59	19	0.00	-11.24	0.00	0.01	0.00	0.00
71	19	0.00	-11.28	0.00	0.00	0.00	0.00
83	19	0.00	-11.15	0.00	0.03	0.00	0.00
95	19	0.00	-11.72	0.00	-0.37	0.00	0.00
105	19	0.00	-3.58	0.00	0.32	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

137. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 15: 3:16 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

SC / EC-1 (1 via)

1 vía con tren tipo SW-2

LOAD 20 → L.I. M^{+}_{max}, C.vano ⑤

LOAD 21 → L.I. M^{+}_{max}, C.vano ⑨

LOAD 22 → L.I. M^{-}_{min}, PILA P-4

LOAD 23 → L.I. $Q_{máx}$, PILA P-4

1 vía con tren tipo UIC-71

LOAD 24 → L.I. M^{+}_{max}, C.vano ⑤

LOAD 25 → L.I. M^{+}_{max}, C.vano ⑨

LOAD 26 → L.I. M^{-}_{min}, PILA P-4

LOAD 27 → L.I. $Q_{máx}$, PILA P-4

```
*****************************************************
*                                                   *
*         S T A A D - III                           *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     3: 8:57                       *
*                                                   *
*****************************************************
```

```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.2360648.2605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.9839454345
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 20
131. MEMBER LOAD
132. 47 TO 52 UNI GY -15
133. 47 TO 52 UMOM X 33.75
134. 53 UNI GY -15 0 2.5
135. 53 UMOM X 33.75 0 2.5
136. 55 UNI GY -15 .5 4.5
137. 55 UMOM X 33.75 0.5 4.5
138. 56 TO 61 UNI GY -15
139. 56 TO 61 UMOM X 33.75
140. 62 UNI GY -15 0 3
141. 62 UMOM X 33.75 0 3
142. * RIPADO + F.CENTRIFUGA
143. 47 TO 52 UMOM X 7.31
144. 53 UMOM X 7.31 0 2.5
145. 55 UMOM X 7.31 0.5 4.5
146. 56 TO 61 UMOM X 7.31
147. 62 UMOM X 7.31 0 3
148. 47 TO 52 UNI Z .984
149. 53 UNI Z .984 0 2.5
150. 55 UNI Z .984 0.5 4.5
151. 56 TO 61 UNI Z .984
152. 62 UNI Z .984 0 3
153. LOAD 21
154. MEMBER LOAD
155. 95 TQ 100 UNI GY -15
156. 95 TO 100 UMOM X 41.06
157. 95 TO 100 UNI Z .984
158. 101 UNI GY -15 0 3.2
159. 101 UMOM X 41.06 0 3.2
160. 101 UNI Z .984 0 3.2
161. 102 UNI GY -15 3.8 4.9
162. 102 UMOM X 41.06 3.8 4.9
163. 102 UNI Z .984 3.8 4.9
164. 103 104 UNI GY -15
165. 103 104 UMOM X 41.06
166. 103 104 UNI Z .984
167. LOAD 22
```



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168. MEMBER LOAD
169. 48 UNI GY -15 2.7 3.7
170. 48 UMOM X 41.06 2.7 3.7
171. 48 UNI Z .984 2.7 3.7
172. 49 TO 53 UNI GY -15
173. 49 TO 53 UMOM X 41.06
174. 49 TO 53 UNI Z .984
175. 54 UNI GY -15 0 1.5
176. 54 UMOM X 41.06 0 1.5
177. 54 UNI Z .984 0 1.5
178. 45 UNI GY -15 0 1
179. 45 UMOM X 41.06 0 1
180. 45 UNI Z .984 0 1
181. 40 TO 44 UNI GY -15
182. 40 TO 44 UMOM X 41.06
183. 40 TQ 44 UNI Z .984
184. 39 UNI GY -15 3 4.5
185. 39 UMOM X 41.06 3 4.5
186. 39 UNI Z .984 3 4.5
188. LOAD 23
189. MEMBER LOAD
190. 47 TO 52 UNI GY -15
191. 47 TO 52 UMOM X 41.06
192. 47 TO 52 UNI Z .984
193. 53 UNI GY -15 0 2.5
194. 53 UMOM X 41.06 0 2.5
195. 53 UNI Z .984 0 2.5
196. 38 UNI GY -15 4 4.5
197. 38 UMOM X 41.06 4 4.5
198. 38 UNI Z .984 4 4.5
199. 39 TO 43 UNI GY -15
200. 39 TO 43 UMOM X 41.06
201. 39 TO 43 UNI Z .984
202. 44 UNI GY -15 0 2
203. 44 UMOM X 41.06 0 2
204. 44 UNI GZ .984 0 2
206. LOAD 24
207. MEMBER LOAD
208. 52 CON GY -25 3.7
209. 52 CON GY -25 2.1
210. 52 UNI GY -8 0 1.3
211. 53 CON GY -25 .8
212. 53 CON GY -25 2.4
213. 53 UNI GY -8 3.2 4.5
214. 54 TO 58 UNI GY -8
215. 71 TO 82 UNI GY -8
216. 95 TO 104 UNI GY -8
217. 47 TO 51 UNI GY -8
218. 23 TO 34 UNI GY -8
219. 1 TO 10 UNI GY -8
220. * TORSORES Y F CENTRIFUGA
221. 52 CMOM X 66.58 3.7
222. 52 CMOM X 66.58 2.1
223. 52 UMOM X 21.307 0 1.3
224. 53 CMOM X 66.58 .8
225. 53 CMOM X 66.58 2.4
226. 53 UMOM X 21.307 3.2 4.5
227. 54 TO 58 UMOM X 21.307
228. 71 TO 82 UMOM X 21.307
229. 95 TO 104 UMOM X 21.307
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230. 47 TO 51 UMOM X 21.307
231. 23 TO 34 UMOM X 21.307
232. 1 TO 10 UMOM X 21.307
233. 52 CON Z .984 3.7
234. 52 CON Z .984 2.1
235. 52 UNI Z .315 0 1.3
236. 53 CON Z .984 .8
237. 53 CON Z .984 2.4
238. 53 UNI Z .315 3.2 4.5
239. 54 TO 58 UNI Z .315
240. 71 TO 82 UNI Z .315
241. 95 TO 104 UNI Z .315
242. 47 TO 51 UNI Z .315
243. 23 TO 34 UNI Z .315
244. LOAD 25
245. MEMBER LOAD
246. 99 CON GY -25 4.1
247. 99 CON GY -25 2.5
248. 99 UNI GY -8 0 1.7
249. 100 CON GY -25 .8
250. 100 CON GY -25 2.4
251. 100 UNI GY -8 3.2 4.9
252. 101 TO 104 UNI GY -8
253. 95 TO 98 UNI GY -8
254. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI GY -8
255. * TORSORES + CENTRIFUGA
256. 99 CMOM X 66.5846 4.1
257. 99 CMOM X 66.5846 2.5
258. 99 UMOM X 21.304 0 1.7
259. 100 CMOM X 66.5846 .8
260. 100 CMOM X 66.5846 2.4
261. 100 UMOM X 21.304 3.2 4.9
262. 101 TO 104 UMOM X 21.304
263. 95 TO 98 UMOM X 21.304
264. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UMOM X 21.304
265. 99 CON Z .984 4.1
266. 99 CON Z .984 2.5
267. 99 UNI Z .315 0 1.7
268. 100 CON Z .984 .8
269. 100 CON Z .984 2.4
270. 100 UNI Z .315 3.2 4.9
271. 101 TO 104 UNI Z .315
272. 95 TO 98 UNI Z .315
273. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI Z .315
275. LOAD 26
276. JOINT LOAD
277. 48 46 FY -25
278. MEMBER LOAD
279. 48 CON GY -25 1.6
280. 48 UNI GY -8 2.4 3.7
281. 45 CON GY -25 2.1
282. 45 UNI GY -8 0 1.3
283. 49 TO 58 35 TO 44 UNI GY -8
284. 71 TO 82 95 TO 104 11 TO 22 UNI GY -8
285. * TORSORES
286. JOINT LOAD
287. 48 46 MX 66.5846
288. MEMBER LOAD
289. 48 CMOM X 66.5846 1.6
290. 48 UMOM X 21.307 2.4 3.7
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291. 45 CMOM X 66.5846 2.1
292. 45 UMOM X 21.307 0 1.3
293. 49 TO 58 35 TO 44 UMOM X 21.307
294. 71 TO 82 95 TO 104 11 TO 22 UMOM X 21.307
295. JOINT LOAD
296. 48 46 FZ .984
297. MEMBER LOAD
298. 48 CON Z .984 1.6
299. 48 UNI Z .315 2.4 3.7
300. 45 CON Z .984 2.1
301. 45 UNI Z .315 0 1.3
302. 49 TO 58 35 TO 44 UNI Z .315
303. 71 TO 82 95 TO 104 11 TO 22 UNI Z .315
304. LOAD 27
305. MEMBER LOAD
306. 47 CON GY -25 0.0001
307. 48 CON GY -25 .8
308. 48 CON GY -25 2.4
309. 49 CON GY -25 0.3
310. 49 UNI GY -8 1.1 4.5
311. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI GY -8
312. 35 TO 45 UNI GY -8
313. *TORSORES + CENTRIFUGA
314. 47 CMOM X 66.5846 0.0001
315. 48 CMOM X 66.5846 .8
316. 48 CMOM X 66.5846 2.4
317. 49 CMOM X 66.5846 0.3
318. 49 UMOM X 21.307 1.1 4.5
319. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UMOM X 21.307
320. 35 TO 45 UMOM X 21.307
321. 47 CON Z .984 0.0001
322. 48 CON Z .984 .8
323. 48 CON Z .984 2.4
324. 49 CON Z .984 0.3
325. 49 UNI Z .315 1.1 4.5
326. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI Z .315
327. 35 TO 45 UNI Z .315
329. PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 105/ 104/ 10
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 8, TOTAL DEGREES OF FREEDOM = 589
SIZE OF STIFFNESS MATRIX = 7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE = 12.36 MEGA-BYTES

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**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      55

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      55

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      39

**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      39
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WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

++ PROCESSING ELEMENT STIFFNESS MATRIX. 3: 9: 1
++ PROCESSING GLOBAL STIFFNESS MATRIX. 3: 9: 2
++ PROCESSING TRIANGULAR FACTORIZATION. 3: 9: 2
++ CALCULATING JOINT DISPLACEMENTS. 3: 9: 2
++ CALCULATING MEMBER FORCES. 3: 9: 3

330. PRINT MEMBER FORCES

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	20	1	-1.24	0.83	0.00	0.01	-0.01	0.00
		2	1.24	-0.83	0.00	-0.01	0.01	0.67
	21	1	-1.50	0.01	0.00	0.00	-0.02	0.00
		2	1.50	-0.01	0.00	0.00	0.01	0.00
	22	1	-1.06	-1.43	0.00	-0.01	-0.01	0.00
		2	1.06	1.43	0.00	0.01	0.01	-1.14
	23	1	-1.00	-1.89	0.00	-0.02	-0.01	0.00
		2	1.00	1.89	0.00	0.02	0.01	-1.51
	24	1	-1.65	137.97	0.00	-400.25	-0.02	0.00
		2	1.65	-131.57	0.00	383.20	0.01	107.82
	25	1	-1.72	137.85	-5.90	-400.19	37.90	0.00
		2	1.72	-131.45	5.65	383.15	-33.28	107.73
	26	1	-1.78	-26.01	0.00	-0.24	-0.02	0.00
		2	1.78	26.01	0.00	0.24	0.02	-20.81
	27	1	-1.83	-25.97	0.00	-0.24	-0.02	0.00
		2	1.83	25.97	0.00	0.24	0.02	-20.78
2	20	2	-1.24	0.83	0.00	0.01	-0.01	-0.67
		3	1.24	-0.83	0.00	-0.01	0.00	3.76
	21	2	-1.50	0.01	0.00	0.00	-0.01	0.00
		3	1.50	-0.01	0.00	0.00	0.00	0.03
	22	2	-1.06	-1.43	0.00	-0.01	-0.01	1.14
		3	1.06	1.43	0.00	0.01	0.00	-6.44
	23	2	-1.00	-1.89	0.00	-0.02	-0.01	1.51
		3	1.00	1.89	0.00	0.02	0.00	-8.50
	24	2	-1.65	131.57	0.00	-383.20	-0.01	-107.82
		3	1.65	-101.97	0.00	304.37	0.00	539.86
	25	2	-1.72	131.45	-5.65	-383.15	33.28	-107.72
		3	1.72	-101.85	4.49	304.32	-14.53	539.32
	26	2	-1.78	-26.01	0.00	-0.24	-0.02	20.81
		3	1.78	26.01	0.00	0.24	0.00	-117.04
	27	2	-1.83	-25.97	0.00	-0.24	-0.02	20.78
		3	1.83	25.97	0.00	0.24	0.00	-116.88
3	20	3	-1.24	0.83	0.00	0.02	0.00	-3.76
		4	1.24	-0.83	0.00	-0.02	0.00	7.72
	21	3	-1.50	0.01	0.00	0.00	0.00	-0.03
		4	1.50	-0.01	0.00	0.00	0.00	0.06
	22	3	-1.06	-1.43	0.00	-0.03	0.00	6.44
		4	1.06	1.43	0.00	0.03	0.00	-13.24
	23	3	-1.00	-1.89	0.00	-0.04	0.00	8.50
		4	1.00	1.89	0.00	0.04	0.00	-17.48
	24	3	-1.65	101.97	0.00	-303.19	0.00	-540.51
		4	1.65	-63.97	0.00	201.98	0.00	934.62
	25	3	-1.71	101.85	-4.49	-303.15	14.53	-539.98
		4	1.71	-63.85	2.99	201.96	3.24	933.51
	26	3	-1.78	-26.01	0.00	-0.49	0.00	117.04
		4	1.78	26.01	0.00	0.49	0.00	-240.59

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	3	-1.83	-25.97	0.00	-0.49	0.00	116.88
		4	1.83	25.97	0.00	0.49	0.00	-240.25
4	20	4	-1.24	0.83	0.00	0.00	0.00	-7.72
		5	1.24	-0.83	0.00	0.00	-0.01	11.69
	21	4	-1.50	0.01	0.00	0.00	0.00	-0.06
		5	1.50	-0.01	0.00	0.00	-0.01	0.08
	22	4	-1.06	-1.43	0.00	0.00	0.00	13.24
		5	1.06	1.43	0.00	0.00	-0.01	-20.04
	23	4	-1.00	-1.89	0.00	0.00	0.00	17.48
		5	1.00	1.89	0.00	0.00	-0.01	-26.46
	24	4	-1.65	63.97	0.00	-204.01	0.00	-934.17
		5	1.65	-25.97	0.00	102.81	-0.01	1147.77
	25	4	-1.71	63.85	-2.99	-203.99	-3.24	-933.07
		5	1.71	-25.85	1.49	102.79	13.88	1146.09
	26	4	-1.78	-26.01	0.00	0.03	0.00	240.59
		5	1.78	26.01	0.00	-0.03	-0.01	-364.13
	27	4	-1.83	-25.97	0.00	0.03	0.00	240.25
		5	1.83	25.97	0.00	-0.03	-0.02	-363.62
5	20	5	-1.24	0.83	0.00	0.02	0.01	-11.69
		6	1.24	-0.83	0.00	-0.02	-0.01	15.65
	21	5	-1.50	0.01	0.00	0.00	0.01	-0.08
		6	1.50	-0.01	0.00	0.00	-0.01	0.11
	22	5	-1.06	-1.43	0.00	-0.04	0.01	20.04
		6	1.06	1.43	0.00	0.04	-0.01	-26.83
	23	5	-1.00	-1.89	0.00	-0.05	0.01	26.46
		6	1.00	1.89	0.00	0.05	-0.01	-35.44
	24	5	-1.65	25.97	0.00	-100.50	0.01	-1147.98
		6	1.65	12.03	0.00	-0.70	-0.01	1181.07
	25	5	-1.71	25.85	-1.50	-100.49	-13.88	-1146.30
		6	1.71	12.15	0.00	-0.70	17.44	1178.83
	26	5	-1.78	-26.01	0.00	-0.70	0.01	364.13
		6	1.78	26.01	0.00	0.70	-0.02	-487.68
	27	5	-1.83	-25.97	0.00	-0.70	0.02	363.62
		6	1.83	25.97	0.00	0.70	-0.02	-486.99
6	20	6	-1.24	0.83	0.00	0.03	0.01	-15.65
		7	1.24	-0.83	0.00	-0.03	-0.01	19.62
	21	6	-1.50	0.01	0.00	0.00	0.01	-0.11
		7	1.50	-0.01	0.00	0.00	-0.01	0.14
	22	6	-1.06	-1.43	0.00	-0.04	0.01	26.83
		7	1.06	1.43	0.00	0.04	-0.01	-33.63
	23	6	-1.00	-1.89	0.00	-0.06	0.01	35.44
		7	1.00	1.89	0.00	0.06	-0.01	-44.41
	24	6	-1.65	-12.03	0.00	0.90	0.01	-1181.08
		7	1.65	50.03	0.00	-102.11	-0.01	1033.67
	25	6	-1.71	-12.15	0.00	0.90	-17.44	-1178.82
		7	1.71	50.15	-1.50	-102.09	13.88	1030.86
	26	6	-1.78	-26.01	0.00	-0.78	0.02	487.68
		7	1.78	26.01	0.00	0.78	-0.01	-611.22

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	6	-1.83	-25.97	0.00	-0.78	0.02	486.99
		7	1.83	25.97	0.00	0.78	-0.01	-610.36
7	20	7	-1.24	0.83	0.00	0.06	0.01	-19.62
		8	1.24	-0.83	0.00	-0.06	0.00	23.58
	21	7	-1.50	0.01	0.00	0.00	0.01	-0.14
		8	1.50	-0.01	0.00	0.00	0.00	0.17
	22	7	-1.06	-1.43	0.00	-0.11	0.01	33.63
		8	1.06	1.43	0.00	0.11	0.00	-40.43
	23	7	-1.00	-1.89	0.00	-0.15	0.01	44.41
		8	1.00	1.89	0.00	0.15	0.00	-53.39
	24	7	-1.65	-50.03	0.00	104.18	0.01	-1033.46
		8	1.65	88.03	0.00	-205.39	0.00	705.57
	25	7	-1.71	-50.15	1.49	104.16	-13.88	-1030.65
		8	1.71	88.15	-2.99	-205.35	3.24	702.18
	26	7	-1.78	-26.01	0.00	-2.01	0.01	611.21
		8	1.78	26.01	0.00	2.01	0.00	-734.76
	27	7	-1.83	-25.97	0.00	-2.00	0.01	610.35
		8	1.83	25.97	0.00	2.00	0.00	-733.72
8	20	8	-1.24	0.83	0.00	0.06	0.00	-23.58
		9	1.24	-0.83	0.00	-0.06	0.01	27.54
	21	8	-1.50	0.01	0.00	0.00	0.00	-0.17
		9	1.50	-0.01	0.00	0.00	0.02	0.20
	22	8	-1.06	-1.43	0.00	-0.11	0.00	40.43
		9	1.06	1.43	0.00	0.11	0.01	-47.23
	23	8	-1.00	-1.89	0.00	-0.15	0.00	53.39
		9	1.00	1.89	0.00	0.15	0.01	-62.37
	24	8	-1.65	-88.03	0.00	205.39	0.00	-705.57
		9	1.65	126.03	0.00	-306.60	0.02	197.16
	25	8	-1.71	-88.15	2.99	205.35	-3.24	-702.18
		9	1.71	126.15	-4.49	-306.55	-14.51	193.21
	26	8	-1.78	-26.01	0.00	-2.01	0.00	734.76
		9	1.78	26.01	0.00	2.01	0.02	-858.30
	27	8	-1.83	-25.97	0.00	-2.00	0.00	733.73
		9	1.83	25.97	0.00	2.00	0.02	-857.10
9	20	9	-1.24	0.83	0.00	0.03	-0.01	-27.54
		10	1.24	-0.83	0.00	-0.03	0.02	30.63
	21	9	-1.50	0.01	0.00	0.00	-0.02	-0.20
		10	1.50	-0.01	0.00	0.00	0.02	0.22
	22	9	-1.06	-1.43	0.00	-0.04	-0.01	47.23
		10	1.06	1.43	0.00	0.04	0.02	-52.52
	23	9	-1.00	-1.89	0.00	-0.06	-0.01	62.37
		10	1.00	1.89	0.00	0.06	0.01	-69.36
	24	9	-1.65	-126.03	0.00	306.32	-0.02	-197.59
		10	1.65	155.63	0.00	-385.16	0.02	-323.50
	25	9	-1.71	-126.15	4.49	306.28	14.51	-193.64
		10	1.71	155.75	-5.65	-385.10	-33.27	-327.89
	26	9	-1.78	-26.01	0.00	-0.81	-0.02	858.31
		10	1.78	26.01	0.00	0.81	0.03	-954.54

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	9	-1.83	-25.97	0.00	-0.81	-0.02	857.10
		10	1.83	25.97	0.00	0.81	0.03	-953.20
10	20	10	-1.24	0.84	-0.01	0.31	-0.02	-30.63
		11	1.24	-0.84	0.01	-0.31	0.03	31.30
	21	10	-1.50	0.01	-0.01	0.00	-0.02	-0.22
		11	1.50	-0.01	0.01	0.00	0.03	0.22
	22	10	-1.06	-1.43	-0.01	-0.52	-0.02	52.52
		11	1.06	1.43	0.01	0.52	0.02	-53.67
	23	10	-1.00	-1.89	-0.01	-0.69	-0.01	69.36
		11	1.00	1.89	0.01	0.69	0.02	-70.87
	24	10	-1.65	-155.62	-0.02	382.20	-0.02	326.99
		11	1.65	162.02	0.02	-399.24	0.04	-454.08
	25	10	-1.76	-155.78	5.64	382.10	33.27	331.40
		11	1.76	162.18	-5.89	-399.14	-37.88	-458.56
	26	10	-1.78	-26.01	-0.02	-9.52	-0.03	954.49
		11	1.78	26.01	0.02	9.52	0.04	-975.30
	27	10	-1.83	-26.00	-0.02	-9.50	-0.03	953.14
		11	1.83	26.00	0.02	9.50	0.04	-973.94
11	20	11	-1.24	-3.07	0.01	-0.33	-0.01	-31.30
		12	1.24	3.07	-0.01	0.33	0.01	28.84
	21	11	-1.50	-0.02	0.01	0.00	-0.02	-0.22
		12	1.50	0.02	-0.01	0.00	0.01	0.21
	22	11	-1.06	5.27	0.01	0.57	-0.01	53.67
		12	1.06	-5.27	-0.01	-0.57	0.01	-49.46
	23	11	-1.00	6.95	0.01	0.75	-0.01	70.87
		12	1.00	-6.95	-0.01	-0.75	0.01	-65.31
	24	11	-1.65	-7.64	0.01	0.57	-0.02	449.29
		12	1.65	7.64	-0.01	-0.57	0.01	-455.41
	25	11	-1.69	-7.21	0.01	0.62	-0.02	453.77
		12	1.69	7.21	-0.01	-0.62	0.01	-459.56
	26	11	-1.78	185.46	-7.08	-473.47	54.41	975.34
		12	1.78	-179.06	6.82	456.43	-48.85	-829.53
	27	11	-1.83	185.35	-7.07	-473.49	54.41	973.98
		12	1.83	-178.95	6.82	456.44	-48.85	-828.26
12	20	12	-1.24	-3.07	0.00	-0.17	-0.01	-28.85
		13	1.24	3.07	0.00	0.17	0.00	17.48
	21	12	-1.50	-0.02	0.00	0.00	-0.01	-0.21
		13	1.50	0.02	0.00	0.00	0.00	0.12
	22	12	-1.06	5.27	0.00	0.29	-0.01	49.46
		13	1.06	-5.27	0.00	-0.29	0.00	-29.98
	23	12	-1.00	6.95	0.00	0.38	-0.01	65.31
		13	1.00	-6.95	0.00	-0.38	0.00	-39.59
	24	12	-1.65	-7.66	0.00	-1.97	-0.01	455.41
		13	1.65	7.66	0.00	1.97	0.00	-483.77
	25	12	-1.69	-7.22	0.00	-1.95	-0.01	459.55
		13	1.69	7.22	0.00	1.95	0.00	-486.28
	26	12	-1.75	179.07	-6.83	-461.05	48.85	826.97
		13	1.75	-149.47	5.67	382.21	-25.72	-219.17

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	12	-1.79	178.94	-6.83	-461.05	48.85	825.71
		13	1.79	-149.34	5.67	382.22	-25.72	-218.40
13	20	13	-1.24	-3.07	0.00	-0.15	0.00	-17.48
		14	1.24	3.07	0.00	0.15	0.00	3.67
	21	13	-1.50	-0.02	0.00	0.00	0.00	-0.12
		14	1.50	0.02	0.00	0.00	0.00	0.03
	22	13	-1.06	5.27	0.00	0.26	0.00	29.98
		14	1.06	-5.27	0.00	-0.26	0.00	-6.29
	23	13	-1.00	6.95	0.00	0.34	0.00	39.59
		14	1.00	-6.95	0.00	-0.34	0.00	-8.30
	24	13	-1.65	-7.67	0.00	-2.52	0.00	483.77
		14	1.65	7.67	0.00	2.52	0.00	-518.26
	25	13	-1.69	-7.22	0.00	-2.49	0.00	486.28
		14	1.69	7.22	0.00	2.49	0.00	-518.79
	26	13	-1.74	149.47	-5.67	-382.46	25.72	218.74
		14	1.74	-113.47	4.25	286.58	-3.40	372.89
	27	13	-1.79	149.34	-5.67	-382.47	25.72	217.97
		14	1.79	-113.34	4.25	286.58	-3.40	373.05
14	20	14	-1.24	-3.07	0.00	-0.16	0.00	-3.67
		15	1.24	3.07	0.00	0.16	-0.02	-10.15
	21	14	-1.50	-0.02	0.00	0.00	0.00	-0.03
		15	1.50	0.02	0.00	0.00	-0.02	-0.07
	22	14	-1.06	5.27	0.00	0.27	0.00	6.28
		15	1.06	-5.27	0.00	-0.27	-0.01	17.41
	23	14	-1.00	6.95	0.00	0.36	0.00	8.30
		15	1.00	-6.95	0.00	-0.36	-0.01	22.99
	24	14	-1.65	-7.66	0.00	-1.33	0.00	518.27
		15	1.65	7.66	0.00	1.33	-0.02	-552.76
	25	14	-1.69	-7.23	0.00	-1.30	0.00	518.79
		15	1.69	7.23	0.00	1.30	-0.02	-551.30
	26	14	-1.75	113.47	-4.25	-287.43	3.40	-372.23
		15	1.75	-77.47	2.83	191.55	12.52	801.87
	27	14	-1.80	113.34	-4.25	-287.44	3.40	-372.40
		15	1.80	-77.34	2.83	191.56	12.52	801.42
15	20	15	-1.24	-3.07	0.00	-0.18	0.02	10.15
		16	1.24	3.07	0.00	0.18	-0.02	-23.97
	21	15	-1.50	-0.02	0.00	0.00	0.02	0.07
		16	1.50	0.02	0.00	0.00	-0.02	-0.17
	22	15	-1.06	5.27	0.00	0.31	0.01	-17.41
		16	1.06	-5.27	0.00	-0.31	-0.02	41.10
	23	15	-1.00	6.95	0.00	0.41	0.01	-22.99
		16	1.00	-6.95	0.00	-0.41	-0.01	54.28
	24	15	-1.65	-7.66	0.00	-2.59	0.02	552.76
		16	1.65	7.66	0.00	2.59	-0.02	-587.25
	25	15	-1.69	-7.23	0.00	-2.57	0.02	551.30
		16	1.69	7.23	0.00	2.57	-0.02	-583.81
	26	15	-1.74	77.48	-2.83	-189.71	-12.52	-802.30
		16	1.74	-41.48	1.42	93.83	22.09	1069.94

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	15	-1.79	77.34	-2.83	-189.72	-12.52	-801.86
		16	1.79	-41.34	1.42	93.84	22.09	1068.88
16	20	16	-1.24	-3.07	0.00	-0.23	0.02	23.97
		17	1.24	3.07	0.00	0.23	-0.01	-37.79
	21	16	-1.50	-0.02	0.00	0.00	0.02	0.17
		17	1.50	0.02	0.00	0.00	-0.01	-0.27
	22	16	-1.06	5.27	0.00	0.40	0.02	-41.10
		17	1.06	-5.27	0.00	-0.40	-0.01	64.79
	23	16	-1.00	6.95	0.00	0.53	0.01	-54.27
		17	1.00	-6.95	0.00	-0.53	-0.01	85.56
	24	16	-1.65	-7.66	0.00	-3.84	0.02	587.24
		17	1.65	7.66	0.00	3.84	-0.01	-621.73
	25	16	-1.69	-7.22	0.00	-3.80	0.02	583.80
		17	1.69	7.22	0.00	3.80	-0.01	-616.31
	26	16	-1.74	41.47	-1.42	-91.56	-22.09	-1070.13
		17	1.74	-5.47	0.00	-4.32	25.29	1175.75
	27	16	-1.79	41.34	-1.42	-91.57	-22.09	-1069.08
		17	1.79	-5.34	0.00	-4.31	25.29	1174.10
17	20	17	-1.24	-3.07	0.00	-0.15	0.01	37.79
		18	1.24	3.07	0.00	0.15	-0.01	-51.61
	21	17	-1.50	-0.02	0.00	0.00	0.01	0.27
		18	1.50	0.02	0.00	0.00	-0.01	-0.37
	22	17	-1.06	5.27	0.00	0.26	0.01	-64.80
		18	1.06	-5.27	0.00	-0.26	-0.01	88.49
	23	17	-1.00	6.95	0.00	0.35	0.01	-85.56
		18	1.00	-6.95	0.00	-0.35	-0.01	116.85
	24	17	-1.65	-7.66	0.00	-2.52	0.01	621.74
		18	1.65	7.66	0.00	2.52	-0.01	-656.24
	25	17	-1.69	-7.22	0.00	-2.50	0.01	616.33
		18	1.69	7.22	0.00	2.50	-0.01	-648.83
	26	17	-1.74	5.47	0.00	1.83	-25.29	-1175.76
		18	1.74	30.53	-1.42	-97.71	22.10	1119.39
	27	17	-1.79	5.34	0.00	1.82	-25.29	-1174.10
		18	1.79	30.66	-1.42	-97.70	22.10	1117.13
18	20	18	-1.24	-3.07	0.00	-0.26	0.01	51.61
		19	1.24	3.07	0.00	0.26	0.00	-65.43
	21	18	-1.50	-0.02	0.00	0.00	0.01	0.37
		19	1.50	0.02	0.00	0.00	0.00	-0.47
	22	18	-1.06	5.27	0.00	0.45	0.01	-88.49
		19	1.06	-5.27	0.00	-0.45	0.00	112.18
	23	18	-1.00	6.95	0.00	0.59	0.01	-116.85
		19	1.00	-6.95	0.00	-0.59	0.00	148.14
	24	18	-1.65	-7.66	0.00	-3.91	0.01	656.23
		19	1.65	7.66	0.00	3.91	0.00	-690.72
	25	18	-1.69	-7.22	0.00	-3.87	0.01	648.82
		19	1.69	7.22	0.00	3.87	0.00	-681.34
	26	18	-1.74	-30.53	1.41	100.08	-22.10	-1119.17
		19	1.74	66.53	-2.83	-195.96	12.55	900.81

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	18	-1.79	-30.66	1.41	100.07	-22.10	-1116.91
		19	1.79	66.66	-2.83	-195.95	12.55	897.95
19	20	19	-1.24	-3.07	0.00	-0.26	0.00	65.43
		20	1.24	3.07	0.00	0.26	0.01	-79.24
	21	19	-1.50	-0.02	0.00	0.00	0.00	0.47
		20	1.50	0.02	0.00	0.00	0.01	-0.57
	22	19	-1.06	5.27	0.00	0.45	0.00	-112.18
		20	1.06	-5.27	0.00	-0.45	0.01	135.87
	23	19	-1.00	6.95	0.00	0.59	0.00	-148.14
		20	1.00	-6.95	0.00	-0.59	0.01	179.43
	24	19	-1.65	-7.66	0.00	-3.91	0.00	690.72
		20	1.65	7.66	0.00	3.91	0.01	-725.21
	25	19	-1.69	-7.23	0.00	-3.87	0.00	681.33
		20	1.69	7.23	0.00	3.87	0.01	-713.85
	26	19	-1.74	-66.52	2.83	195.96	-12.55	-900.81
		20	1.74	102.53	-4.25	-291.84	-3.39	520.43
	27	19	-1.79	-66.66	2.83	195.95	-12.55	-897.94
		20	1.79	102.66	-4.25	-291.83	-3.39	516.96
20	20	20	-1.24	-3.07	0.00	-0.28	-0.01	79.24
		21	1.24	3.07	0.00	0.28	0.02	-93.06
	21	20	-1.50	-0.02	0.00	0.00	-0.01	0.57
		21	1.50	0.02	0.00	0.00	0.03	-0.67
	22	20	-1.06	5.27	0.00	0.47	-0.01	-135.87
		21	1.06	-5.27	0.00	-0.47	0.02	159.57
	23	20	-1.00	6.95	0.00	0.62	-0.01	-179.43
		21	1.00	-6.95	0.00	-0.62	0.02	210.71
	24	20	-1.65	-7.67	0.00	-4.04	-0.01	725.21
		21	1.65	7.67	0.00	4.04	0.03	-759.71
	25	20	-1.69	-7.23	0.00	-4.00	-0.01	713.85
		21	1.69	7.23	0.00	4.00	0.03	-746.36
	26	20	-1.74	-102.53	4.25	291.94	3.39	-520.38
		21	1.74	138.53	-5.67	-387.82	-25.70	-22.00
	27	20	-1.79	-102.66	4.25	291.92	3.39	-516.90
		21	1.79	138.66	-5.67	-387.80	-25.69	-26.07
21	20	21	-1.24	-3.07	0.00	-0.44	-0.02	93.06
		22	1.24	3.07	0.00	0.44	0.04	-104.42
	21	21	-1.50	-0.02	-0.01	0.00	-0.03	0.67
		22	1.50	0.02	0.01	0.00	0.05	-0.75
	22	21	-1.06	5.27	0.00	0.75	-0.02	-159.57
		22	1.06	-5.27	0.00	-0.75	0.03	179.05
	23	21	-1.00	6.95	0.00	0.99	-0.02	-210.71
		22	1.00	-6.95	0.00	-0.99	0.03	236.44
	24	21	-1.65	-7.66	-0.01	-5.35	-0.03	759.70
		22	1.65	7.66	0.01	5.35	0.05	-788.06
	25	21	-1.69	-7.23	-0.01	-5.29	-0.03	746.35
		22	1.69	7.23	0.01	5.29	0.05	-773.08
	26	21	-1.75	-138.53	5.66	387.78	25.70	22.67
		22	1.75	168.13	-6.83	-466.61	-48.81	-589.98

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	21	-1.80	-138.66	5.66	387.76	25.69	26.74
		22	1.80	168.26	-6.83	-466.59	-48.81	-594.55
22	20	22	-1.24	-3.07	-0.01	-0.66	-0.04	104.42
		23	1.24	3.07	0.01	0.66	0.04	-106.88
	21	22	-1.50	-0.02	-0.01	0.00	-0.05	0.75
		23	1.50	0.02	0.01	0.00	0.05	-0.76
	22	22	-1.06	5.27	-0.01	1.14	-0.03	-179.05
		23	1.06	-5.27	0.01	-1.14	0.04	183.26
	23	22	-1.00	6.95	-0.01	1.50	-0.03	-236.43
		23	1.00	-6.95	0.01	-1.50	0.04	242.00
	24	22	-1.65	-7.67	-0.01	-7.07	-0.05	788.05
		23	1.65	7.67	0.01	7.07	0.06	-794.18
	25	22	-1.69	-7.19	-0.01	-6.97	-0.05	773.07
		23	1.69	7.19	0.01	6.97	0.06	-778.83
	26	22	-1.77	-168.12	6.83	465.33	48.81	591.00
		23	1.77	174.52	-7.08	-482.38	-54.37	-728.03
	27	22	-1.81	-168.28	6.82	465.30	48.81	595.56
		23	1.81	174.68	-7.08	-482.35	-54.37	-732.73
23	20	23	-1.24	10.59	0.02	2.18	-0.01	106.88
		24	1.24	-10.59	-0.02	-2.18	0.00	-98.41
	21	23	-1.50	0.08	0.02	0.02	-0.01	0.76
		24	1.50	-0.08	-0.02	-0.02	0.00	-0.70
	22	23	-1.06	-18.15	0.01	-3.74	-0.01	-183.26
		24	1.06	18.15	-0.01	3.74	0.00	168.73
	23	23	-1.00	-23.97	0.01	-4.94	-0.01	-242.00
		24	1.00	23.97	-0.01	4.94	0.00	222.82
	24	23	-1.65	183.44	-7.07	-468.05	54.42	794.21
		24	1.65	-177.04	6.82	451.01	-48.86	-650.02
	25	23	-1.69	181.94	-7.07	-468.30	54.42	778.87
		24	1.69	-175.54	6.82	451.26	-48.86	-635.88
	26	23	-1.68	7.96	0.02	4.59	-0.01	721.75
		24	1.68	-7.96	-0.02	-4.59	0.00	-715.40
	27	23	-1.72	8.43	0.02	4.68	-0.01	726.46
		24	1.72	-8.43	-0.02	-4.68	0.00	-719.70
24	20	24	-1.24	10.59	0.00	1.10	0.00	98.43
		25	1.24	-10.59	0.00	-1.10	-0.01	-59.25
	21	24	-1.50	0.08	0.00	0.01	0.00	0.70
		25	1.50	-0.08	0.00	-0.01	-0.01	-0.42
	22	24	-1.06	-18.15	0.00	-1.89	0.00	-168.77
		25	1.06	18.15	0.00	1.89	-0.01	101.60
	23	24	-1.00	-23.97	0.00	-2.50	0.00	-222.86
		25	1.00	23.97	0.00	2.50	-0.01	134.16
	24	24	-1.57	177.04	-6.83	-458.09	48.86	645.04
		25	1.57	-147.44	5.67	379.26	-25.74	-44.73
	25	24	-1.61	175.52	-6.83	-458.19	48.86	630.92
		25	1.61	-145.92	5.67	379.36	-25.74	-36.23
	26	24	-1.68	7.96	0.00	-3.24	0.00	715.41
		25	1.68	-7.96	0.00	3.24	-0.01	-685.97

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	24	-1.72	8.42	0.00	-3.19	0.00	719.72
		25	1.72	-8.42	0.00	3.19	-0.01	-688.56
25	20	25	-1.24	10.59	0.00	1.10	0.01	59.25
		26	1.24	-10.59	0.00	-1.10	-0.02	-11.61
	21	25	-1.50	0.08	0.00	0.01	0.01	0.42
		26	1.50	-0.08	0.00	-0.01	-0.02	-0.08
	22	25	-1.06	-18.15	0.00	-1.89	0.01	-101.60
		26	1.06	18.15	0.00	1.89	-0.01	19.91
	23	25	-1.00	-23.97	0.00	-2.50	0.01	-134.16
		26	1.00	23.97	0.00	2.50	-0.01	26.29
	24	25	-1.57	147.44	-5.67	-379.26	25.74	44.74
		26	1.57	-111.44	4.25	283.38	-3.42	537.76
	25	25	-1.61	145.92	-5.67	-379.36	25.74	36.24
		26	1.61	-109.93	4.25	283.49	-3.42	539.42
	26	25	-1.68	7.96	0.00	-3.24	0.01	685.97
		26	1.68	-7.96	0.00	3.24	-0.02	-650.16
	27	25	-1.72	8.42	0.00	-3.19	0.01	688.56
		26	1.72	-8.42	0.00	3.19	-0.02	-650.67
26	20	26	-1.24	10.59	0.00	1.08	0.02	11.61
		27	1.24	-10.59	0.00	-1.08	-0.01	36.03
	21	26	-1.50	0.08	0.00	0.01	0.02	0.08
		27	1.50	-0.08	0.00	-0.01	-0.01	0.26
	22	26	-1.06	-18.15	0.00	-1.84	0.01	-19.91
		27	1.06	18.15	0.00	1.84	-0.01	-61.78
	23	26	-1.00	-23.97	0.00	-2.44	0.01	-26.29
		27	1.00	23.97	0.00	2.44	-0.01	-81.58
	24	26	-1.56	111.44	-4.25	-282.05	3.42	-538.45
		27	1.56	-75.44	2.84	186.16	12.53	958.95
	25	26	-1.60	109.92	-4.25	-282.16	3.42	-540.12
		27	1.60	-73.92	2.84	186.29	12.53	953.78
	26	26	-1.68	7.96	0.00	-4.84	0.02	650.15
		27	1.68	-7.96	0.00	4.84	-0.01	-614.35
	27	26	-1.72	8.42	0.00	-4.80	0.02	650.66
		27	1.72	-8.42	0.00	4.80	-0.01	-612.77
27	20	27	-1.24	10.59	0.00	0.99	0.01	-36.03
		28	1.24	-10.59	0.00	-0.99	-0.02	83.67
	21	27	-1.50	0.08	0.00	0.01	0.01	-0.26
		28	1.50	-0.08	0.00	-0.01	-0.02	0.60
	22	27	-1.06	-18.15	0.00	-1.70	0.01	61.79
		28	1.06	18.15	0.00	1.70	-0.01	-143.47
	23	27	-1.00	-23.97	0.00	-2.25	0.01	81.59
		28	1.00	23.97	0.00	2.25	-0.01	-189.45
	24	27	-1.57	75.44	-2.83	-188.36	-12.53	-958.53
		28	1.57	-39.44	1.42	92.49	22.09	1217.00
	25	27	-1.61	73.92	-2.83	-188.48	-12.53	-953.36
		28	1.61	-37.93	1.42	92.62	22.09	1205.00
	26	27	-1.68	7.96	0.00	-3.43	0.01	614.36
		28	1.68	-7.96	0.00	3.43	-0.02	-578.56

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	27	-1.72	8.42	0.00	-3.39	0.01	612.78
		28	1.72	-8.42	0.00	3.39	-0.02	-574.89
28	20	28	-1.24	10.59	0.00	1.17	0.02	-83.67
		29	1.24	-10.59	0.00	-1.17	-0.01	131.32
	21	28	-1.50	0.08	0.00	0.01	0.02	-0.60
		29	1.50	-0.08	0.00	-0.01	-0.01	0.94
	22	28	-1.06	-18.15	0.00	-2.01	0.01	143.46
		29	1.06	18.15	0.00	2.01	-0.01	-225.16
	23	28	-1.00	-23.97	0.00	-2.65	0.01	189.45
		29	1.00	23.97	0.00	2.65	-0.01	-297.33
	24	28	-1.57	39.45	-1.42	-89.91	-22.09	-1217.20
		29	1.57	-3.44	0.00	-5.98	25.29	1313.70
	25	28	-1.61	37.93	-1.42	-90.07	-22.09	-1205.19
		29	1.61	-1.92	0.00	-5.81	25.29	1294.86
	26	28	-1.68	7.96	0.00	-4.66	0.02	578.55
		29	1.68	-7.96	0.00	4.66	-0.02	-542.74
	27	28	-1.72	8.42	0.00	-4.61	0.02	574.88
		29	1.72	-8.42	0.00	4.61	-0.02	-536.99
29	20	29	-1.24	10.59	0.00	1.19	0.01	-131.32
		30	1.24	-10.59	0.00	-1.19	-0.01	178.97
	21	29	-1.50	0.08	0.00	0.01	0.01	-0.94
		30	1.50	-0.08	0.00	-0.01	-0.01	1.28
	22	29	-1.06	-18.15	0.00	-2.05	0.01	225.16
		30	1.06	18.15	0.00	2.05	-0.01	-306.86
	23	29	-1.00	-23.97	0.00	-2.70	0.01	297.33
		30	1.00	23.97	0.00	2.70	0.00	-405.21
	24	29	-1.57	3.44	0.00	6.21	-25.29	-1313.70
		30	1.57	32.56	-1.42	-102.10	22.11	1248.18
	25	29	-1.61	1.92	0.00	6.04	-25.29	-1294.86
		30	1.61	34.08	-1.42	-101.91	22.11	1222.50
	26	29	-1.68	7.96	0.00	-4.75	0.02	542.74
		30	1.68	-7.96	0.00	4.75	-0.01	-506.94
	27	29	-1.72	8.42	0.00	-4.70	0.02	536.99
		30	1.72	-8.42	0.00	4.70	-0.01	-499.09
30	20	30	-1.24	10.59	0.00	1.19	0.01	-178.97
		31	1.24	-10.59	0.00	-1.19	0.00	226.60
	21	30	-1.50	0.08	0.00	0.01	0.01	-1.28
		31	1.50	-0.08	0.00	-0.01	0.00	1.62
	22	30	-1.06	-18.15	0.00	-2.05	0.01	306.86
		31	1.06	18.15	0.00	2.05	0.00	-388.54
	23	30	-1.00	-23.97	0.00	-2.70	0.00	405.22
		31	1.00	23.97	0.00	2.70	0.00	-513.08
	24	30	-1.57	-32.56	1.42	102.10	-22.11	-1248.18
		31	1.57	68.55	-2.83	-197.97	12.55	1020.70
	25	30	-1.61	-34.08	1.42	101.92	-22.11	-1222.50
		31	1.61	70.07	-2.83	-197.77	12.55	988.19
	26	30	-1.68	7.96	0.00	-4.76	0.01	506.94
		31	1.68	-7.96	0.00	4.76	0.00	-471.14

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	30	-1.72	8.42	0.00	-4.70	0.01	499.09
		31	1.72	-8.42	0.00	4.70	0.00	-461.20
31	20	31	-1.24	10.59	0.00	1.67	0.00	-226.60
		32	1.24	-10.59	0.00	-1.67	0.02	274.25
	21	31	-1.50	0.08	0.00	0.01	0.00	-1.62
		32	1.50	-0.08	0.00	-0.01	0.02	1.96
	22	31	-1.06	-18.15	0.00	-2.87	0.00	388.53
		32	1.06	18.15	0.00	2.87	0.01	-470.23
	23	31	-1.00	-23.97	0.00	-3.79	0.00	513.07
		32	1.00	23.97	0.00	3.79	0.01	-620.96
	24	31	-1.57	-68.56	2.83	200.13	-12.55	-1020.27
		32	1.57	104.56	-4.25	-296.02	-3.38	630.72
	25	31	-1.61	-70.08	2.83	199.86	-12.55	-987.78
		32	1.61	106.08	-4.25	-295.74	-3.38	591.37
	26	31	-1.68	7.96	-0.01	-5.75	0.00	471.13
		32	1.68	-7.96	0.01	5.75	0.02	-435.32
	27	31	-1.72	8.42	-0.01	-5.68	0.00	461.19
		32	1.72	-8.42	0.01	5.68	0.02	-423.30
32	20	32	-1.24	10.59	0.00	1.67	-0.02	-274.25
		33	1.24	-10.59	0.00	-1.67	0.04	321.89
	21	32	-1.50	0.08	0.00	0.01	-0.02	-1.96
		33	1.50	-0.08	0.00	-0.01	0.04	2.30
	22	32	-1.06	-18.15	0.00	-2.87	-0.01	470.23
		33	1.06	18.15	0.00	2.87	0.03	-551.92
	23	32	-1.00	-23.97	0.00	-3.79	-0.01	620.96
		33	1.00	23.97	0.00	3.79	0.03	-728.82
	24	32	-1.57	-104.56	4.25	296.02	3.38	-630.72
		33	1.57	140.56	-5.66	-391.89	-25.68	79.25
	25	32	-1.61	-106.08	4.25	295.74	3.38	-591.37
		33	1.61	142.07	-5.66	-391.60	-25.68	33.08
	26	32	-1.68	7.96	-0.01	-5.75	-0.02	435.32
		33	1.68	-7.96	0.01	5.75	0.05	-399.52
	27	32	-1.72	8.42	-0.01	-5.68	-0.02	423.30
		33	1.72	-8.42	0.01	5.68	0.05	-385.41
33	20	33	-1.24	10.59	0.00	1.03	-0.04	-321.89
		34	1.24	-10.59	0.00	-1.03	0.04	361.07
	21	33	-1.50	0.08	0.00	0.01	-0.04	-2.30
		34	1.50	-0.08	0.00	-0.01	0.05	2.58
	22	33	-1.06	-18.15	0.00	-1.76	-0.03	551.92
		34	1.06	18.15	0.00	1.76	0.03	-619.09
	23	33	-1.00	-23.97	0.00	-2.32	-0.03	728.83
		34	1.00	23.97	0.00	2.32	0.03	-817.53
	24	33	-1.56	-140.56	5.67	391.73	25.68	-80.05
		34	1.56	170.16	-6.83	-470.58	-48.81	-494.83
	25	33	-1.60	-142.08	5.67	391.53	25.68	-33.87
		34	1.60	171.68	-6.83	-470.36	-48.81	-546.62
	26	33	-1.68	7.96	0.00	-4.95	-0.05	399.53
		34	1.68	-7.96	0.00	4.95	0.05	-370.09

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	33	-1.72	8.42	0.00	-4.90	-0.05	385.42
		34	1.72	-8.42	0.00	4.90	0.06	-354.26
34	20	34	-1.24	10.58	-0.02	5.10	-0.04	-361.03
		35	1.24	-10.58	0.02	-5.10	0.05	369.50
	21	34	-1.50	0.08	-0.02	0.04	-0.05	-2.58
		35	1.50	-0.08	0.02	-0.04	0.06	2.64
	22	34	-1.06	-18.15	-0.01	-8.75	-0.03	619.04
		35	1.06	18.15	0.01	8.75	0.05	-633.56
	23	34	-1.00	-23.96	-0.01	-11.55	-0.03	817.46
		35	1.00	23.96	0.01	11.55	0.04	-836.63
	24	34	-1.64	-170.19	6.82	464.96	48.81	500.12
		35	1.64	176.59	-7.07	-482.01	-54.36	-638.81
	25	34	-1.68	-171.67	6.82	464.17	48.81	551.90
		35	1.68	178.08	-7.07	-481.21	-54.36	-691.83
	26	34	-1.68	7.94	-0.02	-9.13	-0.05	370.01
		35	1.68	-7.94	0.02	9.13	0.07	-363.65
	27	34	-1.72	8.41	-0.02	-8.90	-0.06	354.18
		35	1.72	-8.41	0.02	8.90	0.07	-347.45
35	20	35	-1.24	-36.65	0.01	-6.50	0.00	-369.63
		36	1.24	36.65	-0.01	6.50	-0.01	340.35
	21	35	-1.50	-0.26	0.01	-0.05	0.00	-2.64
		36	1.50	0.26	-0.01	0.05	-0.01	2.43
	22	35	-0.96	89.06	-7.60	-352.46	89.65	629.09
		36	0.96	-89.06	7.60	352.46	-83.58	-557.93
	23	35	-0.87	125.01	-10.07	-436.37	111.57	831.10
		36	0.87	-125.01	10.07	436.37	-103.53	-731.21
	24	35	-1.46	-6.06	0.01	-5.48	0.00	626.67
		36	1.46	6.06	-0.01	5.48	-0.01	-631.50
	25	35	-1.50	-0.81	0.01	-4.55	0.00	679.70
		36	1.50	0.81	-0.01	4.55	-0.01	-680.32
	26	35	-1.58	143.88	-7.08	-479.15	54.48	357.60
		36	1.58	-137.49	6.83	462.13	-48.92	-245.18
	27	35	-1.63	142.27	-7.08	-477.99	54.43	341.41
		36	1.63	-135.88	6.83	460.97	-48.87	-230.28
36	20	36	-1.24	-36.64	0.00	-5.42	0.01	-340.37
		37	1.24	36.64	0.00	5.42	-0.01	204.79
	21	36	-1.50	-0.26	0.00	-0.04	0.01	-2.43
		37	1.50	0.26	0.00	0.04	-0.02	1.46
	22	36	-0.94	89.06	-7.60	-354.23	83.58	556.80
		37	0.94	-89.06	7.60	354.23	-55.45	-227.23
	23	36	-0.84	125.01	-10.07	-438.69	103.53	729.82
		37	0.84	-125.01	10.07	438.69	-66.25	-267.23
	24	36	-1.46	-6.05	0.00	-7.49	0.01	631.48
		37	1.46	6.05	0.00	7.49	-0.02	-653.86
	25	36	-1.50	-0.79	0.00	-6.71	0.01	680.31
		37	1.50	0.79	0.00	6.71	-0.02	-683.24
	26	36	-1.56	137.49	-6.84	-462.90	48.92	243.71
		37	1.56	-107.89	5.67	384.06	-25.78	210.30

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	36	-1.61	135.89	-6.83	-461.69	48.87	228.81
		37	1.61	-106.28	5.67	382.85	-25.74	219.26
37	20	37	-1.24	-36.64	0.00	-5.50	0.01	-204.79
		38	1.24	36.64	0.00	5.50	-0.02	39.92
	21	37	-1.50	-0.26	0.00	-0.04	0.02	-1.46
		38	1.50	0.26	0.00	0.04	-0.03	0.29
	22	37	-0.94	89.06	-7.60	-354.14	55.45	227.37
		38	0.94	-89.06	7.60	354.14	-21.25	173.35
	23	37	-0.85	125.01	-10.07	-438.59	66.25	267.40
		38	0.85	-125.01	10.07	438.59	-20.93	295.08
	24	37	-1.46	-6.05	0.00	-7.23	0.02	653.86
		38	1.46	6.05	0.00	7.23	-0.03	-681.07
	25	37	-1.50	-0.79	0.00	-6.44	0.02	683.24
		38	1.50	0.79	0.00	6.44	-0.03	-686.80
	26	37	-1.57	107.89	-5.67	-384.14	25.78	-210.15
		38	1.57	-71.89	4.25	288.27	-3.45	614.61
	27	37	-1.61	106.28	-5.67	-382.93	25.74	-219.11
		38	1.61	-70.29	4.25	287.06	-3.43	616.34
38	20	38	-1.24	-36.64	0.00	-5.42	0.02	-39.93
		39	1.24	36.64	0.00	5.42	-0.02	-124.97
	21	38	-1.50	-0.26	0.00	-0.04	0.03	-0.29
		39	1.50	0.26	0.00	0.04	-0.03	-0.89
	22	38	-0.92	89.06	-7.60	-353.77	21.25	-174.10
		39	0.92	-89.06	7.60	353.77	12.97	574.94
	23	38	-0.82	125.01	-10.07	-437.96	20.93	-296.01
		39	0.82	-117.51	9.58	417.43	24.28	856.75
	24	38	-1.46	-6.05	0.00	-8.67	0.03	681.06
		39	1.46	6.05	0.00	8.67	-0.03	-708.27
	25	38	-1.50	-0.79	0.00	-7.90	0.03	686.78
		39	1.50	0.79	0.00	7.90	-0.03	-690.34
	26	38	-1.56	71.89	-4.26	-286.97	3.45	-615.22
		39	1.56	-35.89	2.84	191.07	12.51	857.75
	27	38	-1.60	70.29	-4.25	-285.76	3.43	-616.95
		39	1.60	-34.28	2.84	189.86	12.52	852.26
39	20	39	-1.24	-36.64	0.00	-5.40	0.02	124.97
		40	1.24	36.64	0.00	5.40	-0.02	-289.85
	21	39	-1.50	-0.26	0.00	-0.04	0.03	0.89
		40	1.50	0.26	0.00	0.04	-0.03	-2.07
	22	39	-0.93	89.06	-7.60	-353.87	-12.97	-574.87
		40	0.93	-66.56	6.13	292.28	46.07	958.75
	23	39	-0.83	117.51	-9.58	-417.58	-24.28	-856.67
		40	0.83	-50.01	5.15	232.82	57.44	1233.58
	24	39	-1.46	-6.05	0.00	-8.55	0.03	708.27
		40	1.46	6.05	0.00	8.55	-0.02	-735.48
	25	39	-1.50	-0.79	0.00	-7.78	0.03	690.35
		40	1.50	0.79	0.00	7.78	-0.03	-693.90
	26	39	-1.56	35.88	-2.84	-191.22	-12.51	-857.72
		40	1.56	0.12	1.42	95.34	22.10	938.20

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	39	-1.60	34.28	-2.84	-190.01	-12.52	-852.22
		40	1.60	1.72	1.42	94.13	22.09	925.49
40	20	40	-1.24	-36.64	0.00	-6.11	0.02	289.83
		41	1.24	36.64	0.00	6.11	-0.01	-454.71
	21	40	-1.50	-0.26	0.00	-0.04	0.03	2.07
		41	1.50	0.26	0.00	0.04	-0.01	-3.25
	22	40	-0.91	66.56	-6.13	-289.91	-46.07	-959.47
		41	0.91	0.93	1.70	105.15	63.69	1107.13
	23	40	-0.81	50.01	-5.16	-229.77	-57.44	-1234.14
		41	0.81	17.49	0.73	45.01	70.68	1307.32
	24	40	-1.46	-6.05	0.00	-10.37	0.02	735.46
		41	1.46	6.05	0.00	10.37	-0.01	-762.67
	25	40	-1.50	-0.79	0.00	-9.49	0.03	693.88
		41	1.50	0.79	0.00	9.49	-0.01	-697.43
	26	40	-1.55	-0.11	-1.43	-93.03	-22.10	-938.44
		41	1.55	36.11	0.01	-2.85	25.32	856.93
	27	40	-1.60	-1.72	-1.42	-91.85	-22.09	-925.72
		41	1.60	37.72	0.00	-4.03	25.30	836.99
41	20	41	-1.24	-36.64	0.00	-5.07	0.01	454.72
		42	1.24	36.64	0.00	5.07	0.00	-619.59
	21	41	-1.50	-0.26	0.00	-0.04	0.01	3.25
		42	1.50	0.26	0.00	0.04	-0.01	-4.43
	22	41	-0.91	-0.94	-1.70	-107.68	-63.69	-1106.89
		42	0.91	68.43	-2.73	-77.08	61.37	950.82
	23	41	-0.82	-17.49	-0.73	-48.01	-70.68	-1307.22
		42	0.82	84.98	-3.70	-136.75	63.98	1076.68
	24	41	-1.46	-6.05	0.00	-8.62	0.01	762.69
		42	1.46	6.05	0.00	8.62	-0.01	-789.90
	25	41	-1.50	-0.79	0.00	-7.89	0.01	697.46
		42	1.50	0.79	0.00	7.89	-0.01	-701.02
	26	41	-1.55	-36.11	0.00	0.89	-25.32	-856.94
		42	1.55	72.11	-1.41	-96.77	22.15	613.46
	27	41	-1.60	-37.72	0.00	2.11	-25.30	-837.00
		42	1.60	73.72	-1.42	-97.99	22.11	586.29
42	20	42	-1.24	-36.64	0.00	-6.38	0.00	619.58
		43	1.24	36.64	0.00	6.38	0.01	-784.49
	21	42	-1.50	-0.26	0.00	-0.05	0.01	4.43
		43	1.50	0.26	0.00	0.05	0.01	-5.61
	22	42	-0.92	-68.43	2.73	79.08	-61.37	-950.66
		43	0.92	135.94	-7.16	-263.89	39.14	490.73
	23	42	-0.82	-84.98	3.70	139.03	-63.98	-1076.39
		43	0.82	152.49	-8.13	-323.83	37.36	541.96
	24	42	-1.46	-6.05	0.00	-10.29	0.01	789.88
		43	1.46	6.05	0.00	10.29	0.01	-817.10
	25	42	-1.50	-0.79	0.00	-9.37	0.01	701.01
		43	1.50	0.79	0.00	9.37	0.01	-704.55
	26	42	-1.56	-72.11	1.41	98.06	-22.15	-613.25
		43	1.56	108.12	-2.83	-193.96	12.61	207.66

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	42	-1.60	-73.71	1.41	99.23	-22.11	-586.08
		43	1.60	109.72	-2.83	-195.13	12.56	173.27
43	20	43	-1.24	-36.64	0.00	-6.38	-0.01	784.49
		44	1.24	36.64	0.00	6.38	0.02	-949.37
	21	43	-1.50	-0.26	0.00	-0.05	-0.01	5.61
		44	1.50	0.26	0.00	0.05	0.03	-6.79
	22	43	-0.92	-135.94	7.16	263.89	-39.14	-490.73
		44	0.92	203.44	-11.58	-448.66	-3.03	-272.87
	23	43	-0.82	-152.49	8.13	323.84	-37.36	-541.95
		44	0.82	219.99	-12.56	-508.60	-9.18	-296.12
	24	43	-1.46	-6.05	0.00	-10.29	-0.01	817.10
		44	1.46	6.05	0.00	10.29	0.03	-844.31
	25	43	-1.50	-0.79	0.00	-9.37	-0.01	704.56
		44	1.50	0.79	0.00	9.37	0.03	-708.12
	26	43	-1.56	-108.12	2.83	193.96	-12.61	-207.66
		44	1.56	144.11	-4.25	-289.84	-3.30	-359.84
	27	43	-1.60	-109.72	2.83	195.13	-12.56	-173.26
		44	1.60	145.72	-4.25	-291.01	-3.37	-401.46
44	20	44	-1.24	-36.64	0.00	-6.38	-0.02	949.37
		45	1.24	36.64	0.00	6.38	0.04	-1114.25
	21	44	-1.50	-0.26	0.00	-0.05	-0.03	6.79
		45	1.50	0.26	0.00	0.05	0.04	-7.96
	22	44	-0.92	-203.44	11.58	448.66	3.03	272.87
		45	0.92	270.94	-16.01	-633.42	-65.11	-1340.21
	23	44	-0.82	-219.99	12.56	508.60	9.18	296.12
		45	0.86	249.99	-14.52	-590.72	-72.57	-1391.07
	24	44	-1.46	-6.05	0.00	-10.29	-0.03	844.31
		45	1.46	6.05	0.00	10.29	0.04	-871.52
	25	44	-1.50	-0.79	0.00	-9.37	-0.03	708.12
		45	1.50	0.79	0.00	9.37	0.04	-711.68
	26	44	-1.56	-144.12	4.25	289.84	3.30	359.84
		45	1.56	180.11	-5.66	-385.72	-25.59	-1089.35
	27	44	-1.60	-145.72	4.25	291.01	3.37	401.47
		45	1.60	181.72	-5.67	-386.89	-25.68	-1138.19
45	20	45	-1.24	-36.64	-0.01	-8.32	-0.04	1114.23
		46	1.24	36.64	0.01	8.32	0.06	-1249.79
	21	45	-1.50	-0.26	-0.01	-0.06	-0.04	7.96
		46	1.50	0.26	0.01	0.06	0.07	-8.93
	22	45	-0.95	-270.94	16.01	631.10	65.11	1341.30
		46	0.95	285.94	-16.99	-672.16	-127.49	-2391.74
	23	45	-0.89	-249.99	14.52	588.30	72.57	1392.09
		46	0.89	249.99	-14.52	-588.30	-126.30	-2317.03
	24	45	-1.46	-6.05	-0.01	-11.80	-0.04	871.50
		46	1.46	6.05	0.01	11.80	0.07	-893.88
	25	45	-1.50	-0.79	-0.01	-10.61	-0.04	711.66
		46	1.50	0.79	0.01	10.61	0.07	-714.59
	26	45	-1.57	-180.11	5.66	383.83	25.59	1090.02
		46	1.57	215.51	-7.05	-478.11	-49.36	-1828.13

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	45	-1.61	-181.72	5.66	384.91	25.68	1138.86
		46	1.61	211.32	-6.83	-463.74	-48.79	-1865.96
46	20	46	-1.24	-36.69	-0.01	-12.23	-0.06	1249.76
		47	1.24	36.69	0.01	12.23	0.06	-1279.11
	21	46	-1.50	-0.26	-0.01	-0.09	-0.07	8.93
		47	1.50	0.26	0.01	0.09	0.08	-9.14
	22	46	-1.00	-285.94	16.99	664.67	127.49	2393.84
		47	1.00	285.94	-16.99	-664.67	-141.09	-2622.66
	23	46	-0.93	-250.00	14.52	581.05	126.30	2318.86
		47	0.93	250.00	-14.52	-581.05	-137.92	-2518.92
	24	46	-1.46	-6.02	-0.01	-14.60	-0.07	893.84
		47	1.46	6.02	0.01	14.60	0.07	-898.67
	25	46	-1.50	-0.81	-0.01	-12.85	-0.07	714.54
		47	1.50	0.81	0.01	12.85	0.08	-715.18
	26	46	-1.61	-240.51	8.03	538.95	49.36	1831.27
		47	1.61	240.51	-8.03	-538.95	-55.78	-2023.74
	27	46	-1.63	-211.32	6.82	457.90	48.79	1867.40
		47	1.63	211.32	-6.82	-457.90	-54.25	-2036.51
47	20	47	-0.72	289.11	-20.06	-818.60	143.42	1258.27
		48	0.72	-277.12	19.27	785.79	-127.70	-1032.02
	21	47	-1.50	0.91	0.00	0.14	0.02	9.15
		48	1.50	-0.91	0.00	-0.14	-0.02	-8.42
	22	47	-0.14	284.96	-17.00	-678.64	141.13	2588.71
		48	0.14	-284.96	17.00	678.64	-127.54	-2360.95
	23	47	-0.08	316.43	-19.19	-762.25	131.27	2484.89
		48	0.08	-304.44	18.41	729.43	-116.24	-2236.76
	24	47	-1.25	204.11	-8.05	-537.08	65.46	885.19
		48	1.25	-197.71	7.80	520.05	-59.13	-724.59
	25	47	-1.32	179.89	-7.09	-472.67	54.45	703.30
		48	1.32	-173.50	6.84	455.65	-48.88	-562.09
	26	47	-1.21	240.17	-8.05	-546.30	55.88	1996.31
		48	1.21	-240.17	8.05	546.30	-49.45	-1804.35
	27	47	-1.23	269.14	-9.24	-624.73	58.33	2009.07
		48	1.23	-244.14	8.26	558.15	-51.73	-1813.93
48	20	48	-0.80	277.10	-19.27	-781.49	127.70	1035.27
		49	0.80	-221.58	15.63	629.53	-63.12	-112.49
	21	48	-1.50	0.91	0.00	0.18	0.02	8.42
		49	1.50	-0.91	0.00	-0.18	-0.03	-5.07
	22	48	-0.21	284.96	-17.00	-668.81	127.54	2363.76
		49	0.21	-269.96	16.01	627.75	-65.14	-1316.68
	23	48	-0.15	304.44	-18.41	-720.12	116.24	2239.78
		49	0.15	-248.93	14.77	568.16	-54.86	-1215.80
	24	48	-1.29	197.72	-7.79	-517.03	59.13	726.76
		49	1.29	-168.12	6.63	438.18	-32.44	-49.79
	25	48	-1.35	173.50	-6.83	-453.30	48.88	563.97
		49	1.35	-143.89	5.67	374.46	-25.75	23.34
	26	48	-1.26	215.17	-7.06	-472.22	49.45	1808.05
		49	1.26	-179.77	5.67	377.94	-25.66	-1071.01

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	48	-1.26	244.14	-8.25	-550.60	51.73	1816.24
		49	1.26	-194.14	6.29	417.43	-25.32	-1017.76
49	20	49	-0.79	221.59	-15.63	-629.59	63.12	112.14
		50	0.79	-154.10	11.20	444.86	-2.77	732.98
	21	49	-1.50	0.91	0.00	0.17	0.03	5.07
		50	1.50	-0.91	0.00	-0.17	-0.03	-0.99
	22	49	-0.20	269.96	-16.01	-628.50	65.14	1316.32
		50	0.20	-202.47	11.59	443.77	-3.05	-253.57
	23	49	-0.15	248.93	-14.77	-568.85	54.86	1215.48
		50	0.15	-181.44	10.34	384.12	1.62	-247.33
	24	49	-1.28	168.12	-6.63	-438.21	32.44	49.54
		50	1.28	-132.13	5.21	342.35	-5.81	625.86
	25	49	-1.35	143.89	-5.67	-374.45	25.75	-23.55
		50	1.35	-107.90	4.25	278.60	-3.43	589.98
	26	49	-1.26	179.77	-5.67	-378.55	25.66	1070.80
		50	1.26	-143.78	4.25	282.68	-3.36	-342.94
	27	49	-1.26	194.14	-6.29	-418.01	25.32	1017.52
		50	1.26	-141.94	4.23	278.98	-2.99	-295.27
50	20	50	-0.79	154.10	-11.20	-444.86	2.77	-732.98
		51	0.79	-86.60	6.77	260.09	37.68	1274.55
	21	50	-1.50	0.91	0.00	0.17	0.03	0.99
		51	1.50	-0.91	0.00	-0.17	-0.03	3.09
	22	50	-0.20	202.47	-11.59	-443.76	3.05	253.57
		51	0.20	-134.97	7.16	258.99	39.12	505.69
	23	50	-0.15	181.44	-10.34	-384.12	-1.62	247.34
		51	0.15	-113.94	5.91	199.34	38.18	417.30
	24	50	-1.28	132.12	-5.21	-342.35	5.81	-625.86
		51	1.28	-96.12	3.79	246.47	14.46	1139.43
	25	50	-1.35	107.90	-4.25	-278.60	3.43	-589.98
		51	1.35	-71.90	2.83	182.73	12.51	994.54
	26	50	-1.26	143.78	-4.25	-282.68	3.36	342.95
		51	1.26	-107.78	2.83	186.80	12.57	223.08
	27	50	-1.26	141.95	-4.23	-278.98	2.99	295.27
		51	1.26	-105.94	2.81	183.09	12.86	262.49
51	20	51	-0.78	86.60	-6.78	-257.39	-37.68	-1275.10
		52	0.78	-19.09	2.35	72.61	58.21	1512.92
	21	51	-1.50	0.91	0.00	0.18	0.03	-3.09
		52	1.50	-0.91	0.00	-0.18	-0.02	7.17
	22	51	-0.19	134.97	-7.16	-257.92	-39.12	-506.23
		52	0.19	-67.46	2.73	73.14	61.37	961.74
	23	51	-0.13	113.94	-5.91	-198.46	-38.18	-417.72
		52	0.13	-46.44	1.48	13.68	54.81	778.59
	24	51	-1.27	96.12	-3.80	-244.05	-14.46	-1139.95
		52	1.27	-60.12	2.38	148.17	28.36	1491.52
	25	51	-1.34	71.90	-2.84	-180.63	-12.51	-994.93
		52	1.34	-35.90	1.42	84.75	22.09	1237.49
	26	51	-1.25	107.78	-2.83	-186.32	-12.57	-223.48
		52	1.25	-71.78	1.42	90.44	22.14	627.51

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	51	-1.25	105.94	-2.82	-182.54	-12.86	-262.87
		52	1.25	-69.94	1.40	86.65	22.35	658.65
52	20	52	-0.78	19.09	-2.35	-72.34	-58.21	-1512.93
		53	0.78	48.41	-2.08	-112.45	58.81	1446.95
	21	52	-1.50	0.91	0.00	0.18	0.02	-7.17
		53	1.50	-0.91	0.00	-0.18	-0.01	11.25
	22	52	-0.19	67.46	-2.73	-72.97	-61.37	-961.76
		53	0.19	0.04	-1.70	-111.82	63.69	1113.47
	23	52	-0.13	46.44	-1.48	-13.54	-54.81	-778.59
		53	0.13	21.07	-2.95	-171.25	51.52	835.68
	24	52	-1.27	60.12	-2.38	-147.90	-28.36	-1491.55
		53	1.27	0.28	0.00	-12.96	34.34	1642.05
	25	52	-1.34	35.89	-1.42	-84.53	-22.09	-1237.50
		53	1.34	0.11	0.00	-11.34	25.29	1318.03
	26	52	-1.25	71.78	-1.42	-90.33	-22.14	-627.53
		53	1.25	-35.77	0.00	-5.56	25.32	869.54
	27	52	-1.25	69.94	-1.40	-86.53	-22.35	-658.67
		53	1.25	-33.94	-0.02	-9.36	25.45	892.41
53	20	53	-0.78	-48.41	2.08	112.45	-58.81	-1446.94
		54	0.78	85.91	-4.54	-215.10	41.45	1107.26
	21	53	-1.50	0.91	0.00	0.18	0.01	-11.25
		54	1.50	-0.91	0.00	-0.18	0.00	15.33
	22	53	-0.19	-0.04	1.70	111.83	-63.69	-1113.47
		54	0.19	67.53	-6.13	-296.57	46.09	961.45
	23	53	-0.13	-21.07	2.95	171.25	-51.52	-835.67
		54	0.13	58.57	-5.41	-273.90	30.27	619.02
	24	53	-1.27	-0.28	0.00	12.97	-34.34	-1642.04
		54	1.27	60.67	-2.38	-173.82	28.38	1489.07
	25	53	-1.34	-0.10	0.00	11.35	-25.29	-1318.04
		54	1.34	36.10	-1.42	-107.20	22.12	1236.59
	26	53	-1.25	35.77	0.00	5.57	-25.32	-869.54
		54	1.25	0.22	-1.42	-101.44	22.12	949.52
	27	53	-1.25	33.94	0.02	9.36	-25.45	-892.41
		54	1.25	2.06	-1.44	-105.23	22.18	964.14
54	20	54	-0.78	-85.92	4.54	214.90	-41.45	-1107.30
		55	0.78	85.92	-4.54	-214.90	21.01	720.66
	21	54	-1.50	0.91	0.00	0.18	0.00	-15.33
		55	1.50	-0.91	0.00	-0.18	0.01	19.41
	22	54	-0.19	-67.53	6.13	296.39	-46.09	-961.50
		55	0.19	90.03	-7.60	-357.98	12.98	573.21
	23	54	-0.13	-58.57	5.41	273.79	-30.27	-619.08
		55	0.13	58.57	-5.41	-273.79	5.94	355.49
	24	54	-1.27	-60.67	2.38	173.55	-28.38	-1489.10
		55	1.27	96.68	-3.79	-269.44	14.50	1135.03
	25	54	-1.34	-36.10	1.42	106.98	-22.12	-1236.60
		55	1.34	72.10	-2.83	-202.85	12.56	993.13
	26	54	-1.25	-0.22	1.42	101.26	-22.12	-949.54
		55	1.25	36.23	-2.84	-197.15	12.55	867.53

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	54	-1.25	-2.06	1.44	105.06	-22.18	-964.16
		55	1.25	38.06	-2.85	-200.94	12.53	873.89
55	20	55	-0.79	-85.92	4.54	216.56	-21.01	-720.17
		56	0.79	145.91	-8.48	-380.80	-7.28	213.59
	21	55	-1.50	0.91	-0.01	0.22	-0.01	-19.41
		56	1.50	-0.91	0.01	-0.22	0.04	23.49
	22	55	-0.20	-90.03	7.60	359.30	-12.98	-572.39
		56	0.20	90.03	-7.60	-359.30	-21.22	167.28
	23	55	-0.14	-58.57	5.41	274.60	-5.94	-354.87
		56	0.14	58.57	-5.41	-274.60	-18.38	91.33
	24	55	-1.28	-96.68	3.79	272.05	-14.50	-1134.41
		56	1.28	132.67	-5.21	-367.92	-5.74	618.42
	25	55	-1.35	-72.10	2.83	205.14	-12.56	-992.66
		56	1.35	108.10	-4.25	-301.00	-3.37	587.24
	26	55	-1.26	-36.22	2.83	199.14	-12.55	-867.08
		56	1.26	72.22	-4.25	-295.02	-3.39	623.10
	27	55	-1.26	-38.06	2.85	202.95	-12.53	-873.43
		56	1.26	74.05	-4.27	-298.83	-3.49	621.19
56	20	56	-0.79	-145.91	8.48	380.80	7.28	-213.60
		57	0.79	213.42	-12.90	-565.59	-55.39	-594.99
	21	56	-1.50	0.91	-0.01	0.22	-0.04	-23.49
		57	1.50	-0.91	0.01	-0.22	0.06	27.57
	22	56	-0.20	-90.03	7.60	359.30	21.22	-167.28
		57	0.20	90.03	-7.60	-359.30	-55.43	-237.91
	23	56	-0.14	-58.57	5.41	274.60	18.38	-91.33
		57	0.14	58.57	-5.41	-274.60	-42.71	-172.27
	24	56	-1.28	-132.67	5.21	367.92	5.74	-618.42
		57	1.28	168.68	-6.63	-463.81	-32.37	-59.72
	25	56	-1.35	-108.10	4.25	300.99	3.37	-587.24
		57	1.35	144.10	-5.66	-396.87	-25.67	19.71
	26	56	-1.26	-72.22	4.25	295.01	3.39	-623.11
		57	1.26	108.23	-5.67	-390.91	-25.71	217.05
	27	56	-1.26	-74.05	4.27	298.82	3.49	-621.19
		57	1.26	110.06	-5.69	-394.72	-25.89	206.88
57	20	57	-0.76	-213.42	12.91	566.88	55.39	593.76
		58	0.76	268.92	-16.55	-718.81	-109.88	-1486.10
	21	57	-1.50	0.91	0.00	0.16	-0.06	-27.57
		58	1.50	-0.91	0.00	-0.16	0.07	30.93
	22	57	-0.19	-90.03	7.60	359.82	55.43	237.13
		58	0.19	90.03	-7.60	-359.82	-83.56	-570.26
	23	57	-0.13	-58.57	5.41	274.98	42.71	171.67
		58	0.13	58.57	-5.41	-274.98	-62.71	-388.38
	24	57	-1.27	-168.68	6.63	463.94	32.37	58.71
		58	1.27	198.28	-7.79	-542.78	-59.05	-737.60
	25	57	-1.33	-144.10	5.67	396.83	25.67	-20.57
		58	1.33	173.71	-6.83	-475.66	-48.80	-567.40
	26	57	-1.24	-108.22	5.67	390.44	25.71	-217.90
		58	1.24	137.82	-6.84	-469.27	-48.85	-237.30

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	57	-1.25	-110.06	5.69	394.26	25.89	-207.74
		58	1.25	139.66	-6.85	-473.10	-49.09	-254.26
58	20	58	-0.96	-268.92	16.54	700.50	109.88	1494.81
		59	0.96	280.91	-17.32	-733.33	-123.41	-1714.63
	21	58	-1.50	0.91	-0.02	0.54	-0.07	-30.92
		59	1.50	-0.91	0.02	-0.54	0.09	31.65
	22	58	-0.28	-90.05	7.60	352.79	83.56	574.64
		59	0.28	90.05	-7.60	-352.79	-89.64	-646.61
	23	58	-0.20	-58.58	5.40	270.19	62.71	391.74
		59	0.20	58.58	-5.40	-270.19	-67.03	-438.56
	24	58	-1.36	-198.30	7.78	533.68	59.05	744.23
		59	1.36	204.69	-8.03	-550.72	-65.37	-905.29
	25	58	-1.42	-173.70	6.82	468.65	48.80	573.19
		59	1.42	180.10	-7.07	-485.69	-54.35	-714.64
	26	58	-1.33	-137.83	6.82	466.32	48.85	243.05
		59	1.33	144.22	-7.07	-483.36	-54.41	-355.80
	27	58	-1.33	-139.67	6.84	469.94	49.09	260.06
		59	1.33	146.06	-7.09	-486.98	-54.66	-374.26
59	20	59	-0.04	197.23	-11.12	-438.48	49.77	1675.78
		60	0.04	-185.23	10.34	405.62	-41.19	-1522.74
	21	59	-1.50	-3.14	0.00	-0.80	0.03	-31.68
		60	1.50	3.14	0.00	0.80	-0.03	29.17
	22	59	0.00	18.14	0.00	-2.29	0.00	633.37
		60	0.00	-18.14	0.00	2.29	0.00	-618.86
	23	59	0.00	12.28	0.00	-1.55	0.00	428.44
		60	0.00	-12.28	0.00	1.55	0.00	-418.62
	24	59	-1.07	5.40	0.00	-11.37	0.02	884.46
		60	1.07	-5.40	0.00	11.37	-0.02	-880.15
	25	59	-1.16	-0.31	0.00	-10.82	0.02	696.26
		60	1.16	0.31	0.00	10.82	-0.03	-696.52
	26	59	-1.07	-10.27	0.00	-9.39	0.02	337.69
		60	1.07	10.27	0.00	9.39	-0.02	-345.90
	27	59	-1.07	-9.77	0.00	-9.45	0.02	356.01
		60	1.07	9.77	0.00	9.45	-0.02	-363.81
60	20	60	-0.03	185.25	-10.34	-407.51	41.19	1522.23
		61	0.03	-129.74	6.70	255.57	-9.67	-939.43
	21	60	-1.50	-3.14	0.00	-0.76	0.03	-29.17
		61	1.50	3.14	0.00	0.76	-0.04	17.55
	22	60	0.00	18.14	0.00	-3.06	0.00	618.85
		61	0.00	-18.14	0.00	3.06	0.00	-551.72
	23	60	0.00	12.27	0.00	-2.07	0.00	418.62
		61	0.00	-12.27	0.00	2.07	0.00	-373.21
	24	60	-1.07	5.39	0.00	-12.46	0.02	880.14
		61	1.07	-5.39	0.00	12.46	-0.03	-860.21
	25	60	-1.16	-0.32	0.00	-11.68	0.03	696.51
		61	1.16	0.32	0.00	11.68	-0.03	-697.71
	26	60	-1.07	-10.28	0.00	-9.82	0.02	345.89
		61	1.07	10.28	0.00	9.82	-0.03	-383.92

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	60	-1.07	-9.75	0.00	-9.91	0.02	363.80
		61	1.07	9.75	0.00	9.91	-0.03	-399.89
61	20	61	-0.01	129.74	-6.70	-257.19	9.67	938.99
		62	0.01	-62.25	2.27	72.43	10.50	-507.03
	21	61	-1.50	-3.14	0.00	-0.73	0.04	-17.55
		62	1.50	3.14	0.00	0.73	-0.03	3.42
	22	61	0.00	18.14	0.00	-4.01	0.00	551.71
		62	0.00	-18.14	0.00	4.01	0.00	-470.07
	23	61	0.00	12.27	0.00	-2.71	0.00	373.20
		62	0.00	-12.27	0.00	2.71	0.00	-317.98
	24	61	-1.07	5.39	0.00	-13.94	0.03	860.18
		62	1.07	-5.39	0.00	13.94	-0.02	-835.94
	25	61	-1.16	-0.32	0.00	-12.88	0.03	697.69
		62	1.16	0.32	0.00	12.88	-0.03	-699.15
	26	61	-1.07	-10.28	0.00	-10.48	0.03	383.90
		62	1.07	10.28	0.00	10.48	-0.02	-430.14
	27	61	-1.07	-9.75	0.00	-10.60	0.03	399.87
		62	1.07	9.75	0.00	10.60	-0.02	-443.75
62	20	62	-0.02	62.25	-2.27	-71.45	-10.50	507.16
		63	0.02	-17.25	-0.68	-51.73	11.85	-362.06
	21	62	-1.50	-3.14	0.00	-0.74	0.03	-3.42
		63	1.50	3.14	0.00	0.74	-0.04	-10.71
	22	62	0.00	18.14	0.00	-3.10	0.00	470.08
		63	0.00	-18.14	0.00	3.10	0.00	-388.44
	23	62	0.00	12.27	0.00	-2.10	0.00	317.98
		63	0.00	-12.27	0.00	2.10	0.00	-262.76
	24	62	-1.07	5.39	0.00	-12.32	0.02	835.97
		63	1.07	-5.39	0.00	12.32	-0.03	-811.73
	25	62	-1.16	-0.32	0.00	-11.53	0.03	699.17
		63	1.16	0.32	0.00	11.53	-0.03	-700.64
	26	62	-1.07	-10.28	0.00	-9.64	0.02	430.16
		63	1.07	10.28	0.00	9.64	-0.03	-476.40
	27	62	-1.07	-9.75	0.00	-9.73	0.02	443.76
		63	1.07	9.75	0.00	9.73	-0.03	-487.64
63	20	63	-0.02	17.25	0.68	50.20	-11.85	362.28
		64	0.02	-17.25	-0.68	-50.20	8.77	-284.67
	21	63	-1.50	-3.14	0.00	-0.78	0.04	10.70
		64	1.50	3.14	0.00	0.78	-0.02	-24.83
	22	63	0.00	18.14	0.00	-4.74	0.00	388.42
		64	0.00	-18.14	0.00	4.74	0.00	-306.78
	23	63	0.00	12.27	0.00	-3.21	0.00	262.75
		64	0.00	-12.27	0.00	3.21	0.00	-207.52
	24	63	-1.07	5.39	0.00	-15.76	0.03	811.68
		64	1.07	-5.39	0.00	15.76	-0.02	-787.44
	25	63	-1.16	-0.32	0.00	-14.49	0.03	700.58
		64	1.16	0.32	0.00	14.49	-0.02	-702.04
	26	63	-1.07	-10.28	0.00	-11.66	0.03	476.36
		64	1.07	10.28	0.00	11.66	-0.02	-522.60

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	63	-1.07	-9.75	0.00	-11.80	0.03	487.60
		64	1.07	9.75	0.00	11.80	-0.02	-531.48
64	20	64	-0.02	17.25	0.68	50.80	-8.77	284.56
		65	0.02	-17.25	-0.68	-50.80	5.69	-206.96
	21	64	-1.50	-3.14	0.00	-0.73	0.02	24.83
		65	1.50	3.14	0.00	0.73	-0.02	-38.96
	22	64	0.00	18.14	0.00	-4.10	0.00	306.79
		65	0.00	-18.14	0.00	4.10	0.00	-225.15
	23	64	0.00	12.27	0.00	-2.77	0.00	207.53
		65	0.00	-12.27	0.00	2.77	0.00	-152.30
	24	64	-1.07	5.39	0.00	-14.09	0.02	787.47
		65	1.07	-5.39	0.00	14.09	-0.01	-763.23
	25	64	-1.16	-0.32	0.00	-13.01	0.02	702.07
		65	1.16	0.32	0.00	13.01	-0.01	-703.53
	26	64	-1.07	-10.28	0.00	-10.55	0.02	522.62
		65	1.07	10.28	0.00	10.55	-0.01	-568.86
	27	64	-1.07	-9.75	0.00	-10.67	0.02	531.51
		65	1.07	9.75	0.00	10.67	-0.01	-575.38
65	20	65	-0.02	17.25	0.68	50.37	-5.69	207.06
		66	0.02	-17.25	-0.68	-50.37	2.62	-129.45
	21	65	-1.50	-3.14	0.00	-0.81	0.02	38.96
		66	1.50	3.14	0.00	0.81	0.00	-53.09
	22	65	0.00	18.14	0.00	-4.57	0.00	225.14
		66	0.00	-18.14	0.00	4.57	0.00	-143.49
	23	65	0.00	12.27	0.00	-3.09	0.00	152.29
		66	0.00	-12.27	0.00	3.09	0.00	-97.06
	24	65	-1.07	5.38	0.00	-15.71	0.01	763.19
		66	1.07	-5.38	0.00	15.71	0.00	-738.97
	25	65	-1.16	-0.32	0.00	-14.50	0.01	703.50
		66	1.16	0.32	0.00	14.50	0.00	-704.96
	26	65	-1.07	-10.28	0.00	-11.76	0.01	568.84
		66	1.07	10.28	0.00	11.76	0.00	-615.09
	27	65	-1.07	-9.75	0.00	-11.89	0.01	575.36
		66	1.07	9.75	0.00	11.89	0.00	-619.24
66	20	66	-0.02	17.25	0.68	50.64	-2.62	129.35
		67	0.02	-17.25	-0.68	-50.64	-0.46	-51.74
	21	66	-1.50	-3.14	0.00	-0.70	0.00	53.09
		67	1.50	3.14	0.00	0.70	0.01	-67.22
	22	66	0.00	18.14	0.00	-4.27	0.00	143.50
		67	0.00	-18.14	0.00	4.27	0.00	-61.86
	23	66	0.00	12.27	0.00	-2.89	0.00	97.07
		67	0.00	-12.27	0.00	2.89	0.00	-41.84
	24	66	-1.07	5.39	0.00	-14.14	0.00	738.99
		67	1.07	-5.39	0.00	14.14	0.01	-714.76
	25	66	-1.16	-0.32	0.00	-13.00	0.00	705.00
		67	1.16	0.32	0.00	13.00	0.01	-706.45
	26	66	-1.07	-10.27	0.00	-10.46	0.00	615.11
		67	1.07	10.27	0.00	10.46	0.01	-661.35

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	66	-1.07	-9.75	0.00	-10.58	0.00	619.26
		67	1.07	9.75	0.00	10.58	0.01	-663.14
67	20	67	-0.02	17.25	0.68	50.41	0.46	51.96
		68	0.02	-17.25	-0.68	-50.41	-3.54	25.65
	21	67	-1.50	-3.14	-0.01	-1.00	-0.01	67.22
		68	1.50	3.14	0.01	1.00	0.05	-81.35
	22	67	0.00	18.14	0.00	-4.54	0.00	61.84
		68	0.00	-18.14	0.00	4.54	0.00	19.81
	23	67	0.00	12.27	0.00	-3.07	0.00	41.83
		68	0.00	-12.27	0.00	3.07	0.00	13.40
	24	67	-1.07	5.39	-0.01	-17.29	-0.01	714.68
		68	1.07	-5.39	0.01	17.29	0.03	-690.44
	25	67	-1.16	-0.32	-0.01	-16.12	-0.01	706.39
		68	1.16	0.32	0.01	16.12	0.04	-707.85
	26	67	-1.07	-10.28	-0.01	-13.37	-0.01	661.30
		68	1.07	10.28	0.01	13.37	0.03	-707.55
	27	67	-1.07	-9.75	-0.01	-13.50	-0.01	663.09
		68	1.07	9.75	0.01	13.50	0.03	-706.97
68	20	68	-0.02	17.25	0.68	50.35	3.54	-25.77
		69	0.02	-17.25	-0.68	-50.35	-6.61	103.36
	21	68	-1.50	-3.14	0.00	-0.81	-0.05	81.35
		69	1.50	3.14	0.00	0.81	0.07	-95.47
	22	68	0.00	18.14	0.00	-4.59	0.00	-19.80
		69	0.00	-18.14	0.00	4.59	0.00	101.43
	23	68	0.00	12.27	0.00	-3.10	0.00	-13.40
		69	0.00	-12.27	0.00	3.10	0.00	68.61
	24	68	-1.07	5.38	0.00	-15.71	-0.03	690.48
		69	1.07	-5.38	0.00	15.71	0.05	-666.25
	25	68	-1.16	-0.32	0.00	-14.50	-0.04	707.88
		69	1.16	0.32	0.00	14.50	0.05	-709.34
	26	68	-1.07	-10.28	0.00	-11.76	-0.03	707.58
		69	1.07	10.28	0.00	11.76	0.05	-753.81
	27	68	-1.07	-9.75	0.00	-11.89	-0.03	707.00
		69	1.07	9.75	0.00	11.89	0.05	-750.87
69	20	69	-0.02	17.25	0.68	50.49	6.61	-103.29
		70	0.02	-17.25	-0.68	-50.49	-9.14	167.10
	21	69	-1.50	-3.14	-0.01	-0.94	-0.07	95.47
		70	1.50	3.14	0.01	0.94	0.09	-107.09
	22	69	0.00	18.14	0.00	-4.45	0.00	-101.44
		70	0.00	-18.14	0.00	4.45	0.00	168.57
	23	69	0.00	12.27	0.00	-3.01	0.00	-68.62
		70	0.00	-12.27	0.00	3.01	0.00	114.03
	24	69	-1.07	5.39	0.00	-16.61	-0.05	666.22
		70	1.07	-5.39	0.00	16.61	0.07	-646.30
	25	69	-1.16	-0.32	-0.01	-15.45	-0.05	709.32
		70	1.16	0.32	0.01	15.45	0.07	-710.52
	26	69	-1.07	-10.28	0.00	-12.77	-0.05	753.79
		70	1.07	10.28	0.00	12.77	0.07	-791.82

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	69	-1.07	-9.75	0.00	-12.90	-0.05	750.86
		70	1.07	9.75	0.00	12.90	0.07	-786.94
70	20	70	-0.03	17.25	0.68	51.37	9.14	-166.83
		71	0.03	-17.25	-0.68	-51.37	-9.69	180.64
	21	70	-1.50	-3.14	-0.01	-1.51	-0.09	107.08
		71	1.50	3.14	0.01	1.51	0.10	-109.60
	22	70	0.00	18.14	0.00	-3.56	0.00	-168.59
		71	0.00	-18.14	0.00	3.56	0.00	183.11
	23	70	0.00	12.27	0.00	-2.41	0.00	-114.04
		71	0.00	-12.27	0.00	2.41	0.00	123.86
	24	70	-1.07	5.41	-0.01	-20.03	-0.07	646.20
		71	1.07	-5.41	0.01	20.03	0.07	-641.88
	25	70	-1.16	-0.31	-0.01	-19.21	-0.07	710.43
		71	1.16	0.31	0.01	19.21	0.08	-710.68
	26	70	-1.07	-10.30	-0.01	-16.95	-0.07	791.74
		71	1.07	10.30	0.01	16.95	0.07	-799.96
	27	70	-1.07	-9.74	-0.01	-17.06	-0.07	786.86
		71	1.07	9.74	0.01	17.06	0.07	-794.67
71	20	71	0:00	-5.23	0.00	-0.31	0.00	-182.51
		72	0.00	5.23	0.00	0.31	0.00	178.33
	21	71	-1.50	10.87	0.01	3.99	0.05	109.71
		72	1.50	-10.87	-0.01	-3.99	-0.06	-101.02
	22	71	0.00	-5.24	0.00	-0.31	0.00	-182.91
		72	0.00	5.24	0.00	0.31	0.00	178.72
	23	71	0.00	-3.54	0.00	-0.21	0.00	-123.73
		72	0.00	3.54	0.00	0.21	0.00	120.90
	24	71	-0.89	176.45	-7.08	-460.22	54.45	630.95
		72	0.89	-170.06	6.83	443.19	-48.89	-492.51
	25	71	-0.98	179.51	-7.08	-459.49	54.45	699.72
		72	0.98	-173.12	6.83	442.46	-48.90	-558.80
	26	71	-0.89	180.95	-7.08	-459.95	54.45	788.86
		72	0.89	-174.55	6.83	442.92	-48.89	-646.79
	27	71	-0.89	180.78	-7.08	-459.96	54.45	783.55
		72	0.89	-174.39	6.83	442.93	-48.89	-641.63
72	20	72	0.00	-5.23	0.00	1.54	0.00	-178.33
		73	0.00	5.23	0.00	-1.54	0.00	158.98
	21	72	-1.50	10.87	0.00	2.95	0.06	101.05
		73	1.50	-10.87	0.00	-2.95	-0.04	-60.81
	22	72	0.00	-5.24	0.00	1.54	0.00	-178.72
		73	0.00	5.24	0.00	-1.54	0.00	159.33
	23	72	0.00	-3.54	0.00	1.04	0.00	-120.89
		73	0.00	3.54	0.00	-1.04	0.00	107.78
	24	72	-0.82	170.02	-6.84	-448.26	48.89	487.89
		73	0.82	-140.42	5.67	369.42	-25.75	86.46
	25	72	-0.91	173.10	-6.84	-448.22	48.90	554.20
		73	0.91	-143.50	5.67	369.39	-25.75	31.55
	26	72	-0.82	174.54	-6.84	-449.59	48.89	642.18
		73	0.82	-144.94	5.67	370.75	-25.75	-51.09

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	72	-0.82	174.39	-6.84	-449.55	48.89	637.00
		73	0.82	-144.79	5.67	370.71	-25.75	-46.47
73	20	73	0.00	-5.23	0.00	1.24	0.00	-158.98
		74	0.00	5.23	0.00	-1.24	0.00	135.45
	21	73	-1.50	10.87	0.00	3.06	0.04	60.81
		74	1.50	-10.87	0.00	-3.06	-0.04	-11.87
	22	73	0.00	-5.24	0.00	1.25	0.00	-159.33
		74	0.00	5.24	0.00	-1.25	0.00	135.75
	23	73	0.00	-3.54	0.00	0.84	0.00	-107.78
		74	0.00	3.54	0.00	-0.84	0.00	91.83
	24	73	-0.83	140.42	-5.67	-369.58	25.75	-85.78
		74	0.83	-104.42	4.25	273.69	-3.42	636.71
	25	73	-0.92	143.49	-5.67	-369.45	25.75	-30.86
		74	0.92	-107.49	4.25	273.57	-3.43	595.64
	26	73	-0.83	144.94	-5.67	-370.66	25.75	51.77
		74	0.83	-108.94	4.25	274.76	-3.42	519.51
	27	73	-0.83	144.79	-5.67	-370.62	25.75	47.16
		74	0.83	-108.79	4.25	274.73	-3.42	523.45
74	20	74	0.00	-5.23	0.00	1.24	0.00	-135.45
		75	0.00	5.23	0.00	-1.24	0.00	111.93
	21	74	-1.50	10.87	0.00	3.06	0.04	11.87
		75	1.50	-10.87	0.00	-3.06	-0.04	37.06
	22	74	0.00	-5.24	0.00	1.25	0.00	-135.75
		75	0.00	5.24	0.00	-1.25	0.00	112.17
	23	74	0.00	-3.54	0.00	0.84	0.00	-91.83
		75	0.00	3.54	0.00	-0.84	0.00	75.88
	24	74	-0.83	104.41	-4.25	-273.68	3.42	-636.71
		75	0.83	-68.42	2.84	177.81	12.52	1025.54
	25	74	-0.92	107.49	-4.25	-273.57	3.43	-595.65
		75	0.92	-71.50	2.84	177.71	12.52	998.33
	26	74	-0.83	108.94	-4.25	-274.76	3.42	-519.51
		75	0.83	-72.94	2.84	178.89	12.52	928.71
	27	74	-0.83	108.79	-4.25	-274.72	3.42	-523.45
		75	0.83	-72.79	2.84	178.85	12.52	931.95
75	20	75	0.00	-5.23	0.00	1.50	0.00	-111.92
		76	0.00	5.23	0.00	-1.50	0.00	88.39
	21	75	-1.50	10.87	0.00	3.14	0.04	-37.05
		76	1.50	-10.87	0.00	-3.14	-0.03	86.00
	22	75	0.00	-5.24	0.00	1.50	0.00	-112.17
		76	0.00	5.24	0.00	-1.50	0.00	88.58
	23	75	0.00	-3.54	0.00	1.02	0.00	-75.88
		76	0.00	3.54	0.00	-1.02	0.00	59.92
	24	75	-0.83	68.42	-2.84	-175.47	-12.52	-1025.94
		76	0.83	-32.41	1.42	79.57	22.10	1252.85
	25	75	-0.91	71.50	-2.84	-175.43	-12.52	-998.73
		76	0.91	-35.49	1.42	79.54	22.10	1239.48
	26	75	-0.83	72.94	-2.84	-176.77	-12.52	-929.11
		76	0.83	-36.93	1.42	80.87	22.10	1176.37

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	75	-0.83	72.79	-2.84	-176.72	-12.52	-932.36
		76	0.83	-36.78	1.42	80.82	22.10	1178.93
76	20	76	0.00	-5.23	0.00	1.48	0.00	-88.39
		77	0.00	5.23	0.00	-1.48	0.00	64.86
	21	76	-1.50	10.87	0.00	3.13	0.03	-86.00
		77	1.50	-10.87	0.00	-3.13	-0.01	134.93
	22	76	0.00	-5.24	0.00	1.49	0.00	-88.59
		77	0.00	5.24	0.00	-1.49	0.00	65.01
	23	76	0.00	-3.54	0.00	1.01	0.00	-59.92
		77	0.00	3.54	0.00	-1.01	0.00	43.97
	24	76	-0.83	32.41	-1.42	-79.78	-22.10	-1252.83
		77	0.83	3.59	0.00	-16.10	25.30	1317.69
	25	76	-0.91	35.49	-1.42	-79.75	-22.10	-1239.48
		77	0.91	0.51	0.00	-16.11	25.30	1318.17
	26	76	-0.83	36.93	-1.42	-81.07	-22.10	-1176.36
		77	0.83	-0.94	0.00	-14.81	25.30	1261.57
	27	76	-0.83	36.78	-1.42	-81.02	-22.10	-1178.92
		77	0.83	-0.78	0.00	-14.86	25.30	1263.44
77	20	77	0.00	-5.23	0.00	1.50	0.00	-64.86
		78	0.00	5.23	0.00	-1.50	0.00	41.34
	21	77	-1.50	10.87	0.00	3.15	0.01	-134.93
		78	1.50	-10.87	0.00	-3.15	0.00	183.86
	22	77	0.00	-5.24	0.00	1.50	0.00	-65.01
		78	0.00	5.24	0.00	-1.50	0.00	41.43
	23	77	0.00	-3.54	0.00	1.01	0.00	-43.97
		78	0.00	3.54	0.00	-1.01	0.00	28.02
	24	77	-0.83	-3.59	0.00	16.33	-25.30	-1317.68
		78	0.83	39.59	-1.42	-112.21	22.12	1220.55
	25	77	-0.91	-0.51	0.00	16.35	-25.30	-1318.17
		78	0.91	36.51	-1.42	-112.21	22.12	1234.88
	26	77	-0.83	0.94	0.00	15.04	-25.30	-1261.56
		78	0.83	35.06	-1.42	-110.91	22.12	1184.78
	27	77	-0.83	0.79	0.00	15.08	-25.30	-1263.45
		78	0.83	35.21	-1.42	-110.96	22.12	1185.98
78	20	78	0.00	-5.23	0.00	1.49	0.00	-41.34
		79	0.00	5.23	0.00	-1.49	0.00	17.81
	21	78	-1.50	10.87	0.00	3.12	0.00	-183.86
		79	1.50	-10.87	0.00	-3.12	0.02	232.80
	22	78	0.00	-5.24	0.00	1.49	0.00	-41.43
		79	0.00	5.24	0.00	-1.49	0.00	17.85
	23	78	0.00	-3.54	0.00	1.01	0.00	-28.02
		79	0.00	3.54	0.00	-1.01	0.00	12.07
	24	78	-0.83	-39.59	1.42	111.99	-22.12	-1220.57
		79	0.83	75.59	-2.83	-207.87	12.56	961.43
	25	78	-0.91	-36.51	1.42	111.99	-22.12	-1234.90
		79	0.91	72.51	-2.83	-207.86	12.56	989.63
	26	78	-0.83	-35.06	1.42	110.70	-22.12	-1184.80
		79	0.83	71.06	-2.83	-206.58	12.56	946.03

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	78	-0.83	-35.22	1.42	110.75	-22.12	-1186.00
		79	0.83	71.22	-2.83	-206.63	12.56	946.54
79	20	79	0.00	-5.23	0.00	1.53	0.00	-17.81
		80	0.00	5.23	0.00	-1.53	0.00	-5.72
	21	79	-1.50	10.87	-0.01	3.65	-0.02	-232.79
		80	1.50	-10.87	0.01	-3.65	0.05	281.73
	22	79	0.00	-5.24	0.00	1.53	0.00	-17.85
		80	0.00	5.24	0.00	-1.53	0.00	-5.74
	23	79	0.00	-3.54	0.00	1.04	0.00	-12.07
		80	0.00	3.54	0.00	-1.04	0.00	-3.88
	24	79	-0.83	-75.59	2.83	210.07	-12.56	-960.96
		80	0.83	111.59	-4.25	-305.96	-3.37	539.80
	25	79	-0.92	-72.51	2.83	210.12	-12.56	-989.15
		80	0.92	108.51	-4.25	-306.00	-3.37	581.84
	26	79	-0.83	-71.06	2.83	208.75	-12.56	-945.55
		80	0.83	107.06	-4.25	-304.64	-3.37	544.75
	27	79	-0.83	-71.21	2.83	208.79	-12.56	-946.06
		80	0.83	107.21	-4.25	-304.68	-3.37	544.59
80	20	80	0.00	-5.23	0.00	1.53	0.00	5.72
		81	0.00	5.23	0.00	-1.53	0.00	-29.25
	21	80	-1.50	10.87	-0.01	3.70	-0.05	-281.73
		81	1.50	-10.87	0.01	-3.70	0.08	330.66
	22	80	0.00	-5.24	0.00	1.53	0.00	5.74
		81	0.00	5.24	0.00	-1.53	0.00	-29.32
	23	80	0.00	-3.54	0.00	1.04	0.00	3.88
		81	0.00	3.54	0.00	-1.04	0.00	-19.83
	24	80	-0.83	-111.59	4.25	306.05	3.37	-539.74
		81	0.83	147.59	-5.67	-401.94	-25.69	-43.43
	25	80	-0.92	-108.51	4.25	306.10	3.37	-581.79
		81	0.92	144.51	-5.67	-401.97	-25.68	12.46
	26	80	-0.83	-107.06	4.25	304.73	3.37	-544.69
		81	0.83	143.06	-5.67	-400.62	-25.69	-18.12
	27	80	-0.83	-107.22	4.25	304.78	3.37	-544.53
		81	0.83	143.22	-5.67	-400.66	-25.69	-18.97
81	20	81	0.00	-5.23	0.00	1.53	0.00	29.25
		82	0.00	5.23	0.00	-1.53	0.00	-48.60
	21	81	-1.50	10.87	-0.01	3.65	-0.08	-330.67
		82	1.50	-10.87	0.01	-3.65	0.11	370.90
	22	81	0.00	-5.24	0.00	1.54	0.00	29.32
		82	0.00	5.24	0.00	-1.54	0.00	-48.70
	23	81	0.00	-3.54	0.00	1.04	0.00	19.83
		82	0.00	3.54	0.00	-1.04	0.00	-32.94
	24	81	-0.83	-147.59	5.67	401.95	25.69	43.37
		82	0.83	177.18	-6.83	-480.78	-48.80	-644.14
	25	81	-0.92	-144.51	5.67	401.97	25.68	-12.53
		82	0.92	174.11	-6.83	-480.79	-48.80	-576.86
	26	81	-0.83	-143.07	5.67	400.62	25.69	18.06
		82	0.83	172.66	-6.83	-479.45	-48.80	-602.10

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	81	-0.83	-143.22	5.67	400.67	25.69	18.91
		82	0.83	172.81	-6.83	-479.49	-48.80	-603.51
82	20	82	0.00	-5.23	0.00	1.53	0.00	48.60
		83	0.00	5.23	0.00	-1.53	0.00	-52.78
	21	82	-1.50	10.87	-0.01	3.63	-0.11	-370.89
		83	1.50	-10.87	0.01	-3.63	0.11	379.60
	22	82	0.00	-5.24	0.00	1.54	0.00	48.70
		83	0.00	5.24	0.00	-1.54	0.00	-52.89
	23	82	0.00	-3.54	0.00	1.04	0.00	32.94
		83	0.00	3.54	0.00	-1.04	0.00	-35.78
	24	82	-0.83	-177.17	6.83	480.80	48.80	644.12
		83	0.83	183.56	-7.08	-497.84	-54.37	-788.37
	25	82	-0.92	-174.12	6.83	480.81	48.80	576.84
		83	0.92	180.52	-7.08	-497.84	-54.36	-718.61
	26	82	-0.83	-172.68	6.83	479.47	48.80	602.08
		83	0.83	179.07	-7.08	-496.51	-54.37	-742.70
	27	82	-0.83	-172.84	6.83	479.52	48.80	603.48
		83	0.83	179.24	-7.08	-496.55	-54.37	-744.23
83	20	83	0.00	1.51	0.00	-0.36	0.00	52.70
		84	0.00	-1.51	0.00	0.36	0.00	-51.50
	21	83	-1.50	-37.67	0.00	-12.80	0.06	-380.21
		84	1.50	37.67	0.00	12.80	-0.06	350.05
	22	83	0.00	1.51	0.00	-0.36	0.00	52.82
		84	0.00	-1.51	0.00	0.36	0.00	-51.61
	23	83	0.00	1.02	0.00	-0.24	0.00	35.73
		84	0.00	-1.02	0.00	0.24	0.00	-34.91
	24	83	-0.56	5.89	0.00	-14.55	0.02	769.02
		84	0.56	-5.89	0.00	14.55	-0.02	-764.31
	25	83	-0.65	0.02	0.00	-16.28	0.03	699.21
		84	0.65	-0.02	0.00	16.28	-0.03	-699.18
	26	83	-0.56	4.55	0.00	-14.24	0.02	723.41
		84	0.56	-4.55	0.00	14.24	-0.02	-719.76
	27	83	-0.56	4.58	0.00	-14.25	0.02	724.93
		84	0.56	-4.58	0.00	14.25	-0.02	-721.27
84	20	84	0.00	1.51	0.00	-0.36	0.00	51.49
		85	0.00	-1.51	0.00	0.36	0.00	-45.91
	21	84	-1.50	-37.67	0.00	-12.77	0.06	-350.05
		85	1.50	37.67	0.00	12.77	-0.06	210.68
	22	84	0.00	1.51	0.00	-0.36	0.00	51.61
		85	0.00	-1.51	0.00	0.36	0.00	-46.01
	23	84	0.00	1.02	0.00	-0.25	0.00	34.91
		85	0.00	-1.02	0.00	0.25	0.00	-31.12
	24	84	-0.56	5.87	0.00	-14.61	0.02	764.32
		85	0.56	-5.87	0.00	14.61	-0.02	-742.61
	25	84	-0.65	0.03	0.00	-16.33	0.03	699.18
		85	0.65	-0.03	0.00	16.33	-0.03	-699.07
	26	84	-0.56	4.56	0.00	-14.30	0.02	719.76
		85	0.56	-4.56	0.00	14.30	-0.02	-702.90

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	84	-0.56	4.60	0.00	-14.31	0.02	721.26
		85	0.56	-4.60	0.00	14.31	-0.02	-704.22
85	20	85	0.00	1.51	0.00	-0.47	0.00	45.91
		86	0.00	-1.51	0.00	0.47	0.00	-39.11
	21	85	-1.50	-37.67	0.00	-12.29	0.06	-210.71
		86	1.50	37.67	0.00	12.29	-0.05	41.21
	22	85	0.00	1.51	0.00	-0.47	0.00	46.01
		86	0.00	-1.51	0.00	0.47	0.00	-39.19
	23	85	0.00	1.02	0.00	-0.32	0.00	31.12
		86	0.00	-1.02	0.00	0.32	0.00	-26.51
	24	85	-0.56	5.87	0.00	-16.31	0.02	742.57
		86	0.56	-5.87	0.00	16.31	-0.02	-716.17
	25	85	-0.65	0.03	0.00	-17.93	0.03	699.03
		86	0.65	-0.03	0.00	17.93	-0.02	-698.90
	26	85	-0.56	4.56	0.00	-15.90	0.02	702.86
		86	0.56	-4.56	0.00	15.90	-0.02	-682.34
	27	85	-0.56	4.60	0.00	-15.92	0.02	704.19
		86	0.56	-4.60	0.00	15.92	-0.02	-683.47
86	20	86	0.00	1.51	0.00	-0.47	0.00	39.11
		87	0.00	-1.51	0.00	0.47	0.00	-32.31
	21	86	-1.50	-37.67	0.00	-12.29	0.05	-41.21
		87	1.50	37.67	0.00	12.29	-0.04	-128.33
	22	86	0.00	1.51	0.00	-0.47	0.00	39.19
		87	0.00	-1.51	0.00	0.47	0.00	-32.38
	23	86	0.00	1.02	0.00	-0.32	0.00	26.51
		87	0.00	-1.02	0.00	0.32	0.00	-21.90
	24	86	-0.56	5.87	0.00	-16.30	0.02	716.17
		87	0.56	-5.87	0.00	16.30	-0.02	-689.77
	25	86	-0.65	0.03	0.00	-17.93	0.02	698.90
		87	0.65	-0.03	0.00	17.93	-0.02	-698.77
	26	86	-0.56	4.56	0.00	-15.90	0.02	682.34
		87	0.56	-4.56	0.00	15.90	-0.02	-661.81
	27	86	-0.56	4.60	0.00	-15.91	0.02	683.47
		87	0.56	-4.60	0.00	15.91	-0.02	-662.75
87	20	87	0.00	1.51	0.00	-0.47	0.00	32.31
		88	0.00	-1.51	0.00	0.47	0.00	-25.51
	21	87	-1.50	-37.67	0.00	-12.29	0.04	128.33
		88	1.50	37.67	0.00	12.29	-0.03	-297.84
	22	87	0.00	1.51	0.00	-0.47	0.00	32.38
		88	0.00	-1.51	0.00	0.47	0.00	-25.57
	23	87	0.00	1.02	0.00	-0.32	0.00	21.90
		88	0.00	-1.02	0.00	0.32	0.00	-17.30
	24	87	-0.56	5.87	0.00	-16.31	0.02	689.77
		88	0.56	-5.87	0.00	16.31	-0.01	-663.37
	25	87	-0.65	0.03	0.00	-17.93	0.02	698.78
		88	0.65	-0.03	0.00	17.93	-0.01	-698.64
	26	87	-0.56	4.56	0.00	-15.90	0.02	661.82
		88	0.56	-4.56	0.00	15.90	-0.01	-641.29

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	87	-0.56	4.61	0.00	-15.91	0.02	662.74
		88	0.56	-4.61	0.00	15.91	-0.01	-642.03
88	20	88	0.00	1.51	0.00	-0.52	0.00	25.51
		89	0.00	-1.51	0.00	0.52	0.00	-18.72
	21	88	-1.50	-37.67	-0.01	-12.92	0.03	297.82
		89	1.50	37.67	0.01	12.92	-0.01	-467.33
	22	88	0.00	1.51	0.00	-0.52	0.00	25.57
		89	0.00	-1.51	0.00	0.52	0.00	-18.76
	23	88	0.00	1.02	0.00	-0.35	0.00	17.30
		89	0.00	-1.02	0.00	0.35	0.00	-12.69
	24	88	-0.56	5.87	0.00	-17.71	0.01	663.34
		89	0.56	-5.87	0.00	17.71	0.00	-636.92
	25	88	-0.65	0.03	0.00	-19.41	0.01	698.60
		89	0.65	-0.03	0.00	19.41	0.00	-698.47
	26	88	-0.56	4.56	0.00	-17.26	0.01	641.26
		89	0.56	-4.56	0.00	17.26	0.00	-620.73
	27	88	-0.56	4.61	0.00	-17.27	0.01	642.00
		89	0.56	-4.61	0.00	17.27	0.00	-621.28
89	20	89	0.00	1.51	0.00	-0.48	0.00	18.72
		90	0.00	-1.51	0.00	0.48	0.00	-11.92
	21	89	-1.50	-37.67	0.00	-11.93	0.01	467.36
		90	1.50	37.67	0.00	11.93	0.00	-636.90
	22	89	0.00	1.51	0.00	-0.48	0.00	18.76
		90	0.00	-1.51	0.00	0.48	0.00	-11.94
	23	89	0.00	1.02	0.00	-0.33	0.00	12.69
		90	0.00	-1.02	0.00	0.33	0.00	-8.08
	24	89	-0.56	5.87	0.00	-16.36	0.00	636.96
		90	0.56	-5.87	0.00	16.36	0.00	-610.56
	25	89	-0.65	0.03	0.00	-17.93	0.00	698.52
		90	0.65	-0.03	0.00	17.93	0.00	-698.38
	26	89	-0.56	4.56	0.00	-15.94	0.00	620.78
		90	0.56	-4.56	0.00	15.94	0.00	-600.24
	27	89	-0.56	4.60	0.00	-15.95	0.00	621.31
		90	0.56	-4.60	0.00	15.95	0.00	-600.59
90	20	90	0.00	1.51	0.00	-0.51	0.00	11.92
		91	0.00	-1.51	0.00	0.51	0.00	-5.12
	21	90	-1.50	-37.67	-0.01	-13.28	0.00	636.88
		91	1.50	37.67	0.01	13.28	0.03	-806.40
	22	90	0.00	1.51	0.00	-0.51	0.00	11.94
		91	0.00	-1.51	0.00	0.51	0.00	-5.13
	23	90	0.00	1.02	0.00	-0.34	0.00	8.08
		91	0.00	-1.02	0.00	0.34	0.00	-3.47
	24	90	-0.56	5.87	0.00	-17.65	0.00	610.52
		91	0.56	-5.87	0.00	17.65	0.01	-584.12
	25	90	-0.65	0.03	0.00	-19.41	0.00	698.34
		91	0.65	-0.03	0.00	19.41	0.01	-698.21
	26	90	-0.56	4.56	0.00	-17.21	0.00	600.21
		91	0.56	-4.56	0.00	17.21	0.01	-579.69

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	90	-0.56	4.60	0.00	-17.23	0.00	600.56
		91	0.56	-4.60	0.00	17.23	0.01	-579.83
91	20	91	0.00	1.51	0.00	-0.51	0.00	5.12
		92	0.00	-1.51	0.00	0.51	0.00	1.68
	21	91	-1.50	-37.67	-0.01	-13.29	-0.03	806.40
		92	1.50	37.67	0.01	13.29	0.05	-975.88
	22	91	0.00	1.51	0.00	-0.51	0.00	5.13
		92	0.00	-1.51	0.00	0.51	0.00	1.68
	23	91	0.00	1.02	0.00	-0.34	0.00	3.47
		92	0.00	-1.02	0.00	0.34	0.00	1.14
	24	91	-0.56	5.87	0.00	-17.66	-0.01	584.12
		92	0.56	-5.87	0.00	17.66	0.02	-557.72
	25	91	-0.65	0.03	0.00	-19.42	-0.01	698.22
		92	0.65	-0.03	0.00	19.42	0.02	-698.08
	26	91	-0.56	4.56	0.00	-17.22	-0.01	579.69
		92	0.56	-4.56	0.00	17.22	0.02	-559.17
	27	91	-0.56	4.60	0.00	-17.23	-0.01	579.84
		92	0.56	-4.60	0.00	17.23	0.02	-559.12
92	20	92	0.00	1.51	0.00	-0.50	0.00	-1.68
		93	0.00	-1.51	0.00	0.50	0.00	8.48
	21	92	-1.50	-37.67	-0.01	-15.51	-0.05	975.85
		93	1.50	37.67	0.01	15.51	0.09	-1145.38
	22	92	0.00	1.51	0.00	-0.51	0.00	-1.68
		93	0.00	-1.51	0.00	0.51	0.00	8.49
	23	92	0.00	1.02	0.00	-0.34	0.00	-1.14
		93	0.00	-1.02	0.00	0.34	0.00	5.75
	24	92	-0.56	5.87	0.00	-18.93	-0.02	557.68
		93	0.56	-5.87	0.00	18.93	0.03	-531.27
	25	92	-0.65	0.03	0.00	-21.01	-0.02	698.04
		93	0.65	-0.03	0.00	21.01	0.04	-697.91
	26	92	-0.56	4.56	0.00	-18.50	-0.02	559.13
		93	0.56	-4.56	0.00	18.50	0.03	-538.61
	27	92	-0.56	4.61	0.00	-18.51	-0.02	559.08
		93	0.56	-4.61	0.00	18.51	0.03	-538.36
93	20	93	0.00	1.51	0.00	-0.51	0.00	-8.47
		94	0.00	-1.51	0.00	0.51	0.00	14.06
	21	93	-1.50	-37.67	-0.01	-14.23	-0.09	1145.40
		94	1.50	37.67	0.01	14.23	0.12	-1284.80
	22	93	0.00	1.51	0.00	-0.52	0.00	-8.49
		94	0.00	-1.51	0.00	0.52	0.00	14.10
	23	93	0.00	1.02	0.00	-0.35	0.00	-5.75
		94	0.00	-1.02	0.00	0.35	0.00	9.53
	24	93	-0.56	5.87	0.00	-18.34	-0.03	531.30
		94	0.56	-5.87	0.00	18.34	0.04	-509.58
	25	93	-0.65	0.03	0.00	-20.23	-0.04	697.93
		94	0.65	-0.03	0.00	20.23	0.05	-697.83
	26	93	-0.56	4.56	0.00	-17.89	-0.03	538.62
		94	0.56	-4.56	0.00	17.89	0.04	-521.75

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	93	-0.56	4.60	0.00	-17.91	-0.03	538.38
		94	0.56	-4.60	0.00	17.91	0.04	-521.34
94	20	94	0.00	1.51	0.00	-0.61	0.00	-14.06
		95	0.00	-1.51	0.00	0.61	0.00	15.27
	21	94	-1.50	-37.67	0.00	-5.75	-0.12	1284.86
		95	1.50	37.67	0.00	5.75	0.12	-1314.99
	22	94	0.00	1.51	0.00	-0.61	0.00	-14.09
		95	0.00	-1.51	0.00	0.61	0.00	15.30
	23	94	0.00	1.02	0.00	-0.41	0.00	-9.53
		95	0.00	-1.02	0.00	0.41	0.00	10.35
	24	94	-0.56	5.87	0.00	-14.97	-0.04	509.68
		95	0.56	-5.87	0.00	14.97	0.04	-505.01
	25	94	-0.65	0.04	0.00	-15.62	-0.05	697.96
		95	0.65	-0.04	0.00	15.62	0.05	-697.92
	26	94	-0.56	4.56	0.00	-14.45	-0.04	521.85
		95	0.56	-4.56	0.00	14.45	0.04	-518.22
	27	94	-0.56	4.59	0.00	-14.47	-0.04	521.44
		95	0.56	-4.59	0.00	14.47	0.04	-517.77
95	20	95	0.00	-0.40	0.00	0.30	0.00	-15.24
		96	0.00	0.40	0.00	-0.30	0.00	14.92
	21	95	-0.58	302.70	-18.26	-723.21	116.57	1279.35
		96	0.58	-290.70	17.47	690.36	-102.28	-1041.99
	22	95	0.00	-0.40	0.00	0.30	0.00	-15.27
		96	0.00	0.40	0.00	-0.30	0.00	14.95
	23	95	0.00	-0.27	0.00	0.20	0.00	-10.33
		96	0.00	0.27	0.00	-0.20	0.00	10.12
	24	95	-0.26	165.76	-6.05	-389.67	39.76	486.11
		96	0.26	-159.36	5.80	372.62	-35.02	-356.06
	25	95	-0.30	195.03	-7.01	-451.45	49.18	676.04
		96	0.30	-188.63	6.76	434.41	-43.67	-522.58
	26	95	-0.26	166.13	-6.05	-389.93	39.76	499.31
		96	0.26	-159.73	5.80	372.88	-35.02	-368.96
	27	95	-0.26	166.11	-6.05	-389.92	39.76	498.86
		96	0.26	-159.71	5.80	372.87	-35.02	-368.53
96	20	96	0.00	-0.40	0.00	0.19	0.00	-14.92
		97	0.00	0.40	0.00	-0.19	0.00	13.45
	21	96	-0.70	290.68	-17.47	-682.76	102.28	1046.99
		97	0.70	-235.18	13.83	530.81	-44.38	-74.03
	22	96	0.00	-0.40	0.00	0.19	0.00	-14.96
		97	0.00	0.40	0.00	-0.19	0.00	13.48
	23	96	0.00	-0.27	0.00	0.13	0.00	-10.12
		97	0.00	0.27	0.00	-0.13	0.00	9.12
	24	96	-0.30	159.37	-5.80	-370.02	35.02	358.76
		97	0.30	-129.77	4.63	291.17	-15.73	176.22
	25	96	-0.35	188.64	-6.76	-430.60	43.67	525.72
		97	0.35	-159.04	5.59	351.76	-20.83	117.58
	26	96	-0.30	159.71	-5.80	-370.19	35.02	371.67
		97	0.30	-130.11	4.63	291.34	-15.73	164.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	96	-0.30	159.70	-5.80	-370.18	35.02	371.24
		97	0.30	-130.10	4.63	291.34	-15.73	164.96
97	20	97	0.00	-0.40	0.00	0.21	0.00	-13.45
		98	0.00	0.40	0.00	-0.21	0.00	11.51
	21	97	-0.68	235.18	-13.83	-530.93	44.38	73.21
		98	0.68	-161.68	9.01	329.74	11.56	899.08
	22	97	0.00	-0.40	0.00	0.21	0.00	-13.48
		98	0.00	0.40	0.00	-0.21	0.00	11.53
	23	97	0.00	-0.27	0.00	0.14	0.00	-9.12
		98	0.00	0.27	0.00	-0.14	0.00	7.80
	24	97	-0.29	129.77	-4.63	-290.90	15.73	-176.66
		98	0.29	-90.57	3.09	186.50	3.18	716.47
	25	97	-0.34	159.04	-5.59	-351.58	20.83	-118.12
		98	0.34	-119.84	4.05	247.19	2.79	801.37
	26	97	-0.29	130.11	-4.63	-291.09	15.73	-165.02
		98	0.29	-90.91	3.09	186.68	3.18	706.52
	27	97	-0.29	130.10	-4.63	-291.08	15.73	-165.41
		98	0.29	-90.90	3.09	186.68	3.18	706.85
98	20	98	0.00	-0.40	0.00	0.24	0.00	-11.51
		99	0.00	0.40	0.00	-0.24	0.00	9.56
	21	98	-0.66	161.68	-9.01	-327.84	-11.56	-899.77
		99	0.66	-88.17	4.18	126.63	43.89	1511.95
	22	98	0.00	-0.40	0.00	0.24	0.00	-11.53
		99	0.00	0.40	0.00	-0.24	0.00	9.58
	23	98	0.00	-0.27	0.00	0.16	0.00	-7.80
		99	0.00	0.27	0.00	-0.16	0.00	6.48
	24	98	-0.29	90.57	-3.09	-184.99	-3.18	-716.86
		99	0.29	-51.36	1.54	80.58	14.53	1064.62
	25	98	-0.33	119.84	-4.05	-245.50	-2.79	-801.89
		99	0.33	-80.64	2.50	141.11	18.84	1293.09
	26	98	-0.29	90.91	-3.09	-185.20	-3.18	-706.91
		99	0.29	-51.71	1.54	80.78	14.53	1056.35
	27	98	-0.29	90.90	-3.09	-185.19	-3.18	-707.24
		99	0.29	-51.70	1.54	80.78	14.53	1056.63
99	20	99	0.00	-0.40	0.00	0.22	0.00	-9.56
		100	0.00	0.40	0.00	-0.22	0.00	7.62
	21	99	-0.67	88.17	-4.18	-129.80	-43.89	-1511.69
		100	0.67	-14.69	-0.64	-71.35	52.57	1763.63
	22	99	0.00	-0.40	0.00	0.22	0.00	-9.58
		100	0.00	0.40	0.00	-0.22	0.00	7.63
	23	99	0.00	-0.27	0.00	0.15	0.00	-6.48
		100	0.00	0.27	0.00	-0.15	0.00	5.16
	24	99	-0.29	51.36	-1.54	-82.81	-14.53	-1064.45
		100	0.29	-12.17	0.00	-21.57	18.31	1220.08
	25	99	-0.33	80.64	-2.50	-143.81	-18.84	-1292.80
		100	0.33	-17.04	0.00	-25.57	25.80	1552.81
	26	99	-0.29	51.71	-1.54	-83.00	-14.53	-1056.18
		100	0.29	-12.51	0.00	-21.39	18.31	1213.49

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	99	-0.29	51.69	-1.54	-82.99	-14.53	-1056.46
		100	0.29	-12.50	0.00	-21.39	18.31	1213.71
100	20	100	0.00	-0.40	0.00	0.23	0.00	-7.61
		101	0.00	0.40	0.00	-0.23	0.00	5.67
	21	100	-0.67	14.69	0.64	74.76	-52.57	-1763.49
		101	0.67	58.82	-5.46	-275.97	37.64	1655.37
	22	100	0.00	-0.40	0.00	0.23	0.00	-7.63
		101	0.00	0.40	0.00	-0.23	0.00	5.68
	23	100	0.00	-0.27	0.00	0.16	0.00	-5.16
		101	0.00	0.27	0.00	-0.16	0.00	3.84
	24	100	-0.29	12.17	0.00	23.93	-18.31	-1220.03
		101	0.29	27.03	-1.54	-128.34	14.54	1183.63
	25	100	-0.33	17.04	0.00	28.57	-25.80	-1552.76
		101	0.33	46.56	-2.50	-197.96	18.85	1459.66
	26	100	-0.29	12.51	0.00	23.73	-18.31	-1213.45
		101	0.29	26.69	-1.54	-128.14	14.54	1178.72
	27	100	-0.29	12.50	0.00	23.74	-18.31	-1213.67
		101	0.29	26.70	-1.54	-128.15	14.54	1178.89
101	20	101	0.00	-0.40	0.00	0.23	0.00	-5.67
		102	0.00	0.40	0.00	-0.23	0.00	3.72
	21	101	-0.67	-58.82	5.46	276.25	-37.64	-1655.31
		102	0.67	106.82	-8.61	-407.64	0.51	1208.77
	22	101	0.00	-0.40	0.00	0.23	0.00	-5.68
		102	0.00	0.40	0.00	-0.23	0.00	3.73
	23	101	0.00	-0.27	0.00	0.16	0.00	-3.84
		102	0.00	0.27	0.00	-0.16	0.00	2.52
	24	101	-0.29	-27.03	1.54	128.55	-14.54	-1183.60
		102	0.29	66.23	-3.09	-232.94	3.20	955.15
	25	101	-0.34	-46.56	2.50	198.21	-18.85	-1459.63
		102	0.34	85.76	-4.05	-302.59	2.81	1135.47
	26	101	-0.29	-26.69	1.54	128.35	-14.54	-1178.70
		102	0.29	65.88	-3.09	-232.74	3.20	951.93
	27	101	-0.29	-26.70	1.54	128.35	-14.54	-1178.87
		102	0.29	65.89	-3.09	-232.74	3.20	952.04
102	20	102	0.00	-0.40	0.00	0.24	0.00	-3.72
		103	0.00	0.40	0.00	-0.24	0.00	1.78
	21	102	-0.69	-106.82	8.61	410.17	-0.51	-1207.91
		103	0.69	123.32	-9.69	-455.34	-42.25	675.31
	22	102	0.00	-0.40	0.00	0.24	0.00	-3.73
		103	0.00	0.40	0.00	-0.24	0.00	1.78
	23	102	0.00	-0.27	0.00	0.16	0.00	-2.52
		103	0.00	0.27	0.00	-0.16	0.00	1.20
	24	102	-0.30	-66.23	3.08	234.94	-3.20	-954.66
		103	0.30	105.43	-4.63	-339.36	-15.70	534.02
	25	102	-0.34	-85.76	4.04	304.96	-2.81	-1134.84
		103	0.34	124.97	-5.59	-409.37	-20.79	618.47
	26	102	-0.30	-65.88	3.08	234.73	-3.20	-951.44
		103	0.30	105.09	-4.63	-339.15	-15.70	532.48

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	27	102	-0.30	-65.89	3.08	234.74	-3.20	-951.55
		103	0.30	105.10	-4.63	-339.16	-15.70	532.54
103	20	103	0.00	-0.40	0.00	0.24	0.00	-1.78
		104	0.00	0.40	0.00	-0.24	0.00	0.31
	21	103	-0.69	-123.32	9.69	454.95	42.25	-675.58
		104	0.69	178.81	-13.33	-606.84	-84.83	116.74
	22	103	0.00	-0.40	0.00	0.24	0.00	-1.78
		104	0.00	0.40	0.00	-0.24	0.00	0.31
	23	103	0.00	-0.27	0.00	0.16	0.00	-1.20
		104	0.00	0.27	0.00	-0.16	0.00	0.21
	24	103	-0.29	-105.44	4.63	339.05	15.70	-534.22
		104	0.29	135.03	-5.79	-417.87	-34.98	89.44
	25	103	-0.34	-124.96	5.59	409.01	20.79	-618.70
		104	0.34	154.56	-6.75	-487.82	-43.62	101.67
	26	103	-0.29	-105.09	4.63	338.84	15.70	-532.68
		104	0.29	134.68	-5.79	-417.67	-34.98	89.18
	27	103	-0.29	-105.10	4.63	338.85	15.70	-532.73
		104	0.29	134.70	-5.79	-417.67	-34.98	89.18
104	20	104	0.00	-0.40	0.00	0.24	0.00	-0.31
		105	0.00	0.40	0.00	-0.24	0.00	-0.01
	21	104	-0.70	-178.79	13.33	606.97	84.83	-116.08
		105	0.70	190.79	-14.11	-639.82	-95.80	-31.78
	22	104	0.00	-0.40	0.00	0.24	0.00	-0.31
		105	0.00	0.40	0.00	-0.24	0.00	-0.01
	23	104	0.00	-0.27	0.00	0.16	0.00	-0.21
		105	0.00	0.27	0.00	-0.16	0.00	-0.01
	24	104	-0.30	-135.04	5.79	417.97	34.98	-88.99
		105	0.30	141.44	-6.05	-435.02	-39.72	-21.62
	25	104	-0.35	-154.56	6.75	487.94	43.62	-101.15
		105	0.35	160.96	-7.01	-504.98	-49.13	-25.11
	26	104	-0.30	-134.72	5.79	417.76	34.98	-88.72
		105	0.30	141.12	-6.05	-434.81	-39.72	-21.61
	27	104	-0.30	-134.70	5.79	417.77	34.98	-88.71
		105	0.30	141.10	-6.05	-434.82	-39.72	-21.59

********** END OF LATEST ANALYSIS RESULT **********

331. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	20	-1.24	0.83	0.00	0.01	-0.01	0.00
	21	-1.50	0.01	0.00	0.00	-0.02	0.00
	22	-1.06	-1.43	0.00	-0.01	-0.01	0.00
	23	-1.00	-1.89	0.00	-0.02	-0.01	0.00
	24	-1.65	137.97	0.00	-400.25	-0.02	0.00
	25	-1.72	137.85	-5.90	-400.19	37.90	0.00
	26	-1.78	-26.01	0.00	-0.24	-0.02	0.00
	27	-1.83	-25.97	0.00	-0.24	-0.02	0.00
11	20	0.00	-3.91	0.01	-0.26	0.01	0.00
	21	0.00	-0.03	0.01	0.00	0.02	0.00
	22	0.00	6.70	0.01	0.45	0.01	0.00
	23	0.00	8.84	0.00	0.60	0.01	0.00
	24	0.00	154.38	0.01	-404.05	0.02	0.00
	25	0.00	154.97	-5.90	-403.96	-37.90	0.00
	26	0.00	211.47	-7.08	-475.57	54.45	0.00
	27	0.00	211.36	-7.08	-475.58	54.45	0.00
23	20	0.00	13.66	0.01	1.47	0.03	0.00
	21	0.00	0.10	0.01	0.01	0.04	0.00
	22	0.00	-23.42	0.01	-2.51	0.03	0.00
	23	0.00	-30.92	0.01	-3.32	0.03	0.00
	24	0.00	191.12	-7.08	-471.23	54.48	0.00
	25	0.00	189.13	-7.08	-471.38	54.48	0.00
	26	0.00	182.48	-7.08	-487.14	-54.38	0.00
	27	0.00	183.11	-7.08	-487.08	-54.38	0.00
35	20	0.00	-47.23	0.01	-7.21	0.06	0.00
	21	0.00	-0.34	0.01	-0.05	0.07	0.00
	22	0.00	107.21	-7.60	-351.27	89.70	0.00
	23	0.00	148.97	-10.07	-434.80	111.62	0.00
	24	0.00	170.53	-7.08	-495.10	-54.36	0.00
	25	0.00	177.27	-7.08	-493.99	-54.36	0.00
	26	0.00	135.94	-7.08	-474.39	54.55	0.00
	27	0.00	133.86	-7.08	-473.26	54.50	0.00
47	20	0.00	325.80	-20.06	-805.33	143.48	0.00
	21	0.00	1.17	0.01	0.24	0.10	0.00
	22	0.00	570.90	-34.00	-1341.07	0.04	0.00
	23	0.00	566.43	-33.72	-1341.17	-6.65	0.00
	24	0.00	210.13	-8.04	-521.74	65.54	0.00
	25	0.00	180.70	-7.08	-459.25	54.53	0.00
	26	0.00	480.69	-16.08	-1083.54	0.09	0.00
	27	0.00	480.46	-16.07	-1080.91	4.08	0.00
59	20	0.00	478.14	-28.47	-1190.94	-73.64	0.00
	21	0.00	-4.05	0.01	-1.00	0.12	0.00
	22	0.00	108.18	-7.60	-362.26	-89.64	0.00
	23	0.00	70.85	-5.41	-276.62	-67.03	0.00
	24	0.00	210.09	-8.04	-572.15	-65.35	0.00
	25	0.00	179.79	-7.08	-504.47	-54.33	0.00
	26	0.00	133.96	-7.09	-496.78	-54.38	0.00
	27	0.00	136.30	-7.10	-500.67	-54.64	0.00
71	20	0.00	-22.47	-0.68	-49.37	-9.69	0.00
	21	0.00	14.01	0.01	4.09	0.15	0.00

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
	22	0.00	-23.38	0.00	5.60	0.00	0.00
	23	0.00	-15.82	0.00	3.79	0.00	0.00
	24	0.00	171.04	-7.09	-448.58	54.53	0.00
	25	0.00	179.83	-7.09	-449.55	54.53	0.00
	26	0.00	191.25	-7.09	-453.42	54.53	0.00
	27	0.00	190.52	-7.09	-453.26	54.53	0.00
83	20	0.00	6.74	0.00	-1.90	0.00	0.00
	21	0.00	-48.54	0.01	-16.43	0.17	0.00
	22	0.00	6.75	0.00	-1.90	0.00	0.00
	23	0.00	4.57	0.00	-1.29	0.00	0.00
	24	0.00	189.45	-7.09	-512.78	-54.35	0.00
	25	0.00	180.54	-7.09	-514.52	-54.34	0.00
	26	0.00	183.62	-7.09	-511.14	-54.35	0.00
	27	0.00	183.82	-7.09	-511.20	-54.35	0.00
95	20	0.00	-1.91	0.00	0.70	0.00	0.00
	21	0.00	340.37	-18.26	-700.10	116.69	0.00
	22	0.00	-1.91	0.00	0.70	0.00	0.00
	23	0.00	-1.29	0.00	0.47	0.00	0.00
	24	0.00	159.89	-6.05	-368.16	39.81	0.00
	25	0.00	194.99	-7.01	-426.69	49.23	0.00
	26	0.00	161.57	-6.05	-368.76	39.81	0.00
	27	0.00	161.52	-6.05	-368.74	39.81	0.00
105	20	0.00	0.40	0.00	-0.24	0.00	0.00
	21	0.00	190.79	-14.13	-640.61	-95.80	0.00
	22	0.00	0.40	0.00	-0.24	0.00	0.00
	23	0.00	0.27	0.00	-0.16	0.00	0.00
	24	0.00	141.44	-6.05	-435.55	-39.72	0.00
	25	0.00	160.96	-7.02	-505.60	-49.13	0.00
	26	0.00	141.12	-6.05	-435.35	-39.72	0.00
	27	0.00	141.10	-6.05	-435.35	-39.72	0.00

********** END OF LATEST ANALYSIS RESULT **********

332. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 3: 9: 9 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

ENVOLVENTE DE SC/EC-1. 1 VÍA

(Casos 20 a 27)

	6	-1.78	-26.01	.00	-.70	.02	-487.68
12	5	-1.65	25.97	.00	-100.50	.01	1147.98

C A S O 7

SELECCION DE MAXIMOS DE CARGAS NORMALES

ARCHIVO	NO. HIPOTESIS	HIPOTESIS
L20-27.ANL	8	20 21 22 23 24 25 26

HIPOTESIS	ENVOLVENTE
1	N .MIN
2	N .MAX
3	QY.MIN
4	QY.MAX
5	QZ.MIN
6	QZ.MAX
7	MT.MIN
8	MT.MAX
9	MY.MIN
10	MY.MAX
11	MZ.MIN
12	MZ.MAX

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
1	11	1	.00	.00	.00	.00	.00	.00
		2	-1.78	-26.01	.00	-.24	-.02	-20.81
	12	1	.00	.00	.00	.00	.00	.00
		2	-1.65	131.57	.00	-383.20	-.01	107.82
2	11	2	-1.78	-26.01	.00	-.24	-.02	-20.81
		3	-1.78	-26.01	.00	-.24	.00	-117.04
	12	2	-1.65	131.57	.00	-383.20	-.01	107.82
		3	-1.65	101.97	.00	-304.37	.00	539.86
3	11	3	-1.78	-26.01	.00	-.49	.00	-117.04
		4	-1.78	-26.01	.00	-.49	.00	-240.59
	12	3	-1.65	101.97	.00	-303.19	.00	540.51
		4	-1.65	63.97	.00	-201.98	.00	934.62
4	11	4	-1.78	-26.01	.00	.03	.00	-240.59
		5	-1.78	-26.01	.00	.03	.01	-364.13
	12	4	-1.65	63.97	.00	-204.01	.00	934.17
		5	-1.65	25.97	.00	-102.81	.01	1147.77
5	11	5	-1.78	-26.01	.00	-.70	.01	-364.13

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		6	-1.65	-12.03	.00	.70	.01	1181.07
6	11	6	-1.78	-26.01	.00	-.78	.02	-487.68
		7	-1.78	-26.01	.00	-.78	.01	-611.22
	12	6	-1.65	-12.03	.00	.90	.01	1181.08
		7	-1.65	-50.03	.00	102.11	.01	1033.67
7	11	7	-1.78	-26.01	.00	-2.01	.01	-611.21
		8	-1.78	-26.01	.00	-2.01	.00	-734.76
	12	7	-1.65	-50.03	.00	104.18	.01	1033.46
		8	-1.65	-88.03	.00	205.39	.00	705.57
8	11	8	-1.78	-26.01	.00	-2.01	.00	-734.76
		9	-1.78	-26.01	.00	-2.01	-.02	-858.30
	12	8	-1.65	-88.03	.00	205.39	.00	705.57
		9	-1.65	-126.03	.00	306.60	-.02	197.16
9	11	9	-1.78	-26.01	.00	-.81	-.02	-858.31
		10	-1.78	-26.01	.00	-.81	-.03	-954.54
	12	9	-1.65	-126.03	.00	306.32	-.02	197.59
		10	-1.24	.83	.00	.03	-.02	30.63
10	11	10	-1.78	-26.01	.02	-9.52	-.03	-954.49
		11	-1.78	-26.01	.02	-9.52	-.04	-975.30
	12	10	-1.24	.84	.01	.31	-.02	30.63
		11	-1.24	.84	.01	.31	-.03	31.30
11	11	11	-1.78	185.46	7.08	-473.47	54.41	-975.34
		12	-1.78	179.06	6.82	-456.43	48.85	-829.53
	12	11	-1.24	-3.07	-.01	-.33	-.01	31.30
		12	-1.24	-3.07	-.01	-.33	-.01	28.84
12	11	12	-1.75	179.07	6.83	-461.05	48.85	-826.97
		13	-1.69	-7.22	.00	-1.95	.00	-486.28
	12	12	-1.24	-3.07	.00	-.17	-.01	28.85
		13	-1.24	-3.07	.00	-.17	.00	17.48
13	11	13	-1.69	-7.22	.00	-2.49	.00	-486.28
		14	-1.69	-7.22	.00	-2.49	.00	-518.79
	12	13	-1.24	-3.07	.00	-.15	.00	17.48
		14	-1.79	113.34	4.25	-286.58	3.40	373.05
14	11	14	-1.69	-7.23	.00	-1.30	.00	-518.79
		15	-1.65	-7.66	.00	-1.33	.02	-552.76
	12	14	-1.80	113.34	4.25	-287.44	3.40	372.40
		15	-1.75	77.47	2.83	-191.55	-12.52	801.87
15	11	15	-1.65	-7.66	.00	-2.59	.02	-552.76
		16	-1.65	-7.66	.00	-2.59	.02	-587.25
	12	15	-1.74	77.48	2.83	-189.71	-12.52	802.30
		16	-1.74	41.48	1.42	-93.83	-22.09	1069.94

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
16	11	16	-1.65	-7.66	.00	-3.84	.02	-587.24
		17	-1.65	-7.66	.00	-3.84	.01	-621.73
	12	16	-1.74	41.47	1.42	-91.56	-22.09	1070.13
		17	-1.74	5.47	.00	4.32	-25.29	1175.75
17	11	17	-1.65	-7.66	.00	-2.52	.01	-621.74
		18	-1.65	-7.66	.00	-2.52	.01	-656.24
	12	17	-1.74	5.47	.00	1.83	-25.29	1175.76
		18	-1.74	-30.53	-1.42	97.71	-22.10	1119.39
18	11	18	-1.65	-7.66	.00	-3.91	.01	-656.23
		19	-1.65	-7.66	.00	-3.91	.00	-690.72
	12	18	-1.74	-30.53	-1.41	100.08	-22.10	1119.17
		19	-1.74	-66.53	-2.83	195.96	-12.55	900.81
19	11	19	-1.65	-7.66	.00	-3.91	.00	-690.72
		20	-1.65	-7.66	.00	-3.91	-.01	-725.21
	12	19	-1.74	-66.52	-2.83	195.96	-12.55	900.81
		20	-1.74	-102.53	-4.25	291.84	3.39	520.43
20	11	20	-1.65	-7.67	.00	-4.04	-.01	-725.21
		21	-1.65	-7.67	.00	-4.04	-.03	-759.71
	12	20	-1.74	-102.53	-4.25	291.94	3.39	520.38
		21	-1.00	6.95	.00	.62	-.02	210.71
21	11	21	-1.65	-7.66	.01	-5.35	-.03	-759.70
		22	-1.65	-7.66	.01	-5.35	-.05	-788.06
	12	21	-1.00	6.95	.00	.99	-.02	210.71
		22	-1.00	6.95	.00	.99	-.03	236.44
22	11	22	-1.65	-7.67	.01	-7.07	-.05	-788.05
		23	-1.65	-7.67	.01	-7.07	-.06	-794.18
	12	22	-1.00	6.95	.01	1.50	-.03	236.43
		23	-1.00	6.95	.01	1.50	-.04	242.00
23	11	23	-1.65	183.44	7.07	-468.05	54.42	-794.21
		24	-1.72	8.43	-.02	4.68	.00	-719.70
	12	23	-1.00	-23.97	-.01	-4.94	-.01	242.00
		24	-1.00	-23.97	-.01	-4.94	.00	222.82
24	11	24	-1.72	8.42	.00	-3.19	.00	-719.72
		25	-1.72	8.42	.00	-3.19	.01	-688.56
	12	24	-1.00	-23.97	.00	-2.50	.00	222.86
		25	-1.00	-23.97	.00	-2.50	.01	134.16
25	11	25	-1.72	8.42	.00	-3.19	.01	-688.56
		26	-1.72	8.42	.00	-3.19	.02	-650.67
	12	25	-1.00	-23.97	.00	-2.50	.01	134.16
		26	-1.61	109.93	4.25	-283.49	3.42	539.42

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
26	11	26	-1.72	8.42	.00	-4.80	.02	-650.66
		27	-1.68	7.96	.00	-4.84	.01	-614.35
	12	26	-1.60	109.92	4.25	-282.16	3.42	540.12
		27	-1.56	75.44	2.84	-186.16	-12.53	958.95
27	11	27	-1.68	7.96	.00	-3.43	.01	-614.36
		28	-1.68	7.96	.00	-3.43	.02	-578.56
	12	27	-1.57	75.44	2.83	-188.36	-12.53	958.53
		28	-1.57	39.44	1.42	-92.49	-22.09	1217.00
28	11	28	-1.68	7.96	.00	-4.66	.02	-578.55
		29	-1.68	7.96	.00	-4.66	.02	-542.74
	12	28	-1.57	39.45	1.42	-89.91	-22.09	1217.20
		29	-1.57	3.44	.00	5.98	-25.29	1313.70
29	11	29	-1.68	7.96	.00	-4.75	.02	-542.74
		30	-1.68	7.96	.00	-4.75	.01	-506.94
	12	29	-1.57	3.44	.00	6.21	-25.29	1313.70
		30	-1.57	-32.56	-1.42	102.10	-22.11	1248.18
30	11	30	-1.68	7.96	.00	-4.76	.01	-506.94
		31	-1.00	-23.97	.00	-2.70	.00	-513.08
	12	30	-1.57	-32.56	-1.42	102.10	-22.11	1248.18
		31	-1.57	-68.55	-2.83	197.97	-12.55	1020.70
31	11	31	-1.00	-23.97	.00	-3.79	.00	-513.07
		32	-1.00	-23.97	.00	-3.79	-.01	-620.96
	12	31	-1.57	-68.56	-2.83	200.13	-12.55	1020.27
		32	-1.57	-104.56	-4.25	296.02	3.38	630.72
32	11	32	-1.00	-23.97	.00	-3.79	-.01	-620.96
		33	-1.00	-23.97	.00	-3.79	-.03	-728.82
	12	32	-1.57	-104.56	-4.25	296.02	3.38	630.72
		33	-1.24	10.59	.00	1.67	-.04	321.89
33	11	33	-1.00	-23.97	.00	-2.32	-.03	-728.83
		34	-1.00	-23.97	.00	-2.32	-.03	-817.53
	12	33	-1.24	10.59	.00	1.03	-.04	321.89
		34	-1.24	10.59	.00	1.03	-.04	361.07
34	11	34	-1.00	-23.96	.01	-11.55	-.03	-817.46
		35	-1.00	-23.96	.01	-11.55	-.04	-836.63
	12	34	-1.24	10.58	.02	5.10	-.04	361.03
		35	-1.24	10.58	.02	5.10	-.05	369.50
35	11	35	-.87	125.01	10.07	-436.37	111.57	-831.10
		36	-.87	125.01	10.07	-436.37	103.53	-731.21
	12	35	-1.24	-36.65	-.01	-6.50	.00	369.63
		36	-1.24	-36.65	-.01	-6.50	.01	340.35
36	11	36	-.84	125.01	10.07	-438.69	103.53	-729.82

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		37	-1.50	-.79	.00	-6.71	.02	-683.24
	12	36	-1.24	-36.64	.00	-5.42	.01	340.37
		37	-1.61	106.28	5.67	-382.85	25.74	219.26
37	11	37	-1.50	-.79	.00	-6.44	.02	-683.24
		38	-1.50	-.79	.00	-6.44	.03	-686.80
	12	37	-1.61	106.28	5.67	-382.93	25.74	219.11
		38	-1.61	70.29	4.25	-287.06	3.43	616.34
38	11	38	-1.50	-.79	.00	-7.90	.03	-686.78
		39	-1.46	-6.05	.00	-8.67	.03	-708.27
	12	38	-1.60	70.29	4.25	-285.76	3.43	616.95
		39	-1.56	35.89	2.84	-191.07	-12.51	857.75
39	11	39	-1.46	-6.05	.00	-8.55	.03	-708.27
		40	-1.46	-6.05	.00	-8.55	.02	-735.48
	12	39	-1.56	35.88	2.84	-191.22	-12.51	857.72
		40	-.83	50.01	5.15	-232.82	-57.44	1233.58
40	11	40	-1.46	-6.05	.00	-10.37	.02	-735.46
		41	-1.46	-6.05	.00	-10.37	.01	-762.67
	12	40	-.81	50.01	5.16	-229.77	-57.44	1234.14
		41	-.81	-17.49	.73	-45.01	-70.68	1307.32
41	11	41	-1.46	-6.05	.00	-8.62	.01	-762.69
		42	-1.46	-6.05	.00	-8.62	.01	-789.90
	12	41	-.82	-17.49	.73	-48.01	-70.68	1307.22
		42	-.82	-84.98	-3.70	136.75	-63.98	1076.68
42	11	42	-1.46	-6.05	.00	-10.29	.01	-789.88
		43	-1.46	-6.05	.00	-10.29	-.01	-817.10
	12	42	-.82	-84.98	-3.70	139.03	-63.98	1076.39
		43	-.82	-152.49	-8.13	323.83	-37.36	541.96
43	11	43	-1.46	-6.05	.00	-10.29	-.01	-817.10
		44	-1.24	-36.64	.00	-6.38	-.02	-949.37
	12	43	-.82	-152.49	-8.13	323.84	-37.36	541.95
		44	.00	.00	.00	.00	.00	.00
44	11	44	-1.24	-36.64	.00	-6.38	-.02	-949.37
		45	-.86	-249.99	-14.52	590.72	72.57	-1391.07
	12	44	.00	.00	.00	.00	.00	.00
		45	.00	.00	.00	.00	.00	.00
45	11	45	-.89	-249.99	-14.52	588.30	72.57	-1392.09
		46	-.95	-285.94	-16.99	672.16	127.49	-2391.74
	12	45	.00	.00	.00	.00	.00	.00
		46	.00	.00	.00	.00	.00	.00
46	11	46	-1.00	-285.94	-16.99	664.67	127.49	-2393.84
		47	-1.00	-285.94	-16.99	664.67	141.09	-2622.66

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	46	.00	.00	.00	.00	.00	.00
		47	.00	.00	.00	.00	.00	.00
47	11	47	-.14	284.96	17.00	-678.64	141.13	-2588.71
		48	-.14	284.96	17.00	-678.64	127.54	-2360.95
	12	47	.00	.00	.00	.00	.00	.00
		48	.00	.00	.00	.00	.00	.00
48	11	48	-.21	284.96	17.00	-668.81	127.54	-2363.76
		49	-.21	269.96	16.01	-627.75	65.14	-1316.68
	12	48	.00	.00	.00	.00	.00	.00
		49	-1.35	143.89	5.67	-374.46	25.75	23.34
49	11	49	-.20	269.96	16.01	-628.50	65.14	-1316.32
		50	-1,26	143.78	4.25	-282.68	3.36	-342.94
	12	49	-1.35	143.89	5.67	-374.45	25.75	23.55
		50	-.79	154.10	11.20	-444.86	2.77	732.98
50	11	50	-1:26	143.78	4.25	-282.68	3.36	-342.95
		51	.00	.00	.00	.00	.00	.00
	12	50	-.79	154.10	11.20	-444.86	2.77	732.98
		51	-.79	86.60	6.77	-260.09	-37.68	1274.55
51	11	51	.00	.00	.00	.00	.00	.00
		52	.00	.00	.00	.00	.00	.00
	12	51	-.78	86.60	6.78	-257.39	-37.68	1275.10
		52	-.78	19.09	2.35	-72.61	-58.21	1512.92
52	11	52	.00	.00	.00	.00	.00	.00
		53	.00	.00	.00	.00	.00	.00
	12	52	-.78	19.09	2.35	-72.34	-58.21	1512.93
		53	-1.27	-.28	.00	12.96	-34.34	1642.05
53	11	53	.00	.00	.00	.00	.00	.00
		54	.00	.00	.00	.00	.00	.00
	12	53	-1.27	-.28	.00	12.97	-34.34	1642.04
		54	-1.27	-60.67	-2.38	173.82	-28.38	1489.07
54	11	54	.00	.00	.00	.00	.00	.00
		55	.00	.00	.00	.00	.00	.00
	12	54	-1.27	-60.67	-2.38	173.55	-28.38	1489.10
		55	-1.27	-96.68	-3.79	269.44	-14.50	1135.03
55	11	55	.00	.00	.00	.00	.00	.00
		56	.00	.00	.00	.00	.00	.00
	12	55	-1.28	-96.68	-3.79	272.05	-14.50	1134.41
		56	-1.26	-72.22	-4.25	295.02	3.39	623.10
56	11	56	.00	.00	.00	.00	.00	.00
		57	-.79	-213.42	-12.90	565.59	55.39	-594.99
	12	56	-1.26	-72.22	-4.25	295.01	3.39	623.11

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		57	-1.26	-108.23	-5.67	390.91	25.71	217.05
57	11	57	-.76	-213.42	-12.91	566.88	55.39	-593.76
		58	-.76	-268.92	-16.55	718.81	109.88	-1486.10
	12	57	-1.24	-108.22	-5.67	390.44	25.71	217.90
		58	-1.50	.91	.00	.16	-.07	30.93
58	11	58	-.96	-268.92	-16.54	700.50	109.88	-1494.81
		59	-.96	-280.91	-17.32	733.33	123.41	-1714.63
	12	58	-1.50	.91	.02	.54	-.07	30.92
		59	-1.50	.91	.02	.54	-.09	31.65
59	11	59	-.04	197.23	11.12	-438.48	49.77	-1675.78
		60	-.04	185.23	10.34	-405.62	41.19	-1522.74
	12	59	-1.50	-3.14	.00	-.80	.03	31.68
		60	-1.50	-3.14	.00	-.80	.03	29.17
60	11	60	-.03	185.25	10.34	-407.51	41.19	-1522.23
		61	-.03	129.74	6.70	-255.57	9.67	-939.43
	12	60	-1.50	-3.14	.00	-.76	.03	29.17
		61	-1.50	-3.14	.00	-.76	.04	17.55
61	11	61	-.01	129.74	6.70	-257.19	9.67	-938.99
		62	-1.07	5.39	.00	-13.94	.02	-835.94
	12	61	-1.50	-3.14	.00	-.73	.04	17.55
		62	-1.50	-3.14	.00	-.73	.03	3.42
62	11	62	-1.07	5.39	.00	-12.32	.02	-835.97
		63	-1.07	5.39	.00	-12.32	.03	-811.73
	12	62	-1.50	-3.14	.00	-.74	.03	3.42
		63	.00	.00	.00	.00	.00	.00
63	11	63	-1.07	5.39	.00	-15.76	.03	-811.68
		64	-1.07	5.39	.00	-15.76	.02	-787.44
	12	63	.00	.00	.00	.00	.00	.00
		64	.00	.00	.00	.00	.00	.00
64	11	64	-1.07	5.39	.00	-14.09	.02	-787.47
		65	-1.07	5.39	.00	-14.09	.01	-763.23
	12	64	.00	.00	.00	.00	.00	.00
		65	.00	.00	.00	.00	.00	.00
65	11	65	-1.07	5.38	.00	-15.71	.01	-763.19
		66	-1.07	5.38	.00	-15.71	.00	-738.97
	12	65	.00	.00	.00	.00	.00	.00
		66	.00	.00	.00	.00	.00	.00
66	11	66	-1.07	5.39	.00	-14.14	.00	-738.99
		67	-1.07	5.39	.00	-14.14	-.01	-714.76
	12	66	.00	.00	.00	.00	.00	.00
		67	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
67	11	67	-1.07	5.39	.01	-17.29	-.01	-714.68
		68	-1.16	-.32	.01	-16.12	-.04	-707.85
	12	67	.00	.00	.00	.00	.00	.00
		68	-.02	17.25	-.68	50.41	3.54	25.65
68	11	68	-1.16	-.32	.00	-14.50	-.04	-707.88
		69	-1.07	-10.28	.00	-11.76	-.05	-753.81
	12	68	-.02	17.25	-.68	50.35	3.54	25.77
		69	-.02	17.25	-.68	50.35	6.61	103.36
69	11	69	-1.07	-10.28	.00	-12.77	-.05	-753.79
		70	-1.07	-10.28	.00	-12.77	-.07	-791.82
	12	69	-.02	17.25	-.68	50.49	6.61	103.29
		70	.00	18.14	.00	-4.45	.00	168.57
70	11	70	-1.07	-10.30	.01	-16.95	-.07	-791.74
		71	-1.07	-10.30	.01	-16.95	-.07	-799.96
	12	70	:00	18.14	.00	-3.56	.00	168.59
		71	.00	18.14	.00	-3.56	.00	183.11
71	11	71	-.89	180.95	7.08	-459.95	54.45	-788.86
		72	-.89	174.55	6.83	-442.92	48.89	-646.79
	12	71	.00	-5.24	.00	-.31	.00	182.91
		72	.00	-5.24	.00	-.31	.00	178.72
72	11	72	-.82	174.54	6.84	-449.59	48.89	-642.18
		73	-1.50	10.87	.00	2.95	.04	-60.81
	12	72	.00	-5.24	.00	1.54	.00	178.72
		73	.00	-5.24	.00	1.54	.00	159.33
73	11	73	-1.50	10.87	.00	3.06	.04	-60.81
		74	-1.50	10.87	.00	3.06	.04	-11.87
	12	73	.00	-5.24	.00	1.25	.00	159.33
		74	-.83	104.42	4.25	-273.69	3.42	636.71
74	11	74	-1.50	10.87	.00	3.06	.04	-11.87
		75	.00	.00	.00	.00	.00	.00
	12	74	-.83	104.41	4.25	-273.68	3.42	636.71
		75	-.83	68.42	2.84	-177.81	-12.52	1025.54
75	11	75	.00	.00	.00	.00	.00	.00
		76	.00	.00	.00	.00	.00	.00
	12	75	-.83	68.42	2.84	-175.47	-12.52	1025.94
		76	-.83	32.41	1.42	-79.57	-22.10	1252.85
76	11	76	.00	.00	.00	.00	.00	.00
		77	.00	.00	.00	.00	.00	.00
	12	76	-.83	32.41	1.42	-79.78	-22.10	1252.83
		77	-.91	-.51	.00	16.11	-25.30	1318.17

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
77	11	77	.00	.00	.00	.00	.00	.00
		78	.00	.00	.00	.00	.00	.00
	12	77	-.91	-.51	.00	16.35	-25.30	1318.17
		78	-.91	-36.51	-1.42	112.21	-22.12	1234.88
78	11	78	.00	.00	.00	.00	.00	.00
		79	.00	.00	.00	.00	.00	.00
	12	78	-.91	-36.51	-1.42	111.99	-22.12	1234.90
		79	-.91	-72.51	-2.83	207.86	-12.56	989.63
79	11	79	.00	.00	.00	.00	.00	.00
		80	.00	-5.24	.00	1.53	.00	-5.74
	12	79	-.92	-72.51	-2.83	210.12	-12.56	989.15
		80	-.92	-108.51	-4.25	306.00	3.37	581.84
80	11	80	.00	-5.24	.00	1.53	.00	-5.74
		81	-.83	-147.59	-5.67	401.94	25.69	-43.43
	12	80	-.92	-108.51	-4.25	306.10	3.37	581.79
		81	-1.50	10.87	.01	3.70	-.08	330.66
81	11	81	-.83	-147.59	-5.67	401.95	25.69	-43.37
		82	-.83	-177.18	-6.83	480.78	48.80	-644.14
	12	81	-1.50	10.87	.01	3.65	-.08	330.67
		82	-1.50	10.87	.01	3.65	-.11	370.90
82	11	82	-.83	-177.17	-6.83	480.80	48.80	-644.12
		83	-.83	-183.56	-7.08	497.84	54.37	-788.37
	12	82	-1.50	10.87	.01	3.63	-.11	370.89
		83	-1.50	10.87	.01	3.63	-.11	379.60
83	11	83	-.56	5.89	.00	-14.55	.02	-769.02
		84	-.56	5.89	.00	-14.55	.02	-764.31
	12	83	-1.50	-37.67	.00	-12.80	.06	380.21
		84	-1.50	-37.67	.00	-12.80	.06	350.05
84	11	84	-.56	5.87	.00	-14.61	.02	-764.32
		85	-.56	5.87	.00	-14.61	.02	-742.61
	12	84	-1.50	-37.67	.00	-12.77	.06	350.05
		85	-1.50	-37.67	.00	-12.77	.06	210.68
85	11	85	-.56	5.87	.00	-16.31	.02	-742.57
		86	-.56	5.87	.00	-16.31	.02	-716.17
	12	85	-1.50	-37.67	.00	-12.29	.06	210.71
		86	-1.50	-37.67	.00	-12.29	.05	41.21
86	11	86	-.56	5.87	.00	-16.30	.02	-716.17
		87	-.65	.03	.00	-17.93	.02	-698.77
	12	86	-1.50	-37.67	.00	-12.29	.05	41.21
		87	.00	.00	.00	.00	.00	.00
87	11	87	-.65	.03	.00	-17.93	.02	-698.78

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		88	-.65	.03	.00	-17.93	.01	-698.64
	12	87	.00	.00	.00	.00	.00	.00
		88	.00	.00	.00	.00	.00	.00
88	11	88	-.65	.03	.00	-19.41	.01	-698.60
		89	-.65	.03	.00	-19.41	.00	-698.47
	12	88	.00	.00	.00	.00	.00	.00
		89	.00	.00	.00	.00	.00	.00
89	11	89	-.65	.03	.00	-17.93	.00	-698.52
		90	-.65	.03	.00	-17.93	.00	-698.38
	12	89	.00	.00	.00	.00	.00	.00
		90	.00	.00	.00	.00	.00	.00
90	11	90	-.65	.03	.00	-19.41	.00	-698.34
		91	-1.50	-37.67	.01	-13.28	-.03	-806.40
	12	90	.00	.00	.00	.00	.00	.00
		91	.00	.00	.00	.00	.00	.00
91	11	91	-1.50	-37.67	.01	-13.29	-.03	-806.40
		92	-1.50	-37.67	.01	-13.29	-.05	-975.88
	12	91	.00	.00	.00	.00	.00	.00
		92	.00	1.51	.00	-.51	.00	1.68
92	11	92	-1.50	-37.67	.01	-15.51	-.05	-975.85
		93	-1.50	-37.67	.01	-15.51	-.09	-1145.38
	12	92	.00	1.51	.00	-.50	.00	1.68
		93	.00	1.51	.00	-.51	.00	8.49
93	11	93	-1.50	-37.67	.01	-14.23	-.09	-1145.40
		94	-1.50	-37.67	.01	-14.23	-.12	-1284.80
	12	93	.00	1.51	.00	-.52	.00	8.49
		94	.00	1.51	.00	-.52	.00	14.10
94	11	94	-1.50	-37.67	.00	-5.75	-.12	-1284.86
		95	-1.50	-37.67	.00	-5.75	-.12	-1314.99
	12	94	.00	1.51	.00	-.61	.00	14.09
		95	.00	1.51	.00	-.61	.00	15.30
95	11	95	-.58	302.70	18.26	-723.21	116.57	-1279.35
		96	-.58	290.70	17.47	-690.36	102.28	-1041.99
	12	95	.00	-.40	.00	.30	.00	15.27
		96	.00	-.40	.00	.30	.00	14.95
96	11	96	-.70	290.68	17.47	-682.76	102.28	-1046.99
		97	-.70	235.18	13.83	-530.81	44.38	-74.03
	12	96	.00	-.40	.00	.19	.00	14.96
		97	-.30	129.77	4.63	-291.17	15.73	176.22
97	11	97	-.68	235.18	13.83	-530.93	44.38	-73.21
		98	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	97	-.29	129.77	4.63	-290.90	15.73	176.66
		98	-.68	161.68	9.01	-329.74	-11.56	899.08
98	11	98	.00	.00	.00	.00	.00	.00
		99	.00	.00	.00	.00	.00	.00
	12	98	-.66	161.68	9.01	-327.84	-11.56	899.77
		99	-.66	88.17	4.18	-126.63	-43.89	1511.95
99	11	99	.00	.00	.00	.00	.00	.00
		100	.00	.00	.00	.00	.00	.00
	12	99	-.67	88.17	4.18	-129.80	-43.89	1511.69
		100	-.67	14.69	-.64	71.35	-52.57	1763.63
100	11	100	.00	.00	.00	.00	.00	.00
		101	.00	.00	.00	.00	.00	.00
	12	100	-.67	14.69	-.64	74.76	-52.57	1763.49
		101	-.67	-58.82	-5.46	275.97	-37.64	1655.37
101	11	101	.00	.00	.00	.00	.00	.00
		102	.00	.00	.00	.00	.00	.00
	12	101	-.67	-58.82	-5.46	276.25	-37.64	1655.31
		102	-.67	-106.82	-8.61	407.64	-.51	1208.77
102	11	102	.00	.00	.00	.00	.00	.00
		103	.00	.00	.00	.00	.00	.00
	12	102	-.69	-106.82	-8.61	410.17	-.51	1207.91
		103	-.69	-123.32	-9.69	455.34	42.25	675.31
103	11	103	.00	.00	.00	.00	.00	.00
		104	.00	.00	.00	.00	.00	.00
	12	103	-.69	-123.32	-9.69	454.95	42.25	675.58
		104	-.69	-178.81	-13.33	606.84	84.83	116.74
104	11	104	.00	.00	.00	.00	.00	.00
		105	-.70	-190.79	-14.11	639.82	95.80	-31.78
	12	104	-.70	-178.79	-13.33	606.97	84.83	116.08
		105	.00	.00	.00	.00	.00	.00

SC/EC-1 - (2 vías)

2 vías con 2 trenes tipo VIC-71

LOAD 28 → L.I. M^{+}_{max} C. vano (5)

LOAD 29 → L.I. M^{+}_{mix} C. vano (9)

LOAD 30 → L.I. M^{-}_{min} PILA P-4

LOAD 31 → L.I. Q_{max} PILA P-4

2 vías con 2 trenes: 1 SW2 + 1 VIC-71

LOAD 32 → L.I. M^{+}_{max} C. vano (5)

LOAD 33 → L.I. M^{+}_{mix} C. vano (9)

LOAD 34 → L.I. M^{-}_{min} PILA P-4

LOAD 35 → L.I. Q_{max} PILA P-4

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*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     3:15:45                    *
*                                                *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
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34. 31 113.996141851672 0 7999.1877637447
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36. 33 122.995154049465 0 7999.0544561267
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39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 49. 46 171.686818353569 0 7998.15751510331
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 52. 49 176.985559642506 0 7998.04201737388
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 64. 61 221.971508784523 0 7996.91994766034
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 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
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 77. 74 271.44788613695 0 7995.39342653704
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 90. 87 320.913871097799 0 7993.56080150373
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 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 28
131. MEMBER LOAD
132. 52 CON GY -50 3.7
133. 52 CON GY -50 2.1
134. 52 UNI GY -16 0 1.3
135. 53 CON GY -50 .8
136. 53 CON GY -50 2.4
137. 53 UNI GY -16 3.2 4.5
138. 54 TO 58 UNI GY -16
139. 71 TO 82 UNI GY -16
140. 95 TO 104 UNI GY -16
141. 47 TO 51 UNI GY -16
142. 23 TO 34 UNI GY -16
143. 1 TO 10 UNI GY -16
144. * TORSORES Y F CENTRIFUGA
145. 52 CMOM X 20.67 3.7
146. 52 CMOM X 20.67 2.1
147. 52 UMOM X 6.614 0 1.3
148. 53 CMOM X 20.67 .8
149. 53 CMOM X 20.67 2.4
150. 53 UMOM X 6.614 3.2 4.5
151. 54 TO 58 UMOM X 6.614
152. 71 TO 82 UMOM X 6.614
153. 95 TO 104 UMOM X 6.614
154. 47 TO 51 UMOM X 6.614
155. 23 TO 34 UMOM X 6.614
156. 1 TO 10 UMOM X 6.614
157. 52 CON Z 1.968 3.7
158. 52 CON Z 1.968 2.1
159. 52 UNI Z .63 0 1.3
160. 53 CON Z 1.968 .8
161. 53 CON Z 1.968 2.4
162. 53 UNI Z .63 3.2 4.5
163. 54 TO 58 UNI Z .63
164. 71 TO 82 UNI Z .63
165. 95 TO 104 UNI Z .63
166. 47 TO 51 UNI Z .63
167. 23 TO 34 UNI Z .63
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169. LOAD 29
170. MEMBER LOAD
171. 99 CON GY -50 4.1
172. 99 CON GY -50 2.5
173. 99 UNI GY -16 0 1.7
174. 100 CON GY -50 .8
175. 100 CON GY -50 2.4
176. 100 UNI GY -16 3.2 4.9
177. 101 TO 104 UNI GY -16
178. 95 TO 98 UNI GY -16
179. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI GY -16
180. * TORSORES + CENTRIFUGA
181. 99 CMOM X 20.67 4.1
182. 99 CMOM X 20.67 2.5
183. 99 UMOM X 6.614 0 1.7
184. 100 CMOM X 20.67 .8
185. 100 CMOM X 20.67 2.4
186. 100 UMOM X 6.614 3.2 4.9
187. 101 TO 104 UMOM X 6.614
188. 95 TO 98 UMOM X 6.614
189. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UMOM X 6.614
190. 99 CON Z 1.968 4.1
191. 99 CON Z 1.968 2.5
192. 99 UNI Z .63 0 1.7
193. 100 CON Z 1.968 .8
194. 100 CON Z 1.968 2.4
195. 100 UNI Z .63 3.2 4.9
196. 101 TO 104 UNI Z .63
197. 95 TO 98 UNI Z .63
198. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI Z .63
199. LOAD 30
200. JOINT LOAD
201. 48 46 FY -50
202. MEMBER LOAD
203. 48 CON GY -50 1.6
204. 48 UNI GY -16 2.4 3.7
205. 45 CON GY -50 2.1
206. 45 UNI GY -16 0 1.3
207. 49 TO 58 35 TO 44 UNI GY -16
208. 71 TO 82 95 TO 104 11 TO 22 UNI GY -16
209. * TORSORES
210. JOINT LOAD
211. 48 46 MX 20.67
212. MEMBER LOAD
213. 48 CMOM X 20.67 1.6
214. 48 UMOM X 6.614 2.4 3.7
215. 45 CMOM X 20.67 2.1
216. 45 UMOM X 6.614 0 1.3
217. 49 TO 58 35 TO 44 UMOM X 6.614
218. 71 TO 82 95 TO 104 11 TO 22 UMOM X 6.614
219. JOINT LOAD
220. 48 46 FZ 1.968
221. MEMBER LOAD
222. 48 CON Z 1.968 1.6
223. 48 UNI Z .63 2.4 3.7
224. 45 CON Z 1.968 2.1
225. 45 UNI Z .63 0 1.3
226. 49 TO 58 35 TO 44 UNI Z .63
227. 71 TO 82 95 TO 104 11 TO 22 UNI Z .63
228. LOAD 31
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229. MEMBER LOAD
230. 47 CON GY -50 0.0001
231. 48 CON GY -50 .8
232. 48 CON GY -50 2.4
233. 49 CON GY -50 0.3
234. 49 UNI GY -16 1.1 4.5
235. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI GY -16
236. 35 TO 45 UNI GY -16
237. *TORSORES + CENTRIFUGA
238. 47 CMOM X 20.67 0.0001
239. 48 CMOM X 20.67 .8
240. 48 CMOM X 20.67 2.4
241. 49 CMOM X 20.67 0.3
242. 49 UMOM X 6.614 1.1 4.5
243. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UMOM X 6.614
244. 35 TO 45 UMOM X 6.614
245. 47 CON Z 1.968 0.0001
246. 48 CON Z 1.968 .8
247. 48 CON Z 1.968 2.4
248. 49 CON Z 1.968 0.3
249. 49 UNI Z .63 1.1 4.5
250. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI Z .63
251. 35 TO 45 UNI Z .63
252. LOAD 32
253. MEMBER LOAD
254. 47 TO 52 UNI GY -15
255. 47 TO 52 UMOM X 33.75
256. 53 UNI GY -15 0 2.5
257. 53 UMOM X 33.75 0 2.5
258. 55 UNI GY -15 .5 4.5
259. 55 UMOM X 33.75 0.5 4.5
260. 56 TO 61 UNI GY -15
261. 56 TO 61 UMOM X 33.75
262. 62 UNI GY -15 0 3
263. 62 UMOM X 33.75 0 3
264. * RIPADO + F.CENTRIFUGA
265. 47 TO 52 UMOM X 7.31
266. 53 UMOM X 7.31 0 2.5
267. 55 UMOM X 7.31 0.5 4.5
268. 56 TO 61 UMOM X 7.31
269. 62 UMOM X 7.31 0 3
270. 47 TO 52 UNI Z .984
271. 53 UNI Z .984 0 2.5
272. 55 UNI Z .984 0.5 4.5
273. 56 TO 61 UNI Z .984
274. 62 UNI Z .984 0 3
275. MEMBER LOAD
276. 52 CON GY -25 3.7
277. 52 CON GY -25 2.1
278. 52 UNI GY -8 0 1.3
279. 53 CON GY -25 .8
280. 53 CON GY -25 2.4
281. 53 UNI GY -8 3.2 4.5
282. 54 TO 58 UNI GY -8
283. 71 TO 82 UNI GY -8
284. 95 TO 104 UNI GY -8
285. 47 TO 51 UNI GY -8
286. 23 TO 34 UNI GY -8
287. 1 TO 10 UNI GY -8
288. * TORSORES Y F CENTRIFUGA
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289. 52 CMOM X -45.915 3.7
290. 52 CMOM X -45.915 2.1
291. 52 UMOM X -14.693 0 1.3
292. 53 CMOM X 45.915 .8
293. 53 CMOM X -45.915 2.4
294. 53 UMOM X -14.693 3.2 4.5
295. 54 TO 58 UMOM X -14.693
296. 71 TO 82 UMOM X -14.693
297. 95 TO 104 UMOM X -14.693
298. 47 TO 51 UMOM X -14.693
299. 23 TO 34 UMOM X -14.693
300. 1 TO 10 UMOM X -14.693
301. 52 CON Z .984 3.7
302. 52 CON Z .984 2.1
303. 52 UNI Z .315 0 1.3
304. 53 CON Z .984 .8
305. 53 CON Z .984 2.4
306. 53 UNI Z .315 3.2 4.5
307. 54 TO 58 UNI Z .315
308. 71 TO 82 UNI Z .315
309. 95 TO 104 UNI Z .315
310. 47 TO 51 UNI Z .315
311. 23 TO 34 UNI Z .315
312. LOAD 33
313. MEMBER LOAD
314. 95 TO 100 UNI GY -15
315. 95 TO 100 UMOM X 41.06
316. 95 TO 100 UNI Z .984
317. 101 UNI GY -15 0 3.2
318. 101 UMOM X 41.06 0 3.2
319. 101 UNI Z .984 0 3.2
320. 102 UNI GY -15 3.8 4.9
321. 102 UMOM X 41.06 3.8 4.9
322. 102 UNI Z .984 3.8 4.9
323. 103 104 UNI GY -15
324. 103 104 UMOM X 41.06
325. 103 104 UNI Z .984
326. MEMBER LOAD
327. 99 CON GY -25 4.1
328. 99 CON GY -25 2.5
329. 99 UNI GY -8 0 1.7
330. 100 CON GY -25 .8
331. 100 CON GY -25 2.4
332. 100 UNI GY -8 3.2 4.9
333. 101 TO 104 UNI GY -8
334. 95 TO 98 UNI GY -8
335. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI GY -8
336. * TORSORES + CENTRIFUGA
337. 99 CMOM X -45.915 4.1
338. 99 CMOM X -45.915 2.5
339. 99 UMOM X -14.693 0 1.7
340. 100 CMOM X -45.915 .8
341. 100 CMOM X -45.915 2.4
342. 100 UMOM X -14.693 3.2 4.9
343. 101 TO 104 UMOM X -14.693
344. 95 TO 98 UMOM X -14.693
345. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UMOM X -14.693
346. 99 CON Z .984 4.1
347. 99 CON Z .984 2.5
348. 99 UNI Z .315 0 1.7
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349. 100 CON Z .984 .8
350. 100 CON Z .984 2.4
351. 100 UNI Z .315 3.2 4.9
352. 101 TO 104 UNI Z .315
353. 95 TO 98 UNI Z .315
354. 71 TO 82 47 TO 58 23 TO 34 1 TO 10 UNI Z .315
355. LOAD 34
356. MEMBER LOAD
357. 48 UNI GY -15 2.7 3.7
358. 48 UMOM X 41.06 2.7 3.7
359. 48 UNI Z .984 2.7 3.7
360. 49 TO 53 UNI GY -15
361. 49 TO 53 UMOM X 41.06
362. 49 TO 53 UNI Z .984
363. 54 UNI GY -15 0 1.5
364. 54 UMOM X 41.06 0 1.5
365. 54 UNI Z .984 0 1.5
366. 45 UNI GY -15 0 1
367. 45 UMOM X 41.06 0 1
368. 45 UNI Z .984 0 1
369. 40 TO 44 UNI GY -15
370. 40 TO 44 UMOM X 41.06
371. 40 TO 44 UNI Z .984
372. 39 UNI GY -15 3 4.5
373. 39 UMOM X 41.06 3 4.5
374. 39 UNI Z .984 3 4.5
376. JOINT LOAD
377. 48 46 FY -25
378. MEMBER LOAD
379. 48 CON GY -25 1.6
380. 48 UNI GY -8 2.4 3.7
381. 45 CON GY -25 2.1
382. 45 UNI GY -8 0 1.3
383. 49 TO 58 35 TO 44 UNI GY -8
384. 71 TO 82 95 TO 104 11 TO 22 UNI GY -8
385. * TORSORES
386. JOINT LOAD
387. 48 46 MX -45.915
388. MEMBER LOAD
389. 48 CMOM X -45.915 1.6
390. 48 UMOM X -14.693 2.4 3.7
391. 45 CMOM X -45.915 2.1
392. 45 UMOM X -14.693 0 1.3
393. 49 TO 58 35 TO 44 UMOM X -14.693
394. 71 TO 82 95 TO 104 11 TO 22 UMOM X -14.693
395. JOINT LOAD
396. 48 46 FZ .984
397. MEMBER LOAD
398. 48 CON Z .984 1.6
399. 48 UNI Z .315 2.4 3.7
400. 45 CON Z .984 2.1
401. 45 UNI Z .315 0 1.3
402. 49 TO 58 35 TO 44 UNI Z .315
403. 71 TO 82 95 TO 104 11 TO 22 UNI Z .315
404. LOAD 35
405. MEMBER LOAD
406. 47 TO 52 UNI GY -15
407. 47 TO 52 UMOM X 41.06
408. 47 TO 52 UNI Z .984
409. 53 UNI GY -15 0 2.5
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WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 55

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410. 53 UMOM X 41.06 0 2.5
411. 53 UNI Z .984 0 2.5
412. 38 UNI GY -15 4 4.5
413. 38 UMOM X 41.06 4 4.5
414. 38 UNI Z .984 4 4.5
415. 39 TO 43 UNI GY -15
416. 39 TO 43 UMOM X 41.06
417. 39 TO 43 UNI Z .984
418. 44 UNI GY -15 0 2
419. 44 UMOM X 41.06 0 2
420. 44 UNI GZ .984 0 2
421. MEMBER LOAD
422. 47 CON GY -25 0.0001
423. 48 CON GY -25 .8
424. 48 CON GY -25 2.4
425. 49 CON GY -25 0.3
426. 49 UNI GY -8 1.1 4.5
427. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI GY -8
428. 35 TO 45 UNI GY -8
429. *TORSORES + CENTRIFUGA
430. 47 CMOM X -45.915 0.0001
431. 48 CMOM X -45.915 .8
432. 48 CMOM X -45.915 2.4
433. 49 CMOM X -45.915 0.3
434. 49 UMOM X -14.693 1.1 4.5
435. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UMOM X -14.693
436. 35 TO 45 UMOM X -14.693
437. 47 CON Z .984 0.0001
438. 48 CON Z .984 .8
439. 48 CON Z .984 2.4
440. 49 CON Z .984 0.3
441. 49 UNI Z .315 1.1 4.5
442. 50 TO 58 71 TO 82 95 TO 104 11 TO 22 UNI Z .315
443. 35 TO 45 UNI Z .315
445. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 105/ 104/ 10
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 8, TOTAL DEGREES OF FREEDOM = 589
SIZE OF STIFFNESS MATRIX = 7068 DOUBLE PREC. WORDS
TOTAL REQUIRED DISK SPACE = 12.36 MEGA-BYTES

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 55

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 53

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 39

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 39

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

WARNING LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB 49

++ PROCESSING ELEMENT STIFFNESS MATRIX. 3:15:50
++ PROCESSING GLOBAL STIFFNESS MATRIX. 3:15:50
++ PROCESSING TRIANGULAR FACTORIZATION. 3:15:51
++ CALCULATING JOINT DISPLACEMENTS. 3:15:51
++ CALCULATING MEMBER FORCES. 3:15:52

446. PRINT MEMBER FORCES

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	28	1	-3.29	275.95	0.01	-125.50	-0.03	-0.01
		2	3.29	-263.15	-0.01	120.20	0.03	215.66
	29	1	-3.43	275.73	-11.81	-125.50	75.81	0.00
		2	3.43	-262.93	11.30	120.21	-66.56	215.47
	30	1	-3.57	-51.96	0.01	-0.47	-0.04	0.00
		2	3.57	51.96	-0.01	0.47	0.03	-41.57
	31	1	-3.66	-51.89	0.01	-0.47	-0.04	0.00
		2	3.66	51.89	-0.01	0.47	0.03	-41.51
	32	1	-2.89	138.84	0.01	274.76	-0.03	0.00
		2	2.89	-132.44	-0.01	-263.01	0.02	108.52
	33	1	-3.22	137.90	-5.90	274.75	37.89	0.00
		2	3.22	-131.50	5.65	-263.00	-33.27	107.76
	34	1	-2.84	-27.38	0.01	-0.25	-0.03	0.00
		2	2.84	27.38	-0.01	0.25	0.02	-21.91
	35	1	-2.83	-27.81	0.01	-0.25	-0.03	0.00
		2	2.83	27.81	-0.01	0.25	0.02	-22.25
2	28	2	-3.29	263.17	0.01	-120.20	-0.03	-215.66
		3	3.29	-203.97	-0.01	95.73	0.00	1079.88
	29	2	-3.43	262.93	-11.30	-120.21	66.56	-215.46
		3	3.43	-203.73	8.97	95.73	-29.06	1078.80
	30	2	-3.57	-51.96	0.01	-0.47	-0.03	41.57
		3	3.57	51.96	-0.01	0.47	0.00	-233.83
	31	2	-3.66	-51.89	0.01	-0.47	-0.03	41.51
		3	3.66	51.89	-0.01	0.47	0.00	-233.51
	32	2	-2.89	132.44	0.01	263.01	-0.02	-108.51
		3	2.89	-102.84	-0.01	-208.64	0.00	543.78
	33	2	-3.22	131.49	-5.65	263.00	33.27	-107.76
		3	3.22	-101.89	4.48	-208.63	-14.53	539.51
	34	2	-2.84	-27.38	0.01	-0.25	-0.02	21.91
		3	2.84	27.38	-0.01	0.25	0.00	-123.23
	35	2	-2.83	-27.81	0.01	-0.25	-0.02	22.25
		3	2.83	27.81	-0.01	0.25	0.00	-125.14
3	28	3	-3.29	203.97	0.00	-93.39	0.00	-1080.08
		4	3.29	-127.97	0.00	61.97	0.00	1868.45
	29	3	-3.41	203.73	-8.98	-93.39	29.06	-1079.01
		4	3.41	-127.73	5.99	61.97	6.48	1866.25
	30	3	-3.57	-51.96	0.00	-0.98	0.00	233.83
		4	3.57	51.96	0.00	0.98	0.01	-480.66
	31	3	-3.66	-51.89	0.00	-0.98	0.00	233.51
		4	3.66	51.89	0.00	0.98	0.01	-479.99
	32	3	-2.89	102.84	0.00	209.82	0.00	-543.32
		4	2.89	-64.84	0.00	-140.03	0.00	941.56
	33	3	-3.21	101.89	-4.49	209.80	14.53	-539.06
		4	3.21	-63.89	2.99	-140.01	3.24	932.79
	34	3	-2.84	-27.38	0.00	-0.52	0.00	123.23
		4	2.84	27.38	0.00	0.52	0.00	-253.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	3	-2.83	-27.81	0.00	-0.52	0.00	125.14
		4	2.83	27.81	0.00	0.52	0.00	-257.23
4	28	4	-3.29	127.97	0.01	-66.03	0.00	-1868.32
		5	3.29	-51.97	-0.01	34.61	-0.03	2295.68
	29	4	-3.43	127.73	-5.98	-66.03	-6.48	-1866.11
		5	3.43	-51.73	2.99	34.61	27.77	2292.34
	30	4	-3.57	-51.96	0.01	0.06	-0.01	480.66
		5	3.57	51.96	-0.01	-0.06	-0.03	-727.48
	31	4	-3.66	-51.89	0.01	0.06	-0.01	479.99
		5	3.66	51.89	-0.01	-0.06	-0.03	-726.48
	32	4	-2.89	64.84	0.01	137.98	0.00	-941.86
		5	2.89	-26.84	-0.01	-68.19	-0.02	1159.60
	33	4	-3.21	63.89	-2.99	137.99	-3.24	-933.09
		5	3.21	-25.89	1.49	-68.19	13.87	1146.33
	34	4	-2.84	-27.38	0.01	0.03	0.00	253.31
		5	2.84	27.38	-0.01	-0.03	-0.02	-383.39
	35	4	-2.83	-27.81	0.01	0.03	0.00	257.23
		5	2.83	27.81	-0.01	-0.03	-0.02	-389.32
5	28	5	-3.29	51.97	0.00	-30.01	0.03	-2295.75
		6	3.29	24.03	0.00	-1.41	-0.03	2362.12
	29	5	-3.42	51.73	-2.99	-30.02	-27.77	-2292.41
		6	3.42	24.27	0.00	-1.40	34.87	2357.64
	30	5	-3.57	-51.96	0.00	-1.40	0.03	727.48
		6	3.57	51.96	0.00	1.40	-0.03	-974.30
	31	5	-3.66	-51.89	0.00	-1.39	0.03	726.48
		6	3.66	51.89	0.00	1.39	-0.03	-972.96
	32	5	-2.89	26.84	0.00	70.52	0.02	-1159.46
		6	2.89	11.16	0.00	-0.73	-0.03	1196.70
	33	5	-3.21	25.89	-1.50	70.49	-13.87	-1146.19
		6	3.21	12.11	0.00	-0.70	17.42	1178.92
	34	5	-2.84	-27.38	0.00	-0.74	0.02	383.39
		6	2.84	27.38	0.00	0.74	-0.02	-513.46
	35	5	-2.83	-27.81	0.00	-0.75	0.02	389.32
		6	2.83	27.81	0.00	0.75	-0.02	-521.41
6	28	6	-3.29	-24.03	0.00	1.80	0.03	-2362.13
		7	3.29	100.03	0.00	-33.22	-0.03	2067.47
	29	6	-3.42	-24.27	0.00	1.80	-34.87	-2357.65
		7	3.42	100.27	-2.99	-33.21	27.77	2061.86
	30	6	-3.57	-51.96	0.00	-1.56	0.03	974.31
		7	3.57	51.96	0.00	1.56	-0.03	-1221.13
	31	6	-3.66	-51.89	0.00	-1.56	0.03	972.97
		7	3.66	51.89	0.00	1.56	-0.03	-1219.45
	32	6	-2.89	-11.16	0.00	0.93	0.03	-1196.70
		7	2.89	49.16	0.00	68.87	-0.02	1053.43
	33	6	-3.21	-12.11	0.00	0.90	-17.42	-1178.92
		7	3.21	50.11	-1.50	68.89	13.87	1031.15
	34	6	-2.84	-27.38	0.00	-0.82	0.02	513.46
		7	2.84	27.38	0.00	0.82	-0.02	-643.54

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	6	-2.83	-27.81	0.00	-0.83	0.02	521.41
		7	2.83	27.81	0.00	0.83	-0.02	-653.50
7	28	7	-3.29	-100.03	-0.01	37.36	0.03	-2067.41
		8	3.29	176.02	0.01	-68.78	0.01	1411.80
	29	7	-3.43	-100.26	2.99	37.35	-27.77	-2061.79
		8	3.43	176.26	-5.98	-68.76	6.48	1405.05
	30	7	-3.57	-51.96	-0.01	-4.01	0.03	1221.12
		8	3.57	51.96	0.01	4.01	0.01	-1467.94
	31	7	-3.66	-51.89	-0.01	-4.00	0.03	1219.44
		8	3.66	51.89	0.01	4.00	0.01	-1465.93
	32	7	-2.89	-49.16	-0.01	-66.75	0.02	-1053.57
		8	2.89	87.16	0.01	136.54	0.01	729.81
	33	7	-3.21	-50.11	1.49	-66.83	-13.87	-1031.29
		8	3.21	88.11	-2.99	136.62	3.24	703.03
	34	7	-2.84	-27.38	-0.01	-2.11	0.02	643.54
		8	2.84	27.38	0.01	2.11	0.01	-773.61
	35	7	-2.83	-27.81	-0.01	-2.14	0.02	653.50
		8	2.83	27.81	0.01	2.14	0.01	-785.59
8	28	8	-3.29	-176.03	-0.01	68.78	-0.01	-1411.79
		9	3.29	252.03	0.01	-100.20	0.04	395.15
	29	8	-3.43	-176.27	5.98	68.76	-6.48	-1405.04
		9	3.43	252.27	-8.97	-100.18	-29.02	387.27
	30	8	-3.57	-51.96	-0.01	-4.01	-0.01	1467.94
		9	3.57	51.96	0.01	4.01	0.04	-1714.77
	31	8	-3.66	-51.89	-0.01	-4.00	-0.01	1465.93
		9	3.66	51.89	0.01	4.00	0.04	-1712.41
	32	8	-2.89	-87.16	-0.01	-136.54	-0.01	-729.81
		9	2.89	125.16	0.01	206.34	0.03	225.54
	33	8	-3.21	-88.11	2.99	-136.62	-3.24	-703.03
		9	3.21	126.11	-4.48	206.41	-14.49	194.26
	34	8	-2.84	-27.39	-0.01	-2.11	-0.01	773.61
		9	2.84	27.39	0.01	2.11	0.03	-903.69
	35	8	-2.83	-27.81	-0.01	-2.14	-0.01	785.59
		9	2.83	27.81	0.01	2.14	0.03	-917.68
9	28	9	-3.29	-252.03	0.00	99.65	-0.04	-395.29
		10	3.29	311.23	0.00	-124.12	0.05	-646.74
	29	9	-3.41	-252.27	8.98	99.64	29.02	-387.41
		10	3.41	311.47	-11.31	-124.11	-66.54	-655.51
	30	9	-3.57	-51.96	0.00	-1.63	-0.04	1714.78
		10	3.57	51.96	0.00	1.63	0.05	-1907.03
	31	9	-3.66	-51.89	0.00	-1.62	-0.04	1712.42
		10	3.66	51.89	0.00	1.62	0.05	-1904.41
	32	9	-2.89	-125.16	0.00	-206.65	-0.03	-225.26
		10	2.89	154.76	0.00	261.01	0.04	-292.60
	33	9	-3.21	-126.11	4.49	-206.68	14.49	-193.97
		10	3.21	155.71	-5.65	261.04	-33.25	-327.39
	34	9	-2.84	-27.39	0.00	-0.86	-0.03	903.69
		10	2.84	27.39	0.00	0.86	0.04	-1005.02

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	9	-2.83	-27.81	0.00	-0.87	-0.03	917.68
		10	2.83	27.81	0.00	0.87	0.04	-1020.58
10	28	10	-3.29	-311.21	-0.03	118.22	-0.05	647.86
		11	3.29	324.01	0.03	-123.51	0.07	-901.94
	29	10	-3.52	-311.43	11.27	118.13	66.54	656.63
		11	3.52	324.23	-11.78	-123.42	-75.76	-910.90
	30	10	-3.57	-52.01	-0.04	-19.01	-0.05	1906.91
		11	3.57	52.01	0.04	19.01	0.08	-1948.53
	31	10	-3.66	-51.91	-0.04	-18.98	-0.05	1904.30
		11	3.66	51.91	0.04	18.98	0.08	-1945.84
	32	10	-2.89	-154.77	-0.03	-263.67	-0.04	290.21
		11	2.89	161.17	0.03	275.43	0.06	-416.60
	33	10	-3.26	-155.74	5.62	-264.02	33.25	324.99
		11	3.26	162.14	-5.87	275.77	-37.85	-452.15
	34	10	-2.84	-27.39	-0.03	-10.02	-0.04	1004.96
		11	2.84	27.39	0.03	10.02	0.06	-1026.88
	35	10	-2.83	-27.81	-0.03	-10.17	-0.04	1020.53
		11	2.83	27.81	0.03	10.17	0.06	-1042.78
11	28	11	-3.29	-15.20	0.02	1.15	-0.04	900.44
		12	3.29	15.20	-0.02	-1.15	0.02	-912.58
	29	11	-3.38	-14.33	0.02	1.25	-0.04	909.39
		12	3.38	14.33	-0.02	-1.25	0.02	-920.84
	30	11	-3.57	371.11	-14.15	-136.95	108.82	1948.60
		12	3.57	-358.31	13.65	131.65	-97.70	-1656.84
	31	11	-3.66	370.83	-14.15	-136.97	108.82	1945.93
		12	3.66	-358.03	13.65	131.68	-97.70	-1654.37
	32	11	-2.89	-10.60	0.02	0.25	-0.03	419.84
		12	2.89	10.60	-0.02	-0.25	0.02	-428.31
	33	11	-3.19	-7.12	0.02	0.63	-0.04	455.38
		12	3.19	7.12	-0.02	-0.63	0.02	-461.08
	34	11	-2.84	190.88	-7.07	337.09	54.40	1026.91
		12	2.84	-184.48	6.82	-325.34	-48.84	-876.78
	35	11	-2.83	192.47	-7.07	337.26	54.40	1042.82
		12	2.83	-186.07	6.82	-325.51	-48.84	-891.42
12	28	12	-3.29	-15.19	0.00	-3.94	-0.02	912.58
		13	3.29	15.19	0.00	3.94	0.00	-968.79
	29	12	-3.38	-14.31	0.00	-3.89	-0.02	920.83
		13	3.38	14.31	0.00	3.89	0.00	-973.79
	30	12	-3.49	358.30	-13.67	-140.89	97.70	1656.08
		13	3.49	-299.10	11.33	116.42	-51.45	-439.92
	31	12	-3.58	358.04	-13.67	-140.91	97.70	1653.62
		13	3.58	-298.84	11.33	116.44	-51.45	-438.42
	32	12	-2.89	-10.60	0.00	-2.14	-0.02	428.31
		13	2.89	10.60	0.00	2.14	0.00	-467.53
	33	12	-3.19	-7.11	0.00	-1.94	-0.02	461.07
		13	3.19	7.11	0.00	1.94	0.00	-487.39
	34	12	-2.80	184.49	-6.83	320.44	48.84	878.57
		13	2.80	-154.89	5.67	-266.08	-25.72	-250.73

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	12	-2.80	186.05	-6.83	320.53	48.84	893.22
		13	2.80	-156.45	5.67	-266.17	-25.72	-259.61
13	28	13	-3.29	-15.19	0.00	-5.03	0.00	968.79
		14	3.29	15.19	0.00	5.03	0.00	-1037.15
	29	13	-3.38	-14.32	0.00	-4.98	0.00	973.79
		14	3.38	14.32	0.00	4.98	0.00	-1038.20
	30	13	-3.48	299.10	-11.34	-116.92	51.45	439.79
		14	3.48	-227.10	8.50	87.15	-6.80	744.15
	31	13	-3.57	298.84	-11.34	-116.93	51.45	438.29
		14	3.57	-226.84	8.50	87.17	-6.80	744.47
	32	13	-2.89	-10.60	0.00	-2.66	0.00	467.52
		14	2.89	10.60	0.00	2.66	0.00	-515.22
	33	13	-3.19	-7.11	0.00	-2.49	0.00	487.38
		14	3.19	7.11	0.00	2.49	0.00	-519.39
	34	13	-2.80	154.89	-5.67	265.80	25.72	251.03
		14	2.80	-118.89	4.25	-199.68	-3.40	364.98
	35	13	-2.79	156.45	-5.67	265.87	25.72	259.91
		14	2.79	-120.45	4.25	-199.76	-3.40	363.11
14	28	14	-3.29	-15.19	0.01	-2.65	0.00	1037.16
		15	3.29	15.19	-0.01	2.65	-0.04	-1105.53
	29	14	-3.38	-14.31	0.01	-2.60	0.00	1038.22
		15	3.38	14.31	-0.01	2.60	-0.04	-1102.62
	30	14	-3.50	227.09	-8.50	-88.86	6.80	-743.95
		15	3.50	-155.09	5.66	59.10	25.05	1603.90
	31	14	-3.59	226.83	-8.50	-88.87	6.80	-744.27
		15	3.59	-154.83	5.66	59.11	25.05	1603.03
	32	14	-2.89	-10.60	0.01	-1.48	0.00	515.23
		15	2.89	10.60	-0.01	1.48	-0.04	-562.92
	33	14	-3.19	-7.11	0.01	-1.30	0.00	519.39
		15	3.19	7.11	-0.01	1.30	-0.04	-551.40
	34	14	-2.81	118.89	-4.25	198.84	3.40	-365.44
		15	2.81	-82.89	2.83	-132.72	12.51	819.44
	35	14	-2.80	120.45	-4.25	198.92	3.40	-363.57
		15	2.80	-84.45	2.83	-132.80	12.51	824.59
15	28	15	-3.29	-15.19	0.00	-5.18	0.04	1105.52
		16	3.29	15.19	0.00	5.18	-0.05	-1173.89
	29	15	-3.38	-14.31	0.00	-5.13	0.04	1102.62
		16	3.38	14.31	0.00	5.13	-0.05	-1167.03
	30	15	-3.48	155.09	-5.67	-55.42	-25.05	-1604.04
		16	3.48	-83.09	2.83	25.66	44.18	2139.95
	31	15	-3.58	154.83	-5.67	-55.44	-25.05	-1603.16
		16	3.58	-82.83	2.83	25.67	44.18	2137.90
	32	15	-2.89	-10.60	0.00	-2.77	0.04	562.92
		16	2.89	10.60	0.00	2.77	-0.04	-610.62
	33	15	-3.19	-7.11	0.00	-2.56	0.04	551.39
		16	3.19	7.11	0.00	2.56	-0.05	-583.39
	34	15	-2.80	82.89	-2.83	134.60	-12.51	-819.14
		16	2.80	-46.89	1.42	-68.48	22.08	1111.13

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	15	-2.79	84.45	-2.83	134.69	-12.51	-824.29
		16	2.79	-48.45	1.42	-68.58	22.08	1123.31
16	28	16	-3.29	-15.19	-0.01	-7.67	0.05	1173.87
		17	3.29	15.19	0.01	7.67	-0.02	-1242.24
	29	16	-3.38	-14.31	-0.01	-7.60	0.05	1167.02
		17	3.38	14.31	0.01	7.60	-0.02	-1231.42
	30	16	-3.48	83.09	-2.84	-21.13	-44.18	-2140.02
		17	3.48	-11.10	0.01	-8.64	50.59	2351.94
	31	16	-3.57	82.83	-2.84	-21.15	-44.18	-2137.95
		17	3.57	-10.83	0.01	-8.62	50.59	2348.72
	32	16	-2.89	-10.60	-0.01	-4.06	0.04	610.62
		17	2.89	10.60	0.01	4.06	-0.02	-658.31
	33	16	-3.19	-7.11	-0.01	-3.80	0.05	583.38
		17	3.19	7.11	0.01	3.80	-0.02	-615.39
	34	16	-2.80	46.89	-1.42	70.84	-22.08	-1110.99
		17	2.80	-10.89	0.01	-4.72	25.29	1240.99
	35	16	-2.79	48.45	-1.42	70.95	-22.08	-1123.17
		17	2.79	-12.45	0.00	-4.84	25.29	1260.18
17	28	17	-3.29	-15.20	0.00	-5.04	0.02	1242.26
		18	3.29	15.20	0.00	5.04	-0.03	-1310.63
	29	17	-3.38	-14.31	0.00	-5.00	0.02	1231.45
		18	3.38	14.31	0.00	5.00	-0.03	-1295.86
	30	17	-3.48	11.09	0.00	3.66	-50.59	-2351.96
		18	3.48	60.91	-2.84	-33.42	44.20	2239.89
	31	17	-3.57	10.84	0.00	3.64	-50.59	-2348.72
		18	3.57	61.16	-2.84	-33.41	44.20	2235.49
	32	17	-2.89	-10.60	0.00	-2.67	0.02	658.31
		18	2.89	10.60	0.00	2.67	-0.02	-706.02
	33	17	-3.19	-7.11	0.00	-2.50	0.02	615.39
		18	3.19	7.11	0.00	2.50	-0.02	-647.39
	34	17	-2.80	10.89	0.00	2.09	-25.29	-1241.00
		18	2.80	25.11	-1.42	64.03	22.09	1209.01
	35	17	-2.79	12.45	0.00	2.17	-25.29	-1260.19
		18	2.79	23.55	-1.42	63.95	22.09	1235.22
18	28	18	-3.29	-15.19	-0.01	-7.81	0.03	1310.61
		19	3.29	15.19	0.01	7.81	0.00	-1378.98
	29	18	-3.38	-14.32	-0.01	-7.74	0.03	1295.84
		19	3.38	14.32	0.01	7.74	0.00	-1360.26
	30	18	-3.48	-60.90	2.83	38.16	-44.20	-2239.83
		19	3.48	132.90	-5.66	-67.92	25.10	1803.78
	31	18	-3.58	-61.16	2.83	38.14	-44.20	-2235.41
		19	3.58	133.16	-5.66	-67.90	25.10	1798.17
	32	18	-2.89	-10.60	-0.01	-4.16	0.02	706.01
		19	2.89	10.60	0.01	4.16	0.00	-753.71
	33	18	-3.19	-7.11	-0.01	-3.87	0.02	647.39
		19	3.19	7.11	0.01	3.87	0.00	-679.39
	34	18	-2.80	-25.11	1.41	-61.47	-22.09	-1209.14
		19	2.80	61.11	-2.83	127.59	12.55	1015.13

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	18	-2.79	-23.55	1.41	-61.34	-22.09	-1235.36
		19	2.79	59.55	-2.83	127.45	12.55	1048.36
19	28	19	-3.29	-15.19	-0.01	-7.81	0.00	1378.98
		20	3.29	15.19	0.01	7.81	0.03	-1447.35
	29	19	-3.38	-14.32	-0.01	-7.74	0.00	1360.26
		20	3.38	14.32	0.01	7.74	0.03	-1424.68
	30	19	-3.48	-132.90	5.66	67.92	-25.10	-1803.76
		20	3.48	204.90	-8.50	-97.69	-6.77	1043.69
	31	19	-3.58	-133.17	5.66	67.90	-25.10	-1798.17
		20	3.58	205.17	-8.50	-97.67	-6.77	1036.92
	32	19	-2.89	-10.60	-0.01	-4.16	0.00	753.71
		20	2.89	10.60	0.01	4.16	0.02	-801.40
	33	19	-3.19	-7.11	-0.01	-3.87	0.00	679.38
		20	3.19	7.11	0.01	3.87	0.03	-711.40
	34	19	-2.80	-61.11	2.83	-127.59	-12.55	-1015.14
		20	2.80	97.11	-4.25	193.71	-3.38	659.14
	35	19	-2.79	-59.55	2.83	-127.45	-12.55	-1048.37
		20	2.79	95.55	-4.25	193.57	-3.38	699.39
20	28	20	-3.29	-15.19	-0.01	-8.07	-0.03	1447.35
		21	3.29	15.19	0.01	8.07	0.06	-1515.72
	29	20	-3.38	-14.31	-0.01	-7.99	-0.03	1424.68
		21	3.38	14.31	0.01	7.99	0.06	-1489.09
	30	20	-3.49	-204.90	8.50	97.87	6.77	-1043.67
		21	3.49	276.90	-11.33	-127.64	-51.39	-40.38
	31	20	-3.58	-205.17	8.50	97.85	6.77	-1036.90
		21	3.58	277.17	-11.33	-127.61	-51.39	-48.35
	32	20	-2.89	-10.60	-0.01	-4.31	-0.02	801.40
		21	2.89	10.60	0.01	4.31	0.05	-849.10
	33	20	-3.19	-7.11	-0.01	-3.99	-0.03	711.39
		21	3.19	7.11	0.01	3.99	0.05	-743.40
	34	20	-2.80	-97.11	4.25	-193.59	3.38	-659.17
		21	2.80	133.11	-5.66	259.71	-25.68	141.17
	35	20	-2.79	-95.55	4.25	-193.45	3.38	-699.42
		21	2.79	131.55	-5.66	259.57	-25.68	188.44
21	28	21	-3.29	-15.19	-0.01	-10.69	-0.06	1515.71
		22	3.29	15.19	0.01	10.69	0.10	-1571.92
	29	21	-3.38	-14.31	-0.01	-10.57	-0.06	1489.08
		22	3.38	14.31	0.01	10.57	0.10	-1542.03
	30	21	-3.51	-276.90	11.33	127.57	51.39	40.61
		22	3.51	336.10	-13.66	-152.04	-97.61	-1174.67
	31	21	-3.60	-277.17	11.33	127.53	51.39	48.57
		22	3.60	336.37	-13.66	-152.00	-97.61	-1183.61
	32	21	-2.89	-10.60	-0.01	-5.77	-0.05	849.09
		22	2.89	10.60	0.01	5.77	0.09	-888.31
	33	21	-3.19	-7.11	-0.01	-5.28	-0.05	743.39
		22	3.19	7.11	0.01	5.28	0.10	-769.70
	34	21	-2.81	-133.11	5.66	-259.46	25.68	-141.62
		22	2.81	162.71	-6.83	313.83	-48.77	-405.65

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	21	-2.80	-131.55	5.66	-259.24	25.68	-188.89
		22	2.80	161.15	-6.83	313.61	-48.77	-352.61
22	28	22	-3.29	-15.24	-0.02	-14.11	-0.10	1571.89
		23	3.29	15.24	0.02	14.11	0.12	-1584.04
	29	22	-3.38	-14.30	-0.02	-13.92	-0.10	1542.01
		23	3.38	14.30	0.02	13.92	0.12	-1553.46
	30	22	-3.54	-336.19	13.65	149.48	97.61	1174.97
		23	3.54	348.99	-14.15	-154.78	-108.74	-1449.03
	31	22	-3.63	-336.38	13.65	149.43	97.61	1183.94
		23	3.63	349.18	-14.15	-154.72	-108.73	-1458.14
	32	22	-2.89	-10.60	-0.02	-7.70	-0.09	888.30
		23	2.89	10.60	0.02	7.70	0.10	-896.76
	33	22	-3.19	-7.13	-0.02	-6.95	-0.10	769.67
		23	3.19	7.13	0.02	6.95	0.11	-775.38
	34	22	-2.83	-162.71	6.82	-314.71	48.77	404.97
		23	2.83	169.11	-7.07	326.46	-54.33	-537.70
	35	22	-2.82	-161.13	6.82	-314.37	48.77	351.93
		23	2.82	167.53	-7.07	326.13	-54.33	-483.42
23	28	23	-3.29	367.12	-14.14	-126.10	108.83	1584.09
		24	3.29	-354.32	13.63	120.81	-97.73	-1295.52
	29	23	-3.38	364.11	-14.13	-126.73	108.83	1553.53
		24	3.38	-351.31	13.63	121.44	-97.73	-1267.36
	30	23	-3.35	16.09	0.04	9.21	-0.03	1446.87
		24	3.35	-16.09	-0.04	-9.21	0.00	-1434.02
	31	23	-3.45	16.97	0.04	9.40	-0.03	1456.01
		24	3.45	-16.97	-0.04	-9.40	0.00	-1442.43
	32	23	-2.89	194.26	-7.05	344.13	54.41	896.80
		24	2.89	-187.86	6.80	-332.38	-48.86	-743.95
	33	23	-3.19	182.24	-7.05	341.65	54.40	775.41
		24	3.19	-175.84	6.80	-329.90	-48.87	-632.16
	34	23	-2.74	-10.03	0.03	0.89	-0.02	541.86
		24	2.74	10.03	-0.03	-0.89	0.00	-549.88
	35	23	-2.73	-15.43	0.03	-0.22	-0.02	487.57
		24	2.73	15.43	-0.03	0.22	0.00	-499.90
24	28	24	-3.15	354.31	-13.67	-134.98	97.73	1294.12
		25	3.15	-295.11	11.34	110.51	-51.47	-92.68
	29	24	-3.23	351.28	-13.67	-135.30	97.73	1265.95
		25	3.23	-292.08	11.34	110.82	-51.47	-75.73
	30	24	-3.35	16.07	0.00	-6.48	0.00	1434.04
		25	3.35	-16.07	0.00	6.48	-0.02	-1374.58
	31	24	-3.45	16.97	0.00	-6.38	0.00	1442.46
		25	3.45	-16.97	0.00	6.38	-0.02	-1379.65
	32	24	-2.81	187.86	-6.83	324.22	48.86	747.54
		25	2.81	-158.26	5.67	-269.85	-25.74	-107.22
	33	24	-3.11	175.83	-6.83	322.96	48.87	635.75
		25	3.11	-146.23	5.67	-268.60	-25.75	-39.92
	34	24	-2.74	-10.04	0.00	-5.13	0.00	549.86
		25	2.74	10.04	0.00	5.13	-0.02	-587.02

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	24	-2.73	-15.42	0.00	-5.69	0.00	499.87
		25	2.73	15.42	0.00	5.69	-0.02	-556.93
25	28	25	-3.15	295.11	-11.34	-110.51	51.47	92.68
		26	3.15	-223.11	8.50	80.75	-6.84	1073.31
	29	25	-3.23	292.09	-11.34	-110.82	51.47	75.73
		26	3.23	-220.09	8.50	81.06	-6.84	1076.64
	30	25	-3.35	16.07	0.00	-6.47	0.02	1374.58
		26	3.35	-16.07	0.00	6.47	-0.04	-1302.28
	31	25	-3.45	16.97	0.00	-6.38	0.02	1379.65
		26	3.45	-16.97	0.00	6.38	-0.04	-1303.27
	32	25	-2.81	158.26	-5.67	269.85	25.74	107.22
		26	2.81	-122.26	4.25	-203.74	-3.44	523.94
	33	25	-3.11	146.23	-5.67	268.60	25.75	39.91
		26	3.11	-110.23	4.25	-202.48	-3.44	537.13
	34	25	-2.74	-10.04	0.00	-5.13	0.02	587.02
		26	2.74	10.04	0.00	5.13	-0.04	-632.20
	35	25	-2.73	-15.42	0.00	-5.69	0.02	556.92
		26	2.73	15.42	0.00	5.69	-0.04	-626.31
26	28	26	-3.12	223.11	-8.51	-78.09	6.84	-1073.51
		27	3.12	-151.11	5.67	48.33	25.07	1915.53
	29	26	-3.21	220.08	-8.51	-78.40	6.84	-1076.83
		27	3.21	-148.08	5.67	48.64	25.07	1905.22
	30	26	-3.35	16.07	0.00	-9.69	0.04	1302.26
		27	3.35	-16.07	0.00	9.69	-0.03	-1229.95
	31	26	-3.45	16.97	0.00	-9.59	0.04	1303.25
		27	3.45	-16.97	0.00	9.59	-0.03	-1226.87
	32	26	-2.80	122.26	-4.26	205.03	3.44	-523.44
		27	2.80	-86.26	2.84	-138.91	12.52	992.61
	33	26	-3.10	110.23	-4.26	203.81	3.44	-536.63
		27	3.10	-74.23	2.84	-137.69	12.52	951.69
	34	26	-2.74	-10.04	0.00	-6.69	0.04	632.19
		27	2.74	10.04	0.00	6.69	-0.02	-677.38
	35	26	-2.73	-15.42	0.00	-7.23	0.04	626.29
		27	2.73	15.42	0.00	7.23	-0.02	-695.67
27	28	27	-3.14	151.10	-5.67	-52.72	-25.07	-1915.42
		28	3.14	-79.11	2.83	22.96	44.19	2433.37
	29	27	-3.22	148.08	-5.67	-53.01	-25.07	-1905.11
		28	3.22	-76.09	2.83	23.25	44.19	2409.42
	30	27	-3.35	16.07	0.00	-6.87	0.03	1229.96
		28	3.35	-16.07	0.00	6.87	-0.05	-1157.67
	31	27	-3.45	16.98	0.00	-6.78	0.03	1226.88
		28	3.45	-16.98	0.00	6.78	-0.05	-1150.50
	32	27	-2.81	86.26	-2.83	136.63	-12.52	-992.94
		28	2.81	-50.26	1.41	-70.52	22.08	1300.07
	33	27	-3.11	74.24	-2.83	135.50	-12.52	-952.00
		28	3.11	-38.24	1.41	-69.39	22.07	1205.04
	34	27	-2.74	-10.04	0.00	-5.13	0.02	677.40
		28	2.74	10.04	0.00	5.13	-0.04	-722.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	27	-2.73	-15.42	0.00	-5.64	0.02	695.69
		28	2.73	15.42	0.00	5.64	-0.04	-765.07
28	28	28	-3.13	79.12	-2.84	-17.82	-44.19	-2433.44
		29	3.13	-7.11	0.00	-11.95	50.58	2627.43
	29	28	-3.21	76.08	-2.84	-18.15	-44.19	-2409.47
		29	3.21	-4.07	0.00	-11.62	50.58	2589.68
	30	28	-3.35	16.07	0.00	-9.31	0.05	1157.65
		29	3.35	-16.07	0.00	9.31	-0.03	-1085.34
	31	28	-3.45	16.97	0.00	-9.21	0.05	1150.49
		29	3.45	-16.97	0.00	9.21	-0.03	-1074.10
	32	28	-2.80	50.26	-1.42	73.27	-22.08	-1299.92
		29	2.80	-14.26	0.00	-7.15	25.28	1445.11
	33	28	-3.11	38.24	-1.42	71.94	-22.07	-1204.89
		29	3.11	-2.24	0.00	-5.82	25.28	1295.95
	34	28	-2.74	-10.04	0.00	-6.66	0.04	722.56
		29	2.74	10.04	0.00	6.66	-0.03	-767.75
	35	28	-2.73	-15.42	0.00	-7.26	0.04	765.05
		29	2.73	15.42	0.00	7.26	-0.03	-834.44
29	28	29	-3.13	7.11	0.00	12.41	-50.58	-2627.45
		30	3.13	64.90	-2.83	-42.18	44.22	2497.40
	29	29	-3.21	4.07	0.00	12.07	-50.58	-2589.88
		30	3.21	67.93	-2.83	-41.84	44.21	2446.21
	30	29	-3.35	16.06	0.00	-9.51	0.03	1085.33
		30	3.35	-16.06	0.00	9.51	-0.02	-1013.03
	31	29	-3.45	16.97	0.00	-9.40	0.03	1074.10
		30	3.45	-16.97	0.00	9.40	-0.02	-997.71
	32	29	-2.80	14.26	0.00	7.40	-25.28	-1445.11
		30	2.80	21.75	-1.41	58.72	22.10	1428.26
	33	29	-3.11	2.23	0.00	6.04	-25.28	-1295.95
		30	3.11	33.77	-1.41	60.08	22.10	1224.98
	34	29	-2.74	-10.04	0.00	-6.80	0.03	767.75
		30	2.74	10.04	0.00	6.80	-0.01	-812.95
	35	29	-2.73	-15.42	0.00	-7.40	0.03	834.44
		30	2.73	15.42	0.00	7.40	-0.01	-903.84
30	28	30	-3.13	-64.90	2.83	42.19	-44.22	-2497.41
		31	3.13	136.89	-5.67	-71.95	25.10	2043.46
	29	30	-3.21	-67.92	2.83	41.85	-44.21	-2446.22
		31	3.21	139.91	-5.67	-71.60	25.10	1978.63
	30	30	-3.35	16.07	0.00	-9.51	0.02	1013.02
		31	3.35	-16.07	0.00	9.51	0.00	-940.72
	31	30	-3.45	16.98	0.00	-9.41	0.02	997.71
		31	3.45	-16.98	0.00	9.41	0.00	-921.34
	32	30	-2.80	-21.74	1.41	-58.72	-22.10	-1428.25
		31	2.80	57.74	-2.83	124.83	12.55	1249.45
	33	30	-3.11	-33.77	1.41	-60.08	-22.10	-1224.99
		31	3.11	69.77	-2.83	126.19	12.55	992.06
	34	30	-2.74	-10.04	0.00	-6.80	0.01	812.94
		31	2.74	10.04	0.00	6.80	0.00	-858.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	30	-2.73	-15.42	0.00	-7.41	0.01	903.83
		31	2.73	15.42	0.00	7.41	0.00	-973.22
31	28	31	-3.14	-136.89	5.66	76.26	-25.10	-2043.32
		32	3.14	208.90	-8.50	-106.03	-6.76	1265.21
	29	31	-3.23	-139.92	5.66	75.79	-25.10	-1978.47
		32	3.23	211.93	-8.49	-105.55	-6.75	1186.74
	30	31	-3.35	16.07	-0.01	-11.50	0.00	940.70
		32	3.35	-16.07	0.01	11.50	0.05	-868.38
	31	31	-3.45	16.97	-0.01	-11.35	0.00	921.32
		32	3.45	-16.97	0.01	11.35	0.05	-844.92
	32	31	-2.81	-57.74	2.83	-122.19	-12.55	-1249.71
		32	2.81	93.75	-4.24	188.32	-3.36	908.83
	33	31	-3.11	-69.77	2.83	-124.09	-12.55	-992.32
		32	3.11	105.77	-4.24	190.22	-3.36	597.33
	34	31	-2.74	-10.04	-0.01	-8.61	0.00	858.11
		32	2.74	10.04	0.01	8.61	0.04	-903.30
	35	31	-2.73	-15.42	-0.01	-9.46	0.00	973.20
		32	2.73	15.42	0.01	9.46	0.04	-1042.58
32	28	32	-3.14	-208.89	8.50	106.04	6.76	-1265.21
		33	3.14	280.89	-11.33	-135.80	-51.36	163.32
	29	32	-3.23	-211.92	8.49	105.56	6.75	-1186.73
		33	3.23	283.91	-11.33	-135.32	-51.36	71.23
	30	32	-3.35	16.07	-0.01	-11.50	-0.05	868.39
		33	3.35	-16.07	0.01	11.50	0.10	-796.09
	31	32	-3.45	16.97	-0.01	-11.36	-0.05	844.92
		33	3.45	-16.97	0.01	11.36	0.10	-768.55
	32	32	-2.81	-93.74	4.24	-188.31	3.36	-908.83
		33	2.81	129.74	-5.66	254.42	-25.64	406.05
	33	32	-3.11	-105.77	4.24	-190.21	3.36	-597.33
		33	3.11	141.76	-5.66	256.33	-25.64	40.43
	34	32	-2.74	-10.04	-0.01	-8.62	-0.04	903.30
		33	2.74	10.04	0.01	8.62	0.08	-948.49
	35	32	-2.73	-15.42	-0.01	-9.47	-0.04	1042.59
		33	2.73	15.42	0.01	9.47	0.08	-1111.96
33	28	33	-3.12	-280.89	11.34	135.47	51.36	-163.59
		34	3.12	340.09	-13.67	-159.94	-97.62	-985.33
	29	33	-3.20	-283.92	11.34	135.17	51.36	-71.48
		34	3.20	343.13	-13.67	-159.65	-97.62	-1088.64
	30	33	-3.35	16.07	0.00	-9.90	-0.10	796.11
		34	3.35	-16.07	0.00	9.90	0.11	-736.65
	31	33	-3.45	16.97	0.00	-9.81	-0.10	768.57
		34	3.45	-16.97	0.00	9.81	0.11	-705.77
	32	33	-2.80	-129.74	5.67	-255.24	25.64	-405.53
		34	2.80	159.34	-6.83	309.61	-48.77	-129.32
	33	33	-3.10	-141.77	5.67	-256.41	25.64	-39.92
		34	3.10	171.37	-6.83	310.77	-48.76	-539.44
	34	33	-2.74	-10.04	0.00	-6.71	-0.08	948.50
		34	2.74	10.04	0.00	6.71	0.09	-985.66

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	33	-2.73	-15.42	0.00	-7.23	-0.08	1111.98
		34	2.73	15.42	0.00	7.23	0.09	-1169.04
34	28	34	-3.27	-340.09	13.63	148.81	97.62	987.11
		35	3.27	352.89	-14.14	-154.10	-108.73	-1264.35
	29	34	-3.36	-343.18	13.63	147.35	97.62	1090.35
		35	3.36	355.99	-14.13	-152.64	-108.73	-1370.11
	30	34	-3.35	16.07	-0.04	-18.21	-0.11	736.51
		35	3.35	-16.07	0.04	18.21	0.14	-723.62
	31	34	-3.45	16.99	-0.04	-17.78	-0.11	705.62
		35	3.45	-16.99	0.04	17.78	0.15	-692.01
	32	34	-2.88	-159.31	6.80	-311.05	48.77	125.83
		35	2.88	165.71	-7.05	322.81	-54.31	-255.91
	33	34	-3.18	-171.38	6.80	-316.84	48.76	535.90
		35	3.18	177.78	-7.05	328.60	-54.30	-675.61
	34	34	-2.74	-10.04	-0.03	-17.83	-0.09	985.51
		35	2.74	10.04	0.03	17.83	0.12	-993.55
	35	34	-2.73	-15.40	-0.03	-20.42	-0.09	1168.87
		35	2.73	15.40	0.03	20.42	0.12	-1181.23
35	28	35	-2.92	-11.67	0.01	-10.92	0.01	1260.11
		36	2.92	11.67	-0.01	10.92	-0.02	-1269.45
	29	35	-3.01	-1.24	0.01	-9.06	0.01	1365.89
		36	3.01	1.24	-0.01	9.06	-0.02	-1366.87
	30	35	-3.17	288.37	-14.17	-145.93	108.97	722.03
		36	3.17	-275.59	13.66	140.65	-97.85	-496.69
	31	35	-3.26	285.26	-14.16	-146.03	108.86	690.42
		36	3.26	-272.47	13.66	140.74	-97.75	-467.59
	32	35	-2.70	-42.31	0.01	-11.94	0.01	263.69
		36	2.70	42.31	-0.01	11.94	-0.02	-297.51
	33	35	-3.00	-0.71	0.01	-4.55	0.01	683.53
		36	3.00	0.71	-0.01	4.55	-0.02	-684.11
	34	35	-2.55	233.57	-14.68	-19.24	144.14	993.52
		36	2.55	-227.18	14.43	30.98	-132.50	-809.45
	35	35	-2.51	267.98	-17.15	-104.40	166.00	1180.10
		36	2.51	-261.59	16.90	116.14	-152.40	-968.52
36	28	36	-2.92	-11.73	0.00	-14.95	0.02	1269.43
		37	2.92	11.73	0.00	14.95	-0.03	-1312.82
	29	36	-3.01	-1.24	0.00	-13.40	0.02	1366.83
		37	3.01	1.24	0.00	13.40	-0.03	-1371.41
	30	36	-3.13	275.61	-13.67	-142.22	97.85	496.25
		37	3.13	-216.40	11.34	117.75	-51.56	414.08
	31	36	-3.22	272.47	-13.67	-142.22	97.75	467.14
		37	3.22	-213.26	11.34	117.75	-51.49	431.59
	32	36	-2.70	-42.33	0.00	-12.89	0.02	297.48
		37	2.70	42.33	0.00	12.89	-0.03	-454.11
	33	36	-3.00	-0.71	0.00	-6.73	0.02	684.08
		37	3.00	0.71	0.00	6.73	-0.03	-686.71
	34	36	-2.50	227.18	-14.44	-33.55	132.50	809.34
		37	2.50	-197.57	13.27	87.92	-81.23	-23.45

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	36	-2.45	261.59	-16.91	-119.22	152.40	968.15
		37	2.45	-231.99	15.74	173.59	-92.00	-54.90
37	28	37	-2.92	-11.72	0.01	-14.44	0.03	1312.83
		38	2.92	11.72	-0.01	14.44	-0.06	-1365.57
	29	37	-3.01	-1.24	0.01	-12.87	0.03	1371.41
		38	3.01	1.24	-0.01	12.87	-0.06	-1377.00
	30	37	-3.13	216.40	-11.34	-117.91	51.56	-414.04
		38	3.13	-144.41	8.51	88.15	-6.91	1225.77
	31	37	-3.22	213.26	-11.33	-117.92	51.49	-431.55
		38	3.22	-141.27	8.50	88.16	-6.87	1229.16
	32	37	-2.70	-42.33	0.00	-12.71	0.03	454.11
		38	2.70	42.33	0.00	12.71	-0.05	-644.57
	33	37	-3.00	-0.71	0.01	-6.46	0.03	686.72
		38	3.00	0.71	-0.01	6.46	-0.06	-689.91
	34	37	-2.51	197.57	-13.27	-87.91	81.23	23.48
		38	2.51	-161.58	11.85	154.02	-24.70	784.52
	35	37	-2.46	231.99	-15.74	-173.57	92.00	54.97
		38	2.46	-195.99	14.32	239.68	-24.37	907.90
38	28	38	-2.92	-11.72	0.00	-17.32	0.06	1365.55
		39	2.92	11.72	0.00	17.32	-0.05	-1418.30
	29	38	-3.01	-1.24	0.00	-15.77	0.06	1376.97
		39	3.01	1.24	0.00	15.77	-0.05	-1382.55
	30	38	-3.11	144.41	-8.51	-85.56	6.91	-1225.95
		39	3.11	-72.40	5.68	55.79	25.03	1713.84
	31	38	-3.21	141.27	-8.51	-85.56	6.87	-1229.35
		39	3.21	-69.26	5.67	55.79	25.04	1703.12
	32	38	-2.70	-42.33	0.00	-14.07	0.05	644.55
		39	2.70	42.33	0.00	14.07	-0.05	-835.05
	33	38	-3.00	-0.71	0.00	-7.92	0.06	689.90
		39	3.00	0.71	0.00	7.92	-0.05	-693.10
	34	38	-2.48	161.58	-11.86	-152.36	24.70	-784.84
		39	2.48	-125.57	10.44	218.49	25.48	1431.03
	35	38	-2.43	196.00	-14.33	-237.76	24.37	-908.40
		39	2.43	-152.49	12.42	283.36	36.80	1707.61
39	28	39	-2.92	-11.73	0.00	-17.08	0.05	1418.31
		40	2.92	11.73	0.00	17.08	-0.05	-1471.07
	29	39	-3.01	-1.24	0.00	-15.54	0.05	1382.56
		40	3.01	1.24	0.00	15.54	-0.05	-1388.12
	30	39	-3.11	72.40	-5.68	-56.09	-25.03	-1713.83
		40	3.11	-0.40	2.84	26.32	44.20	1877.62
	31	39	-3.21	69.26	-5.67	-56.09	-25.04	-1703.11
		40	3.21	2.74	2.84	26.32	44.18	1852.78
	32	39	-2.70	-42.32	0.00	-13.93	0.05	835.04
		40	2.70	42.32	0.00	13.93	-0.05	-1025.51
	33	39	-3.00	-0.71	0.00	-7.80	0.05	693.10
		40	3.00	0.71	0.00	7.80	-0.05	-696.29
	34	39	-2.48	125.57	-10.44	-218.74	-25.48	-1430.99
		40	2.48	-67.07	7.55	223.26	68.17	1898.16

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	39	-2.43	152.49	-12.42	-283.66	-36.80	-1707.56
		40	2.43	-48.99	6.57	165.01	79.52	2160.86
40	28	40	-2.92	-11.72	-0.01	-20.71	0.05	1471.02
		41	2.92	11.72	0.01	20.71	-0.01	-1523.77
	29	40	-3.01	-1.24	-0.01	-18.96	0.05	1388.09
		41	3.01	1.24	0.01	18.96	-0.01	-1393.66
	30	40	-3.11	0.40	-2.85	-21.69	-44.20	-1877.68
		41	3.11	71.60	0.02	-8.07	50.64	1717.50
	31	40	-3.20	-2.73	-2.84	-21.75	-44.18	-1852.83
		41	3.20	74.73	0.01	-8.01	50.59	1678.56
	32	40	-2.70	-42.32	-0.01	-16.46	0.05	1025.48
		41	2.70	42.32	0.01	16.46	-0.01	-1215.94
	33	40	-3.00	-0.71	-0.01	-9.52	0.05	696.27
		41	3.00	0.71	0.01	9.52	-0.01	-699.47
	34	40	-2.46	67.08	-7.55	-218.57	-68.17	-1898.71
		41	2.46	36.42	1.71	99.93	89.01	1967.68
	35	40	-2.41	49.00	-6.58	-159.68	-79.52	-2161.27
		41	2.41	54.50	0.73	41.03	95.97	2148.88
41	28	41	-2.92	-11.72	0.00	-17.22	0.01	1523.82
		42	2.92	11.72	0.00	17.22	-0.01	-1576.56
	29	41	-3.01	-1.24	0.00	-15.77	0.01	1393.71
		42	3.01	1.24	0.00	15.77	-0.01	-1399.27
	30	41	-3.11	-71.60	-0.01	4.14	-50.64	-1717.51
		42	3.11	143.59	-2.83	-33.90	44.30	1233.35
	31	41	-3.20	-74.74	0.00	4.16	-50.59	-1678.56
		42	3.20	146.73	-2.83	-33.93	44.22	1180.29
	32	41	-2.70	-42.33	0.00	-13.67	0.01	1215.98
		42	2.70	42.33	0.00	13.67	-0.01	-1406.44
	33	41	-3.00	-0.71	0.00	-7.91	0.01	699.49
		42	3.00	0.71	0.00	7.91	-0.01	-702.69
	34	41	-2.47	-36.42	-1.70	-104.44	-89.01	-1967.44
		42	2.47	139.91	-4.14	-14.21	83.53	1570.73
	35	41	-2.42	-54.50	-0.73	-45.95	-95.97	-2148.77
		42	2.42	157.99	-5.12	-72.69	86.09	1670.69
42	28	42	-2.92	-11.72	-0.01	-20.55	0.01	1576.54
		43	2.92	11.72	0.01	20.55	0.02	-1629.29
	29	42	-3.01	-1.24	-0.01	-18.72	0.01	1399.24
		43	3.01	1.24	0.01	18.72	0.02	-1404.82
	30	42	-3.11	-143.59	2.82	36.50	-44.30	-1233.28
		43	3.11	215.61	-5.66	-66.27	25.23	424.92
	31	42	-3.21	-146.73	2.83	36.42	-44.22	-1180.22
		43	3.21	218.75	-5.66	-66.19	25.11	357.74
	32	42	-2.70	-42.32	-0.01	-16.64	0.01	1406.41
		43	2.70	42.32	0.01	16.64	0.02	-1596.93
	33	42	-3.00	-0.71	-0.01	-9.40	0.01	702.67
		43	3.00	0.71	0.01	9.40	0.02	-705.87
	34	42	-2.48	-139.92	4.14	17.53	-83.53	-1570.70
		43	2.48	243.44	-9.98	-136.20	51.75	707.98

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	42	-2.43	-158.00	5.11	76.22	-86.09	-1670.53
		43	2.43	261.52	-10.96	-194.89	49.92	726.43
43	28	43	-2.92	-11.72	-0.01	-20.56	-0.02	1629.29
		44	2.92	11.72	0.01	20.56	0.05	-1682.05
	29	43	-3.01	-1.24	-0.01	-18.73	-0.02	1404.82
		44	3.01	1.24	0.01	18.73	0.06	-1410.40
	30	43	-3.11	-215.61	5.66	66.27	-25.23	-424.92
		44	3.11	287.61	-8.49	-96.04	-6.60	-707.28
	31	43	-3.21	-218.74	5.66	66.19	-25.11	-357.74
		44	3.21	290.74	-8.50	-95.95	-6.74	-788.57
	32	43	-2.70	-42.33	-0.01	-16.65	-0.02	1596.93
		44	2.70	42.33	0.01	16.65	0.05	-1787.39
	33	43	-3.00	-0.71	-0.01	-9.40	-0.02	705.87
		44	3.00	0.71	0.01	9.40	0.06	-709.06
	34	43	-2.48	-243.43	9.98	136.20	-51.75	-707.98
		44	2.48	346.93	-15.83	-254.85	-6.32	-620.31
	35	43	-2.43	-261.52	10.96	194.90	-49.92	-726.43
		44	2.43	365.01	-16.81	-313.55	-12.55	-683.23
44	28	44	-2.92	-11.73	-0.01	-20.56	-0.05	1682.05
		45	2.92	11.73	0.01	20.56	0.09	-1734.80
	29	44	-3.01	-1.24	-0.01	-18.73	-0.06	1410.40
		45	3.01	1.24	0.01	18.73	0.09	-1415.98
	30	44	-3.11	-287.61	8.49	96.04	6.60	707.28
		45	3.11	359.60	-11.33	-125.80	-51.18	-2163.47
	31	44	-3.21	-290.74	8.50	95.95	6.74	788.57
		45	3.21	362.74	-11.33	-125.71	-51.36	-2258.87
	32	44	-2.70	-42.33	-0.01	-16.65	-0.05	1787.40
		45	2.70	42.33	0.01	16.65	0.08	-1977.86
	33	44	-3.00	-0.71	-0.01	-9.40	-0.06	709.07
		45	3.00	0.71	0.01	9.40	0.09	-712.26
	34	44	-2.48	-346.93	15.83	254.85	6.32	620.30
		45	2.48	450.43	-21.67	-373.50	-90.70	-2414.33
	35	44	-2.43	-365.01	16.81	313.55	12.55	683.22
		45	2.47	431.01	-20.19	-329.55	-98.25	-2511.75
45	28	45	-2.92	-11.72	-0.01	-23.57	-0.09	1734.76
		46	2.92	11.72	0.01	23.57	0.13	-1778.14
	29	45	-3.01	-1.24	-0.01	-21.19	-0.09	1415.94
		46	3.01	1.24	0.01	21.19	0.13	-1420.54
	30	45	-3.13	-359.60	11.32	122.04	51.18	2163.68
		46	3.13	430.40	-14.11	-151.31	-98.71	-3637.60
	31	45	-3.23	-362.74	11.33	121.79	51.36	2259.09
		46	3.23	421.94	-13.66	-146.26	-97.58	-3710.69
	32	45	-2.70	-42.33	-0.01	-20.08	-0.08	1977.83
		46	2.70	42.33	0.01	20.08	0.12	-2134.44
	33	45	-3.00	-0.71	-0.01	-10.64	-0.09	712.25
		46	3.00	0.71	0.01	10.64	0.13	-714.88
	34	45	-2.51	-450.43	21.67	369.31	90.70	2414.97
		46	2.51	500.83	-24.05	-345.35	-176.85	-4201.21

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	45	-2.50	-431.01	20.19	325.19	98.25	2512.31
		46	2.50	460.61	-21.35	-270.83	-175.09	-4161.76
46	28	46	-2.92	-11.78	-0.02	-29.13	-0.13	1778.07
		47	2.92	11.78	0.02	29.13	0.15	-1787.43
	29	46	-3.01	-1.25	-0.02	-25.63	-0.13	1420.46
		47	3.01	1.25	0.02	25.63	0.15	-1421.44
	30	46	-3.22	-480.40	16.06	160.59	98.71	3638.57
		47	3.22	480.40	-16.06	-160.59	-111.57	-4023.01
	31	46	-3.27	-421.94	13.65	134.65	97.58	3711.13
		47	3.27	421.94	-13.65	-134.65	-108.50	-4048.78
	32	46	-2.70	-42.29	-0.02	-26.76	-0.12	2134.39
		47	2.70	42.29	0.02	26.76	0.14	-2168.25
	33	46	-3.00	-0.76	-0.02	-12.87	-0.13	714.83
		47	3.00	0.76	0.02	12.87	0.15	-715.41
	34	46	-2.61	-525.83	25.02	286.30	176.85	4201.14
		47	2.61	525.83	-25.02	-286.30	-196.87	-4621.93
	35	46	-2.57	-460.61	21.34	257.80	175.09	4162.59
		47	2.57	460.61	-21.34	-257.80	-192.17	-4531.19
47	28	47	-2.51	408.74	-16.10	-154.43	130.93	1784.20
		48	2.51	-395.95	15.60	149.15	-118.26	-1462.65
	29	47	-2.64	360.25	-14.18	-135.53	108.90	1418.63
		48	2.64	-347.46	13.68	130.24	-97.77	-1135.82
	30	47	-2.41	480.99	-16.09	-175.25	111.76	4014.60
		48	2.41	-480.99	16.09	175.25	-98.89	-3630.17
	31	47	-2.45	539.00	-18.48	-199.34	116.67	4040.40
		48	2.45	-489.00	16.52	178.67	-103.46	-3649.55
	32	47	-1.97	493.69	-28.11	-480.11	208.88	2156.56
		48	1.97	-475.30	27.07	459.04	-186.83	-1769.32
	33	47	-2.82	181.24	-7.10	337.36	54.47	724.46
		48	2.82	-174.85	6.84	-325.61	-48.90	-582.15
	34	47	-1.35	525.77	-25.04	-307.59	197.01	4607.00
		48	1.35	-525.77	25.04	307.59	-176.99	-4186.77
	35	47	-1.30	586.29	-28.44	-336.85	189.60	4516.22
		48	1.30	-549.30	26.67	349.95	-167.97	-4072.38
48	28	48	-2.57	395.97	-15.59	-143.06	118.26	1463.23
		49	2.57	-336.75	13.26	118.58	-64.88	-107.38
	29	48	-2.70	347.44	-13.67	-125.51	97.77	1136.35
		49	2.70	-288.23	11.34	101.04	-51.49	39.93
	30	48	-2.52	430.99	-14.12	-139.49	98.89	3631.31
		49	2.52	-360.19	11.33	110.22	-51.32	-2154.86
	31	48	-2.52	489.00	-16.51	-163.48	103.46	3650.27
		49	2.52	-389.00	12.57	122.14	-50.64	-2050.64
	32	48	-2.09	475.31	-27.06	-451.67	186.83	1771.21
		49	2.09	-390.19	22.26	354.09	-95.56	-169.66
	33	48	-2.85	174.85	-6.83	328.03	48.90	580.79
		49	2.85	-145.24	5.67	-273.66	-25.77	11.52
	34	48	-1.47	500.77	-24.06	-336.08	176.99	4187.02
		49	1.47	-450.37	21.68	360.03	-90.79	-2400.52

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	48	-1.41	549.30	-26.66	-333.01	167.97	4073.81
		49	1.41	-443.79	21.05	272.88	-80.18	-2248.68
49	28	49	-2.57	336.76	-13.26	-118.65	64.88	107.32
		50	2.57	-264.77	10.42	88.89	-11.61	1245.84
	29	49	-2.69	288.23	-11.34	-101.01	51.50	-39.99
		50	2.69	-216.24	8.50	71.26	-6.86	1174.82
	30	49	-2.51	360.19	-11.33	-111.44	51.32	2154.79
		50	2.51	-288.20	8.50	81.68	-6.71	-696.20
	31	49	-2.51	389.00	-12.57	-123.31	50.64	2050.57
		50	2.51	-284.61	8.46	80.15	-5.98	-602.82
	32	49	-2.07	390.19	-22.26	-354.19	95.56	169.46
		50	2.07	-286.71	16.41	235.56	-8.57	1353.25
	33	49	-2.84	145.24	-5.67	273.66	25.77	-11.36
		50	2.84	-109.25	4.25	-207.56	-3.46	583.85
	34	49	-1.46	450.37	-21.68	-361.40	90.79	2400.32
		50	1.46	-346.89	15.83	242.77	-6.41	-606.82
	35	49	-1.40	443.79	-21.05	-274.15	80.18	2248.53
		50	1.40	-324.11	14.57	185.29	-1.38	-554.88
50	28	50	-2.57	264.77	-10.42	-88.89	11.61	-1245.84
		51	2.57	-192.77	7.59	59.13	28.92	2275.32
	29	50	-2.69	216.25	-8.50	-71.26	6.86	-1174.82
		51	2.69	-144.24	5.67	41.50	25.03	1985.94
	30	50	-2.51	288.20	-8.50	-81.68	6.71	696.20
		51	2.51	-216.20	5.66	51.92	25.15	438.75
	31	50	-2.51	284.61	-8.46	-80.15	5.98	602.82
		51	2.51	-212.61	5.63	50.38	25.72	515.95
	32	50	-2.07	286.71	-16.41	-235.57	8.57	-1353.25
		51	2.07	-183.20	10.57	116.91	52.14	2410.59
	33	50	-2.84	109.25	-4.25	207.55	3.46	-583.85
		51	2.84	-73.25	2.83	-141.43	12.48	994.48
	34	50	-1.46	346.90	-15.83	-242.76	6.41	606.82
		51	1.46	-243.39	9.99	124.11	51.70	721.36
	35	50	-1.40	324.11	-14.57	-185.29	1.38	554.89
		51	1.40	-220.61	8.72	66.63	51.04	670.75
51	28	51	-2.55	192.77	-7.59	-54.32	-28.92	-2275.43
		52	2.55	-120.76	4.76	24.55	56.71	2980.93
	29	51	-2.68	144.24	-5.67	-37.30	-25.03	-1986.02
		52	2.68	-72.24	2.84	7.53	44.19	2473.14
	30	51	-2.50	216.20	-5.67	-50.99	-25.15	-438.86
		52	2.50	-144.20	2.83	21.22	44.27	1249.82
	31	51	-2.50	212.61	-5.63	-49.29	-25.72	-516.06
		52	2.50	-140.61	2.80	19.53	44.69	1310.84
	32	51	-2.05	183.21	-10.57	-111.81	-52.14	-2410.84
		52	2.05	-79.70	4.73	-6.85	86.57	3002.42
	33	51	-2.84	73.25	-2.84	143.54	-12.48	-994.18
		52	2.84	-37.25	1.42	-77.41	22.07	1242.82
	34	51	-1.44	243.39	-9.99	-122.58	-51.70	-721.62
		52	1.44	-139.88	4.15	3.92	83.51	1584.05

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	51	-1.38	220.61	-8.73	-65.21	-51.04	-670.89
		52	1.38	-117.10	2.88	-53.45	77.16	1430.79
52	28	52	-2.55	120.76	-4.76	-24.03	-56.72	-2980.93
		53	2.55	0.04	0.00	-25.91	68.68	3284.27
	29	52	-2.68	72.24	-2.84	-7.09	-44.19	-2473.13
		53	2.68	-0.23	0.00	-22.67	50.59	2636.18
	30	52	-2.50	144.20	-2.83	-21.00	-44.27	-1249.82
		53	2.50	-72.19	0.00	-8.76	50.64	1736.74
	31	52	-2.50	140.60	-2.80	-19.29	-44.69	-1310.84
		53	2.50	-68.60	-0.04	-10.47	50.90	1781.59
	32	52	-2.05	79.69	-4.73	7.38	-86.57	-3002.42
		53	2.05	48.21	-2.08	-81.23	93.15	3089.12
	33	52	-2.84	37.25	-1.42	77.63	-22.07	-1242.80
		53	2.84	-1.24	0.00	-11.51	25.28	1329.41
	34	52	-1.44	139.89	-4.15	-3.64	-83.51	-1584.05
		53	1.44	-36.38	-1.70	-115.02	89.01	1980.68
	35	52	-1.38	117.10	-2.88	53.70	-77.16	-1430.78
		53	1.38	-13.59	-2.96	-172.36	76.97	1724.85
53	28	53	-2.55	-0.03	0.00	25.93	-68.68	-3284.25
		54	2.55	120.82	-4.75	-75.87	56.76	2980.65
	29	53	-2.68	0.23	0.00	22.68	-50.59	-2636.20
		54	2.68	71.76	-2.83	-52.44	44.23	2475.28
	30	53	-2.50	72.20	0.00	8.77	-50.64	-1736.73
		54	2.50	-0.21	-2.84	-38.53	44.25	1899.62
	31	53	-2.50	68.60	0.04	10.48	-50.90	-1781.59
		54	2.50	3.39	-2.87	-40.24	44.36	1928.28
	32	53	-2.05	-48.21	2.08	81.25	-93.15	-3089.13
		54	2.05	146.11	-6.92	-164.80	69.83	2598.65
	33	53	-2.84	1.24	0.00	11.52	-25.28	-1329.41
		54	2.84	34.75	-1.41	54.59	22.11	1254.03
	34	53	-1.44	36.37	1.70	115.03	-89.01	-1980.67
		54	1.44	67.11	-7.54	-233.66	68.21	1911.53
	35	53	-1.38	13.59	2.96	172.37	-76.97	-1724.84
		54	1.38	59.91	-6.84	-208.91	52.45	1583.17
54	28	54	-2.55	-120.83	4.75	75.33	-56.76	-2980.66
		55	2.55	192.84	-7.59	-105.09	29.00	2274.86
	29	54	-2.68	-71.76	2.83	51.99	-44.23	-2475.28
		55	2.68	143.76	-5.67	-81.76	25.11	1990.34
	30	54	-2.50	0.20	2.84	38.19	-44.25	-1899.61
		55	2.50	71.80	-5.67	-67.95	25.10	1738.49
	31	54	-2.50	-3.39	2.87	39.89	-44.36	-1928.28
		55	2.50	75.39	-5.71	-69.65	25.05	1751.01
	32	54	-2.05	-146.10	6.92	164.32	-69.83	-2598.68
		55	2.05	182.10	-8.33	-98.20	35.51	1860.18
	33	54	-2.84	-34.75	1.41	-54.82	-22.11	-1254.01
		55	2.84	70.75	-2.83	120.94	12.57	1016.61
	34	54	-1.44	-67.11	7.55	233.32	-68.21	-1911.56
		55	1.44	125.61	-10.44	-228.78	25.53	1444.18

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	54	-1.38	-59.91	6.84	208.62	-52.45	-1583.21
		55	1.38	95.91	-8.26	-142.50	18.47	1232.60
55	28	55	-2.57	-192.84	7.58	110.32	-29.00	-2274.61
		56	2.57	264.83	-10.41	-140.08	-11.49	1244.97
	29	55	-2.69	-143.77	5.66	86.33	-25.11	-1990.15
		56	2.69	215.76	-8.49	-116.09	-6.73	1181.27
	30	55	-2.51	-71.81	5.67	71.94	-25.10	-1738.34
		56	2.51	143.80	-8.50	-101.71	-6.78	1253.27
	31	55	-2.52	-75.40	5.70	73.68	-25.05	-1750.83
		56	2.52	147.39	-8.54	-103.44	-6.98	1249.61
	32	55	-2.07	-182.10	8.33	102.48	-35.51	-1859.95
		56	2.07	278.09	-13.68	-200.60	-13.03	839.57
	33	55	-2.84	-70.75	2.82	-118.61	-12.57	-1016.88
		56	2.84	106.75	-4.24	184.72	-3.33	617.54
	34	55	-1.46	-125.61	10.44	232.10	-25.53	-1443.64
		56	1.46	161.61	-11.85	-165.99	-24.61	797.45
	35	55	-1.40	-95.91	8.26	145.33	-18.47	-1232.27
		56	1.40	131.90	-9.67	-79.22	-21.87	719.74
56	28	56	-2.57	-264.83	10.41	140.07	11.49	-1244.97
		57	2.57	336.84	-13.25	-169.84	-64.74	-108.97
	29	56	-2.69	-215.75	8.49	116.09	6.73	-1181.27
		57	2.69	287.76	-11.33	-145.85	-51.34	48.20
	30	56	-2.51	-143.80	8.50	101.70	6.78	-1253.27
		57	2.51	215.81	-11.34	-131.46	-51.42	444.06
	31	56	-2.52	-147.39	8.54	103.43	6.98	-1249.60
		57	2.52	219.40	-11.37	-133.20	-51.78	424.22
	32	56	-2.07	-278.09	13.68	200.60	13.03	-839.58
		57	2.07	381.61	-19.53	-319.27	-87.76	-644.94
	33	56	-2.84	-106.75	4.24	-184.72	3.33	-617.53
		57	2.84	142.76	-5.66	250.85	-25.61	56.06
	34	56	-1.46	-161.61	11.85	165.98	24.61	-797.45
		57	1.46	197.61	-13.27	-99.86	-81.15	-10.91
	35	56	-1.40	-131.90	9.67	79.21	21.87	-719.74
		57	1.40	167.91	-11.09	-13.09	-68.60	45.07
57	28	57	-2.54	-336.84	13.26	170.08	64.74	108.59
		58	2.54	396.04	-15.59	-194.55	-118.10	-1464.45
	29	57	-2.67	-287.77	11.34	145.75	51.34	-48.52
		58	2.67	346.97	-13.67	-170.22	-97.60	-1125.78
	30	57	-2.49	-215.81	11.34	130.50	51.42	-444.34
		58	2.49	275.01	-13.67	-154.97	-97.70	-463.68
	31	57	-2.49	-219.40	11.38	132.27	51.78	-424.50
		58	2.49	278.60	-13.71	-156.75	-98.19	-496.82
	32	57	-2.03	-381.61	19.53	320.67	87.76	644.25
		58	2.03	466.71	-24.34	-418.23	-168.93	-2213.68
	33	57	-2.83	-142.76	5.67	-250.97	25.61	-55.52
		58	2.83	172.36	-6.83	305.34	-48.73	-527.46
	34	57	-1.43	-197.61	13.27	99.88	81.15	10.70
		58	1.43	227.21	-14.44	-45.51	-132.41	-796.64

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	57	-1.38	-167.91	11.09	12.99	68.60	-45.10
		58	1.38	197.51	-12.26	41.38	-111.81	-630.94
58	28	58	-2.73	-396.04	15.55	176.55	118.10	1466.72
		59	2.73	408.83	-16.06	-181.84	-130.74	-1788.53
	29	58	-2.83	-346.92	13.63	156.38	97.60	1127.79
		59	2.83	359.71	-14.14	-161.67	-108.70	-1410.28
	30	58	-2.66	-275.05	13.64	149.26	97.71	465.56
		59	2.66	287.84	-14.15	-154.55	-108.81	-690.57
	31	58	-2.66	-278.71	13.68	150.63	98.19	498.68
		59	2.66	291.50	-14.18	-155.92	-109.32	-726.61
	32	58	-2.33	-466.73	24.31	391.01	168.93	2218.64
		59	2.33	485.12	-25.35	-412.09	-188.78	-2599.16
	33	58	-2.92	-172.40	6.79	-311.79	48.73	523.67
		59	2.92	178.80	-7.05	323.54	-54.26	-664.04
	34	58	-1.61	-227.19	14.42	35.73	132.41	797.15
		59	1.61	233.59	-14.67	-23.98	-144.04	-981.36
	35	58	-1.53	-197.51	12.24	-49.12	111.81	630.39
		59	1.53	203.91	-12.49	60.87	-121.70	-790.84
59	28	59	-2.14	11.28	0.00	-22.69	0.04	1780.60
		60	2.14	-11.28	0.00	22.69	-0.05	-1771.58
	29	59	-2.31	-0.11	0.00	-21.59	0.05	1403.34
		60	2.31	0.11	0.00	21.59	-0.05	-1403.43
	30	59	-2.14	-20.04	0.00	-18.72	0.04	684.15
		60	2.14	20.04	0.00	18.72	-0.05	-700.22
	31	59	-2.14	-19.04	0.00	-18.85	0.04	720.12
		60	2.14	19.04	0.00	18.85	-0.05	-735.35
	32	59	-1.11	203.17	-11.12	-449.80	49.79	2571.51
		60	1.11	-191.16	10.34	416.95	-41.21	-2413.75
	33	59	-2.66	-2.94	0.01	-11.57	0.06	675.39
		60	2.66	2.94	-0.01	11.57	-0.06	-677.74
	34	59	-1.07	8.35	0.00	-11.63	0.02	979.84
		60	1.07	-8.35	0.00	11.63	-0.02	-973.19
	35	59	-1.07	2.94	0.00	-10.95	0.02	792.55
		60	1.07	-2.94	0.00	10.95	-0.02	-790.17
60	28	60	-2.14	11.32	0.00	-24.89	0.05	1771.53
		61	2.14	-11.32	0.00	24.89	-0.06	-1729.63
	29	60	-2.31	-0.12	0.00	-23.33	0.05	1403.41
		61	2.31	0.12	0.00	23.33	-0.06	-1403.86
	30	60	-2.14	-20.09	0.00	-19.59	0.05	700.20
		61	2.14	20.09	0.00	19.59	-0.06	-774.53
	31	60	-2.14	-19.06	0.00	-19.76	0.05	735.34
		61	2.14	19.06	0.00	19.76	-0.06	-805.86
	32	60	-1.09	191.17	-10.34	-419.94	41.21	2413.22
		61	1.09	-135.67	6.69	268.00	-9.70	-1808.51
	33	60	-2.66	-2.94	0.00	-12.41	0.06	677.73
		61	2.66	2.94	0.00	12.41	-0.07	-688.60
	34	60	-1.07	8.33	0.00	-12.83	0.02	973.17
		61	1.07	-8.33	0.00	12.83	-0.03	-942.33

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	60	-1.07	2.97	0.00	-11.93	0.02	790.16
		61	1.07	-2.97	0.00	11.93	-0.03	-779.18
61	28	61	-2.14	11.32	0.00	-27.87	0.06	1729.59
		62	2.14	-11.32	0.00	27.87	-0.05	-1678.65
	29	61	-2.31	-0.12	0.00	-25.75	0.06	1403.82
		62	2.31	0.12	0.00	25.75	-0.05	-1404.38
	30	61	-2.14	-20.08	0.00	-20.92	0.06	774.50
		62	2.14	20.08	0.00	20.92	-0.05	-864.88
	31	61	-2.14	-19.06	0.00	-21.15	0.06	805.83
		62	2.14	19.06	0.00	21.15	-0.05	-891.58
	32	61	-1.08	135.67	-6.70	-271.12	9.70	1808.04
		62	1.08	-68.17	2.27	86.35	10.47	-1349.42
	33	61	-2.66	-2.94	0.00	-13.60	0.07	688.58
		62	2.66	2.94	0.00	13.60	-0.06	-701.80
	34	61	-1.07	8.33	0.00	-14.46	0.03	942.31
		62	1.07	-8.33	0.00	14.46	-0.02	-904.81
	35	61	-1.07	2.97	0.00	-13.27	0.03	779.16
		62	1.07	-2.97	0.00	13.27	-0.02	-765.81
62	28	62	-2.14	11.32	0.00	-24.62	0.05	1678.70
		63	2.14	-11.32	0.00	24.62	-0.06	-1627.75
	29	62	-2.31	-0.12	0.00	-23.02	0.05	1404.43
		63	2.31	0.12	0.00	23.02	-0.07	-1404.97
	30	62	-2.14	-20.09	0.00	-19.25	0.05	864.93
		63	2.14	20.09	0.00	19.25	-0.06	-955.31
	31	62	-2.14	-19.06	0.00	-19.42	0.05	891.62
		63	2.14	19.06	0.00	19.42	-0.06	-977.36
	32	62	-1.09	68.17	-2.27	-83.74	-10.47	1349.58
		63	1.09	-23.17	-0.69	-39.44	11.82	-1177.83
	33	62	-2.66	-2.94	0.00	-12.23	0.06	701.83
		63	2.66	2.94	0.00	12.23	-0.08	-715.05
	34	62	-1.07	8.33	0.00	-12.70	0.02	904.84
		63	1.07	-8.33	0.00	12.70	-0.03	-867.35
	35	62	-1.07	2.97	0.00	-11.79	0.02	765.83
		63	1.07	-2.97	0.00	11.79	-0.03	-752.48
63	28	63	-2.14	11.32	-0.01	-31.50	0.06	1627.62
		64	2.14	-11.32	0.01	31.50	-0.03	-1576.69
	29	63	-2.31	-0.12	-0.01	-28.97	0.07	1404.86
		64	2.31	0.12	0.01	28.97	-0.03	-1405.43
	30	63	-2.14	-20.08	-0.01	-23.29	0.06	955.22
		64	2.14	20.08	0.01	23.29	-0.03	-1045.61
	31	63	-2.14	-19.06	-0.01	-23.56	0.06	977.27
		64	2.14	19.06	0.01	23.56	-0.03	-1063.03
	32	63	-1.09	23.17	0.68	34.46	-11.82	1177.99
		64	1.09	-23.17	-0.68	-34.46	8.76	-1073.72
	33	63	-2.66	-2.94	-0.01	-15.26	0.08	714.99
		64	2.66	2.94	0.01	15.26	-0.04	-728.22
	34	63	-1.07	8.33	0.00	-16.37	0.03	867.28
		64	1.07	-8.33	0.00	16.37	-0.02	-829.79

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	63	-1.07	2.97	0.00	-14.97	0.03	752.42
		64	1.07	-2.97	0.00	14.97	-0.02	-739.07
64	28	64	-2.14	11.32	0.00	-28.17	0.03	1576.75
		65	2.14	-11.32	0.00	28.17	-0.02	-1525.81
	29	64	-2.31	-0.13	0.00	-26.00	0.03	1405.48
		65	2.31	0.13	0.00	26.00	-0.02	-1406.05
	30	64	-2.14	-20.09	0.00	-21.08	0.03	1045.66
		65	2.14	20.09	0.00	21.08	-0.02	-1136.04
	31	64	-2.14	-19.06	0.00	-21.31	0.03	1063.08
		65	2.14	19.06	0.00	21.31	-0.02	-1148.83
	32	64	-1.09	23.17	0.68	36.73	-8.76	1073.65
		65	1.09	-23.17	-0.68	-36.73	5.68	-969.38
	33	64	-2.66	-2.94	0.00	-13.72	0.04	728.25
		65	2.66	2.94	0.00	13.72	-0.03	-741.47
	34	64	-1.07	8.33	0.00	-14.62	0.02	829.82
		65	1.07	-8.33	0.00	14.62	-0.01	-792.32
	35	64	-1.07	2.97	0.00	-13.41	0.02	739.10
		65	1.07	-2.97	0.00	13.41	-0.01	-725.74
65	28	65	-2.14	11.32	-0.01	-31.40	0.02	1525.74
		66	2.14	-11.32	0.01	31.40	0.01	-1474.79
	29	65	-2.31	-0.13	-0.01	-28.97	0.02	1405.97
		66	2.31	0.13	0.01	28.97	0.01	-1406.55
	30	65	-2.14	-20.09	-0.01	-23.48	0.02	1135.99
		66	2.14	20.09	0.01	23.48	0.01	-1226.39
	31	65	-2.14	-19.06	-0.01	-23.74	0.02	1148.78
		66	2.14	19.06	0.01	23.74	0.01	-1234.54
	32	65	-1.09	23.17	0.68	34.68	-5.68	969.46
		66	1.09	-23.17	-0.68	-34.68	2.62	-865.20
	33	65	-2.66	-2.94	-0.01	-15.29	0.03	741.44
		66	2.66	2.94	0.01	15.29	0.01	-754.67
	34	65	-1.07	8.33	0.00	-16.29	0.01	792.28
		66	1.07	-8.33	0.00	16.29	0.00	-754.80
	35	65	-1.07	2.97	0.00	-14.94	0.01	725.72
		66	1.07	-2.97	0.00	14.94	0.00	-712.36
66	28	66	-2.14	11.32	0.00	-28.27	-0.01	1474.86
		67	2.14	-11.32	0.00	28.27	0.02	-1423.92
	29	66	-2.31	-0.13	0.00	-25.99	-0.01	1406.58
		67	2.31	0.13	0.00	25.99	0.02	-1407.17
	30	66	-2.14	-20.09	0.00	-20.89	-0.01	1226.44
		67	2.14	20.09	0.00	20.89	0.02	-1316.82
	31	66	-2.14	-19.06	0.00	-21.13	-0.01	1234.58
		67	2.14	19.06	0.00	21.13	0.02	-1320.35
	32	66	-1.09	23.17	0.68	36.51	-2.62	865.11
		67	1.09	-23.17	-0.68	-36.51	-0.45	-760.86
	33	66	-2.66	-2.94	0.00	-13.69	-0.01	754.70
		67	2.66	2.94	0.00	13.69	0.02	-767.92
	34	66	-1.07	8.33	0.00	-14.70	0.00	754.83
		67	1.07	-8.33	0.00	14.70	0.01	-717.33

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	66	-1.07	2.97	0.00	-13.43	0.00	712.39
		67	1.07	-2.97	0.00	13.43	0.01	-699.04
67	28	67	-2.14	11.32	-0.01	-34.55	-0.02	1423.77
		68	2.14	-11.32	0.01	34.55	0.07	-1372.83
	29	67	-2.31	-0.12	-0.01	-32.20	-0.02	1407.03
		68	2.31	0.12	0.01	32.20	0.07	-1407.58
	30	67	-2.14	-20.09	-0.01	-26.69	-0.02	1316.71
		68	2.14	20.09	0.01	26.69	0.07	-1407.12
	31	67	-2.14	-19.06	-0.01	-26.95	-0.02	1320.23
		68	2.14	19.06	0.01	26.95	0.07	-1406.00
	32	67	-1.09	23.17	0.68	33.16	0.45	761.01
		68	1.09	-23.17	-0.68	-33.16	-3.50	-656.73
	33	67	-2.66	-2.94	-0.01	-17.08	-0.02	767.85
		68	2.66	2.94	0.01	17.08	0.08	-781.08
	34	67	-1.07	8.33	-0.01	-17.86	-0.01	717.26
		68	1.07	-8.33	0.01	17.86	0.03	-679.76
	35	67	-1.07	2.97	-0.01	-16.52	-0.01	698.97
		68	1.07	-2.97	0.01	16.52	0.03	-685.62
68	28	68	-2.14	11.32	-0.01	-31.41	-0.07	1372.90
		69	2.14	-11.32	0.01	31.41	0.10	-1321.95
	29	68	-2.31	-0.12	-0.01	-28.98	-0.07	1407.65
		69	2.31	0.12	0.01	28.98	0.10	-1408.21
	30	68	-2.14	-20.09	-0.01	-23.47	-0.07	1407.18
		69	2.14	20.09	0.01	23.47	0.10	-1497.55
	31	68	-2.14	-19.06	-0.01	-23.73	-0.07	1406.05
		69	2.14	19.06	0.01	23.73	0.10	-1491.79
	32	68	-1.09	23.17	0.68	34.66	3.50	656.66
		69	1.09	-23.17	-0.68	-34.66	-6.57	-552.41
	33	68	-2.66	-2.94	-0.01	-15.29	-0.08	781.12
		69	2.66	2.94	0.01	15.29	0.12	-794.34
	34	68	-1.07	8.33	0.00	-16.31	-0.03	679.80
		69	1.07	-8.33	0.00	16.31	0.05	-642.31
	35	68	-1.07	2.97	0.00	-14.95	-0.03	685.65
		69	1.07	-2.97	0.00	14.95	0.05	-672.31
69	28	69	-2.14	11.32	-0.01	-33.19	-0.10	1321.92
		70	2.14	-11.32	0.01	33.19	0.13	-1280.02
	29	69	-2.31	-0.12	-0.01	-30.87	-0.10	1408.18
		70	2.31	0.12	0.01	30.87	0.14	-1408.62
	30	69	-2.14	-20.09	-0.01	-25.49	-0.10	1497.52
		70	2.14	20.09	0.01	25.49	0.13	-1571.84
	31	69	-2.14	-19.05	-0.01	-25.74	-0.10	1491.76
		70	2.14	19.05	0.01	25.74	0.13	-1562.26
	32	69	-1.09	23.17	0.68	33.91	6.57	552.46
		70	1.09	-23.17	-0.68	-33.91	-9.08	-466.73
	33	69	-2.66	-2.94	-0.01	-16.36	-0.12	794.31
		70	2.66	2.94	0.01	16.36	0.16	-805.20
	34	69	-1.07	8.33	0.00	-17.17	-0.05	642.29
		70	1.07	-8.33	0.00	17.17	0.07	-611.46

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	69	-1.07	2.97	0.00	-15.85	-0.05	672.28
		70	1.07	-2.97	0.00	15.85	0.07	-661.30
70	28	70	-2.14	11.32	-0.02	-39.96	-0.13	1279.84
		71	2.14	-11.32	0.02	39.96	0.15	-1270.75
	29	70	-2.31	-0.19	-0.02	-38.32	-0.14	1408.43
		71	2.31	0.19	0.02	38.32	0.16	-1408.55
	30	70	-2.14	-20.09	-0.02	-33.80	-0.13	1571.70
		71	2.14	20.09	0.02	33.80	0.15	-1587.74
	31	70	-2.14	-19.11	-0.02	-34.00	-0.13	1562.10
		71	2.14	19.11	0.02	34.00	0.15	-1577.38
	32	70	-1.09	23.15	0.67	31.45	9.08	466.91
		71	1.09	-23.15	-0.67	-31.45	-9.62	-448.35
	33	70	-2.66	-2.92	-0.03	-20.62	-0.16	805.11
		71	2.66	2.92	0.03	20.62	0.18	-807.43
	34	70	-1.07	8.37	-0.01	-20.40	-0.07	611.37
		71	1.07	-8.37	0.01	20.40	0.07	-604.67
	35	70	-1.07	2.98	-0.01	-19.35	-0.07	661.22
		71	1.07	-2.98	0.01	19.35	0.07	-658.82
71	28	71	-1.78	353.56	-14.16	-110.33	108.90	1269.01
		72	1.78	-340.78	13.66	105.05	-97.79	-991.58
	29	71	-1.96	359.68	-14.16	-109.01	108.91	1406.72
		72	1.96	-346.89	13.66	103.72	-97.79	-1124.35
	30	71	-1.78	362.59	-14.16	-109.79	108.90	1585.67
		72	1.78	-349.80	13.66	104.51	-97.79	-1300.97
	31	71	-1.78	362.27	-14.16	-109.81	108.90	1575.30
		72	1.78	-349.49	13.66	104.52	-97.79	-1290.82
	32	71	-0.89	171.88	-7.08	349.57	54.45	455.68
		72	0.89	-165.48	6.83	-337.83	-48.89	-320.86
	33	71	-2.48	191.07	-7.07	354.53	54.50	816.71
		72	2.48	-184.67	6.81	-342.79	-48.95	-666.54
	34	71	-0.89	176.43	-7.08	349.84	54.45	613.90
		72	0.89	-170.04	6.83	-338.10	-48.89	-475.45
	35	71	-0.89	177.97	-7.08	349.93	54.45	667.99
		72	0.89	-171.57	6.83	-338.19	-48.89	-528.30
72	28	72	-1.64	340.74	-13.67	-115.31	97.79	990.44
		73	1.64	-281.54	11.34	90.84	-51.50	160.85
	29	72	-1.82	346.89	-13.67	-115.36	97.79	1123.21
		73	1.82	-287.68	11.34	90.89	-51.51	50.84
	30	72	-1.64	349.81	-13.67	-117.97	97.79	1299.82
		73	1.64	-290.60	11.34	93.50	-51.50	-114.98
	31	72	-1.64	349.51	-13.67	-117.89	97.79	1289.68
		73	1.64	-290.31	11.34	93.41	-51.50	-105.93
	32	72	-0.82	165.49	-6.84	334.49	48.89	324.33
		73	0.82	-135.89	5.67	-280.12	-25.75	233.26
	33	72	-2.41	184.67	-6.84	335.87	48.95	670.07
		73	2.41	-155.06	5.67	-281.50	-25.80	-41.52
	34	72	-0.82	170.02	-6.84	333.16	48.89	478.93
		73	0.82	-140.42	5.67	-278.79	-25.75	95.44

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	72	-0.82	171.57	-6.84	332.70	48.89	531.78
		73	0.82	-141.97	5.67	-278.33	-25.75	48.32
73	28	73	-1.66	281.53	-11.34	-91.13	51.50	-160.68
		74	1.66	-209.52	8.50	61.37	-6.85	1265.67
	29	73	-1.84	287.68	-11.34	-90.98	51.51	-50.67
		74	1.84	-215.68	8.50	61.22	-6.85	1183.36
	30	73	-1.66	290.60	-11.34	-93.29	51.50	115.15
		74	1.66	-218.59	8.50	63.52	-6.85	1030.67
	31	73	-1.66	290.31	-11.34	-93.22	51.50	106.10
		74	1.66	-218.30	8.50	63.45	-6.85	1038.37
	32	73	-0.83	135.89	-5.67	279.69	25.75	-233.78
		74	0.83	-99.88	4.25	-213.56	-3.42	764.32
	33	73	-2.42	155.06	-5.67	281.58	25.80	41.00
		74	2.42	-119.06	4.25	-215.45	-3.47	575.84
	34	73	-0.83	140.42	-5.67	278.61	25.75	-95.95
		74	0.83	-104.42	4.25	-212.49	-3.42	646.90
	35	73	-0.83	141.97	-5.67	278.24	25.75	-48.83
		74	0.83	-105.97	4.25	-212.12	-3.42	606.76
74	28	74	-1.66	209.52	-8.50	-61.36	6.85	-1265.66
		75	1.66	-137.53	5.67	31.60	25.05	2046.47
	29	74	-1.84	215.67	-8.50	-61.21	6.85	-1183.36
		75	1.84	-143.68	5.67	31.45	25.04	1991.82
	30	74	-1.66	218.59	-8.50	-63.51	6.85	-1030.67
		75	1.66	-146.60	5.67	33.76	25.05	1852.27
	31	74	-1.66	218.30	-8.50	-63.44	6.85	-1038.37
		75	1.66	-146.30	5.67	33.68	25.05	1858.64
	32	74	-0.83	99.88	-4.25	213.57	3.42	-764.32
		75	0.83	-63.89	2.84	-147.46	12.52	1132.77
	33	74	-2.42	119.06	-4.25	215.46	3.47	-575.85
		75	2.42	-83.06	2.84	-149.34	12.48	1030.56
	34	74	-0.83	104.42	-4.25	212.49	3.42	-646.90
		75	0.83	-68.42	2.84	-146.38	12.52	1035.74
	35	74	-0.83	105.97	-4.25	212.12	3.42	-606.75
		75	0.83	-69.97	2.84	-146.01	12.52	1002.57
75	28	75	-1.65	137.53	-5.67	-26.92	-25.05	-2046.52
		76	1.65	-65.52	2.84	-2.85	44.20	2503.46
	29	75	-1.83	143.69	-5.67	-26.90	-25.04	-1991.89
		76	1.83	-71.67	2.84	-2.87	44.20	2476.55
	30	75	-1.65	146.60	-5.67	-29.52	-25.05	-1852.34
		76	1.65	-74.59	2.84	-0.24	44.20	2350.11
	31	75	-1.65	146.30	-5.67	-29.44	-25.05	-1858.72
		76	1.65	-74.29	2.84	-0.33	44.20	2355.13
	32	75	-0.83	63.89	-2.84	150.04	-12.52	-1132.44
		76	0.83	-27.88	1.42	-83.91	22.10	1338.95
	33	75	-2.41	83.06	-2.84	151.70	-12.48	-1030.22
		76	2.41	-47.06	1.42	-85.57	22.07	1323.05
	34	75	-0.83	68.42	-2.84	148.75	-12.52	-1035.41
		76	0.83	-32.42	1.42	-82.61	22.10	1262.32

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	75	-0.83	69.97	-2.84	148.30	-12.52	-1002.23
		76	0.83	-33.96	1.42	-82.17	22.10	1236.13
76	28	76	-1.65	65.52	-2.84	2.42	-44.20	-2503.45
		77	1.65	6.48	0.00	-32.18	50.59	2636.32
	29	76	-1.83	71.67	-2.84	2.45	-44.20	-2476.54
		77	1.83	0.33	0.00	-32.21	50.59	2637.06
	30	76	-1.65	74.59	-2.84	-0.15	-44.20	-2350.11
		77	1.65	-2.59	0.00	-29.61	50.60	2523.76
	31	76	-1.65	74.29	-2.84	-0.07	-44.20	-2355.15
		77	1.65	-2.29	0.00	-29.69	50.60	2527.45
	32	76	-0.83	27.88	-1.42	83.69	-22.10	-1338.97
		77	0.83	8.12	0.00	-17.57	25.30	1383.44
	33	76	-2.41	47.05	-1.42	85.34	-22.07	-1323.06
		77	2.41	-11.06	0.01	-19.23	25.28	1453.82
	34	76	-0.83	32.41	-1.42	82.40	-22.10	-1262.33
		77	0.83	3.58	0.00	-16.28	25.30	1327.21
	35	76	-0.83	33.97	-1.42	81.96	-22.10	-1236.14
		77	0.83	2.03	0.00	-15.85	25.30	1307.98
77	28	77	-1.65	-6.47	0.00	32.65	-50.60	-2636.28
		78	1.65	78.47	-2.83	-62.41	44.23	2445.16
	29	77	-1.83	-0.32	0.00	32.68	-50.59	-2637.06
		78	1.83	72.32	-2.83	-62.44	44.23	2473.58
	30	77	-1.65	2.59	0.00	30.06	-50.60	-2523.75
		78	1.65	69.41	-2.83	-59.82	44.23	2373.43
	31	77	-1.65	2.30	0.00	30.14	-50.60	-2527.45
		78	1.65	69.70	-2.83	-59.90	44.23	2375.77
	32	77	-0.83	-8.12	0.00	17.82	-25.30	-1383.44
		78	0.83	44.11	-1.42	48.30	22.12	1265.91
	33	77	-2.41	11.06	-0.01	19.48	-25.28	-1453.82
		78	2.41	24.94	-1.41	46.63	22.12	1422.58
	34	77	-0.83	-3.59	0.00	16.52	-25.30	-1327.20
		78	0.83	39.59	-1.42	49.60	22.12	1230.07
	35	77	-0.83	-2.03	0.00	16.08	-25.30	-1307.97
		78	0.83	38.03	-1.42	50.04	22.12	1217.83
78	28	78	-1.65	-78.48	2.83	61.98	-44.23	-2445.14
		79	1.65	150.48	-5.67	-91.74	25.11	1930.03
	29	78	-1.83	-72.32	2.83	62.01	-44.23	-2473.60
		79	1.83	144.32	-5.67	-91.77	25.12	1986.17
	30	78	-1.65	-69.40	2.83	59.40	-44.23	-2373.43
		79	1.65	141.40	-5.67	-89.16	25.11	1899.14
	31	78	-1.65	-69.71	2.83	59.48	-44.23	-2375.78
		79	1.65	141.70	-5.67	-89.25	25.11	1900.15
	32	78	-0.83	-44.11	1.42	-48.52	-22.12	-1265.90
		79	0.83	80.11	-2.83	114.64	12.56	986.40
	33	78	-2.41	-24.94	1.41	-46.88	-22.12	-1422.57
		79	2.41	60.94	-2.83	113.00	12.58	1229.34
	34	78	-0.83	-39.58	1.42	-49.81	-22.12	-1230.07
		79	0.83	75.58	-2.83	115.93	12.56	970.96

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	78	-0.83	-38.03	1.42	-50.25	-22.12	-1217.81
		79	0.83	74.03	-2.83	116.37	12.56	965.68
79	28	79	-1.66	-150.47	5.66	96.17	-25.11	-1929.82
		80	1.66	222.48	-8.50	-125.93	-6.75	1090.62
	29	79	-1.84	-144.32	5.66	96.32	-25.12	-1985.96
		80	1.84	216.33	-8.50	-126.08	-6.74	1174.47
	30	79	-1.66	-141.40	5.66	93.51	-25.11	-1898.93
		80	1.66	213.41	-8.50	-123.28	-6.75	1100.55
	31	79	-1.66	-141.70	5.66	93.60	-25.11	-1899.94
		80	1.66	213.71	-8.50	-123.36	-6.75	1100.24
	32	79	-0.83	-80.11	2.83	-112.38	-12.56	-986.66
		80	0.83	116.12	-4.25	178.50	-3.37	545.11
	33	79	-2.42	-60.94	2.82	-110.18	-12.58	-1229.60
		80	2.42	96.94	-4.24	176.30	-3.32	874.35
	34	79	-0.83	-75.58	2.83	-113.70	-12.56	-971.22
		80	0.83	111.58	-4.25	179.83	-3.37	550.08
	35	79	-0.83	-74.03	2.83	-114.16	-12.56	-965.94
		80	0.83	110.03	-4.25	180.28	-3.38	551.77
80	28	80	-1.67	-222.48	8.50	126.12	6.75	-1090.61
		81	1.67	294.49	-11.33	-155.89	-51.37	-72.62
	29	80	-1.84	-216.32	8.50	126.29	6.74	-1174.45
		81	1.84	288.33	-11.33	-156.05	-51.36	38.90
	30	80	-1.67	-213.41	8.50	123.47	6.75	-1100.53
		81	1.67	285.41	-11.33	-153.24	-51.37	-21.87
	31	80	-1.67	-213.70	8.50	123.56	6.75	-1100.21
		81	1.67	285.71	-11.33	-153.32	-51.37	-23.54
	32	80	-0.83	-116.11	4.25	-178.40	3.37	-545.14
		81	0.83	152.12	-5.67	244.53	-25.69	-58.41
	33	80	-2.42	-96.94	4.24	-176.15	3.32	-874.39
		81	2.42	132.94	-5.66	242.27	-25.60	357.11
	34	80	-0.83	-111.58	4.25	-179.73	3.37	-550.10
		81	0.83	147.58	-5.67	245.85	-25.69	-33.05
	35	80	-0.83	-110.03	4.25	-180.18	3.38	-551.80
		81	0.83	146.04	-5.67	246.30	-25.69	-24.39
81	28	81	-1.66	-294.48	11.33	155.90	51.37	72.60
		82	1.66	353.67	-13.66	-180.37	-97.61	-1271.56
	29	81	-1.84	-288.33	11.33	156.05	51.36	-38.94
		82	1.84	347.52	-13.66	-180.52	-97.60	-1137.27
	30	81	-1.66	-285.41	11.33	153.24	51.37	21.84
		82	1.66	344.60	-13.66	-177.71	-97.61	-1187.26
	31	81	-1.66	-285.71	11.33	153.33	51.37	23.51
		82	1.66	344.90	-13.66	-177.80	-97.61	-1190.01
	32	81	-0.83	-152.12	5.67	-244.52	25.69	58.45
		82	0.83	181.72	-6.83	298.88	-48.80	-675.99
	33	81	-2.42	-132.94	5.66	-242.33	25.60	-357.08
		82	2.42	162.54	-6.82	296.69	-48.69	-189.52
	34	81	-0.83	-147.58	5.67	-245.85	25.69	33.10
		82	0.83	177.18	-6.83	300.20	-48.80	-633.86

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	81	-0.83	-146.04	5.67	-246.30	25.69	24.43
		82	0.83	175.63	-6.83	300.66	-48.80	-619.46
82	28	82	-1.66	-353.66	13.66	180.42	97.61	1271.56
		83	1.66	366.46	-14.17	-185.70	-108.74	-1559.46
	29	82	-1.84	-347.50	13.66	180.56	97.60	1137.27
		83	1.84	360.29	-14.17	-185.85	-108.72	-1420.23
	30	82	-1.66	-344.63	13.66	177.75	97.61	1187.25
		83	1.66	357.42	-14.17	-183.04	-108.74	-1467.91
	31	82	-1.66	-344.92	13.66	177.84	97.61	1190.01
		83	1.66	357.72	-14.17	-183.13	-108.74	-1470.89
	32	82	-0.83	-181.74	6.83	-298.85	48.80	676.00
		83	0.83	188.14	-7.08	310.60	-54.37	-823.84
	33	82	-2.42	-162.55	6.82	-296.68	48.69	189.54
		83	2.42	168.95	-7.08	308.43	-54.25	-322.06
	34	82	-0.83	-177.20	6.83	-300.18	48.80	633.87
		83	0.83	183.60	-7.08	311.93	-54.37	-778.10
	35	82	-0.83	-175.63	6.83	-300.64	48.80	619.48
		83	0.83	182.02	-7.08	312.38	-54.37	-762.45
83	28	83	-1.13	12.22	0.00	-29.10	0.04	1551.36
		84	1.13	-12.22	0.00	29.10	-0.04	-1541.55
	29	83	-1.30	0.64	0.00	-32.55	0.05	1412.01
		84	1.30	-0.64	0.00	32.55	-0.05	-1411.53
	30	83	-1.13	9.68	0.00	-28.48	0.04	1459.94
		84	1.13	-9.68	0.00	28.48	-0.04	-1452.19
	31	83	-1.13	9.75	0.00	-28.50	0.04	1462.93
		84	1.13	-9.75	0.00	28.50	-0.04	-1455.13
	32	83	-0.56	7.92	0.00	-14.91	0.02	835.01
		84	0.56	-7.92	0.00	14.91	-0.02	-828.68
	33	83	-2.15	-37.08	0.00	-29.07	0.08	332.60
		84	2.15	37.08	0.00	29.07	-0.08	-362.28
	34	83	-0.56	6.59	0.00	-14.60	0.02	789.32
		84	0.56	-6.59	0.00	14.60	-0.02	-784.03
	35	83	-0.56	6.15	0.00	-14.49	0.02	773.70
		84	0.56	-6.15	0.00	14.49	-0.02	-768.79
84	28	84	-1.13	12.26	0.00	-29.23	0.04	1541.54
		85	1.13	-12.26	0.00	29.23	-0.05	-1496.17
	29	84	-1.30	0.62	0.00	-32.66	0.05	1411.51
		85	1.30	-0.62	0.00	32.66	-0.05	-1409.22
	30	84	-1.13	9.64	0.00	-28.60	0.04	1452.19
		85	1.13	-9.64	0.00	28.60	-0.05	-1416.52
	31	84	-1.13	9.73	0.00	-28.62	0.04	1455.13
		85	1.13	-9.73	0.00	28.62	-0.05	-1419.13
	32	84	-0.56	7.91	0.00	-14.98	0.02	828.68
		85	0.56	-7.91	0.00	14.98	-0.02	-799.43
	33	84	-2.15	-37.08	0.00	-29.10	0.08	362.28
		85	2.15	37.08	0.00	29.10	-0.09	-499.46
	34	84	-0.56	6.60	0.00	-14.67	0.02	784.04
		85	0.56	-6.60	0.00	14.67	-0.02	-759.64

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	84	-0.56	6.15	0.00	-14.56	0.02	768.78
		85	0.56	-6.15	0.00	14.56	-0.02	-746.03
85	28	85	-1.13	12.26	0.00	-32.65	0.05	1496.10
		86	1.13	-12.26	0.00	32.65	-0.04	-1440.91
	29	85	-1.30	0.62	0.00	-35.88	0.05	1409.14
		86	1.30	-0.62	0.00	35.88	-0.05	-1406.35
	30	85	-1.13	9.64	0.00	-31.83	0.05	1416.45
		86	1.13	-9.64	0.00	31.83	-0.04	-1373.06
	31	85	-1.13	9.73	0.00	-31.86	0.05	1419.06
		86	1.13	-9.73	0.00	31.86	-0.04	-1375.29
	32	85	-0.56	7.90	0.00	-16.81	0.02	799.40
		86	0.56	-7.90	0.00	16.81	-0.02	-763.82
	33	85	-2.15	-37.08	0.00	-30.24	0.09	499.39
		86	2.15	37.08	0.00	30.24	-0.08	-666.24
	34	85	-0.56	6.60	0.00	-16.40	0.02	759.60
		86	0.56	-6.60	0.00	16.40	-0.02	-729.92
	35	85	-0.56	6.15	0.00	-16.26	0.02	745.99
		86	0.56	-6.15	0.00	16.26	-0.02	-718.33
86	28	86	-1.13	12.26	0.00	-32.63	0.04	1440.91
		87	1.13	-12.26	0.00	32.63	-0.03	-1385.72
	29	86	-1.30	0.62	0.00	-35.87	0.05	1406.35
		87	1.30	-0.62	0.00	35.87	-0.04	-1403.57
	30	86	-1.13	9.64	0.00	-31.82	0.04	1373.07
		87	1.13	-9.64	0.00	31.82	-0.03	-1329.67
	31	86	-1.13	9.73	0.00	-31.85	0.04	1375.29
		87	1.13	-9.73	0.00	31.85	-0.03	-1331.50
	32	86	-0.56	7.91	0.00	-16.80	0.02	763.82
		87	0.56	-7.91	0.00	16.80	-0.02	-728.24
	33	86	-2.15	-37.08	0.00	-30.23	0.08	666.24
		87	2.15	37.08	0.00	30.23	-0.06	-833.13
	34	86	-0.56	6.60	0.00	-16.40	0.02	729.92
		87	0.56	-6.60	0.00	16.40	-0.02	-700.24
	35	86	-0.56	6.15	0.00	-16.26	0.02	718.33
		87	0.56	-6.15	0.00	16.26	-0.02	-690.66
87	28	87	-1.13	12.26	0.00	-32.65	0.03	1385.72
		88	1.13	-12.26	0.00	32.65	-0.02	-1330.54
	29	87	-1.30	0.62	0.00	-35.88	0.04	1403.58
		88	1.30	-0.62	0.00	35.88	-0.03	-1400.77
	30	87	-1.13	9.64	0.00	-31.83	0.03	1329.66
		88	1.13	-9.64	0.00	31.83	-0.02	-1286.29
	31	87	-1.13	9.73	0.00	-31.86	0.03	1331.50
		88	1.13	-9.73	0.00	31.86	-0.02	-1287.73
	32	87	-0.56	7.90	0.00	-16.81	0.02	728.24
		88	0.56	-7.90	0.00	16.81	-0.01	-692.67
	33	87	-2.15	-37.08	0.00	-30.24	0.06	833.12
		88	2.15	37.08	0.00	30.24	-0.05	-999.98
	34	87	-0.56	6.60	0.00	-16.40	0.02	700.24
		88	0.56	-6.60	0.00	16.40	-0.01	-670.55

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	87	-0.56	6.15	0.00	-16.26	0.02	690.66
		88	0.56	-6.15	0.00	16.26	-0.01	-662.99
88	28	88	-1.13	12.26	0.00	-35.46	0.02	1330.47
		89	1.13	-12.26	0.00	35.46	-0.01	-1275.28
	29	88	-1.30	0.62	0.00	-38.85	0.03	1400.70
		89	1.30	-0.62	0.00	38.85	-0.01	-1397.90
	30	88	-1.13	9.65	0.00	-34.55	0.02	1286.21
		89	1.13	-9.65	0.00	34.55	-0.01	-1242.81
	31	88	-1.13	9.73	0.00	-34.58	0.02	1287.66
		89	1.13	-9.73	0.00	34.58	-0.01	-1243.87
	32	88	-0.56	7.91	0.00	-18.27	0.01	692.63
		89	0.56	-7.91	0.00	18.27	0.00	-657.06
	33	88	-2.15	-37.08	-0.01	-32.36	0.05	999.91
		89	2.15	37.08	0.01	32.36	-0.01	-1166.78
	34	88	-0.56	6.59	0.00	-17.82	0.01	670.52
		89	0.56	-6.59	0.00	17.82	0.00	-640.84
	35	88	-0.56	6.15	0.00	-17.66	0.01	662.96
		89	0.56	-6.15	0.00	17.66	0.00	-635.28
89	28	89	-1.13	12.26	0.00	-32.75	0.01	1275.35
		90	1.13	-12.26	0.00	32.75	0.00	-1220.16
	29	89	-1.30	0.62	0.00	-35.88	0.01	1397.99
		90	1.30	-0.62	0.00	35.88	0.00	-1395.21
	30	89	-1.13	9.64	0.00	-31.91	0.01	1242.88
		90	1.13	-9.64	0.00	31.91	0.00	-1199.49
	31	89	-1.13	9.73	0.00	-31.94	0.01	1243.95
		90	1.13	-9.73	0.00	31.94	0.00	-1200.16
	32	89	-0.56	7.91	0.00	-16.88	0.00	657.10
		90	0.56	-7.91	0.00	16.88	0.00	-621.52
	33	89	-2.15	-37.09	0.00	-29.88	0.01	1166.84
		90	2.15	37.09	0.00	29.88	0.00	-1333.73
	34	89	-0.56	6.60	0.00	-16.46	0.00	640.87
		90	0.56	-6.60	0.00	16.46	0.00	-611.18
	35	89	-0.56	6.15	0.00	-16.32	0.00	635.32
		90	0.56	-6.15	0.00	16.32	0.00	-607.65
90	28	90	-1.13	12.26	0.00	-35.34	0.00	1220.09
		91	1.13	-12.26	0.00	35.34	0.02	-1164.90
	29	90	-1.30	0.62	0.00	-38.84	0.00	1395.12
		91	1.30	-0.62	0.00	38.84	0.02	-1392.33
	30	90	-1.13	9.64	0.00	-34.46	0.00	1199.42
		91	1.13	-9.64	0.00	34.46	0.02	-1156.02
	31	90	-1.13	9.73	0.00	-34.49	0.00	1200.09
		91	1.13	-9.73	0.00	34.49	0.02	-1156.31
	32	90	-0.56	7.90	0.00	-18.20	0.00	621.48
		91	0.56	-7.90	0.00	18.20	0.01	-585.90
	33	90	-2.15	-37.08	-0.01	-32.71	0.00	1333.66
		91	2.15	37.08	0.01	32.71	0.04	-1500.52
	34	90	-0.56	6.59	0.00	-17.76	0.00	611.14
		91	0.56	-6.59	0.00	17.76	0.01	-581.46

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	90	-0.56	6.15	0.00	-17.61	0.00	607.61
		91	0.56	-6.15	0.00	17.61	0.01	-579.95
91	28	91	-1.13	12.26	0.00	-35.35	-0.02	1164.90
		92	1.13	-12.26	0.00	35.35	0.04	-1109.73
	29	91	-1.30	0.62	0.00	-38.85	-0.02	1392.34
		92	1.30	-0.62	0.00	38.85	0.05	-1389.54
	30	91	-1.13	9.64	0.00	-34.47	-0.02	1156.03
		92	1.13	-9.64	0.00	34.47	0.04	-1112.63
	31	91	-1.13	9.73	0.00	-34.50	-0.02	1156.31
		92	1.13	-9.73	0.00	34.50	0.04	-1112.54
	32	91	-0.56	7.91	0.00	-18.20	-0.01	585.91
		92	0.56	-7.91	0.00	18.20	0.02	-550.33
	33	91	-2.15	-37.08	-0.01	-32.72	-0.04	1500.52
		92	2.15	37.08	0.01	32.72	0.07	-1667.35
	34	91	-0.56	6.60	0.00	-17.76	-0.01	581.46
		92	0.56	-6.60	0.00	17.76	0.02	-551.79
	35	91	-0.56	6.15	0.00	-17.61	-0.01	579.95
		92	0.56	-6.15	0.00	17.61	0.02	-552.28
92	28	92	-1.13	12.26	-0.01	-37.89	-0.04	1109.65
		93	1.13	-12.26	0.01	37.89	0.07	-1054.46
	29	92	-1.30	0.62	-0.01	-42.02	-0.05	1389.46
		93	1.30	-0.62	0.01	42.02	0.08	-1386.68
	30	92	-1.13	9.64	-0.01	-37.01	-0.04	1112.56
		93	1.13	-9.64	0.01	37.01	0.07	-1069.16
	31	92	-1.13	9.73	-0.01	-37.04	-0.04	1112.46
		93	1.13	-9.73	0.01	37.04	0.07	-1068.68
	32	92	-0.56	7.91	0.00	-19.46	-0.02	550.29
		93	0.56	-7.91	0.00	19.46	0.03	-514.71
	33	92	-2.15	-37.08	-0.01	-36.53	-0.07	1667.28
		93	2.15	37.08	0.01	36.53	0.13	-1834.14
	34	92	-0.56	6.60	0.00	-19.02	-0.02	551.75
		93	0.56	-6.60	0.00	19.02	0.03	-522.06
	35	92	-0.56	6.15	0.00	-18.87	-0.02	552.24
		93	0.56	-6.15	0.00	18.87	0.03	-524.57
93	28	93	-1.13	12.26	-0.01	-36.71	-0.07	1054.50
		94	1.13	-12.26	0.01	36.71	0.09	-1009.12
	29	93	-1.30	0.62	-0.01	-40.47	-0.08	1386.72
		94	1.30	-0.62	0.01	40.47	0.10	-1384.43
	30	93	-1.13	9.64	-0.01	-35.82	-0.07	1069.20
		94	1.13	-9.64	0.01	35.82	0.09	-1033.52
	31	93	-1.13	9.73	-0.01	-35.84	-0.07	1068.71
		94	1.13	-9.73	0.01	35.84	0.09	-1032.72
	32	93	-0.56	7.91	0.00	-18.88	-0.03	514.74
		94	0.56	-7.91	0.00	18.88	0.04	-485.48
	33	93	-2.15	-37.08	-0.01	-34.48	-0.13	1834.18
		94	2.15	37.08	0.01	34.48	0.17	-1971.40
	34	93	-0.56	6.60	0.00	-18.44	-0.03	522.08
		94	0.56	-6.60	0.00	18.44	0.04	-497.67

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	93	-0.56	6.15	0.00	-18.29	-0.03	524.59
		94	0.56	-6.15	0.00	18.29	0.04	-501.84
94	28	94	-1.13	12.29	0.00	-30.05	-0.09	1009.35
		95	1.13	-12.29	0.00	30.05	0.09	-999.51
	29	94	-1.30	0.59	0.00	-31.34	-0.10	1384.66
		95	1.30	-0.59	0.00	31.34	0.10	-1384.16
	30	94	-1.13	9.73	0.00	-28.99	-0.09	1033.76
		95	1.13	-9.73	0.00	28.99	0.09	-1025.98
	31	94	-1.13	9.74	0.00	-29.03	-0.09	1032.96
		95	1.13	-9.74	0.00	29.03	0.09	-1025.13
	32	94	-0.56	7.87	0.00	-15.68	-0.04	485.59
		95	0.56	-7.87	0.00	15.68	0.04	-479.27
	33	94	-2.15	-37.09	0.00	-21.47	-0.17	1971.57
		95	2.15	37.09	0.00	21.47	0.17	-2001.26
	34	94	-0.56	6.61	0.00	-15.15	-0.04	497.79
		95	0.56	-6.61	0.00	15.15	0.04	-492.50
	35	94	-0.56	6.13	0.00	-14.97	-0.04	501.95
		95	0.56	-6.13	0.00	14.97	0.04	-497.04
95	28	95	-0.52	332.93	-12.10	-88.09	79.53	996.76
		96	0.52	-320.13	11.60	82.80	-70.05	-735.54
	29	95	-0.60	391.72	-14.02	-101.95	98.36	1381.00
		96	0.60	-378.92	13.52	96.66	-87.35	-1072.74
	30	95	-0.52	333.67	-12.10	-88.61	79.53	1023.24
		96	0.52	-320.87	11.60	83.32	-70.05	-761.41
	31	95	-0.52	333.61	-12.10	-88.59	79.53	1022.33
		96	0.52	-320.81	11.60	83.30	-70.05	-760.58
	32	95	-0.26	166.76	-6.05	301.88	39.76	495.43
		96	0.26	-160.36	5.80	-290.13	-35.02	-364.57
	33	95	-0.87	499.31	-25.27	-373.66	165.75	1984.31
		96	0.87	-480.91	24.23	352.56	-145.95	-1592.17
	34	95	-0.26	167.14	-6.05	301.62	39.76	508.65
		96	0.26	-160.73	5.80	-289.86	-35.02	-377.49
	35	95	-0.26	167.26	-6.05	301.53	39.76	513.16
		96	0.26	-160.86	5.80	-289.77	-35.02	-381.92
96	28	96	-0.60	320.15	-11.59	-77.44	70.05	736.12
		97	0.60	-260.94	9.26	52.97	-31.47	339.04
	29	96	-0.69	378.92	-13.51	-88.85	87.35	1073.40
		97	0.69	-319.72	11.18	64.38	-41.66	219.25
	30	96	-0.60	320.84	-11.59	-77.78	70.05	762.01
		97	0.60	-261.63	9.26	53.30	-31.47	315.69
	31	96	-0.60	320.82	-11.59	-77.76	70.05	761.16
		97	0.60	-261.61	9.26	53.29	-31.47	316.46
	32	96	-0.30	160.38	-5.80	292.77	35.02	362.44
		97	0.30	-130.78	4.63	-238.40	-15.73	176.26
	33	96	-1.05	480.96	-24.22	-340.96	145.95	1594.68
		97	1.05	-395.85	19.42	243.39	-65.20	27.64
	34	96	-0.30	160.72	-5.80	292.60	35.02	375.38
		97	0.30	-131.12	4.63	-238.23	-15.73	164.60

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	96	-0.30	160.84	-5.80	292.55	35.02	379.80
		97	0.30	-131.24	4.63	-238.18	-15.73	160.61
97	28	97	-0.59	260.94	-9.26	-52.44	31.47	-339.12
		98	0.59	-182.54	6.18	20.03	6.36	1425.63
	29	97	-0.68	319.72	-11.18	-64.04	41.66	-219.35
		98	0.68	-241.32	8.10	31.63	5.58	1593.86
	30	97	-0.59	261.63	-9.26	-52.81	31.47	-315.77
		98	0.59	-183.23	6.18	20.40	6.36	1405.67
	31	97	-0.59	261.61	-9.26	-52.80	31.47	-316.54
		98	0.59	-183.21	6.18	20.39	6.36	1406.32
	32	97	-0.29	130.78	-4.63	238.67	15.73	-175.90
		98	0.29	-91.58	3.09	-166.68	3.18	720.66
	33	97	-1.02	395.85	-19.42	-243.35	65.20	-28.02
		98	1.02	-283.15	13.05	114.15	14.35	1691.57
	34	97	-0.29	131.12	-4.63	238.49	15.73	-164.23
		98	0.29	-91.92	3.09	-166.49	3.18	710.68
	35	97	-0.29	131.24	-4.63	238.42	15.73	-160.25
		98	0.29	-92.04	3.09	-166.43	3.18	707.27
98	28	98	-0.57	182.54	-6.18	-17.04	-6.36	-1425.67
		99	0.57	-104.13	3.09	-15.38	29.06	2128.08
	29	98	-0.66	241.32	-8.10	-28.28	-5.58	-1593.92
		99	0.66	-162.91	5.01	-4.14	37.69	2584.36
	30	98	-0.57	183.23	-6.18	-17.45	-6.36	-1405.70
		99	0.57	-104.83	3.09	-14.96	29.06	2111.49
	31	98	-0.57	183.21	-6.18	-17.43	-6.36	-1406.36
		99	0.57	-104.80	3.09	-14.98	29.06	2112.05
	32	98	-0.29	91.58	-3.09	168.19	-3.18	-720.31
		99	0.29	-52.37	1.54	-96.19	14.53	1073.02
	33	98	-0.99	283.16	-13.06	-110.60	-14.35	-1691.81
		99	0.99	-170.45	6.69	-18.61	62.73	2803.22
	34	98	-0.29	91.92	-3.09	167.99	-3.18	-710.33
		99	0.29	-52.72	1.54	-95.99	14.53	1064.73
	35	98	-0.29	92.04	-3.09	167.92	-3.18	-706.92
		99	0.29	-52.84	1.54	-95.91	14.53	1061.89
99	28	99	-0.58	104.13	-3.09	10.92	-29.06	-2128.11
		100	0.58	-25.75	0.00	-43.32	36.62	2446.26
	29	99	-0.67	162.91	-5.01	-1.28	-37.69	-2584.36
		100	0.67	-35.71	0.00	-51.31	51.59	3112.45
	30	99	-0.58	104.82	-3.09	10.54	-29.06	-2111.52
		100	0.58	-26.44	0.00	-42.94	36.62	2433.04
	31	99	-0.58	104.80	-3.09	10.55	-29.06	-2112.06
		100	0.58	-26.42	0.00	-42.95	36.62	2433.49
	32	99	-0.29	52.37	-1.54	93.94	-14.53	-1073.21
		100	0.29	-13.18	0.00	-21.96	18.31	1233.79
	33	99	-1.01	170.44	-6.69	12.74	-62.73	-2803.26
		100	1.01	-33.36	-0.64	-97.08	78.37	3323.25
	34	99	-0.29	52.72	-1.54	93.75	-14.53	-1064.92
		100	0.29	-13.53	0.00	-21.77	18.31	1227.19

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	99	-0.29	52.83	-1.54	93.69	-14.53	-1062.09
		100	0.29	-13.64	0.00	-21.71	18.31	1224.93
100	28	100	-0.58	25.75	0.00	48.05	-36.62	-2446.18
		101	0.58	52.66	-3.08	-80.46	29.07	2380.24
	29	100	-0.67	35.71	0.00	57.32	-51.59	-3112.32
		101	0.67	91.49	-5.00	-109.91	37.71	2934.16
	30	100	-0.58	26.44	0.00	47.65	-36.62	-2432.96
		101	0.58	51.97	-3.08	-80.06	29.07	2370.42
	31	100	-0.58	26.42	0.00	47.66	-36.62	-2433.40
		101	0.58	51.99	-3.08	-80.07	29.07	2370.73
	32	100	-0.29	13.18	0.00	24.35	-18.31	-1233.74
		101	0.29	26.02	-1.54	47.65	14.54	1202.29
	33	100	-1.01	33.36	0.63	103.51	-78.37	-3323.05
		101	1.01	103.74	-7.96	-187.91	56.50	3129.85
	34	100	-0.29	13.53	0.00	24.15	-18.31	-1227.15
		101	0.29	25.68	-1.54	47.85	14.54	1197.37
	35	100	-0.29	13.65	0.00	24.08	-18.31	-1224.88
		101	0.29	25.56	-1.54	47.92	14.54	1195.70
101	28	101	-0.58	-52.66	3.08	80.87	-29.07	-2380.25
		102	0.58	131.05	-6.17	-113.27	6.40	1930.22
	29	101	-0.67	-91.49	5.00	110.41	-37.71	-2934.14
		102	0.67	169.88	-8.09	-142.81	5.63	2293.86
	30	101	-0.58	-51.97	3.08	80.46	-29.07	-2370.39
		102	0.58	130.36	-6.17	-112.87	6.40	1923.78
	31	101	-0.58	-51.99	3.08	80.48	-29.07	-2370.72
		102	0.58	130.38	-6.17	-112.88	6.40	1923.99
	32	101	-0.29	-26.02	1.54	-47.45	-14.54	-1202.30
		102	0.29	65.22	-3.09	119.43	3.20	978.79
	33	101	-1.01	-103.74	7.96	188.45	-56.50	-3129.82
		102	1.01	190.94	-12.65	-247.85	3.33	2367.16
	34	101	-0.29	-25.68	1.54	-47.65	-14.54	-1197.38
		102	0.29	64.87	-3.09	119.64	3.20	975.57
	35	101	-0.29	-25.56	1.54	-47.72	-14.54	-1195.70
		102	0.29	64.75	-3.09	119.71	3.20	974.46
102	28	102	-0.59	-131.04	6.17	117.31	-6.40	-1929.99
		103	0.59	209.46	-9.26	-149.73	-31.40	1095.59
	29	102	-0.69	-169.88	8.09	147.62	-5.63	-2293.56
		103	0.69	248.30	-11.18	-180.03	-41.59	1268.83
	30	102	-0.59	-130.36	6.17	116.89	-6.40	-1923.53
		103	0.59	208.77	-9.26	-149.31	-31.40	1092.51
	31	102	-0.59	-130.38	6.17	116.91	-6.40	-1923.74
		103	0.59	208.79	-9.26	-149.32	-31.40	1092.61
	32	102	-0.30	-65.22	3.08	-117.39	-3.20	-979.04
		103	0.30	104.42	-4.63	189.39	-15.70	563.35
	33	102	-1.04	-190.94	12.65	252.81	-3.33	-2366.63
		103	1.04	246.65	-15.28	-225.96	-63.05	1325.68
	34	102	-0.30	-64.87	3.08	-117.59	-3.20	-975.82
		103	0.30	104.08	-4.63	189.60	-15.70	561.81

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	35	102	-0.30	-64.75	3.08	-117.67	-3.20	-974.71
		103	0.30	103.96	-4.63	189.67	-15.70	561.28
103	28	103	-0.59	-209.46	9.26	149.09	31.40	-1095.68
		104	0.59	268.65	-11.59	-173.56	-69.96	211.33
	29	103	-0.68	-248.30	11.18	179.29	41.59	-1268.94
		104	0.68	307.49	-13.51	-203.76	-87.25	240.93
	30	103	-0.59	-208.77	9.26	148.67	31.40	-1092.61
		104	0.59	267.96	-11.59	-173.14	-69.96	210.80
	31	103	-0.59	-208.79	9.26	148.69	31.40	-1092.70
		104	0.59	267.98	-11.59	-173.15	-69.96	210.82
	32	103	-0.29	-104.42	4.63	-189.72	15.70	-563.24
		104	0.29	134.02	-5.79	244.08	-34.98	122.20
	33	103	-1.03	-246.65	15.28	225.19	63.05	-1325.82
		104	1.03	331.73	-20.08	-322.73	-128.45	256.00
	34	103	-0.29	-104.08	4.63	-189.93	15.70	-561.70
		104	0.29	133.67	-5.79	244.29	-34.98	121.94
	35	103	-0.29	-103.96	4.63	-190.00	15.70	-561.17
		104	0.29	133.56	-5.79	244.36	-34.98	121.84
104	28	104	-0.60	-268.58	11.59	173.79	69.96	-211.15
		105	0.60	281.37	-12.09	-179.08	-79.43	-8.90
	29	104	-0.70	-307.41	13.51	204.03	87.25	-240.66
		105	0.70	320.21	-14.01	-209.32	-98.25	-10.36
	30	104	-0.60	-268.04	11.59	173.38	69.96	-210.59
		105	0.60	280.84	-12.09	-178.67	-79.43	-8.86
	31	104	-0.60	-268.06	11.59	173.39	69.96	-210.64
		105	0.60	280.86	-12.09	-178.68	-79.43	-8.89
	32	104	-0.30	-134.00	5.79	-243.94	34.98	-122.46
		105	0.30	140.40	-6.05	255.69	-39.72	12.70
	33	104	-1.05	-331.69	20.08	323.02	128.45	-255.63
		105	1.05	350.09	-21.12	-344.11	-144.93	-17.08
	34	104	-0.30	-133.65	5.79	-244.15	34.98	-122.21
		105	0.30	140.05	-6.05	255.90	-39.72	12.71
	35	104	-0.30	-133.54	5.79	-244.22	34.98	-122.12
		105	0.30	139.94	-6.05	255.97	-39.72	12.71

********** END OF LATEST ANALYSIS RESULT **********

447. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	28	-3.29	275.95	0.01	-125.50	-0.03	0.00
	29	-3.43	275.73	-11.81	-125.50	75.81	0.00
	30	-3.57	-51.96	0.01	-0.47	-0.04	0.00
	31	-3.66	-51.89	0.01	-0.47	-0.04	0.00
	32	-2.89	138.84	0.01	274.76	-0.03	0.00
	33	-3.22	137.90	-5.90	274.75	37.89	0.00
	34	-2.84	-27.38	0.01	-0.25	-0.03	0.00
	35	-2.83	-27.81	0.01	-0.25	-0.03	0.00
11	28	0.00	308.80	0.02	-133.09	0.04	0.00
	29	0.00	309.91	-11.80	-133.01	-75.80	0.00
	30	0.00	423.12	-14.16	-141.13	108.90	0.00
	31	0.00	422.74	-14.16	-141.16	108.90	0.00
	32	0.00	150.57	0.01	270.70	0.03	0.00
	33	0.00	155.02	-5.89	271.00	-37.89	0.00
	34	0.00	218.27	-7.07	334.89	54.46	0.00
	35	0.00	220.28	-7.07	335.02	54.46	0.00
23	28	0.00	382.36	-14.16	-132.43	108.95	0.00
	29	0.00	378.41	-14.16	-132.85	108.95	0.00
	30	0.00	365.08	-14.16	-164.24	-108.76	0.00
	31	0.00	366.15	-14.16	-164.11	-108.76	0.00
	32	0.00	204.86	-7.07	340.27	54.51	0.00
	33	0.00	189.37	-7.07	338.60	54.52	0.00
	34	0.00	159.08	-7.07	320.39	-54.35	0.00
	35	0.00	152.10	-7.07	319.64	-54.35	0.00
35	28	0.00	341.22	-14.16	-180.05	-108.72	0.00
	29	0.00	354.75	-14.16	-177.99	-108.72	0.00
	30	0.00	272.30	-14.17	-136.33	109.11	0.00
	31	0.00	268.27	-14.16	-136.49	109.01	0.00
	32	0.00	123.40	-7.07	307.82	-54.31	0.00
	33	0.00	177.07	-7.07	316.02	-54.29	0.00
	34	0.00	243.62	-14.68	-13.21	144.25	0.00
	35	0.00	283.38	-17.15	-98.03	166.12	0.00
47	28	0.00	420.52	-16.08	-123.51	131.08	0.00
	29	0.00	361.50	-14.16	-108.47	109.05	0.00
	30	0.00	961.39	-32.17	-331.83	0.19	0.00
	31	0.00	960.94	-32.14	-329.95	8.16	0.00
	32	0.00	535.98	-28.10	-451.28	209.02	0.00
	33	0.00	182.00	-7.07	351.08	54.63	0.00
	34	0.00	1051.60	-50.08	-589.36	0.14	0.00
	35	0.00	1046.90	-49.79	-590.21	-2.57	0.00
59	28	0.00	420.11	-16.09	-224.17	-130.69	0.00
	29	0.00	359.61	-14.17	-198.75	-108.65	0.00
	30	0.00	267.80	-14.17	-180.88	-108.77	0.00
	31	0.00	272.46	-14.21	-182.78	-109.28	0.00
	32	0.00	688.29	-36.51	-890.62	-138.99	0.00
	33	0.00	175.86	-7.07	304.79	-54.21	0.00
	34	0.00	241.94	-14.69	-46.36	-144.02	0.00
	35	0.00	206.85	-12.51	41.28	-121.67	0.00
71	28	0.00	342.24	-14.17	-86.74	109.05	0.00
	29	0.00	359.87	-14.17	-88.83	109.07	0.00

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
	30	0.00	382.67	-14.17	-96.44	109.05	0.00
	31	0.00	381.39	-14.17	-96.12	109.05	0.00
	32	0.00	148.73	-7.77	312.46	44.83	0.00
	33	0.00	193.99	-7.08	364.88	54.68	0.00
	34	0.00	168.05	-7.09	362.58	54.53	0.00
	35	0.00	174.99	-7.09	360.92	54.53	0.00
83	28	0.00	378.68	-14.18	-215.03	-108.69	0.00
	29	0.00	360.93	-14.18	-218.61	-108.67	0.00
	30	0.00	367.11	-14.18	-211.73	-108.69	0.00
	31	0.00	367.47	-14.18	-211.84	-108.69	0.00
	32	0.00	196.05	-7.09	295.86	-54.35	0.00
	33	0.00	131.87	-7.08	279.54	-54.17	0.00
	34	0.00	190.19	-7.09	297.50	-54.35	0.00
	35	0.00	188.17	-7.09	298.07	-54.35	0.00
95	28	0.00	320.65	-12.10	-44.23	79.62	0.00
	29	0.00	391.13	-14.02	-51.47	98.46	0.00
	30	0.00	323.94	-12.10	-45.44	79.62	0.00
	31	0.00	323.88	-12.10	-45.40	79.62	0.00
	32	0.00	158.89	-6.05	324.62	39.81	0.00
	33	0.00	536.41	-25.28	-324.84	165.92	0.00
	34	0.00	160.52	-6.05	324.02	39.81	0.00
	35	0.00	161.13	-6.05	323.81	39.81	0.00
105	28	0.00	281.37	-12.11	-179.30	-79.43	0.00
	29	0.00	320.21	-14.03	-209.57	-98.25	0.00
	30	0.00	280.84	-12.11	-178.89	-79.43	0.00
	31	0.00	280.86	-12.11	-178.90	-79.43	0.00
	32	0.00	140.40	-6.05	256.01	-39.72	0.00
	33	0.00	350.09	-21.15	-344.53	-144.93	0.00
	34	0.00	140.05	-6.05	256.22	-39.72	0.00
	35	0.00	139.94	-6.05	256.29	-39.72	0.00

********** END OF LATEST ANALYSIS RESULT **********

448. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 3:15:58 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

ENVOLVENTE SC - EC-1 . 2 VÍAS

(Casos 20 a 35)

		6	-3.57	-51.96	.00	-1.40	.03	-974.30
	12	5	-3.29	51.97	.00	-30.01	.03	2295.75

C A S O 7

SELECCION DE MAXIMOS DE CARGAS NORMALES

ARCHIVO	NO. HIPOTESIS	HIPOTESIS
L28-35.ANL	8	28 29 30 31 32 33 34

HIPOTESIS	ENVOLVENTE
1	N .MIN
2	N .MAX
3	QY.MIN
4	QY.MAX
5	QZ.MIN
6	QZ.MAX
7	MT.MIN
8	MT.MAX
9	MY.MIN
10	MY.MAX
11	MZ.MIN
12	MZ.MAX

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
1	11	1	.00	.00	.00	.00	.00	.00
		2	-3.57	-51.96	-.01	-.47	-.03	-41.57
	12	1	-3.29	275.95	-.01	-125.50	-.03	.01
		2	-3.29	263.15	-.01	-120.20	-.03	215.66
2	11	2	-3.57	-51.96	-.01	-.47	-.03	-41.57
		3	-3.57	-51.96	-.01	-.47	.00	-233.83
	12	2	-3.29	263.17	-.01	-120.20	-.03	215.66
		3	-3.29	203.97	-.01	-95.73	.00	1079.88
3	11	3	-3.57	-51.96	.00	-.98	.00	-233.83
		4	-3.57	-51.96	.00	-.98	-.01	-480.66
	12	3	-3.29	203.97	.00	-93.39	.00	1080.08
		4	-3.29	127.97	.00	-61.97	.00	1868.45
4	11	4	-3.57	-51.96	-.01	.06	-.01	-480.66
		5	-3.57	-51.96	-.01	.06	.03	-727.48
	12	4	-3.29	127.97	-.01	-66.03	.00	1868.32
		5	-3.29	51.97	-.01	-34.61	.03	2295.68
5	11	5	-3.57	-51.96	.00	-1.40	.03	-727.48

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		6	-3.29	-24.03	.00	1.41	.03	2362.12
6	11	6	-3.57	-51.96	.00	-1.56	.03	-974.31
		7	-3.57	-51.96	.00	-1.56	.03	-1221.13
	12	6	-3.29	-24.03	.00	1.80	.03	2362.13
		7	-3.29	-100.03	.00	33.22	.03	2067.47
7	11	7	-3.57	-51.96	.01	-4.01	.03	-1221.12
		8	-3.57	-51.96	.01	-4.01	-.01	-1467.94
	12	7	-3.29	-100.03	.01	37.36	.03	2067.41
		8	-3.29	-176.02	.01	68.78	-.01	1411.80
8	11	8	-3.57	-51.96	.01	-4.01	-.01	-1467.94
		9	-3.57	-51.96	.01	-4.01	-.04	-1714.77
	12	8	-3:29	-176.03	.01	68.78	-.01	1411.79
		9	-3.29	-252.03	.01	100.20	-.04	395.15
9	11	9	-3.57	-51.96	.00	-1.63	-.04	-1714.78
		10	-3.57	-51.96	.00	-1.63	-.05	-1907.03
	12	9	-3.29	-252.03	.00	99.65	-.04	395.29
		10	.00	.00	.00	.00	.00	.00
10	11	10	-3.57	-52.01	.04	-19.01	-.05	-1906.91
		11	-3.57	-52.01	.04	-19.01	-.08	-1948.53
	12	10	.00	.00	.00	.00	.00	.00
		11	.00	.00	.00	.00	.00	.00
11	11	11	-3.57	371.11	14.15	-136.95	108.82	-1948.60
		12	-3.57	358.31	13.65	-131.65	97.70	-1656.84
	12	11	.00	.00	.00	.00	.00	.00
		12	.00	.00	.00	.00	.00	.00
12	11	12	-3.49	358.30	13.67	-140.89	97.70	-1656.08
		13	-3.38	-14.31	.00	-3.89	.00	-973.79
	12	12	.00	.00	.00	.00	.00	.00
		13	.00	.00	.00	.00	.00	.00
13	11	13	-3.38	-14.32	.00	-4.98	.00	-973.79
		14	-3.38	-14.32	.00	-4.98	.00	-1038.20
	12	13	.00	.00	.00	.00	.00	.00
		14	-3.57	226.84	8.50	-87.17	6.80	744.47
14	11	14	-3.38	-14.31	-.01	-2.60	.00	-1038.22
		15	-3.29	-15.19	-.01	-2.65	.04	-1105.53
	12	14	-3.59	226.83	8.50	-88.87	6.80	744.27
		15	-3.50	155.09	5.66	-59.10	-25.05	1603.90
15	11	15	-3.29	-15.19	.00	-5.18	.04	-1105.52
		16	-3.29	-15.19	.00	-5.18	.05	-1173.89
	12	15	-3.48	155.09	5.67	-55.42	-25.05	1604.04
		16	-3.48	83.09	2.83	-25.66	-44.18	2139.95

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
16	11	16	-3.29	-15.19	.01	-7.67	.05	-1173.87
		17	-3.29	-15.19	.01	-7.67	.02	-1242.24
	12	16	-3.48	83.09	2.84	-21.13	-44.18	2140.02
		17	-3.48	11.10	.01	8.64	-50.59	2351.94
17	11	17	-3.29	-15.20	.00	-5.04	.02	-1242.26
		18	-3.29	-15.20	.00	-5.04	.03	-1310.63
	12	17	-3.48	11.09	.00	3.66	-50.59	2351.96
		18	-3.48	-60.91	-2.84	33.42	-44.20	2239.89
18	11	18	-3.29	-15.19	.01	-7.81	.03	-1310.61
		19	-3.29	-15.19	.01	-7.81	.00	-1378.98
	12	18	-3.48	-60.90	-2.83	38.16	-44.20	2239.83
		19	-3.48	-132.90	-5.66	67.92	-25.10	1803.78
19	11	19	-3.29	-15.19	.01	-7.81	.00	-1378.98
		20	-3.29	-15.19	.01	-7.81	-.03	-1447.35
	12	19	-3.48	-132.90	-5.66	67.92	-25.10	1803.76
		20	-3.48	-204.90	-8.50	97.69	6.77	1043.69
20	11	20	-3.29	-15.19	.01	-8.07	-.03	-1447.35
		21	-3.29	-15.19	.01	-8.07	-.06	-1515.72
	12	20	-3.49	-204.90	-8.50	97.87	6.77	1043.67
		21	-2.79	-131.55	-5.66	-259.57	25.68	188.44
21	11	21	-3.29	-15.19	.01	-10.69	-.06	-1515.71
		22	-3.29	-15.19	.01	-10.69	-.10	-1571.92
	12	21	-2.80	-131.55	-5.66	-259.24	25.68	188.89
		22	.00	.00	.00	.00	.00	.00
22	11	22	-3.29	-15.24	.02	-14.11	-.10	-1571.89
		23	-3.29	-15.24	.02	-14.11	-.12	-1584.04
	12	22	.00	.00	.00	.00	.00	.00
		23	.00	.00	.00	.00	.00	.00
23	11	23	-3.29	367.12	14.14	-126.10	108.83	-1584.09
		24	-3.45	16.97	-.04	9.40	.00	-1442.43
	12	23	.00	.00	.00	.00	.00	.00
		24	.00	.00	.00	.00	.00	.00
24	11	24	-3.45	16.97	.00	-6.38	.00	-1442.46
		25	-3.45	16.97	.00	-6.38	.02	-1379.65
	12	24	.00	.00	.00	.00	.00	.00
		25	.00	.00	.00	.00	.00	.00
25	11	25	-3.45	16.97	.00	-6.38	.02	-1379.65
		26	-3.45	16.97	.00	-6.38	.04	-1303.27
	12	25	.00	.00	.00	.00	.00	.00
		26	-3.23	220.09	8.50	-81.06	6.84	1076.64

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
26	11	26	-3.45	16.97	.00	-9.59	.04	-1303.25
		27	-3.35	16.07	.00	-9.69	.03	-1229.95
	12	26	-3.21	220.08	8.51	-78.40	6.84	1076.83
		27	-3.12	151.11	5.67	-48.33	-25.07	1915.53
27	11	27	-3.35	16.07	.00	-6.87	.03	-1229.96
		28	-3.35	16.07	.00	-6.87	.05	-1157.67
	12	27	-3.14	151.10	5.67	-52.72	-25.07	1915.42
		28	-3.14	79.11	2.83	-22.96	-44.19	2433.37
28	11	28	-3.35	16.07	.00	-9.31	.05	-1157.65
		29	-3.35	16.07	.00	-9.31	.03	-1085.34
	12	28	-3.13	79.12	2.84	-17.82	-44.19	2433.44
		29	-3.13	7.11	.00	11.95	-50.58	2627.43
29	11	29	-3.35	16.06	.00	-9.51	.03	-1085.33
		30	-3.35	16.06	.00	-9.51	.02	-1013.03
	12	29	-3.13	7.11	.00	12.41	-50.58	2627.45
		30	-3:13	-64.90	-2.83	42.18	-44.22	2497.40
30	11	30	-3.35	16.07	.00	-9.51	.02	-1013.02
		31	-2.73	-15.42	.00	-7.41	.00	-973.22
	12	30	-3.13	-64.90	-2.83	42.19	-44.22	2497.41
		31	-3.13	-136.89	-5.67	71.95	-25.10	2043.46
31	11	31	-2.73	-15.42	.01	-9.46	.00	-973.20
		32	-2.73	-15.42	.01	-9.46	-.04	-1042.58
	12	31	-3.14	-136.89	-5.66	76.26	-25.10	2043.32
		32	-3.14	-208.90	-8.50	106.03	6.76	1265.21
32	11	32	-2.73	-15.42	.01	-9.47	-.04	-1042.59
		33	-2.73	-15.42	.01	-9.47	-.08	-1111.96
	12	32	-3.14	-208.89	-8.50	106.04	6.76	1265.21
		33	-2.81	-129.74	-5.66	-254.42	25.64	406.05
33	11	33	-2.73	-15.42	.00	-7.23	-.08	-1111.98
		34	-2.73	-15.42	.00	-7.23	-.09	-1169.04
	12	33	-2.80	-129.74	-5.67	-255.24	25.64	405.53
		34	.00	.00	.00	.00	.00	.00
34	11	34	-2.73	-15.40	.03	-20.42	-.09	-1168.87
		35	-3.36	-355.99	-14.13	152.64	108.73	-1370.11
	12	34	.00	.00	.00	.00	.00	.00
		35	.00	.00	.00	.00	.00	.00
35	11	35	-3.01	-1.24	-.01	-9.06	.01	-1365.89
		36	-3.01	-1.24	-.01	-9.06	.02	-1366.87
	12	35	.00	.00	.00	.00	.00	.00
		36	.00	.00	.00	.00	.00	.00
36	11	36	-3.01	-1.24	.00	-13.40	.02	-1366.83

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		37	-3.01	-1.24	.00	-13.40	.03	-1371.41
	12	36	.00	.00	.00	.00	.00	.00
		37	-3.22	213.26	11.34	-117.75	51.49	431.59
37	11	37	-3.01	-1.24	-.01	-12.87	.03	-1371.41
		38	-3.01	-1.24	-.01	-12.87	.06	-1377.00
	12	37	-3.22	213.26	11.33	-117.92	51.49	431.55
		38	-3.22	141.27	8.50	-88.16	6.87	1229.16
38	11	38	-3.01	-1.24	.00	-15.77	.06	-1376.97
		39	-2.92	-11.72	.00	-17.32	.05	-1418.30
	12	38	-3.21	141.27	8.51	-85.56	6.87	1229.35
		39	-3.11	72.40	5.68	-55.79	-25.03	1713.84
39	11	39	-2.92	-11.73	.00	-17.08	.05	-1418.31
		40	-2.92	-11.73	.00	-17.08	.05	-1471.07
	12	39	-3.11	72.40	5.68	-56.09	-25.03	1713.83
		40	-2.43	48.99	6.57	-165.01	-79.52	2160.86
40	11	40	-2.92	-11.72	.01	-20.71	.05	-1471.02
		41	-2.92	-11.72	.01	-20.71	.01	-1523.77
	12	40	-2.41	49.00	6.58	-159.68	-79.52	2161.27
		41	-2.41	-54.50	.73	-41.03	-95.97	2148.88
41	11	41	-2.92	-11.72	.00	-17.22	.01	-1523.82
		42	-2.92	-11.72	.00	-17.22	.01	-1576.56
	12	41	-2.42	-54.50	.73	-45.95	-95.97	2148.77
		42	-2.42	-157.99	-5.12	72.69	-86.09	1670.69
42	11	42	-2.92	-11.72	.01	-20.55	.01	-1576.54
		43	-2.92	-11.72	.01	-20.55	-.02	-1629.29
	12	42	-2.43	-158.00	-5.11	76.22	-86.09	1670.53
		43	-2.43	-261.52	-10.96	194.89	-49.92	726.43
43	11	43	-2.92	-11.72	.01	-20.56	-.02	-1629.29
		44	-2.70	-42.33	.01	-16.65	-.05	-1787.39
	12	43	-2.43	-261.52	-10.96	194.90	-49.92	726.43
		44	.00	.00	.00	.00	.00	.00
44	11	44	-2.70	-42.33	.01	-16.65	-.05	-1787.40
		45	-2.47	-431.01	-20.19	329.55	98.25	-2511.75
	12	44	.00	.00	.00	.00	.00	.00
		45	.00	.00	.00	.00	.00	.00
45	11	45	-2.50	-431.01	-20.19	325.19	98.25	-2512.31
		46	-2.51	-500.83	-24.05	345.35	176.85	-4201.21
	12	45	.00	.00	.00	.00	.00	.00
		46	.00	.00	.00	.00	.00	.00
46	11	46	-2.61	-525.83	-25.02	286.30	176.85	-4201.14
		47	-2.61	-525.83	-25.02	286.30	196.87	-4621.93

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	46	.00	.00	.00	.00	.00	.00
		47	.00	.00	.00	.00	.00	.00
47	11	47	-1.35	525.77	25.04	-307.59	197.01	-4607.00
		48	-1.35	525.77	25.04	-307.59	176.99	-4186.77
	12	47	.00	.00	.00	.00	.00	.00
		48	.00	.00	.00	.00	.00	.00
48	11	48	-1.47	500.77	24.06	-336.08	176.99	-4187.02
		49	-1.47	450.37	21.68	-360.03	90.79	-2400.52
	12	48	.00	.00	.00	.00	.00	.00
		49	-2.70	288.23	11.34	-101.04	51.49	39.93
49	11	49	-1.46	450.37	21.68	-361.40	90.79	-2400.32
		50	-2.51	288.20	8.50	-81.68	6.71	-696.20
	12	49	-2.69	288.23	11.34	-101.01	51.50	39.99
		50	-2.07	286.71	16.41	-235.56	8.57	1353.25
50	11	50	-2.51	288.20	8.50	-81.68	6.71	-696.20
		51	.00	.00	.00	.00	.00	.00
	12	50	-2.07	286.71	16.41	-235.57	8.57	1353.25
		51	-2.07	183.20	10.57	-116.91	-52.14	2410.59
51	11	51	.00	.00	.00	.00	.00	.00
		52	.00	.00	.00	.00	.00	.00
	12	51	-2.05	183.21	10.57	-111.81	-52.14	2410.84
		52	-2.05	79.70	4.73	6.85	-86.57	3002.42
52	11	52	.00	.00	.00	.00	.00	.00
		53	.00	.00	.00	.00	.00	.00
	12	52	-2.05	79.69	4.73	7.38	-86.57	3002.42
		53	-2.55	-.04	.00	25.91	-68.68	3284.27
53	11	53	.00	.00	.00	.00	.00	.00
		54	.00	.00	.00	.00	.00	.00
	12	53	-2.55	-.03	.00	25.93	-68.68	3284.25
		54	-2.55	-120.82	-4.75	75.87	-56.76	2980.65
54	11	54	.00	.00	.00	.00	.00	.00
		55	.00	.00	.00	.00	.00	.00
	12	54	-2.55	-120.83	-4.75	75.33	-56.76	2980.66
		55	-2.55	-192.84	-7.59	105.09	-29.00	2274.86
55	11	55	.00	.00	.00	.00	.00	.00
		56	.00	.00	.00	.00	.00	.00
	12	55	-2.57	-192.84	-7.58	110.32	-29.00	2274.61
		56	-2.51	-143.80	-8.50	101.71	6.78	1253.27
56	11	56	.00	.00	.00	.00	.00	.00
		57	-2.07	-381.61	-19.53	319.27	87.76	-644.94
	12	56	-2.51	-143.80	-8.50	101.70	6.78	1253.27

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		57	-2.51	-215.81	-11.34	131.46	51.42	444.06
57	11	57	-2.03	-381.61	-19.53	320.67	87.76	-644.25
		58	-2.03	-466.71	-24.34	418.23	168.93	-2213.68
	12	57	-2.49	-215.81	-11.34	130.50	51.42	444.34
		58	.00	.00	.00	.00	.00	.00
58	11	58	-2.33	-466.73	-24.31	391.01	168.93	-2218.64
		59	-2.33	-485.12	-25.35	412.09	188.78	-2599.16
	12	58	.00	.00	.00	.00	.00	.00
		59	.00	.00	.00	.00	.00	.00
59	11	59	-1.11	203.17	11.12	-449.80	49.79	-2571.51
		60	-1.11	191.16	10.34	-416.95	41.21	-2413.75
	12	59	.00	.00	.00	.00	.00	.00
		60	.00	.00	.00	.00	.00	.00
60	11	60	-1.09	191.17	10.34	-419.94	41.21	-2413.22
		61	-1.09	135.67	6.69	-268.00	9.70	-1808.51
	12	60	.00	.00	.00	.00	.00	.00
		61	.00	.00	.00	.00	.00	.00
61	11	61	-1.08	135.67	6.70	-271.12	9.70	-1808.04
		62	-2.14	11.32	.00	-27.87	.05	-1678.65
	12	61	.00	.00	.00	.00	.00	.00
		62	.00	.00	.00	.00	.00	.00
62	11	62	-2.14	11.32	.00	-24.62	.05	-1678.70
		63	-2.14	11.32	.00	-24.62	.06	-1627.75
	12	62	.00	.00	.00	.00	.00	.00
		63	.00	.00	.00	.00	.00	.00
63	11	63	-2.14	11.32	.01	-31.50	.06	-1627.62
		64	-2.14	11.32	.01	-31.50	.03	-1576.69
	12	63	.00	.00	.00	.00	.00	.00
		64	.00	.00	.00	.00	.00	.00
64	11	64	-2.14	11.32	.00	-28.17	.03	-1576.75
		65	-2.14	11.32	.00	-28.17	.02	-1525.81
	12	64	.00	.00	.00	.00	.00	.00
		65	.00	.00	.00	.00	.00	.00
65	11	65	-2.14	11.32	.01	-31.40	.02	-1525.74
		66	-2.14	11.32	.01	-31.40	-.01	-1474.79
	12	65	.00	.00	.00	.00	.00	.00
		66	.00	.00	.00	.00	.00	.00
66	11	66	-2.14	11.32	.00	-28.27	-.01	-1474.86
		67	-2.14	11.32	.00	-28.27	-.02	-1423.92
	12	66	.00	.00	.00	.00	.00	.00
		67	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
67	11	67	-2.14	11.32	.01	-34.55	-.02	-1423.77
		68	-2.31	-.12	.01	-32.20	-.07	-1407.58
	12	67	.00	.00	.00	.00	.00	.00
		68	.00	.00	.00	.00	.00	.00
68	11	68	-2.31	-.12	.01	-28.98	-.07	-1407.65
		69	-2.14	-20.09	.01	-23.47	-.10	-1497.55
	12	68	.00	.00	.00	.00	.00	.00
		69	.00	.00	.00	.00	.00	.00
69	11	69	-2.14	-20.09	.01	-25.49	-.10	-1497.52
		70	-2.14	-20.09	.01	-25.49	-.13	-1571.84
	12	69	.00	.00	.00	.00	.00	.00
		70	.00	.00	.00	.00	.00	.00
70	11	70	-2.14	-20.09	.02	-33.80	-.13	-1571.70
		71	-2.14	-20.09	.02	-33.80	-.15	-1587.74
	12	70	.00	.00	.00	.00	.00	.00
		71	.00	.00	.00	.00	.00	.00
71	11	71	-1.78	362.59	14.16	-109.79	108.90	-1585.67
		72	-1.78	349.80	13.66	-104.51	97.79	-1300.97
	12	71	.00	.00	.00	.00	.00	.00
		72	.00	.00	.00	.00	.00	.00
72	11	72	-1.64	349.81	13.67	-117.97	97.79	-1299.82
		73	-1.64	290.60	11.34	-93.50	51.50	-114.98
	12	72	.00	.00	.00	.00	.00	.00
		73	-.82	135.89	5.67	280.12	25.75	233.26
73	11	73	-1.66	290.60	11.34	-93.29	51.50	-115.15
		74	.00	.00	.00	.00	.00	.00
	12	73	-.83	135.89	5.67	279.69	25.75	233.78
		74	-1.66	209.52	8.50	-61.37	6.85	1265.67
74	11	74	.00	.00	.00	.00	.00	.00
		75	.00	.00	.00	.00	.00	.00
	12	74	-1.66	209.52	8.50	-61.36	6.85	1265.66
		75	-1.66	137.53	5.67	-31.60	-25.05	2046.47
75	11	75	.00	.00	.00	.00	.00	.00
		76	.00	.00	.00	.00	.00	.00
	12	75	-1.65	137.53	5.67	-26.92	-25.05	2046.52
		76	-1.65	65.52	2.84	2.85	-44.20	2503.46
76	11	76	.00	.00	.00	.00	.00	.00
		77	.00	.00	.00	.00	.00	.00
	12	76	-1.65	65.52	2.84	2.42	-44.20	2503.45
		77	-1.83	-.33	.00	32.21	-50.59	2637.06

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
77	11	77	.00	.00	.00	.00	.00	.00
		78	.00	.00	.00	.00	.00	.00
	12	77	-1.83	-.32	.00	32.68	-50.59	2637.06
		78	-1.83	-72.32	-2.83	62.44	-44.23	2473.58
78	11	78	.00	.00	.00	.00	.00	.00
		79	.00	.00	.00	.00	.00	.00
	12	78	-1.83	-72.32	-2.83	62.01	-44.23	2473.60
		79	-1.83	-144.32	-5.67	91.77	-25.12	1986.17
79	11	79	.00	.00	.00	.00	.00	.00
		80	.00	.00	.00	.00	.00	.00
	12	79	-1.84	-144.32	-5.66	96.32	-25.12	1985.96
		80	-1.84	-216.33	-8.50	126.08	6.74	1174.47
80	11	80	.00	.00	.00	.00	.00	.00
		81	-1.67	-294.49	-11.33	155.89	51.37	-72.62
	12	80	-1.84	-216.32	-8.50	126.29	6.74	1174.45
		81	-2.42	-132.94	-5.66	-242.27	25.60	357.11
81	11	81	-1.66	-294.48	-11.33	155.90	51.37	-72.60
		82	-1.66	-353.67	-13.66	180.37	97.61	-1271.56
	12	81	-2.42	-132.94	-5.66	-242.33	25.60	357.08
		82	.00	.00	.00	.00	.00	.00
82	11	82	-1.66	-353.66	-13.66	180.42	97.61	-1271.56
		83	-1.66	-366.46	-14.17	185.70	108.74	-1559.46
	12	82	.00	.00	.00	.00	.00	.00
		83	.00	.00	.00	.00	.00	.00
83	11	83	-1.13	12.22	.00	-29.10	.04	-1551.36
		84	-1.13	12.22	.00	-29.10	.04	-1541.55
	12	83	.00	.00	.00	.00	.00	.00
		84	.00	.00	.00	.00	.00	.00
84	11	84	-1.13	12.26	.00	-29.23	.04	-1541.54
		85	-1.13	12.26	.00	-29.23	.05	-1496.17
	12	84	.00	.00	.00	.00	.00	.00
		85	.00	.00	.00	.00	.00	.00
85	11	85	-1.13	12.26	.00	-32.65	.05	-1496.10
		86	-1.13	12.26	.00	-32.65	.04	-1440.91
	12	85	.00	.00	.00	.00	.00	.00
		86	.00	.00	.00	.00	.00	.00
86	11	86	-1.13	12.26	.00	-32.63	.04	-1440.91
		87	-1.30	.62	.00	-35.87	.04	-1403.57
	12	86	.00	.00	.00	.00	.00	.00
		87	.00	.00	.00	.00	.00	.00
87	11	87	-1.30	.62	.00	-35.88	.04	-1403.58

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
		88	-1.30	.62	.00	-35.88	.03	-1400.77
	12	87	.00	.00	.00	.00	.00	.00
		88	.00	.00	.00	.00	.00	.00
88	11	88	-1.30	.62	.00	-38.85	.03	-1400.70
		89	-1.30	.62	.00	-38.85	.01	-1397.90
	12	88	.00	.00	.00	.00	.00	.00
		89	.00	.00	.00	.00	.00	.00
89	11	89	-1.30	.62	.00	-35.88	.01	-1397.99
		90	-1.30	.62	.00	-35.88	.00	-1395.21
	12	89	.00	.00	.00	.00	.00	.00
		90	.00	.00	.00	.00	.00	.00
90	11	90	-1.30	.62	.00	-38.84	.00	-1395.12
		91	-2.15	-37.08	.01	-32.71	-.04	-1500.52
	12	90	.00	.00	.00	.00	.00	.00
		91	.00	.00	.00	.00	.00	.00
91	11	91	-2.15	-37.08	.01	-32.72	-.04	-1500.52
		92	-2.15	-37.08	.01	-32.72	-.07	-1667.35
	12	91	.00	.00	.00	.00	.00	.00
		92	.00	.00	.00	.00	.00	.00
92	11	92	-2.15	-37.08	.01	-36.53	-.07	-1667.28
		93	-2.15	-37.08	.01	-36.53	-.13	-1834.14
	12	92	.00	.00	.00	.00	.00	.00
		93	.00	.00	.00	.00	.00	.00
93	11	93	-2.15	-37.08	.01	-34.48	-.13	-1834.18
		94	-2.15	-37.08	.01	-34.48	-.17	-1971.40
	12	93	.00	.00	.00	.00	.00	.00
		94	.00	.00	.00	.00	.00	.00
94	11	94	-2.15	-37.09	.00	-21.47	-.17	-1971.57
		95	-2.15	-37.09	.00	-21.47	-.17	-2001.26
	12	94	.00	.00	.00	.00	.00	.00
		95	.00	.00	.00	.00	.00	.00
95	11	95	-.87	499.31	25.27	-373.66	165.75	-1984.31
		96	-.87	480.91	24.23	-352.56	145.95	-1592.17
	12	95	.00	.00	.00	.00	.00	.00
		96	.00	.00	.00	.00	.00	.00
96	11	96	-1.05	480.96	24.22	-340.96	145.95	-1594.68
		97	.00	.00	.00	.00	.00	.00
	12	96	.00	.00	.00	.00	.00	.00
		97	-.60	260.94	9.26	-52.97	31.47	339.04
97	11	97	.00	.00	.00	.00	.00	.00
		98	.00	.00	.00	.00	.00	.00

ESFUERZOS EN NUDOS

UNIDADES : MTON MET

MIEM	CARGA	NOD	AXIL	Q-Y	Q-Z	TORSION	M-Y	M-Z
	12	97	-.59	260.94	9.26	-52.44	31.47	339.12
		98	-1.02	283.15	13.05	-114.15	-14.35	1691.57
98	11	98	.00	.00	.00	.00	.00	.00
		99	.00	.00	.00	.00	.00	.00
	12	98	-.99	283.16	13.06	-110.60	-14.35	1691.81
		99	-.99	170.45	6.69	18.61	-62.73	2803.22
99	11	99	.00	.00	.00	.00	.00	.00
		100	.00	.00	.00	.00	.00	.00
	12	99	-1.01	170.44	6.69	12.74	-62.73	2803.26
		100	-1.01	33.36	-.64	97.08	-78.37	3323.25
100	11	100	.00	.00	.00	.00	.00	.00
		101	.00	.00	.00	.00	.00	.00
	12	100	-1.01	33.36	-.63	103.51	-78.37	3323.05
		101	-1.01	-103.74	-7.96	187.91	-56.50	3129.85
101	11	101	.00	.00	.00	.00	.00	.00
		102	.00	.00	.00	.00	.00	.00
	12	101	-1.01	-103.74	-7.96	188.45	-56.50	3129.82
		102	-1.01	-190.94	-12.65	247.85	-3.33	2367.16
102	11	102	.00	.00	.00	.00	.00	.00
		103	.00	.00	.00	.00	.00	.00
	12	102	-1.04	-190.94	-12.65	252.81	-3.33	2366.63
		103	-1.04	-246.65	-15.28	225.96	63.05	1325.68
103	11	103	.00	.00	.00	.00	.00	.00
		104	.00	.00	.00	.00	.00	.00
	12	103	-1.03	-246.65	-15.28	225.19	63.05	1325.82
		104	-1.03	-331.73	-20.08	322.73	128.45	256.00
104	11	104	.00	.00	.00	.00	.00	.00
		105	-1.05	-350.09	-21.12	344.11	144.93	-17.08
	12	104	-1.05	-331.69	-20.08	323.02	128.45	255.63
		105	-.30	-140.05	-6.05	-255.90	39.72	12.71

LOAD 40 : VIENTO (IAP-97)

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*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 30, 1998                *
*           Time=    16:18:26                    *
*                                                *
**************************************************

 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
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23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
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31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
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34. 31 113.996141851672 0 7999.1877637447
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36. 33 122.995154049465 0 7999.0544561267
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38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
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 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
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 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
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 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
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 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 35Q0000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 40 VIENTO
131. MEMBER LOAD
132. * VIENTO TRANSVERSAL CONCOMITANTE CON LA SC
133. 1 TO 104 UNI Z 1.31644
134. * VIENTO VERTICAL
135. 1 TO 104 UNI GY -.63
136. * MOMENTO VOLCADOR
137. 1 TO 104 UMOM X 8.2467
138. LOAD 41 -1*VIENTO
139. MEMBER LOAD
140. * VIENTO TRANSVERSAL CONCOMITANTE CON LA SC
141. 1 TO 104 UNI Z -1.31644
142. * VIENTO VERTICAL
143. 1 TO 104 UNI GY -.63
144. * MOMENTO VOLCADOR
145. 1 TO 104 UMOM X -8.2467
148. PERFORM ANALYSIS

        P R O B L E M   S T A T I S T I C S
        -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
  ORIGINAL/FINAL BAND-WIDTH =    1/    1
  TOTAL PRIMARY LOAD CASES  =    2, TOTAL DEGREES OF FREEDOM =   589
  SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =   12.29 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              16:18:29
++ PROCESSING GLOBAL STIFFNESS MATRIX.               16:18:29
++ PROCESSING TRIANGULAR FACTORIZATION.              16:18:29
++ CALCULATING JOINT DISPLACEMENTS.                  16:18:30
++ CALCULATING MEMBER  FORCES.                       16:18:30

149. PRINT MEMBER FORCES
```

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	40	1	-12.57	8.72	-24.66	-154.70	158.35	0.00
		2	12.57	-8.22	23.60	148.11	-139.04	6.78
	41	1	12.57	8.77	24.66	154.55	-158.35	0.00
		2	-12.57	-8.27	-23.60	-147.95	139.04	6.81
2	40	2	-12.57	8.22	-23.60	-148.11	139.04	-6.78
		3	12.57	-5.89	18.73	117.59	-60.72	32.88
	41	2	12.57	8.27	23.60	147.95	-139.04	-6.81
		3	-12.57	-5.93	-18.73	-117.44	60.72	33.08
3	40	3	-12.53	5.89	-18.76	-117.52	60.72	-33.13
		4	12.53	-2.90	12.51	78.35	13.54	54.00
	41	3	12.53	5.93	18.76	117.51	-60.72	-32.83
		4	-12.53	-2.94	-12.51	-78.34	-13.54	53.91
4	40	4	-12.56	2.90	-12.48	-78.47	-13.54	-53.83
		5	12.56	0.10	6.23	39.30	57.97	60.47
	41	4	12.56	2.94	12.48	78.22	13.54	-54.08
		5	-12.56	0.05	-6.23	-39.05	-57.97	60.94
5	40	5	-12.55	-0.10	-6.25	-39.17	-57.97	-60.55
		6	12.55	3.09	0.00	0.00	72.82	52.99
	41	5	12.55	-0.05	6.25	39.17	57.97	-60.86
		6	-12.55	3.04	0.00	0.00	-72.82	53.51
6	40	6	-12.55	-3.09	0.00	0.01	-72.82	-52.99
		7	12.55	6.08	-6.25	-39.18	57.98	31.21
	41	6	12.55	-3.04	0.00	0.01	72.82	-53.51
		7	-12.55	6.04	6.25	39.16	-57.98	31.95
7	40	7	-12.56	-6.08	6.23	39.24	-57.98	-31.13
		8	12.56	9.07	-12.48	-78.41	13.55	-4.87
	41	7	12.56	-6.04	-6.23	-39.10	57.98	-32.03
		8	-12.56	9.03	12.48	78.27	-13.55	-3.75
8	40	8	-12.56	-9.07	12.48	78.41	-13.55	4.87
		9	12.56	12.07	-18.73	-117.59	-60.58	-55.07
	41	8	12.56	-9.03	-12.48	-78.27	13.55	3.75
		9	-12.56	12.02	18.73	117.44	60.58	-53.74
9	40	9	-12.53	-12.07	18.75	117.66	60.58	54.91
		10	12.53	14.40	-23.62	-148.17	-138.97	-103.87
	41	9	12.53	-12.02	-18.75	-117.37	-60.58	53.90
		10	-12.53	14.35	23.62	147.88	138.97	-102.69
10	40	10	-12.75	-14.40	23.51	147.22	138.97	105.22
		11	12.75	14.90	-24.56	-153.82	-158.20	-116.94

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	10	12.75	-14.35	-23.51	-148.81	-138.97	101.34
		11	-12.75	14.86	24.56	155.41	158.20	-113.03
11	40	11	-12.45	14.23	-29.53	-185.01	227.33	115.10
		12	12.45	-13.73	28.48	178.41	-204.12	-103.91
	41	11	12.45	14.35	29.53	186.10	-227.33	114.87
		12	-12.45	-13.85	-28.48	-179.50	204.12	-103.59
12	40	12	-12.29	13.73	-28.55	-178.99	204.12	102.92
		13	12.29	-11.40	23.68	148.48	-107.51	-56.44
	41	12	12.29	13.85	28.55	178.92	-204.12	104.59
		13	-12.29	-11.52	-23.68	-148.41	107.51	-57.67
13	40	13	-12.27	11.40	-23.69	-148.54	107.50	56.27
		14	12.27	-8.56	17.77	111.43	-14.22	-11.37
	41	13	12.27	11.52	23.69	148.34	-107.50	57.83
		14	-12.27	-8.68	-17.77	-111.23	14.22	-12.39
14	40	14	-12.31	8.56	-17.74	-111.41	14.22	11.63
		15	12.31	-5.73	11.82	74.29	52.28	20.52
	41	14	12.31	8.68	17.74	111.26	-14.22	12.14
		15	-12.31	-5.85	-11.82	-74.15	-52.28	20.55
15	40	15	-12.28	5.73	-11.84	-74.25	-52.28	-20.69
		16	12.28	-2.89	5.92	37.14	92.25	40.08
	41	15	12.28	5.85	11.84	74.20	52.28	-20.38
		16	-12.28	-3.01	-5.92	-37.09	-92.25	40.31
16	40	16	-12.27	2.89	-5.95	-37.05	-92.25	-40.15
		17	12.27	-0.06	0.02	-0.06	105.68	46.78
	41	16	12.27	3.01	5.95	37.17	92.25	-40.23
		17	-12.27	-0.18	-0.02	-0.06	-105.68	47.40
17	40	17	-12.27	0.06	0.00	-0.04	-105.68	-46.78
		18	12.27	2.78	-5.93	-37.07	92.33	40.66
	41	17	12.27	0.18	0.00	-0.04	105.68	-47.40
		18	-12.27	2.66	5.93	37.15	-92.33	41.81
18	40	18	-12.28	-2.78	5.90	37.15	-92.33	-40.58
		19	12.28	5.61	-11.83	-74.26	52.44	21.69
	41	18	12.28	-2.66	-5.90	-37.06	92.33	-41.89
		19	-12.28	5.49	11.83	74.17	-52.44	23.55
19	40	19	-12.28	-5.61	11.83	74.26	-52.44	-21.69
		20	12.28	8.45	-17.75	-111.38	-14.11	-9.95
	41	19	12.28	-5.49	-11.83	-74.17	52.44	-23.55
		20	-12.28	8.33	17.75	111.28	14.11	-7.55
20	40	20	-12.28	-8.45	17.75	111.37	14.11	9.97
		21	12.28	11.28	-23.67	-148.48	-107.30	-54.37

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	20	12.28	-8.33	-17.75	-111.28	-14.11	7.54
		21	-12.28	11.16	23.67	148.39	107.30	-51.39
21	40	21	-12.33	-11.28	23.65	148.39	107.30	54.63
		22	12.33	13.62	-28.52	-178.90	-203.82	-100.69
	41	21	12.33	-11.16	-23.65	-148.48	-107.30	51.14
		22	-12.33	13.50	28.52	179.00	203.82	-96.76
22	40	22	-12.39	-13.62	28.49	178.68	203.82	101.08
		23	12.39	14.12	-29.55	-185.28	-227.04	-112.17
	41	22	12.39	-13.50	-28.49	-179.20	-203.82	96.37
		23	-12.39	14.00	29.55	185.80	227.04	-107.36
23	40	23	-12.01	14.03	-29.47	-184.50	227.37	109.77
		24	12.01	-13.53	28.42	177.91	-204.22	-98.75
	41	23	12.01	14.25	29.47	186.63	-227.37	109.75
		24	-12.01	-13.75	-28.42	-180.03	204.22	-98.55
24	40	24	-11.69	13.53	-28.55	-178.98	204.22	96.79
		25	11.69	-11.20	23.68	148.46	-107.59	-51.05
	41	24	11.69	13.75	28.55	178.94	-204.22	100.52
		25	-11.69	-11.42	-23.68	-148.43	107.59	-53.97
25	40	25	-11.69	11.20	-23.68	-148.46	107.59	51.05
		26	11.69	-8.36	17.76	111.35	-14.36	-7.03
	41	25	11.69	11.42	23.68	148.43	-107.59	53.97
		26	-11.69	-8.58	-17.76	-111.32	14.36	-8.98
26	40	26	-11.65	8.36	-17.78	-111.37	14.36	6.76
		27	11.65	-5.53	11.86	74.26	52.34	24.50
	41	26	11.65	8.58	17.78	111.30	-14.36	9.25
		27	-11.65	-5.75	-11.86	-74.18	-52.34	22.98
27	40	27	-11.68	5.53	-11.83	-74.31	-52.34	-24.33
		28	11.68	-2.69	5.91	37.21	92.26	42.83
	41	27	11.68	5.75	11.83	74.13	52.34	-23.15
		28	-11.68	-2.91	-5.91	-37.02	-92.26	42.62
28	40	28	-11.66	2.69	-5.93	-37.12	-92.26	-42.91
		29	11.66	0.14	0.01	0.00	105.64	48.65
	41	28	11.66	2.91	5.93	37.11	92.26	-42.55
		29	-11.66	-0.08	-0.01	0.00	-105.64	49.26
29	40	29	-11.66	-0.14	-0.01	0.00	-105.64	-48.65
		30	11.66	2.98	-5.91	-37.12	92.37	41.64
	41	29	11.66	0.08	0.01	0.01	105.64	-49.26
		30	-11.66	2.76	5.91	37.10	-92.37	43.22
30	40	30	-11.66	-2.98	5.91	37.12	-92.37	-41.64
		31	11.66	5.81	-11.84	-74.22	52.44	21.87

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	30	11.66	-2.76	-5.91	-37.10	92.37	-43.22
		31	-11.66	5.59	11.84	74.21	-52.44	24.43
31	40	31	-11.69	-5.81	11.81	74.27	-52.44	-21.71
		32	11.69	8.65	-17.74	-111.38	-14.05	-10.83
	41	31	11.69	-5.59	-11.81	-74.16	52.44	-24.58
		32	-11.69	8.43	17.74	111.27	14.05	-6.97
32	40	32	-11.69	-8.65	17.74	111.38	14.05	10.83
		33	11.69	11.48	-23.66	-148.49	-107.17	-56.11
	41	32	11.69	-8.43	-17.74	-111.27	-14.05	6.97
		33	-11.69	11.26	23.66	148.38	107.17	-51.28
33	40	33	-11.64	-11.48	23.68	148.60	107.17	55.81
		34	11.64	13.81	-28.55	-179.12	-203.82	-102.61
	41	33	11.64	-11.26	-23.68	-148.27	-107.17	51.58
		34	-11.64	13.60	28.55	178.79	203.82	-97.58
34	40	34	-11.96	-13.81	28.42	177.95	203.82	104.62
		35	11.96	14.32	-29.47	-184.55	-226.98	-115.88
	41	34	11.96	-13.60	-28.42	-179.88	-203.82	95.55
		35	-11.96	14.10	29.47	186.48	226.98	-106.63
35	40	35	-10.85	14.03	-29.57	-185.28	227.49	108.88
		36	10.85	-13.53	28.52	178.69	-204.28	-97.87
	41	35	10.85	14.34	29.57	185.85	-227.49	113.64
		36	-10.85	-13.83	-28.52	-179.26	204.28	-102.38
36	40	36	-10.76	13.53	-28.55	-179.00	204.28	97.31
		37	10.76	-11.19	23.68	148.48	-107.63	-51.57
	41	36	10.76	13.83	28.55	178.93	-204.28	102.95
		37	-10.76	-11.50	-23.68	-148.41	107.63	-56.07
37	40	37	-10.77	11.19	-23.68	-148.46	107.63	51.63
		38	10.77	-8.36	17.75	111.35	-14.42	-7.64
	41	37	10.77	11.50	23.68	148.44	-107.63	56.01
		38	-10.77	-8.67	-17.75	-111.33	14.42	-10.63
38	40	38	-10.73	8.36	-17.78	-111.37	14.42	7.40
		39	10.73	-5.52	11.85	74.25	52.25	23.84
	41	38	10.73	8.67	17.78	111.31	-14.42	10.86
		39	-10.73	-5.83	-11.85	-74.19	-52.25	21.77
39	40	39	-10.73	5.52	-11.85	-74.26	-52.25	-23.83
		40	10.73	-2.69	5.93	37.15	92.24	42.30
	41	39	10.73	5.83	11.85	74.19	52.25	-21.79
		40	-10.73	-3.00	-5.93	-37.08	-92.24	41.66
40	40	40	-10.72	2.69	-5.95	-37.05	-92.24	-42.39
		41	10.72	0.15	0.03	-0.06	105.70	48.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	40	10.72	3.00	5.95	37.18	92.24	-41.57
		41	-10.72	-0.16	-0.03	-0.07	-105.70	48.68
41	40	41	-10.72	-0.15	0.00	-0.05	-105.70	-48.12
		42	10.72	2.98	-5.92	-37.06	92.39	41.08
	41	41	10.72	0.16	0.00	-0.04	105.70	-48.68
		42	-10.72	2.67	5.92	37.15	-92.39	43.04
42	40	42	-10.73	-2.98	5.90	37.15	-92.39	-41.00
		43	10.73	5.82	-11.82	-74.27	52.51	21.20
	41	42	10.73	-2.67	-5.90	-37.06	92.39	-43.12
		43	-10.73	5.51	11.82	74.17	-52.51	24.71
43	40	43	-10.73	-5.82	11.82	74.27	-52.51	-21.20
		44	10.73	8.65	-17.75	-111.37	-14.01	-11.35
	41	43	10.73	-5.51	-11.82	-74.17	52.51	-24.71
		44	-10.73	8.34	17.75	111.28	14.01	-6.45
44	40	44	-10.73	-8.65	17.75	111.37	14.01	11.35
		45	10.73	11.49	-23.67	-148.48	-107.20	-56.66
	41	44	10.73	-8.34	-17.75	-111.28	-14.01	6.45
		45	-10.73	11.18	23.67	148.39	107.20	-50.36
45	40	45	-10.77	-11.49	23.65	148.39	107.20	56.91
		46	10.77	13.82	-28.52	-178.90	-203.71	-103.72
	41	45	10.77	-11.18	-23.65	-148.48	-107.20	50.10
		46	-10.77	13.51	28.52	178.99	203.71	-95.77
46	40	46	-10.86	-13.82	28.49	178.57	203.71	104.28
		47	10.86	14.32	-29.54	-185.17	-226.93	-115.54
	41	46	10.86	-13.51	-28.49	-179.29	-203.71	95.21
		47	-10.86	14.01	29.54	185.89	226.93	-106.22
47	40	47	-9.36	13.98	-29.65	-185.97	227.62	106.15
		48	9.36	-13.47	28.60	179.38	-204.34	-95.18
	41	47	9.36	14.38	29.65	185.11	-227.62	115.61
		48	-9.36	-13.87	-28.60	-178.51	204.34	-104.32
48	40	48	-9.48	13.47	-28.56	-178.98	204.34	95.92
		49	9.48	-11.14	23.68	148.46	-107.67	-50.38
	41	48	9.48	13.87	28.56	178.95	-204.34	103.58
		49	-9.48	-11.54	-23.68	-148.43	107.67	-56.55
49	40	49	-9.47	11.14	-23.69	-148.49	107.67	50.30
		50	9.47	-8.31	17.77	111.39	-14.41	-6.55
	41	49	9.47	11.54	23.69	148.39	-107.67	56.63
		50	-9.47	-8.71	-17.77	-111.29	14.41	-11.07
50	40	50	-9.47	8.31	-17.77	-111.39	14.41	6.55
		51	9.47	-5.47	11.84	74.28	52.21	24.44

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	50	9.47	8.71	17.77	111.29	-14.41	11.07
		51	-9.47	-5.87	-11.84	-74.18	-52.21	21.74
51	40	51	-9.44	5.47	-11.86	-74.23	-52.21	-24.60
		52	9.44	-2.64	5.94	37.11	92.27	42.84
	41	51	9.44	5.87	11.86	74.23	52.21	-21.58
		52	-9.44	-3.04	-5.94	-37.11	-92.27	41.64
52	40	52	-9.44	2.64	-5.94	-37.11	-92.27	-42.85
		53	9.44	0.20	0.02	-0.01	105.67	48.33
	41	52	9.44	3.04	5.94	37.12	92.27	-41.63
		53	-9.44	-0.20	-0.02	-0.01	-105.67	48.92
53	40	53	-9.44	-0.20	-0.02	0.01	-105.67	-48.33
		54	9.44	3.03	-5.91	-37.11	92.42	41.05
	41	53	9.44	0.20	0.02	0.01	105.67	-48.93
		54	-9.44	2.63	5.91	37.10	-92.42	43.46
54	40	54	-9.44	-3.03	5.91	37.10	-92.42	-41.06
		55	9.44	5.87	-11.83	-74.22	52.50	21.02
	41	54	9.44	-2.63	-5.91	-37.10	92.42	-43.46
		55	-9.44	5.47	11.83	74.22	-52.50	25.23
55	40	55	-9.47	-5.87	11.81	74.26	-52.50	-20.85
		56	9.47	8.70	-17.73	-111.37	-13.97	-11.94
	41	55	9.47	-5.47	-11.81	-74.16	52.50	-25.40
		56	-9.47	8.30	17.73	111.27	13.97	-5.57
56	40	56	-9.47	-8.70	17.73	111.37	13.97	11.94
		57	9.47	11.54	-23.66	-148.49	-107.12	-57.49
	41	56	9.47	-8.30	-17.73	-111.27	-13.97	5.57
		57	-9.47	11.14	23.66	148.38	107.12	-49.31
57	40	57	-9.41	-11.54	23.68	148.61	107.12	57.17
		58	9.41	13.87	-28.55	-179.12	-203.76	-104.18
	41	57	9.41	-11.14	-23.68	-148.27	-107.12	49.63
		58	-9.41	13.47	28.55	178.79	203.76	-95.15
58	40	58	-9.76	-13.87	28.43	177.83	203.76	106.37
		59	9.76	14.37	-29.49	-184.43	-226.91	-117.66
	41	58	9.76	-13.47	-28.43	-179.94	-203.76	92.95
		59	-9.76	13.97	29.49	186.54	226.91	-103.92
59	40	59	-7.91	13.91	-29.60	-185.43	227.64	106.06
		60	7.91	-13.41	28.55	178.83	-204.37	-95.13
	41	59	7.91	14.41	29.60	185.70	-227.64	115.53
		60	-7.91	-13.90	-28.55	-179.10	204.37	-104.20
60	40	60	-7.88	13.41	-28.56	-178.95	204.37	94.91
		61	7.88	-11.08	23.69	148.44	-107.70	-49.60

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	60	7.88	13.90	28.56	178.97	-204.37	104.43
		61	-7.88	-11.57	-23.69	-148.46	107.70	-57.30
61	40	61	-7.84	11.08	-23.70	-148.52	107.70	49.34
		62	7.84	-8.24	17.78	111.41	-14.38	-5.87
	41	61	7.84	11.57	23.70	148.36	-107.70	57.56
		62	-7.84	-8.73	-17.78	-111.25	14.38	-11.87
62	40	62	-7.87	8.24	-17.76	-111.40	14.38	6.09
		63	7.87	-5.41	11.84	74.29	52.22	24.63
	41	62	7.87	8.73	17.76	111.27	-14.38	11.66
		63	-7.87	-5.90	-11.84	-74.17	-52.22	21.27
63	40	63	-7.82	5.41	-11.87	-74.19	-52.22	-24.94
		64	7.82	-2.57	5.95	37.08	92.31	42.90
	41	63	7.82	5.90	11.87	74.26	52.22	-20.96
		64	-7.82	-3.07	-5.95	-37.14	-92.31	41.13
64	40	64	-7.83	2.57	-5.93	-37.17	-92.31	-42.82
		65	7.83	0.26	0.01	0.06	105.67	48.02
	41	64	7.83	3.07	5.93	37.06	92.31	-41.21
		65	-7.83	-0.23	-0.01	0.05	-105.67	48.62
65	40	65	-7.83	-0.26	-0.02	0.04	-105.67	-48.02
		66	7.83	3.10	-5.90	-37.15	92.45	40.47
	41	65	7.83	0.23	0.02	0.05	105.67	-48.62
		66	-7.83	2.60	5.90	37.06	-92.45	43.28
66	40	66	-7.82	-3.10	5.92	37.07	-92.45	-40.55
		67	7.82	5.93	-11.84	-74.18	52.49	20.23
	41	66	7.82	-2.60	-5.92	-37.15	92.45	-43.20
		67	-7.82	5.44	11.84	74.26	-52.49	25.10
67	40	67	-7.87	-5.93	11.81	74.27	-52.49	-19.91
		68	7.87	8.77	-17.73	-111.38	-13.97	-13.17
	41	67	7.87	-5.44	-11.81	-74.15	52.49	-25.43
		68	-7.87	8.28	17.73	111.26	13.97	-5.44
68	40	68	-7.83	-8.77	17.75	111.41	13.97	12.91
		69	7.83	11.60	-23.67	-148.51	-107.15	-58.73
	41	68	7.83	-8.28	-17.75	-111.25	-13.97	5.69
		69	-7.83	11.11	23.67	148.36	107.15	-49.30
69	40	69	-7.87	-11.60	23.66	148.43	107.15	58.93
		70	7.87	13.93	-28.53	-178.95	-203.71	-106.17
	41	69	7.87	-11.11	-23.66	-148.42	-107.15	49.10
		70	-7.87	13.44	28.53	178.93	203.71	-94.52
70	40	70	-8.02	-13.93	28.49	178.38	203.71	107.11
		71	8.02	14.44	-29.55	-184.98	-226.94	-118.47

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	70	8.02	-13.44	-28.49	-179.43	-203.71	93.57
		71	-8.02	13.94	29.55	186.03	226.94	-104.53
71	40	71	-6.16	13.93	-29.57	-184.70	227.64	106.86
		72	6.16	-13.43	28.52	178.11	-204.43	-95.93
	41	71	6.16	14.53	29.57	186.51	-227.64	116.13
		72	-6.16	-14.03	-28.52	-179.92	204.43	-104.72
72	40	72	-5.87	13.43	-28.58	-179.09	204.43	94.08
		73	5.87	-11.10	23.71	148.58	-107.69	-48.70
	41	72	5.87	14.03	28.58	178.82	-204.43	106.58
		73	-5.87	-11.70	-23.71	-148.31	107.69	-58.98
73	40	73	-5.91	11.10	-23.70	-148.49	107.69	48.98
		74	5.91	-8.26	17.77	111.37	-14.38	-5.41
	41	73	5.91	11.70	23.70	148.42	-107.69	58.71
		74	-5.91	-8.86	-17.77	-111.30	14.38	-12.45
74	40	74	-5.91	8.26	-17.77	-111.37	14.38	5.41
		75	5.91	-5.43	11.85	74.27	52.26	25.39
	41	74	5.91	8.86	17.77	111.30	-14.38	12.45
		75	-5.91	-6.03	-11.85	-74.20	-52.26	21.05
75	40	75	-5.89	5.43	-11.86	-74.21	-52.26	-25.56
		76	5.89	-2.59	5.94	37.09	92.32	43.60
	41	75	5.89	6.03	11.86	74.25	52.26	-20.88
		76	-5.89	-3.19	-5.94	-37.13	-92.32	41.62
76	40	76	-5.89	2.59	-5.94	-37.10	-92.32	-43.60
		77	5.89	0.24	0.01	-0.01	105.70	48.88
	41	76	5.89	3.19	5.94	37.12	92.32	-41.63
		77	-5.89	-0.36	-0.01	-0.01	-105.70	49.61
77	40	77	-5.89	-0.24	-0.01	0.02	-105.70	-48.88
		78	5.89	3.08	-5.91	-37.13	92.43	41.41
	41	77	5.89	0.36	0.01	0.02	105.70	-49.61
		78	-5.89	2.48	5.91	37.09	-92.43	44.83
78	40	78	-5.89	-3.08	5.91	37.12	-92.43	-41.41
		79	5.89	5.91	-11.84	-74.23	52.51	21.19
	41	78	5.89	-2.48	-5.91	-37.10	92.43	-44.82
		79	-5.89	5.31	11.84	74.20	-52.51	27.29
79	40	79	-5.91	-5.91	11.82	74.28	-52.51	-21.02
		80	5.91	8.75	-17.75	-111.39	-14.02	-11.97
	41	79	5.91	-5.31	-11.82	-74.14	52.51	-27.46
		80	-5.91	8.15	17.75	111.25	14.02	-2.83
80	40	80	-5.92	-8.75	17.75	111.39	14.02	11.99
		81	5.92	11.58	-23.67	-148.50	-107.21	-57.74

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	80	5.92	-8.15	-17.75	-111.25	-14.02	2.81
		81	-5.92	10.98	23.67	148.37	107.21	-45.86
81	40	81	-5.91	-11.58	23.67	148.51	107.21	57.72
		82	5.91	13.91	-28.54	-179.02	-203.79	-104.88
	41	81	5.91	-10.98	-23.67	-148.36	-107.21	45.89
		82	-5.91	13.31	28.54	178.87	203.79	-90.83
82	40	82	-5.91	-13.91	28.54	179.02	203.79	104.88
		83	5.91	14.42	-29.59	-185.62	-227.03	-116.20
	41	82	5.91	-13.31	-28.54	-178.86	-203.79	90.84
		83	-5.91	13.82	29.59	185.46	227.03	-101.69
83	40	83	-3.68	13.66	-29.62	-185.55	227.61	102.20
		84	3.68	-13.15	28.56	178.95	-204.32	-91.47
	41	83	3.68	14.30	29.62	185.58	-227.61	115.69
		84	-3.68	-13.79	-28.56	-178.98	204.32	-104.44
84	40	84	-3.68	13.15	-28.56	-178.96	204.32	91.45
		85	3.68	-10.82	23.69	148.45	-107.66	-47.11
	41	84	3.68	13.79	28.56	178.97	-204.32	104.46
		85	-3.68	-11.46	-23.69	-148.46	107.66	-57.73
85	40	85	-3.62	10.82	-23.70	-148.55	107.66	46.77
		86	3.62	-7.99	17.78	111.45	-14.34	-4.45
	41	85	3.62	11.46	23.70	148.33	-107.66	58.07
		86	-3.62	-8.63	-17.78	-111.22	14.34	-12.87
86	40	86	-3.62	7.99	-17.78	-111.45	14.34	4.45
		87	3.62	-5.15	11.85	74.33	52.34	25.11
	41	86	3.62	8.63	17.78	111.22	-14.34	12.87
		87	-3.62	-5.79	-11.85	-74.11	-52.34	19.59
87	40	87	-3.62	5.15	-11.85	-74.33	-52.34	-25.11
		88	3.62	-2.32	5.93	37.22	92.35	41.91
	41	87	3.62	5.79	11.85	74.11	52.34	-19.59
		88	-3.62	-2.96	-5.93	-37.00	-92.35	39.28
88	40	88	-3.61	2.32	-5.94	-37.14	-92.35	-41.99
		89	3.61	0.52	0.01	0.03	105.73	46.04
	41	88	3.61	2.96	5.94	37.08	92.35	-39.20
		89	-3.61	-0.12	-0.01	0.03	-105.73	46.14
89	40	89	-3.61	-0.52	-0.01	-0.12	-105.73	-46.04
		90	3.61	3.35	-5.92	-36.99	92.43	37.32
	41	89	3.61	0.12	0.01	-0.13	105.73	-46.14
		90	-3.61	2.71	5.92	37.24	-92.43	40.31
90	40	90	-3.62	-3.35	5.91	37.07	-92.43	-37.24
		91	3.62	6.19	-11.84	-74.18	52.49	15.77

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	90	3.62	-2.71	-5.91	-37.15	92.43	-40.39
		91	-3.62	5.55	11.84	74.26	-52.49	21.81
91	40	91	-3.62	-6.19	11.84	74.18	-52.49	-15.77
		92	3.62	9.02	-17.76	-111.28	-14.08	-18.45
	41	91	3.62	-5.55	-11.84	-74.26	52.49	-21.81
		92	-3.62	8.38	17.76	111.37	14.08	-9.52
92	40	92	-3.66	-9.02	17.75	111.24	14.08	18.70
		93	3.66	11.86	-23.67	-148.35	-107.29	-65.69
	41	92	3.66	-8.38	-17.75	-111.39	-14.08	9.27
		93	-3.66	11.22	23.67	148.50	107.29	-53.36
93	40	93	-3.64	-11.86	23.68	148.43	107.29	65.52
		94	3.64	14.19	-28.55	-178.94	-203.93	-113.72
	41	93	3.64	-11.22	-23.68	-148.44	-107.29	53.53
		94	-3.64	13.55	28.55	178.96	203.93	-99.35
94	40	94	-3.45	-14.19	28.58	179.69	203.93	112.54
		95	3.45	14.69	-29.63	-186.28	-227.19	-124.08
	41	94	3.45	-13.55	-28.58	-178.30	-203.93	100.53
		95	-3.45	14.05	29.63	184.89	227.19	-111.56
95	40	95	-1.08	14.77	-25.28	-158.31	166.18	109.29
		96	1.08	-14.26	24.23	151.71	-146.37	-97.67
	41	95	1.08	15.56	25.28	158.27	-166.18	126.45
		96	-1.08	-15.06	-24.23	-151.67	146.37	-114.20
96	40	96	-1.25	14.26	-24.22	-150.99	146.37	98.78
		97	1.25	-11.93	19.35	120.48	-65.75	-50.32
	41	96	1.25	15.06	24.22	152.50	-146.37	113.09
		97	-1.25	-12.73	-19.35	-121.98	65.75	-61.68
97	40	97	-1.22	11.93	-19.35	-120.56	65.75	50.13
		98	1.22	-8.84	12.90	80.15	13.28	0.76
	41	97	1.22	12.73	19.35	121.89	-65.75	61.86
		98	-1.22	-9.64	-12.90	-81.48	-13.28	-7.06
98	40	98	-1.20	8.84	-12.91	-80.15	-13.28	-0.93
		99	1.20	-5.76	6.45	39.73	60.72	36.70
	41	98	1.20	9.64	12.91	81.46	13.28	7.23
		99	-1.20	-6.55	-6.45	-41.05	-60.72	32.45
99	40	99	-1.21	5.76	-6.45	-39.81	-60.72	-36.61
		100	1.21	-2.67	0.00	-0.59	76.53	57.25
	41	99	1.21	6.55	6.45	40.98	60.72	-32.54
		100	-1.21	-3.47	0.00	-0.58	-76.53	57.09
100	40	100	-1.21	2.67	-0.01	0.70	-76.53	-57.25
		101	1.21	0.42	-6.45	-41.11	60.75	62.76

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
	41	100	1.21	3.47	0.01	0.69	76.53	-57.09
		101	-1.21	-0.38	6.45	39.72	-60.75	66.52
101	40	101	-1.21	-0.42	6.45	41.12	-60.75	-62.76
		102	1.21	3.50	-12.90	-81.53	13.37	53.15
	41	101	1.21	0.38	-6.45	-39.71	60.75	-66.52
		102	-1.21	2.71	12.90	80.11	-13.37	60.83
102	40	102	-1.24	-3.50	12.89	81.64	-13.37	-52.98
		103	1.24	6.59	-19.34	-122.05	-65.62	28.23
	41	102	1.24	-2.71	-12.89	-79.98	13.37	-61.00
		103	-1.24	5.79	19.34	120.40	65.62	40.17
103	40	103	-1.23	-6.59	19.34	122.04	65.62	-28.30
		104	1.23	8.92	-24.21	-152.55	-146.19	-0.39
	41	103	1.23	-5.79	-19.34	-120.42	-65.62	-40.10
		104	-1.23	8.12	24.21	150.93	146.19	14.36
104	40	104	-1.25	-8.92	24.22	152.55	146.19	0.57
		105	1.25	9.42	-25.27	-159.14	-165.99	-7.90
	41	104	1.25	-8.12	-24.22	-150.91	-146.19	-14.53
		105	-1.25	8.63	25.27	157.51	165.99	7.82

********** END OF LATEST ANALYSIS RESULT **********

150. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	40	-12.57	8.72	-24.66	-154.70	158.35	0.00
	41	12.57	8.77	24.66	154.55	-158.35	0.00
11	40	0.00	29.13	-54.24	-340.21	69.13	0.00
	41	0.00	29.21	54.24	340.15	-69.13	0.00
23	40	0.00	28.15	-59.18	-371.21	0.34	0.00
	41	0.00	28.25	59.18	371.03	-0.34	0.00
35	40	0.00	28.35	-59.19	-371.22	0.51	0.00
	41	0.00	28.44	59.19	371.08	-0.51	0.00
47	40	0.00	28.30	-59.20	-371.15	0.69	0.00
	41	0.00	28.39	59.20	371.23	-0.69	0.00
59	40	0.00	28.29	-59.21	-371.26	0.73	0.00
	41	0.00	28.38	59.21	371.21	-0.73	0.00
71	40	0.00	28.37	-59.23	-371.31	0.70	0.00
	41	0.00	28.48	59.23	371.30	-0.70	0.00
83	40	0.00	28.07	-59.25	-371.44	0.58	0.00
	41	0.00	28.12	59.25	371.30	-0.58	0.00
95	40	0.00	29.46	-54.93	-343.29	-61.01	0.00
	41	0.00	29.62	54.93	345.14	61.01	0.00
105	40	0.00	9.42	-25.30	-159.34	-165.99	0.00
	41	0.00	8.63	25.30	157.70	165.99	0.00

********** END OF LATEST ANALYSIS RESULT **********

151. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 16:18:35 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 50 : GRADIENTE T° 10°C

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 30, 1998                   *
*           Time=    17:56:44                       *
*                                                   *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 50 GRADIENTE DE TEMPERATURA DE 10 çC
131. TEMP LOAD
132. 1 TO 104 TEMP 0 10
133. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =    589
   SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              17:56:46
++ PROCESSING GLOBAL STIFFNESS MATRIX.               17:56:46
++ PROCESSING TRIANGULAR FACTORIZATION.              17:56:47
++ CALCULATING JOINT DISPLACEMENTS.                  17:56:47
++ CALCULATING MEMBER  FORCES.                       17:56:47

134. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	50	1	0.00	48.83	0.00	-1.83	0.00	0.00
		2	0.00	-48.83	0.00	1.83	0.00	39.07
2	50	2	0.00	48.83	0.00	-1.83	0.00	-39.06
		3	0.00	-48.83	0.00	1.83	0.00	219.71
3	50	3	0.00	48.83	0.00	-1.35	0.00	-219.72
		4	0.00	-48.83	0.00	1.35	0.00	451.64
4	50	4	0.00	48.82	0.00	-2.33	0.00	-451.64
		5	0.00	-48.82	0.00	2.33	0.00	683.55
5	50	5	0.00	48.82	0.00	-0.96	0.00	-683.56
		6	0.00	-48.82	0.00	0.96	0.00	915.48
6	50	6	0.00	48.83	0.00	-0.81	0.00	-915.48
		7	0.00	-48.83	0.00	0.81	0.00	1147.40
7	50	7	0.00	48.83	0.00	1.50	0.00	-1147.40
		8	0.00	-48.83	0.00	-1.50	0.00	1379.32
8	50	8	0.00	48.83	0.00	1.49	0.00	-1379.32
		9	0.00	-48.83	0.00	-1.49	0.00	1611.24
9	50	9	0.00	48.83	0.00	-0.74	0.00	-1611.24
		10	0.00	-48.83	0.00	0.74	0.00	1791.89
10	50	10	0.00	48.83	0.00	15.59	0.00	-1791.83
		11	0.00	-48.83	0.00	-15.59	0.00	1830.89
11	50	11	0.00	-11.28	0.00	-12.83	0.00	-1830.95
		12	0.00	11.28	0.00	12.83	0.00	1821.93
12	50	12	0.00	-11.27	0.00	-2.67	0.00	-1821.97
		13	0.00	11.27	0.00	2.67	0.00	1780.26
13	50	13	0.00	-11.27	0.00	-0.67	0.00	-1780.26
		14	0.00	11.27	0.00	0.67	0.00	1729.53
14	50	14	0.00	-11.27	0.00	-4.63	0.00	-1729.53
		15	0.00	11.27	0.00	4.63	0.00	1678.80
15	50	15	0.00	-11.27	0.00	-0.78	0.00	-1678.80
		16	0.00	11.27	0.00	0.78	0.00	1628.07
16	50	16	0.00	-11.27	0.00	2.66	0.00	-1628.07
		17	0.00	11.27	0.00	-2.66	0.00	1577.34

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	50	17	0.00	-11.27	0.00	-0.67	0.00	-1577.34
		18	0.00	11.27	0.00	0.67	0.00	1526.61
18	50	18	0.00	-11.27	0.00	2.56	0.00	-1526.61
		19	0.00	11.27	0.00	-2.56	0.00	1475.88
19	50	19	0.00	-11.27	0.00	2.56	0.00	-1475.88
		20	0.00	11.27	0.00	-2.56	0.00	1425.15
20	50	20	0.00	-11.27	0.00	2.81	0.00	-1425.15
		21	0.00	11.27	0.00	-2.81	0.00	1374.42
21	50	21	0.00	-11.27	0.00	5.19	0.00	-1374.41
		22	0.00	11.27	0.00	-5.19	0.00	1332.70
22	50	22	0.00	-11.28	0.00	8.08	0.00	-1332.69
		23	0.00	11.28	0.00	-8.08	0.00	1323.67
23	50	23	0.00	3.23	0.00	-17.83	0.00	-1323.66
		24	0.00	-3.23	0.00	17.83	0.00	1326.25
24	50	24	0.00	3.23	0.00	-3.32	0.00	-1326.37
		25	0.00	-3.23	0.00	3.32	0.00	1338.33
25	50	25	0.00	3.23	0.00	-3.33	0.00	-1338.33
		26	0.00	-3.23	0.00	3.33	0.00	1352.88
26	50	26	0.00	3.23	0.00	0.01	0.00	-1352.88
		27	0.00	-3.23	0.00	-0.01	0.00	1367.43
27	50	27	0.00	3.23	0.00	-3.12	0.00	-1367.43
		28	0.00	-3.23	0.00	3.12	0.00	1381.98
28	50	28	0.00	3.23	0.00	-0.20	0.00	-1381.98
		29	0.00	-3.23	0.00	0.20	0.00	1396.53
29	50	29	0.00	3.23	0.00	0.05	0.00	-1396.53
		30	0.00	-3.23	0.00	-0.05	0.00	1411.08
30	50	30	0.00	3.23	0.00	0.05	0.00	-1411.08
		31	0.00	-3.23	0.00	-0.05	0.00	1425.63
31	50	31	0.00	3.23	0.00	3.06	0.00	-1425.63
		32	0.00	-3.23	0.00	-3.06	0.00	1440.18
32	50	32	0.00	3.23	0.00	3.07	0.00	-1440.18
		33	0.00	-3.23	0.00	-3.07	0.00	1454.73
33	50	33	0.00	3.23	0.00	0.14	0.00	-1454.73
		34	0.00	-3.23	0.00	-0.14	0.00	1466.70

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	50	34	0.00	3.23	0.00	16.70	0.00	-1466.60
		35	0.00	-3.23	0.00	-16.70	0.00	1469.19
35	50	35	0.00	-0.87	0.00	-8.26	0.00	-1469.38
		36	0.00	0.87	0.00	8.26	0.00	1468.69
36	50	36	0.00	-0.87	0.00	-3.60	0.00	-1468.71
		37	0.00	0.87	0.00	3.60	0.00	1465.50
37	50	37	0.00	-0.87	0.00	-4.16	0.00	-1465.50
		38	0.00	0.87	0.00	4.16	0.00	1461.61
38	50	38	0.00	-0.87	0.00	-1.08	0.00	-1461.61
		39	0.00	0.87	0.00	1.08	0.00	1457.71
39	50	39	0.00	-0.87	0.00	-1.33	0.00	-1457.72
		40	0.00	0.87	0.00	1.33	0.00	1453.82
40	50	40	0.00	-0.87	0.00	2.26	0.00	-1453.82
		41	0.00	0.87	0.00	-2.26	0.00	1449.92
41	50	41	0.00	-0.87	0.00	-1.06	0.00	-1449.92
		42	0.00	0.87	0.00	1.06	0.00	1446.03
42	50	42	0.00	-0.87	0.00	1.99	0.00	-1446.03
		43	0.00	0.87	0.00	-1.99	0.00	1442.13
43	50	43	0.00	-0.87	0.00	2.00	0.00	-1442.13
		44	0.00	0.87	0.00	-2.00	0.00	1438.23
44	50	44	0.00	-0.87	0.00	2.00	0.00	-1438.23
		45	0.00	0.87	0.00	-2.00	0.00	1434.34
45	50	45	0.00	-0.87	0.00	4.49	0.00	-1434.33
		46	0.00	0.87	0.00	-4.49	0.00	1431.13
46	50	46	0.00	-0.87	0.00	8.97	0.00	-1431.11
		47	0.00	0.87	0.00	-8.97	0.00	1430.42
47	50	47	0.00	-0.01	0.00	1.94	0.00	-1430.63
		48	0.00	0.01	0.00	-1.94	0.00	1430.62
48	50	48	0.00	-0.01	0.00	-4.01	0.00	-1430.62
		49	0.00	0.01	0.00	4.01	0.00	1430.60
49	50	49	0.00	-0.01	0.00	-3.20	0.00	-1430.60
		50	0.00	0.01	0.00	3.20	0.00	1430.57
50	50	50	0.00	-0.01	0.00	-3.20	0.00	-1430.57
		51	0.00	0.01	0.00	3.20	0.00	1430.55

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	50	51	0.00	-0.01	0.00	-0.18	0.00	-1430.55
		52	0.00	0.01	0.00	0.18	0.00	1430.53
52	50	52	0.00	-0.01	0.00	0.08	0.00	-1430.53
		53	0.00	0.01	0.00	-0.08	0.00	1430.50
53	50	53	0.00	-0.01	0.00	0.08	0.00	-1430.50
		54	0.00	0.01	0.00	-0.08	0.00	1430.48
54	50	54	0.00	-0.01	0.00	-0.18	0.00	-1430.48
		55	0.00	0.01	0.00	0.18	0.00	1430.45
55	50	55	0.00	-0.01	0.00	3.11	0.00	-1430.45
		56	0.00	0.01	0.00	-3.11	0.00	1430.42
56	50	56	0.00	-0.01	0.00	3.10	0.00	-1430.42
		57	0.00	0.01	0.00	-3.10	0.00	1430.40
57	50	57	0.00	-0.01	0.00	-0.01	0.00	-1430.40
		58	0.00	0.01	0.00	0.01	0.00	1430.38
58	50	58	0.00	-0.01	0.00	17.56	0.00	-1430.27
		59	0.00	0.01	0.00	-17.56	0.00	1430.27
59	50	59	0.00	0.86	0.00	-5.79	0.00	-1430.57
		60	0.00	-0.86	0.00	5.79	0.00	1431.26
60	50	60	0.00	0.86	0.00	-4.01	0.00	-1431.27
		61	0.00	-0.86	0.00	4.01	0.00	1434.46
61	50	61	0.00	0.86	0.00	-1.54	0.00	-1434.46
		62	0.00	-0.86	0.00	1.54	0.00	1438.34
62	50	62	0.00	0.86	0.00	-4.33	0.00	-1438.33
		63	0.00	-0.86	0.00	4.33	0.00	1442.21
63	50	63	0.00	0.86	0.00	1.77	0.00	-1442.21
		64	0.00	-0.86	0.00	-1.77	0.00	1446.09
64	50	64	0.00	0.86	0.00	-1.28	0.00	-1446.09
		65	0.00	-0.86	0.00	1.28	0.00	1449.97
65	50	65	0.00	0.86	0.00	1.78	0.00	-1449.97
		66	0.00	-0.86	0.00	-1.78	0.00	1453.85
66	50	66	0.00	0.86	0.00	-1.29	0.00	-1453.85
		67	0.00	-0.86	0.00	1.29	0.00	1457.72
67	50	67	0.00	0.86	0.00	5.13	0.00	-1457.71
		68	0.00	-0.86	0.00	-5.13	0.00	1461.59

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	50	68	0.00	0.86	0.00	1.79	0.00	-1461.60
		69	0.00	-0.86	0.00	-1.79	0.00	1465.47
69	50	69	0.00	0.86	0.00	3.76	0.00	-1465.47
		70	0.00	-0.86	0.00	-3.76	0.00	1468.66
70	50	70	0.00	0.86	0.00	11.53	0.00	-1468.62
		71	0.00	-0.86	0.00	-11.53	0.00	1469.31
71	50	71	0.00	-3.26	0.00	-16.69	0.00	-1469.57
		72	0.00	3.26	0.00	16.69	0.00	1466.96
72	50	72	0.00	-3.26	0.00	-1.49	0.00	-1467.06
		73	0.00	3.26	0.00	1.49	0.00	1455.00
73	50	73	0.00	-3.26	0.00	-4.18	0.00	-1454.99
		74	0.00	3.26	0.00	4.18	0.00	1440.33
74	50	74	0.00	-3.26	0.00	-4.17	0.00	-1440.33
		75	0.00	3.26	0.00	4.17	0.00	1425.67
75	50	75	0.00	-3.26	0.00	-0.91	0.00	-1425.68
		76	0.00	3.26	0.00	0.91	0.00	1411.01
76	50	76	0.00	-3.26	0.00	-1.15	0.00	-1411.01
		77	0.00	3.26	0.00	1.15	0.00	1396.35
77	50	77	0.00	-3.26	0.00	-0.91	0.00	-1396.35
		78	0.00	3.26	0.00	0.91	0.00	1381.69
78	50	78	0.00	-3.26	0.00	-1.15	0.00	-1381.69
		79	0.00	3.26	0.00	1.15	0.00	1367.02
79	50	79	0.00	-3.26	0.00	1.98	0.00	-1367.02
		80	0.00	3.26	0.00	-1.98	0.00	1352.36
80	50	80	0.00	-3.26	0.00	2.22	0.00	-1352.36
		81	0.00	3.26	0.00	-2.22	0.00	1337.70
81	50	81	0.00	-3.26	0.00	2.01	0.00	-1337.70
		82	0.00	3.26	0.00	-2.01	0.00	1325.64
82	50	82	0.00	-3.26	0.00	1.96	0.00	-1325.64
		83	0.00	3.26	0.00	-1.96	0.00	1323.04
83	50	83	0.00	11.33	0.00	-1.15	0.00	-1323.15
		84	0.00	-11.33	0.00	1.15	0.00	1332.22
84	50	84	0.00	11.33	0.00	-1.04	0.00	-1332.22
		85	0.00	-11.33	0.00	1.04	0.00	1374.14

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	50	85	0.00	11.33	0.00	2.10	0.00	-1374.14
		86	0.00	-11.33	0.00	-2.10	0.00	1425.12
86	50	86	0.00	11.33	0.00	2.09	0.00	-1425.12
		87	0.00	-11.33	0.00	-2.09	0.00	1476.11
87	50	87	0.00	11.33	0.00	2.10	0.00	-1476.11
		88	0.00	-11.33	0.00	-2.10	0.00	1527.09
88	50	88	0.00	11.33	0.00	5.33	0.00	-1527.08
		89	0.00	-11.33	0.00	-5.33	0.00	1578.07
89	50	89	0.00	11.33	0.00	1.98	0.00	-1578.08
		90	0.00	-11.33	0.00	-1.98	0.00	1629.07
90	50	90	0.00	11.33	0.00	5.44	0.00	-1629.06
		91	0.00	-11.33	0.00	-5.44	0.00	1680.05
91	50	91	0.00	11.33	0.00	5.45	0.00	-1680.05
		92	0.00	-11.33	0.00	-5.45	0.00	1731.02
92	50	92	0.00	11.33	0.00	9.40	0.00	-1731.00
		93	0.00	-11.33	0.00	-9.40	0.00	1781.99
93	50	93	0.00	11.33	0.00	7.41	0.00	-1782.00
		94	0.00	-11.33	0.00	-7.41	0.00	1823.93
94	50	94	0.00	11.33	0.00	-4.63	0.00	-1823.94
		95	0.00	-11.33	0.00	4.63	0.00	1833.00
95	50	95	0.00	-47.75	0.00	-7.91	0.00	-1834.34
		96	0.00	47.75	0.00	7.91	0.00	1796.14
96	50	96	0.00	-47.75	0.00	-20.98	0.00	-1796.03
		97	0.00	47.75	0.00	20.98	0.00	1619.34
97	50	97	0.00	-47.75	0.00	-18.48	0.00	-1619.37
		98	0.00	47.75	0.00	18.48	0.00	1385.40
98	50	98	0.00	-47.75	0.00	-15.57	0.00	-1385.43
		99	0.00	47.75	0.00	15.57	0.00	1151.44
99	50	99	0.00	-47.75	0.00	-17.98	0.00	-1151.40
		100	0.00	47.75	0.00	17.98	0.00	917.48
100	50	100	0.00	-47.75	0.00	-16.20	0.00	-917.51
		101	0.00	47.75	0.00	16.20	0.00	683.52
101	50	101	0.00	-47.75	0.00	-16.09	0.00	-683.52
		102	0.00	47.75	0.00	16.09	0.00	449.57

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	50	102	0.00	-47.75	0.00	-15.15	0.00	-449.61
		103	0.00	47.75	0.00	15.15	0.00	215.59
103	50	103	0.00	-47.75	0.00	-15.27	0.00	-215.58
		104	0.00	47.75	0.00	15.27	0.00	38.94
104	50	104	0.00	-47.81	0.00	-15.23	0.00	-38.98
		105	0.00	47.81	0.00	15.23	0.00	0.74

********** END OF LATEST ANALYSIS RESULT **********

135. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	50	0.00	48.83	0.00	-1.83	0.00	0.00
11	50	0.00	-60.10	0.00	-6.63	0.00	0.00
23	50	0.00	14.51	0.00	-8.84	0.00	0.00
35	50	0.00	-4.10	0.00	-7.49	0.00	0.00
47	50	0.00	0.86	0.00	-8.49	0.00	0.00
59	50	0.00	0.87	0.00	-7.69	0.00	0.00
71	50	0.00	-4.12	0.00	-9.33	0.00	0.00
83	50	0.00	14.59	0.00	-3.05	0.00	0.00
95	50	0.00	-59.08	0.00	-28.76	0.00	0.00
105	50	0.00	47.81	0.00	15.25	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

136. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 30,1998 TIME= 17:56:51 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

DESCENSO DE PILA 4 (1,25cm)

(LOAD 60)

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     2:15: 2                    *
*                                                *
**************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
49. 46 171.686818353569 0 7998.15751510331
50. 47 172.486633245312 0 7998.14030643072
51. 48 173.286446412189 0 7998.12301777672
52. 49 176.985559642506 0 7998.04201737388
53. 50 181.484430040364 0 7997.94119768662
54. 51 185.983243015416 0 7997.83784740085
55. 52 190.481997144209 0 7997.73196654926
56. 53 194.980691003309 0 7997.62355516536
57. 54 199.479323169302 0 7997.51261328345
58. 55 203.977892218791 0 7997.39914093863
59. 56 208.476396728403 0 7997.28313816681
60. 57 212.974835274781 0 7997.16460500468
61. 58 216.67350099441 0 7997.06524882515
62. 59 217.473206434592 0 7997.04354148976
63. 60 218.272909700042 0 7997.02175418393
64. 61 221.971508784523 0 7996.91994766034
65. 62 226.469740901283 0 7996.79382355554
66. 63 230.967901361604 0 7996.66516921527
67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
70. 67 248.959798173919 0 7996.12525032551
71. 68 253.457579003821 0 7995.98394543445
72. 69 257.955279638162 0 7995.84011056417
73. 70 261.653327968335 0 7995.71995107152
74. 71 262.452898653843 0 7995.69374576016
75. 72 263.252466714822 0 7995.66746049187
76. 73 266.950434627788 0 7995.54485106875
77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
80. 77 284.939719645652 0 7994.92397438326
81. 78 289.436819065736 0 7994.76243097749
82. 79 293.933826906203 0 7994.59835797898
83. 80 298.430741744173 0 7994.43175543966
84. 81 302.927562156794 0 7994.26262341223
85. 82 306.624876089259 0 7994.12166440837
86. 83 307.424286721243 0 7994.0909619502
87. 84 308.223694278984 0 7994.06017955113
88. 85 311.920914014729 0 7993.9167711079
89. 86 316.417442614491 0 7993.74005094044
90. 87 320.913871097799 0 7993.56080150373
91. 88 325.410198041955 0 7993.3790228545
92. 89 329.906422024294 0 7993.19471505024
93. 90 334.402541622181 0 7993.00787814929
94. 91 338.898555413017 0 7992.81851221076
95. 92 343.394461974235 0 7992.62661729456
96. 93 347.890259883301 0 7992.43219346141
97. 94 351.586722433043 0 7992.27043940636
98. 95 352.385947717718 0 7992.23524077283
99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 60 DESCENSO DE 1.25 CM DE PILA P-4
131. SUPPORT DISPLACEMENT
132. 47 FY -0.0125
133. PERFORM ANALYSIS

                P R O B L E M   S T A T I S T I C S
                -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
 ORIGINAL/FINAL BAND-WIDTH =    1/    1
 TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
 SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =   12.27 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.          2:15: 5
++ PROCESSING GLOBAL STIFFNESS MATRIX.           2:15: 5
++ PROCESSING TRIANGULAR FACTORIZATION.          2:15: 6
++ CALCULATING JOINT DISPLACEMENTS.              2:15: 6
++ CALCULATING MEMBER  FORCES.                   2:15: 6

134. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	60	1	0.00	-1.87	0.00	-0.02	0.00	0.00
		2	0.00	1.87	0.00	0.02	0.00	-1.50
2	60	2	0.00	-1.87	0.00	-0.02	0.00	1.50
		3	0.00	1.87	0.00	0.02	0.00	-8.42
3	60	3	0.00	-1.87	0.00	-0.04	0.00	8.42
		4	0.00	1.87	0.00	0.04	0.00	-17.31
4	60	4	0.00	-1.87	0.00	0.00	0.00	17.31
		5	0.00	1.87	0.00	0.00	0.00	-26.19
5	60	5	0.00	-1.87	0.00	-0.05	0.00	26.19
		6	0.00	1.87	0.00	0.05	0.00	-35.08
6	60	6	0.00	-1.87	0.00	-0.06	0.00	35.08
		7	0.00	1.87	0.00	0.06	0.00	-43.97
7	60	7	0.00	-1.87	0.00	-0.14	0.00	43.97
		8	0.00	1.87	0.00	0.14	0.00	-52.85
8	60	8	0.00	-1.87	0.00	-0.14	0.00	52.85
		9	0.00	1.87	0.00	0.14	0.00	-61.74
9	60	9	0.00	-1.87	0.00	-0.06	0.00	61.74
		10	0.00	1.87	0.00	0.06	0.00	-68.66
10	60	10	0.00	-1.87	0.00	-0.68	0.00	68.66
		11	0.00	1.87	0.00	0.68	0.00	-70.16
11	60	11	0.00	6.88	0.00	0.74	0.00	70.16
		12	0.00	-6.88	0.00	-0.74	0.00	-64.65
12	60	12	0.00	6.88	0.00	0.38	0.00	64.66
		13	0.00	-6.88	0.00	-0.38	0.00	-39.19
13	60	13	0.00	6.88	0.00	0.34	0.00	39.19
		14	0.00	-6.88	0.00	-0.34	0.00	-8.22
14	60	14	0.00	6.88	0.00	0.36	0.00	8.22
		15	0.00	-6.88	0.00	-0.36	0.00	22.76
15	60	15	0.00	6.88	0.00	0.41	0.00	-22.76
		16	0.00	-6.88	0.00	-0.41	0.00	53.73
16	60	16	0.00	6.88	0.00	0.52	0.00	-53.73
		17	0.00	-6.88	0.00	-0.52	0.00	84.70

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	60	17	0.00	6.88	0.00	0.34	0.00	-84.70
		18	0.00	-6.88	0.00	-0.34	0.00	115.68
18	60	18	0.00	6.88	0.00	0.59	0.00	-115.68
		19	0.00	-6.88	0.00	-0.59	0.00	146.65
19	60	19	0.00	6.88	0.00	0.59	0.00	-146.65
		20	0.00	-6.88	0.00	-0.59	0.00	177.62
20	60	20	0.00	6.88	0.00	0.62	0.00	-177.62
		21	0.00	-6.88	0.00	-0.62	0.00	208.60
21	60	21	0.00	6.88	0.00	0.98	0.00	-208.59
		22	0.00	-6.88	0.00	-0.98	0.00	234.06
22	60	22	0.00	6.88	0.00	1.49	0.00	-234.06
		23	0.00	-6.88	0.00	-1.49	0.00	239.56
23	60	23	0.00	-23.73	0.00	-4.89	0.00	-239.56
		24	0.00	23.73	0.00	4.89	0.00	220.58
24	60	24	0.00	-23.73	0.00	-2.48	0.00	-220.62
		25	0.00	23.73	0.00	2.48	0.00	132.81
25	60	25	0.00	-23.73	0.00	-2.48	0.00	-132.81
		26	0.00	23.73	0.00	2.48	0.00	26.02
26	60	26	0.00	-23.73	0.00	-2.41	0.00	-26.03
		27	0.00	23.73	0.00	2.41	0.00	-80.76
27	60	27	0.00	-23.73	0.00	-2.23	0.00	80.77
		28	0.00	23.73	0.00	2.23	0.00	-187.55
28	60	28	0.00	-23.73	0.00	-2.62	0.00	187.54
		29	0.00	23.73	0.00	2.62	0.00	-294.35
29	60	29	0.00	-23.73	0.00	-2.68	0.00	294.34
		30	0.00	23.73	0.00	2.68	0.00	-401.14
30	60	30	0.00	-23.73	0.00	-2.68	0.00	401.14
		31	0.00	23.73	0.00	2.68	0.00	-507.92
31	60	31	0.00	-23.73	0.00	-3.75	0.00	507.91
		32	0.00	23.73	0.00	3.75	0.00	-614.72
32	60	32	0.00	-23.73	0.00	-3.75	0.00	614.71
		33	0.00	23.73	0.00	3.75	0.00	-721.49
33	60	33	0.00	-23.73	0.00	-2.30	0.00	721.50
		34	0.00	23.73	0.00	2.30	0.00	-809.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	60	34	0.00	-23.75	0.00	-11.43	0.00	809.24
		35	0.00	23.75	0.00	11.43	0.00	-828.23
35	60	35	0.00	46.97	0.00	6.07	0.00	828.41
		36	0.00	-46.97	0.00	-6.07	0.00	-790.87
36	60	36	0.00	46.97	0.00	3.56	0.00	790.88
		37	0.00	-46.97	0.00	-3.56	0.00	-617.07
37	60	37	0.00	46.97	0.00	3.79	0.00	617.07
		38	0.00	-46.97	0.00	-3.79	0.00	-405.72
38	60	38	0.00	46.97	0.00	2.94	0.00	405.72
		39	0.00	-46.97	0.00	-2.94	0.00	-194.32
39	60	39	0.00	46.97	0.00	2.97	0.00	194.32
		40	0.00	-46.97	0.00	-2.97	0.00	17.05
40	60	40	0.00	46.97	0.00	3.01	0.00	-17.03
		41	0.00	-46.97	0.00	-3.01	0.00	228.41
41	60	41	0.00	46.97	0.00	2.49	0.00	-228.41
		42	0.00	-46.97	0.00	-2.49	0.00	439.77
42	60	42	0.00	46.97	0.00	3.42	0.00	-439.75
		43	0.00	-46.97	0.00	-3.42	0.00	651.18
43	60	43	0.00	46.97	0.00	3.42	0.00	-651.19
		44	0.00	-46.97	0.00	-3.42	0.00	862.53
44	60	44	0.00	46.97	0.00	3.42	0.00	-862.54
		45	0.00	-46.97	0.00	-3.42	0.00	1073.91
45	60	45	0.00	46.95	0.00	5.28	0.00	-1073.93
		46	0.00	-46.95	0.00	-5.28	0.00	1247.67
46	60	46	0.00	46.71	0.00	9.17	0.00	-1247.34
		47	0.00	-46.71	0.00	-9.17	0.00	1284.67
47	60	47	0.00	-45.45	0.00	6.71	0.00	-1283.79
		48	0.00	45.45	0.00	-6.71	0.00	1248.39
48	60	48	0.00	-46.95	0.00	1.53	0.00	-1247.64
		49	0.00	46.95	0.00	-1.53	0.00	1073.86
49	60	49	0.00	-46.97	0.00	2.14	0.00	-1073.84
		50	0.00	46.97	0.00	-2.14	0.00	862.54
50	60	50	0.00	-46.97	0.00	2.13	0.00	-862.54
		51	0.00	46.97	0.00	-2.13	0.00	651.18

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	60	51	0.00	-46.97	0.00	3.51	0.00	-651.17
		52	0.00	46.97	0.00	-3.51	0.00	439.81
52	60	52	0.00	-46.97	0.00	3.59	0.00	-439.80
		53	0.00	46.97	0.00	-3.59	0.00	228.43
53	60	53	0.00	-46.97	0.00	3.59	0.00	-228.42
		54	0.00	46.97	0.00	-3.59	0.00	17.11
54	60	54	0.00	-46.97	0.00	3.59	0.00	-17.10
		55	0.00	46.97	0.00	-3.59	0.00	-194.27
55	60	55	0.00	-46.97	0.00	3.14	0.00	194.27
		56	0.00	46.97	0.00	-3.14	0.00	-405.61
56	60	56	0.00	-46.97	0.00	3.14	0.00	405.61
		57	0.00	46.97	0.00	-3.14	0.00	-617.00
57	60	57	0.00	-46.97	0.00	4.48	0.00	616.99
		58	0.00	46.97	0.00	-4.48	0.00	-790.78
58	60	58	0.00	-46.97	0.00	-5.23	0.00	790.77
		59	0.00	46.97	0.00	5.23	0.00	-828.33
59	60	59	0.00	23.71	0.00	-3.00	0.00	828.15
		60	0.00	-23.71	0.00	3.00	0.00	-809.17
60	60	60	0.00	23.72	0.00	-4.00	0.00	809.17
		61	0.00	-23.72	0.00	4.00	0.00	-721.39
61	60	61	0.00	23.72	0.00	-5.25	0.00	721.38
		62	0.00	-23.72	0.00	5.25	0.00	-614.63
62	60	62	0.00	23.72	0.00	-4.05	0.00	614.64
		63	0.00	-23.72	0.00	4.05	0.00	-507.90
63	60	63	0.00	23.72	0.00	-6.20	0.00	507.87
		64	0.00	-23.72	0.00	6.20	0.00	-401.12
64	60	64	0.00	23.72	0.00	-5.35	0.00	401.13
		65	0.00	-23.72	0.00	5.35	0.00	-294.38
65	60	65	0.00	23.72	0.00	-5.98	0.00	294.37
		66	0.00	-23.72	0.00	5.98	0.00	-187.62
66	60	66	0.00	23.72	0.00	-5.58	0.00	187.63
		67	0.00	-23.72	0.00	5.58	0.00	-80.88
67	60	67	0.00	23.72	0.00	-5.94	0.00	80.85
		68	0.00	-23.72	0.00	5.94	0.00	25.91

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	60	68	0.00	23.72	0.00	-6.00	0.00	-25.89
		69	0.00	-23.72	0.00	6.00	0.00	132.62
69	60	69	0.00	23.72	0.00	-5.82	0.00	-132.63
		70	0.00	-23.72	0.00	5.82	0.00	220.40
70	60	70	0.00	23.72	0.00	-4.65	0.00	-220.43
		71	0.00	-23.72	0.00	4.65	0.00	239.42
71	60	71	0.00	-6.85	0.00	-0.41	0.00	-239.16
		72	0.00	6.85	0.00	0.41	0.00	233.69
72	60	72	0.00	-6.85	0.00	2.01	0.00	-233.68
		73	0.00	6.85	0.00	-2.01	0.00	208.33
73	60	73	0.00	-6.85	0.00	1.63	0.00	-208.33
		74	0.00	6.85	0.00	-1.63	0.00	177.50
74	60	74	0.00	-6.85	0.00	1.63	0.00	-177.50
		75	0.00	6.85	0.00	-1.63	0.00	146.67
75	60	75	0.00	-6.85	0.00	1.96	0.00	-146.66
		76	0.00	6.85	0.00	-1.96	0.00	115.83
76	60	76	0.00	-6.85	0.00	1.94	0.00	-115.83
		77	0.00	6.85	0.00	-1.94	0.00	85.00
77	60	77	0.00	-6.85	0.00	1.96	0.00	-85.00
		78	0.00	6.85	0.00	-1.96	0.00	54.17
78	60	78	0.00	-6.85	0.00	1.95	0.00	-54.17
		79	0.00	6.85	0.00	-1.95	0.00	23.34
79	60	79	0.00	-6.85	0.00	2.00	0.00	-23.33
		80	0.00	6.85	0.00	-2.00	0.00	-7.50
80	60	80	0.00	-6.85	0.00	2.00	0.00	7.50
		81	0.00	6.85	0.00	-2.00	0.00	-38.33
81	60	81	0.00	-6.85	0.00	2.01	0.00	38.33
		82	0.00	6.85	0.00	-2.01	0.00	-63.68
82	60	82	0.00	-6.85	0.00	2.01	0.00	63.68
		83	0.00	6.85	0.00	-2.01	0.00	-69.16
83	60	83	0.00	1.98	0.00	-0.47	0.00	69.06
		84	0.00	-1.98	0.00	0.47	0.00	-67.48
84	60	84	0.00	1.98	0.00	-0.48	0.00	67.48
		85	0.00	-1.98	0.00	0.48	0.00	-60.16

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	60	85	0.00	1.98	0.00	-0.61	0.00	60.15
		86	0.00	-1.98	0.00	0.61	0.00	-51.25
86	60	86	0.00	1.98	0.00	-0.61	0.00	51.25
		87	0.00	-1.98	0.00	0.61	0.00	-42.34
87	60	87	0.00	1.98	0.00	-0.61	0.00	42.34
		88	0.00	-1.98	0.00	0.61	0.00	-33.43
88	60	88	0.00	1.98	0.00	-0.69	0.00	33.43
		89	0.00	-1.98	0.00	0.69	0.00	-24.52
89	60	89	0.00	1.98	0.00	-0.63	0.00	24.53
		90	0.00	-1.98	0.00	0.63	0.00	-15.62
90	60	90	0.00	1.98	0.00	-0.67	0.00	15.62
		91	0.00	-1.98	0.00	0.67	0.00	-6.71
91	60	91	0.00	1.98	0.00	-0.67	0.00	6.71
		92	0.00	-1.98	0.00	0.67	0.00	2.20
92	60	92	0.00	1.98	0.00	-0.66	0.00	-2.20
		93	0.00	-1.98	0.00	0.66	0.00	11.11
93	60	93	0.00	1.98	0.00	-0.67	0.00	-11.11
		94	0.00	-1.98	0.00	0.67	0.00	18.43
94	60	94	0.00	1.98	0.00	-0.80	0.00	-18.42
		95	0.00	-1.98	0.00	0.80	0.00	20.01
95	60	95	0.00	-0.52	0.00	0.39	0.00	-19.97
		96	0.00	0.52	0.00	-0.39	0.00	19.55
96	60	96	0.00	-0.52	0.00	0.25	0.00	-19.56
		97	0.00	0.52	0.00	-0.25	0.00	17.63
97	60	97	0.00	-0.52	0.00	0.28	0.00	-17.63
		98	0.00	0.52	0.00	-0.28	0.00	15.08
98	60	98	0.00	-0.52	0.00	0.31	0.00	-15.08
		99	0.00	0.52	0.00	-0.31	0.00	12.53
99	60	99	0.00	-0.52	0.00	0.29	0.00	-12.53
		100	0.00	0.52	0.00	-0.29	0.00	9.98
100	60	100	0.00	-0.52	0.00	0.30	0.00	-9.98
		101	0.00	0.52	0.00	-0.30	0.00	7.43
101	60	101	0.00	-0.52	0.00	0.31	0.00	-7.43
		102	0.00	0.52	0.00	-0.31	0.00	4.88

IEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	60	102	0.00	-0.52	0.00	0.32	0.00	-4.88
		103	0.00	0.52	0.00	-0.32	0.00	2.33
103	60	103	0.00	-0.52	0.00	0.31	0.00	-2.33
		104	0.00	0.52	0.00	-0.31	0.00	0.40
104	60	104	0.00	-0.52	0.00	0.32	0.00	-0.40
		105	0.00	0.52	0.00	-0.32	0.00	-0.02

********** END OF LATEST ANALYSIS RESULT **********

135. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	60	0.00	-1.87	0.00	-0.02	0.00	0.00
11	60	0.00	8.75	0.00	0.59	0.00	0.00
23	60	0.00	-30.61	0.00	-3.29	0.00	0.00
35	60	0.00	70.71	0.00	7.66	0.00	0.00
47	60	0.00	-92.16	0.00	-3.75	0.00	0.00
59	60	0.00	70.68	0.00	-6.84	0.00	0.00
71	60	0.00	-30.57	0.00	7.33	0.00	0.00
83	60	0.00	8.83	0.00	-2.49	0.00	0.00
95	60	0.00	-2.50	0.00	0.91	0.00	0.00
105	60	0.00	0.52	0.00	-0.32	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

136. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 2:15: 9 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

DESCENSO DE PILA P-9 / 1,25m

(LOADG1)

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     2:15:21                    *
*                                                *
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 61 DESCENSO DE 1.25 CM DE PILA P-9
131. SUPPORT DISPLACEMENT
132. 105 FY -0.0125
133. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
 ORIGINAL/FINAL BAND-WIDTH =    1/    1
 TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
 SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =   12.27 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              2:15:24
++ PROCESSING GLOBAL STIFFNESS MATRIX.               2:15:24
++ PROCESSING TRIANGULAR FACTORIZATION.              2:15:24
++ CALCULATING JOINT DISPLACEMENTS.                  2:15:25
++ CALCULATING MEMBER  FORCES.                       2:15:25

134. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	61	1	0.00	0.00	0.00	0.00	0.00	0.00
		2	0.00	0.00	0.00	0.00	0.00	0.00
2	61	2	0.00	0.00	0.00	0.00	0.00	0.00
		3	0.00	0.00	0.00	0.00	0.00	0.01
3	61	3	0.00	0.00	0.00	0.00	0.00	-0.01
		4	0.00	0.00	0.00	0.00	0.00	0.02
4	61	4	0.00	0.00	0.00	0.00	0.00	-0.02
		5	0.00	0.00	0.00	0.00	0.00	0.04
5	61	5	0.00	0.00	0.00	0.00	0.00	-0.04
		6	0.00	0.00	0.00	0.00	0.00	0.05
6	61	6	0.00	0.00	0.00	0.00	0.00	-0.05
		7	0.00	0.00	0.00	0.00	0.00	0.06
7	61	7	0.00	0.00	0.00	0.00	0.00	-0.06
		8	0.00	0.00	0.00	0.00	0.00	0.08
8	61	8	0.00	0.00	0.00	0.00	0.00	-0.08
		9	0.00	0.00	0.00	0.00	0.00	0.09
9	61	9	0.00	0.00	0.00	0.00	0.00	-0.09
		10	0.00	0.00	0.00	0.00	0.00	0.10
10	61	10	0.00	0.00	0.00	0.00	0.00	-0.10
		11	0.00	0.00	0.00	0.00	0.00	0.10
11	61	11	0.00	-0.01	0.00	0.00	0.00	-0.10
		12	0.00	0.01	0.00	0.00	0.00	0.09
12	61	12	0.00	-0.01	0.00	0.00	0.00	-0.09
		13	0.00	0.01	0.00	0.00	0.00	0.06
13	61	13	0.00	-0.01	0.00	0.00	0.00	-0.06
		14	0.00	0.01	0.00	0.00	0.00	0.01
14	61	14	0.00	-0.01	0.00	0.00	0.00	-0.01
		15	0.00	0.01	0.00	0.00	0.00	-0.03
15	61	15	0.00	-0.01	0.00	0.00	0.00	0.03
		16	0.00	0.01	0.00	0.00	0.00	-0.08
16	61	16	0.00	-0.01	0.00	0.00	0.00	0.08
		17	0.00	0.01	0.00	0.00	0.00	-0.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	61	17	0.00	-0.01	0.00	0.00	0.00	0.12
		18	0.00	0.01	0.00	0.00	0.00	-0.16
18	61	18	0.00	-0.01	0.00	0.00	0.00	0.16
		19	0.00	0.01	0.00	0.00	0.00	-0.21
19	61	19	0.00	-0.01	0.00	0.00	0.00	0.21
		20	0.00	0.01	0.00	0.00	0.00	-0.25
20	61	20	0.00	-0.01	0.00	0.00	0.00	0.25
		21	0.00	0.01	0.00	0.00	0.00	-0.30
21	61	21	0.00	-0.01	0.00	0.00	0.00	0.30
		22	0.00	0.01	0.00	0.00	0.00	-0.33
22	61	22	0.00	-0.01	0.00	0.00	0.00	0.33
		23	0.00	0.01	0.00	0.00	0.00	-0.34
23	61	23	0.00	0.03	0.00	0.01	0.00	0.34
		24	0.00	-0.03	0.00	-0.01	0.00	-0.31
24	61	24	0.00	0.03	0.00	0.00	0.00	0.31
		25	0.00	-0.03	0.00	0.00	0.00	-0.19
25	61	25	0.00	0.03	0.00	0.00	0.00	0.19
		26	0.00	-0.03	0.00	0.00	0.00	-0.04
26	61	26	0.00	0.03	0.00	0.00	0.00	0.04
		27	0.00	-0.03	0.00	0.00	0.00	0.11
27	61	27	0.00	0.03	0.00	0.00	0.00	-0.11
		28	0.00	-0.03	0.00	0.00	0.00	0.27
28	61	28	0.00	0.03	0.00	0.00	0.00	-0.27
		29	0.00	-0.03	0.00	0.00	0.00	0.42
29	61	29	0.00	0.03	0.00	0.00	0.00	-0.42
		30	0.00	-0.03	0.00	0.00	0.00	0.57
30	61	30	0.00	0.03	0.00	0.00	0.00	-0.57
		31	0.00	-0.03	0.00	0.00	0.00	0.72
31	61	31	0.00	0.03	0.00	0.01	0.00	-0.72
		32	0.00	-0.03	0.00	-0.01	0.00	0.87
32	61	32	0.00	0.03	0.00	0.01	0.00	-0.87
		33	0.00	-0.03	0.00	-0.01	0.00	1.02
33	61	33	0.00	0.03	0.00	0.00	0.00	-1.02
		34	0.00	-0.03	0.00	0.00	0.00	1.15

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	61	34	0.00	0.03	0.00	0.02	0.00	-1.15
		35	0.00	-0.03	0.00	-0.02	0.00	1.18
35	61	35	0.00	-0.12	0.00	-0.02	0.00	-1.18
		36	0.00	0.12	0.00	0.02	0.00	1.08
36	61	36	0.00	-0.12	0.00	-0.02	0.00	-1.08
		37	0.00	0.12	0.00	0.02	0.00	0.65
37	61	37	0.00	-0.12	0.00	-0.02	0.00	-0.65
		38	0.00	0.12	0.00	0.02	0.00	0.13
38	61	38	0.00	-0.12	0.00	-0.02	0.00	-0.13
		39	0.00	0.12	0.00	0.02	0.00	-0.40
39	61	39	0.00	-0.12	0.00	-0.02	0.00	0.40
		40	0.00	0.12	0.00	0.02	0.00	-0.92
40	61	40	0.00	-0.12	0.00	-0.02	0.00	0.92
		41	0.00	0.12	0.00	0.02	0.00	-1.45
41	61	41	0.00	-0.12	0.00	-0.02	0.00	1.45
		42	0.00	0.12	0.00	0.02	0.00	-1.97
42	61	42	0.00	-0.12	0.00	-0.02	0.00	1.97
		43	0.00	0.12	0.00	0.02	0.00	-2.50
43	61	43	0.00	-0.12	0.00	-0.02	0.00	2.50
		44	0.00	0.12	0.00	0.02	0.00	-3.02
44	61	44	0.00	-0.12	0.00	-0.02	0.00	3.02
		45	0.00	0.12	0.00	0.02	0.00	-3.55
45	61	45	0.00	-0.12	0.00	-0.03	0.00	3.55
		46	0.00	0.12	0.00	0.03	0.00	-3.98
46	61	46	0.00	-0.12	0.00	-0.04	0.00	3.98
		47	0.00	0.12	0.00	0.04	0.00	-4.07
47	61	47	0.00	0.40	0.00	0.06	0.00	4.08
		48	0.00	-0.40	0.00	-0.06	0.00	-3.75
48	61	48	0.00	0.40	0.00	0.08	0.00	3.75
		49	0.00	-0.40	0.00	-0.08	0.00	-2.26
49	61	49	0.00	0.40	0.00	0.08	0.00	2.26
		50	0.00	-0.40	0.00	-0.08	0.00	-0.44
50	61	50	0.00	0.40	0.00	0.08	0.00	0.44
		51	0.00	-0.40	0.00	-0.08	0.00	1.38

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	61	51	0.00	0.40	0.00	0.08	0.00	-1.38
		52	0.00	-0.40	0.00	-0.08	0.00	3.19
52	61	52	0.00	0.40	0.00	0.08	0.00	-3.19
		53	0.00	-0.40	0.00	-0.08	0.00	5.01
53	61	53	0.00	0.40	0.00	0.08	0.00	-5.01
		54	0.00	-0.40	0.00	-0.08	0.00	6.83
54	61	54	0.00	0.40	0.00	0.08	0.00	-6.83
		55	0.00	-0.40	0.00	-0.08	0.00	8.65
55	61	55	0.00	0.40	0.00	0.10	0.00	-8.65
		56	0.00	-0.40	0.00	-0.10	0.00	10.46
56	61	56	0.00	0.40	0.00	0.10	0.00	-10.46
		57	0.00	-0.40	0.00	-0.10	0.00	12.28
57	61	57	0.00	0.40	0.00	0.07	0.00	-12.28
		58	0.00	-0.40	0.00	-0.07	0.00	13.78
58	61	58	0.00	0.40	0.00	0.24	0.00	-13.78
		59	0.00	-0.40	0.00	-0.24	0.00	14.10
59	61	59	0.00	-1.40	0.00	-0.36	0.00	-14.11
		60	0.00	1.40	0.00	0.36	0.00	12.99
60	61	60	0.00	-1.40	0.00	-0.34	0.00	-12.99
		61	0.00	1.40	0.00	0.34	0.00	7.82
61	61	61	0.00	-1.40	0.00	-0.33	0.00	-7.82
		62	0.00	1.40	0.00	0.33	0.00	1.52
62	61	62	0.00	-1.40	0.00	-0.33	0.00	-1.52
		63	0.00	1.40	0.00	0.33	0.00	-4.77
63	61	63	0.00	-1.40	0.00	-0.35	0.00	4.77
		64	0.00	1.40	0.00	0.35	0.00	-11.06
64	61	64	0.00	-1.40	0.00	-0.33	0.00	11.06
		65	0.00	1.40	0.00	0.33	0.00	-17.36
65	61	65	0.00	-1.40	0.00	-0.36	0.00	17.36
		66	0.00	1.40	0.00	0.36	0.00	-23.65
66	61	66	0.00	-1.40	0.00	-0.31	0.00	23.65
		67	0.00	1.40	0.00	0.31	0.00	-29.94
67	61	67	0.00	-1.40	0.00	-0.44	0.00	29.94
		68	0.00	1.40	0.00	0.44	0.00	-36.24

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	61	68	0.00	-1.40	0.00	-0.36	0.00	36.24
		69	0.00	1.40	0.00	0.36	0.00	-42.53
69	61	69	0.00	-1.40	0.00	-0.42	0.00	42.53
		70	0.00	1.40	0.00	0.42	0.00	-47.70
70	61	70	0.00	-1.40	0.00	-0.67	0.00	47.70
		71	0.00	1.40	0.00	0.67	0.00	-48.82
71	61	71	0.00	4.84	0.00	1.78	0.00	48.87
		72	0.00	-4.84	0.00	-1.78	0.00	-45.00
72	61	72	0.00	4.84	0.00	1.31	0.00	45.01
		73	0.00	-4.84	0.00	-1.31	0.00	-27.09
73	61	73	0.00	4.84	0.00	1.36	0.00	27.09
		74	0.00	-4.84	0.00	-1.36	0.00	-5.29
74	61	74	0.00	4.84	0.00	1.36	0.00	5.29
		75	0.00	-4.84	0.00	-1.36	0.00	16.51
75	61	75	0.00	4.84	0.00	1.40	0.00	-16.51
		76	0.00	-4.84	0.00	-1.40	0.00	38.31
76	61	76	0.00	4.84	0.00	1.39	0.00	-38.31
		77	0.00	-4.84	0.00	-1.39	0.00	60.11
77	61	77	0.00	4.84	0.00	1.40	0.00	-60.11
		78	0.00	-4.84	0.00	-1.40	0.00	81.90
78	61	78	0.00	4.84	0.00	1.39	0.00	-81.90
		79	0.00	-4.84	0.00	-1.39	0.00	103.70
79	61	79	0.00	4.84	0.00	1.63	0.00	-103.70
		80	0.00	-4.84	0.00	-1.63	0.00	125.50
80	61	80	0.00	4.84	0.00	1.65	0.00	-125.50
		81	0.00	-4.84	0.00	-1.65	0.00	147.30
81	61	81	0.00	4.84	0.00	1.63	0.00	-147.30
		82	0.00	-4.84	0.00	-1.63	0.00	165.22
82	61	82	0.00	4.84	0.00	1.62	0.00	-165.22
		83	0.00	-4.84	0.00	-1.62	0.00	169.09
83	61	83	0.00	-16.78	0.00	-5.70	0.00	-169.37
		84	0.00	16.78	0.00	5.70	0.00	155.93
84	61	84	0.00	-16.78	0.00	-5.69	0.00	-155.93
		85	0.00	16.78	0.00	5.69	0.00	93.85

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	61	85	0.00	-16.78	0.00	-5.47	0.00	-93.86
		86	0.00	16.78	0.00	5.47	0.00	18.36
86	61	86	0.00	-16.78	0.00	-5.47	0.00	-18.36
		87	0.00	16.78	0.00	5.47	0.00	-57.17
87	61	87	0.00	-16.78	0.00	-5.47	0.00	57.17
		88	0.00	16.78	0.00	5.47	0.00	-132.68
88	61	88	0.00	-16.78	0.00	-5.75	0.00	132.66
		89	0.00	16.78	0.00	5.75	0.00	-208.18
89	61	89	0.00	-16.78	0.00	-5.31	0.00	208.19
		90	0.00	16.78	0.00	5.31	0.00	-283.71
90	61	90	0.00	-16.78	0.00	-5.91	0.00	283.70
		91	0.00	16.78	0.00	5.91	0.00	-359.21
91	61	91	0.00	-16.78	0.00	-5.92	0.00	359.21
		92	0.00	16.78	0.00	5.92	0.00	-434.71
92	61	92	0.00	-16.78	0.00	-6.91	0.00	434.70
		93	0.00	16.78	0.00	6.91	0.00	-510.22
93	61	93	0.00	-16.78	0.00	-6.34	0.00	510.23
		94	0.00	16.78	0.00	6.34	0.00	-572.32
94	61	94	0.00	-16.79	0.00	-2.56	0.00	572.34
		95	0.00	16.79	0.00	2.56	0.00	-585.77
95	61	95	0.00	15.27	0.00	-11.57	0.00	585.63
		96	0.00	-15.27	0.00	11.57	0.00	-573.41
96	61	96	0.00	15.27	0.00	-7.40	0.00	573.48
		97	0.00	-15.27	0.00	7.40	0.00	-516.98
97	61	97	0.00	15.27	0.00	-8.20	0.00	516.96
		98	0.00	-15.27	0.00	8.20	0.00	-442.14
98	61	98	0.00	15.27	0.00	-9.13	0.00	442.12
		99	0.00	-15.27	0.00	9.13	0.00	-367.29
99	61	99	0.00	15.27	0.00	-8.36	0.00	367.30
		100	0.00	-15.27	0.00	8.36	0.00	-292.50
100	61	100	0.00	15.27	0.00	-8.92	0.00	292.48
		101	0.00	-15.27	0.00	8.92	0.00	-217.65
101	61	101	0.00	15.27	0.00	-8.96	0.00	217.65
		102	0.00	-15.27	0.00	8.96	0.00	-142.83

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	61	102	0.00	15.27	0.00	-9.26	0.00	142.82
		103	0.00	-15.27	0.00	9.26	0.00	-67.97
103	61	103	0.00	15.29	0.00	-9.22	0.00	67.99
		104	0.00	-15.29	0.00	9.22	0.00	-11.48
104	61	104	0.00	15.63	0.00	-9.26	0.00	10.71
		105	0.00	-15.63	0.00	9.26	0.00	0.71

********** END OF LATEST ANALYSIS RESULT **********

135. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	61	0.00	0.00	0.00	0.00	0.00	0.00
11	61	0.00	-0.01	0.00	0.00	0.00	0.00
23	61	0.00	0.04	0.00	0.00	0.00	0.00
35	61	0.00	-0.15	0.00	-0.02	0.00	0.00
47	61	0.00	0.52	0.00	0.11	0.00	0.00
59	61	0.00	-1.80	0.00	-0.44	0.00	0.00
71	61	0.00	6.24	0.00	1.82	0.00	0.00
83	61	0.00	-21.62	0.00	-7.32	0.00	0.00
95	61	0.00	32.05	0.00	-0.88	0.00	0.00
105	61	0.00	-15.63	0.00	9.28	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

136. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 2:15:28 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 10,1

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     2:48:22                    *
*                                                *
**************************************************

 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.499966203465l 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 101 M MINIMO EN VANO 5
131. MEMBER LOAD
132. 59 TO 65 UNI GY -12
133. 66 UNI GY -12 0 3
134. 66 UNI GY -10 3 4.5
135. 67 TO 70 UNI GY -10
136. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
 ORIGINAL/FINAL BAND-WIDTH =     1/    1
 TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
 SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES


**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      66


++ PROCESSING ELEMENT STIFFNESS MATRIX.                 2:48:25
++ PROCESSING GLOBAL STIFFNESS MATRIX.                  2:48:25
++ PROCESSING TRIANGULAR FACTORIZATION.                 2:48:26
++ CALCULATING JOINT DISPLACEMENTS.                     2:48:26
++ CALCULATING MEMBER  FORCES.                          2:48:26

 137. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	101	1	0.00	-0.25	0.00	0.00	0.00	0.00
		2	0.00	0.25	0.00	0.00	0.00	-0.20
2	101	2	0.00	-0.25	0.00	0.00	0.00	0.20
		3	0.00	0.25	0.00	0.00	0.00	-1.12
3	101	3	0.00	-0.25	0.00	0.00	0.00	1.12
		4	0.00	0.25	0.00	0.00	0.00	-2.31
4	101	4	0.00	-0.25	0.00	0.00	0.00	2.31
		5	0.00	0.25	0.00	0.00	0.00	-3.49
5	101	5	0.00	-0.25	0.00	-0.01	0.00	3.49
		6	0.00	0.25	0.00	0.01	0.00	-4.67
6	101	6	0.00	-0.25	0.00	-0.01	0.00	4.67
		7	0.00	0.25	0.00	0.01	0.00	-5.86
7	101	7	0.00	-0.25	0.00	-0.02	0.00	5.86
		8	0.00	0.25	0.00	0.02	0.00	-7.04
8	101	8	0.00	-0.25	0.00	-0.02	0.00	7.04
		9	0.00	0.25	0.00	0.02	0.00	-8.22
9	101	9	0.00	-0.25	0.00	-0.01	0.00	8.22
		10	0.00	0.25	0.00	0.01	0.00	-9.15
10	101	10	0.00	-0.25	0.00	-0.09	0.00	9.15
		11	0.00	0.25	0.00	0.09	0.00	-9.35
11	101	11	0.00	0.92	0.00	0.10	0.00	9.35
		12	0.00	-0.92	0.00	-0.10	0.00	-8.61
12	101	12	0.00	0.92	0.00	0.05	0.00	8.61
		13	0.00	-0.92	0.00	-0.05	0.00	-5.22
13	101	13	0.00	0.92	0.00	0.04	0.00	5.22
		14	0.00	-0.92	0.00	-0.04	0.00	-1.09
14	101	14	0.00	0.92	0.00	0.05	0.00	1.09
		15	0.00	-0.92	0.00	-0.05	0.00	3.03
15	101	15	0.00	0.92	0.00	0.05	0.00	-3.03
		16	0.00	-0.92	0.00	-0.05	0.00	7.16
16	101	16	0.00	0.92	0.00	0.07	0.00	-7.16
		17	0.00	-0.92	0.00	-0.07	0.00	11.28

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	101	17	0.00	0.92	0.00	0.05	0.00	-11.28
		18	0.00	-0.92	0.00	-0.05	0.00	15.41
18	101	18	0.00	0.92	0.00	0.08	0.00	-15.41
		19	0.00	-0.92	0.00	-0.08	0.00	19.54
19	101	19	0.00	0.92	0.00	0.08	0.00	-19.54
		20	0.00	-0.92	0.00	-0.08	0.00	23.66
20	101	20	0.00	0.92	0.00	0.08	0.00	-23.66
		21	0.00	-0.92	0.00	-0.08	0.00	27.79
21	101	21	0.00	0.92	0.00	0.13	0.00	-27.79
		22	0.00	-0.92	0.00	-0.13	0.00	31.18
22	101	22	0.00	0.92	0.00	0.20	0.00	-31.18
		23	0.00	-0.92	0.00	-0.20	0.00	31.91
23	101	23	0.00	-3.16	0.00	-0.65	0.00	-31.91
		24	0.00	3.16	0.00	0.65	0.00	29.39
24	101	24	0.00	-3.16	0.00	-0.33	0.00	-29.39
		25	0.00	3.16	0.00	0.33	0.00	17.69
25	101	25	0.00	-3.16	0.00	-0.33	0.00	-17.69
		26	0.00	3.16	0.00	0.33	0.00	3.47
26	101	26	0.00	-3.16	0.00	-0.32	0.00	-3.47
		27	0.00	3.16	0.00	0.32	0.00	-10.76
27	101	27	0.00	-3.16	0.00	-0.30	0.00	10.76
		28	0.00	3.16	0.00	0.30	0.00	-24.99
28	101	28	0.00	-3.16	0.00	-0.35	0.00	24.98
		29	0.00	3.16	0.00	0.35	0.00	-39.21
29	101	29	0.00	-3.16	0.00	-0.36	0.00	39.21
		30	0.00	3.16	0.00	0.36	0.00	-53.44
30	101	30	0.00	-3.16	0.00	-0.36	0.00	53.44
		31	0.00	3.16	0.00	0.36	0.00	-67.66
31	101	31	0.00	-3.16	0.00	-0.50	0.00	67.66
		32	0.00	3.16	0.00	0.50	0.00	-81.89
32	101	32	0.00	-3.16	0.00	-0.50	0.00	81.89
		33	0.00	3.16	0.00	0.50	0.00	-96.12
33	101	33	0.00	-3.16	0.00	-0.31	0.00	96.12
		34	0.00	3.16	0.00	0.31	0.00	-107.82

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	101	34	0.00	-3.16	0.00	-1.52	0.00	107.81
		35	0.00	3.16	0.00	1.52	0.00	-110.33
35	101	35	0.00	10.94	0.00	1.94	0.00	110.37
		36	0.00	-10.94	0.00	-1.94	0.00	-101.63
36	101	36	0.00	10.94	0.00	1.62	0.00	101.64
		37	0.00	-10.94	0.00	-1.62	0.00	-61.15
37	101	37	0.00	10.94	0.00	1.64	0.00	61.15
		38	0.00	-10.94	0.00	-1.64	0.00	-11.92
38	101	38	0.00	10.94	0.00	1.62	0.00	11.92
		39	0.00	-10.94	0.00	-1.62	0.00	37.32
39	101	39	0.00	10.94	0.00	1.61	0.00	-37.32
		40	0.00	-10.94	0.00	-1.61	0.00	86.55
40	101	40	0.00	10.94	0.00	1.83	0.00	-86.54
		41	0.00	-10.94	0.00	-1.83	0.00	135.78
41	101	41	0.00	10.94	0.00	1.51	0.00	-135.78
		42	0.00	-10.94	0.00	-1.51	0.00	185.01
42	101	42	0.00	10.94	0.00	1.90	0.00	-185.01
		43	0.00	-10.94	0.00	-1.90	0.00	234.25
43	101	43	0.00	10.94	0.00	1.91	0.00	-234.25
		44	0.00	-10.94	0.00	-1.91	0.00	283.48
44	101	44	0.00	10.94	0.00	1.91	0.00	-283.48
		45	0.00	-10.94	0.00	-1.91	0.00	332.72
45	101	45	0.00	10.94	0.00	2.48	0.00	-332.71
		46	0.00	-10.94	0.00	-2.48	0.00	373.19
46	101	46	0.00	10.95	0.00	3.65	0.00	-373.18
		47	0.00	-10.95	0.00	-3.65	0.00	381.94
47	101	47	0.00	-37.88	0.00	-5.94	0.00	-382.19
		48	0.00	37.88	0.00	5.94	0.00	351.92
48	101	48	0.00	-37.88	0.00	-7.41	0.00	-351.89
		49	0.00	37.88	0.00	7.41	0.00	211.70
49	101	49	0.00	-37.88	0.00	-7.28	0.00	-211.71
		50	0.00	37.88	0.00	7.28	0.00	41.28
50	101	50	0.00	-37.88	0.00	-7.29	0.00	-41.28
		51	0.00	37.88	0.00	7.29	0.00	-129.18

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	101	51	0.00	-37.88	0.00	-7.56	0.00	129.17
		52	0.00	37.88	0.00	7.56	0.00	-299.64
52	101	52	0.00	-37.88	0.00	-7.61	0.00	299.64
		53	0.00	37.88	0.00	7.61	0.00	-470.11
53	101	53	0.00	-37.88	0.00	-7.61	0.00	470.11
		54	0.00	37.88	0.00	7.61	0.00	-640.55
54	101	54	0.00	-37.88	0.00	-7.50	0.00	640.55
		55	0.00	37.88	0.00	7.50	0.00	-811.02
55	101	55	0.00	-37.88	0.00	-9.36	0.00	811.00
		56	0.00	37.88	0.00	9.36	0.00	-981.44
56	101	56	0.00	-37.88	0.00	-9.36	0.00	981.44
		57	0.00	37.88	0.00	9.36	0.00	-1151.93
57	101	57	0.00	-37.88	0.00	-6.85	0.00	1151.94
		58	0.00	37.88	0.00	6.85	0.00	-1292.10
58	101	58	0.00	-37.88	0.00	-22.72	0.00	1291.92
		59	0.00	37.88	0.00	22.72	0.00	-1322.21
59	101	59	0.00	265.86	0.00	13.53	0.00	1322.94
		60	0.00	-256.26	0.00	-13.53	0.00	-1114.02
60	101	60	0.00	256.27	0.00	12.15	0.00	1114.03
		61	0.00	-211.86	0.00	-12.15	0.00	-247.91
61	101	61	0.00	211.86	0.00	11.72	0.00	247.93
		62	0.00	-157.87	0.00	-11.72	0.00	583.94
62	101	62	0.00	157.87	0.00	10.59	0.00	-583.97
		63	0.00	-103.87	0.00	-10.59	0.00	1172.82
63	101	63	0.00	103.87	0.00	15.55	0.00	-1172.77
		64	0.00	-49.87	0.00	-15.55	0.00	1518.68
64	101	64	0.00	49.87	0.00	12.34	0.00	-1518.71
		65	0.00	4.13	0.00	-12.34	0.00	1621.62
65	101	65	0.00	-4.13	0.00	15.77	0.00	-1621.60
		66	0.00	58.13	0.00	-15.77	0.00	1481.48
66	101	66	0.00	-58.13	0.00	12.63	0.00	-1481.52
		67	0.00	109.13	0.00	-12.63	0.00	1100.70
67	101	67	0.00	-109.13	0.00	17.48	0.00	-1100.62
		68	0.00	154.13	0.00	-17.48	0.00	508.21

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	101	68	0.00	-154.14	0.00	16.32	0.00	-508.24
		69	0.00	199.13	0.00	-16.32	0.00	-286.45
69	101	69	0.00	-199.13	0.00	15.94	0.00	286.48
		70	0.00	236.13	0.00	-15.94	0.00	-1091.69
70	101	70	0.00	-236.13	0.00	10.17	0.00	1091.77
		71	0.00	244.14	0.00	-10.17	0.00	-1283.99
71	101	71	0.00	36.77	0.00	2.19	0.00	1283.16
		72	0.00	-36.77	0.00	-2.19	0.00	-1253.77
72	101	72	0.00	36.76	0.00	-10.80	0.00	1253.73
		73	0.00	-36.76	0.00	10.80	0.00	-1117.71
73	101	73	0.00	36.76	0.00	-8.74	0.00	1117.73
		74	0.00	-36.76	0.00	8.74	0.00	-952.30
74	101	74	0.00	36.76	0.00	-8.74	0.00	952.30
		75	0.00	-36.76	0.00	8.74	0.00	-786.90
75	101	75	0.00	36.76	0.00	-10.54	0.00	786.88
		76	0.00	-36.76	0.00	10.54	0.00	-621.44
76	101	76	0.00	36.76	0.00	-10.43	0.00	621.44
		77	0.00	-36.76	0.00	10.43	0.00	-456.03
77	101	77	0.00	36.76	0.00	-10.52	0.00	456.03
		78	0.00	-36.76	0.00	10.52	0.00	-290.62
78	101	78	0.00	36.76	0.00	-10.46	0.00	290.62
		79	0.00	-36.76	0.00	10.46	0.00	-125.22
79	101	79	0.00	36.76	0.00	-10.75	0.00	125.19
		80	0.00	-36.76	0.00	10.75	0.00	40.23
80	101	80	0.00	36.76	0.00	-10.74	0.00	-40.24
		81	0.00	-36.76	0.00	10.74	0.00	205.66
81	101	81	0.00	36.76	0.00	-10.78	0.00	-205.65
		82	0.00	-36.76	0.00	10.78	0.00	341.65
82	101	82	0.00	36.76	0.00	-10.79	0.00	-341.65
		83	0.00	-36.76	0.00	10.79	0.00	371.04
83	101	83	0.00	-10.62	0.00	2.53	0.00	-370.54
		84	0.00	10.62	0.00	-2.53	0.00	362.04
84	101	84	0.00	-10.62	0.00	2.56	0.00	-362.03
		85	0.00	10.62	0.00	-2.56	0.00	322.75

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	101	85	0.00	-10.62	0.00	3.30	0.00	-322.74
		86	0.00	10.62	0.00	-3.30	0.00	274.95
86	101	86	0.00	-10.62	0.00	3.29	0.00	-274.95
		87	0.00	10.62	0.00	-3.29	0.00	227.16
87	101	87	0.00	-10.62	0.00	3.30	0.00	-227.16
		88	0.00	10.62	0.00	-3.30	0.00	179.37
88	101	88	0.00	-10.62	0.00	3.68	0.00	-179.37
		89	0.00	10.62	0.00	-3.68	0.00	131.58
89	101	89	0.00	-10.62	0.00	3.40	0.00	-131.58
		90	0.00	10.62	0.00	-3.40	0.00	83.79
90	101	90	0.00	-10.62	0.00	3.57	0.00	-83.78
		91	0.00	10.62	0.00	-3.57	0.00	35.99
91	101	91	0.00	-10.62	0.00	3.57	0.00	-35.99
		92	0.00	10.62	0.00	-3.57	0.00	-11.78
92	101	92	0.00	-10.62	0.00	3.55	0.00	11.79
		93	0.00	10.62	0.00	-3.55	0.00	-59.59
93	101	93	0.00	-10.62	0.00	3.61	0.00	59.58
		94	0.00	10.62	0.00	-3.61	0.00	-98.88
94	101	94	0.00	-10.62	0.00	4.27	0.00	98.85
		95	0.00	10.62	0.00	-4.27	0.00	-107.35
95	101	95	0.00	2.79	0.00	-2.12	0.00	107.14
		96	0.00	-2.79	0.00	2.12	0.00	-104.91
96	101	96	0.00	2.79	0.00	-1.35	0.00	104.92
		97	0.00	-2.79	0.00	1.35	0.00	-94.59
97	101	97	0.00	2.79	0.00	-1.50	0.00	94.59
		98	0.00	-2.79	0.00	1.50	0.00	-80.90
98	101	98	0.00	2.79	0.00	-1.67	0.00	80.90
		99	0.00	-2.79	0.00	1.67	0.00	-67.22
99	101	99	0.00	2.79	0.00	-1.53	0.00	67.22
		100	0.00	-2.79	0.00	1.53	0.00	-53.54
100	101	100	0.00	2.79	0.00	-1.63	0.00	53.54
		101	0.00	-2.79	0.00	1.63	0.00	-39.85
101	101	101	0.00	2.79	0.00	-1.64	0.00	39.85
		102	0.00	-2.79	0.00	1.64	0.00	-26.17

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	101	102	0.00	2.79	0.00	-1.69	0.00	26.17
		103	0.00	-2.79	0.00	1.69	0.00	-12.48
103	101	103	0.00	2.79	0.00	-1.69	0.00	12.48
		104	0.00	-2.79	0.00	1.69	0.00	-2.15
104	101	104	0.00	2.79	0.00	-1.69	0.00	2.15
		105	0.00	-2.79	0.00	1.69	0.00	0.08

********** END OF LATEST ANALYSIS RESULT **********

138. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	101	0.00	-0.25	0.00	0.00	0.00	0.00
11	101	0.00	1.17	0.00	0.08	0.00	0.00
23	101	0.00	-4.08	0.00	-0.44	0.00	0.00
35	101	0.00	14.10	0.00	2.15	0.00	0.00
47	101	0.00	-48.83	0.00	-9.99	0.00	0.00
59	101	0.00	303.74	0.00	21.77	0.00	0.00
71	101	0.00	280.90	0.00	-24.49	0.00	0.00
83	101	0.00	-47.38	0.00	13.35	0.00	0.00
95	101	0.00	13.41	0.00	-4.90	0.00	0.00
105	101	0.00	-2.79	0.00	1.69	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

139. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 2:48:29 ****

****

* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 102

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     4:21:45                    *
*                                                *
**************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.499966203465 1 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48.  45 167.987652272271 0 7998.23606482605
 49.  46 171.686818353569 0 7998.15751510331
 50.  47 172.486633245312 0 7998.14030643072
 51.  48 173.286446412189 0 7998.12301777672
 52.  49 176.985559642506 0 7998.04201737388
 53.  50 181.484430040364 0 7997.94119768662
 54.  51 185.983243015416 0 7997.83784740085
 55.  52 190.481997144209 0 7997.73196654926
 56.  53 194.980691003309 0 7997.62355516536
 57.  54 199.479323169302 0 7997.51261328345
 58.  55 203.977892218791 0 7997.39914093863
 59.  56 208.476396728403 0 7997.28313816681
 60.  57 212.974835274781 0 7997.16460500468
 61.  58 216.67350099441 0 7997.06524882515
 62.  59 217.473206434592 0 7997.04354148976
 63.  60 218.272909700042 0 7997.02175418393
 64.  61 221.971508784523 0 7996.91994766034
 65.  62 226.469740901283 0 7996.79382355554
 66.  63 230.967901361604 0 7996.66516921527
 67.  64 235.465988742239 0 7996.53398468022
 68.  65 239.964001619965 0 7996.4002699919
 69.  66 244.461938571584 0 7996.26402519263
 70.  67 248.959798173919 0 7996.12525032551
 71.  68 253.457579003821 0 7995.98394543445
 72.  69 257.955279638162 0 7995.84011056417
 73.  70 261.653327968335 0 7995.71995107152
 74.  71 262.452898653843 0 7995.69374576016
 75.  72 263.252466714822 0 7995.66746049187
 76.  73 266.950434627788 0 7995.54485106875
 77.  74 271.44788613695 0 7995.39342653704
 78.  75 275.945251758306 0 7995.23947221295
 79.  76 280.442530068863 0 7995.08298814519
 80.  77 284.939719645652 0 7994.92397438326
 81.  78 289.436819065736 0 7994.76243097749
 82.  79 293.933826906203 0 7994.59835797898
 83.  80 298.430741744173 0 7994.43175543966
 84.  81 302.927562156794 0 7994.26262341223
 85.  82 306.624876089259 0 7994.12166440837
 86.  83 307.424286721243 0 7994.0909619502
 87.  84 308.223694278984 0 7994.06017955113
 88.  85 311.920914014729 0 7993.9167711079
 89.  86 316.417442614491 0 7993.74005094044
 90.  87 320.913871097799 0 7993.56080150373
 91.  88 325.410198041955 0 7993.3790228545
 92.  89 329.906422024294 0 7993.19471505024
 93.  90 334.402541622181 0 7993.00787814929
 94.  91 338.898555413017 0 7992.81851221076
 95.  92 343.394461974235 0 7992.62661729456
 96.  93 347.890259883301 0 7992.43219346141
 97.  94 351.586722433043 0 7992.27043940636
 98.  95 352.385947717718 0 7992.23524077283
 99.  96 353.185169478534 0 7992.19996221694
100.  97 356.881524055022 0 7992.03575929113
101.  98 361.77657870835 0 7991.81567024028
102.  99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 102 M MINIMO EN VANO 9
131. MEMBER LOAD
132. 88 TO 94 UNI GY -12
133. 87 UNI GY -12 1.5 4.5
134. 83 84 85 86 UNI GY -10
135. 87 UNI GY -10 0 1.5
136. PERFORM ANALYSIS
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                P R O B L E M   S T A T I S T I C S
                -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =     1/    1
   TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


**WARNING** LOAD BEYOND ITS LENGTH. FULL LENGTH ASSUMED. MEMB      87


++ PROCESSING ELEMENT STIFFNESS MATRIX.                 4:21:48
++ PROCESSING GLOBAL STIFFNESS MATRIX.                  4:21:48
++ PROCESSING TRIANGULAR FACTORIZATION.                 4:21:48
++ CALCULATING JOINT DISPLACEMENTS.                     4:21:48
++ CALCULATING MEMBER  FORCES.                          4:21:49

 137. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	102	1	0.00	-0.02	0.00	0.00	0.00	0.00
		2	0.00	0.02	0.00	0.00	0.00	-0.02
2	102	2	0.00	-0.02	0.00	0.00	0.00	0.02
		3	0.00	0.02	0.00	0.00	0.00	-0.09
3	102	3	0.00	-0.02	0.00	0.00	0.00	0.09
		4	0.00	0.02	0.00	0.00	0.00	-0.19
4	102	4	0.00	-0.02	0.00	0.00	0.00	0.19
		5	0.00	0.02	0.00	0.00	0.00	-0.28
5	102	5	0.00	-0.02	0.00	0.00	0.00	0.28
		6	0.00	0.02	0.00	0.00	0.00	-0.38
6	102	6	0.00	-0.02	0.00	0.00	0.00	0.38
		7	0.00	0.02	0.00	0.00	0.00	-0.47
7	102	7	0.00	-0.02	0.00	0.00	0.00	0.47
		8	0.00	0.02	0.00	0.00	0.00	-0.57
8	102	8	0.00	-0.02	0.00	0.00	0.00	0.57
		9	0.00	0.02	0.00	0.00	0.00	-0.66
9	102	9	0.00	-0.02	0.00	0.00	0.00	0.66
		10	0.00	0.02	0.00	0.00	0.00	-0.74
10	102	10	0.00	-0.02	0.00	-0.01	0.00	0.74
		11	0.00	0.02	0.00	0.01	0.00	-0.76
11	102	11	0.00	0.07	0.00	0.01	0.00	0.76
		12	0.00	-0.07	0.00	-0.01	0.00	-0.70
12	102	12	0.00	0.07	0.00	0.00	0.00	0.70
		13	0.00	-0.07	0.00	0.00	0.00	-0.42
13	102	13	0.00	0.07	0.00	0.00	0.00	0.42
		14	0.00	-0.07	0.00	0.00	0.00	-0.09
14	102	14	0.00	0.07	0.00	0.00	0.00	0.09
		15	0.00	-0.07	0.00	0.00	0.00	0.25
15	102	15	0.00	0.07	0.00	0.00	0.00	-0.25
		16	0.00	-0.07	0.00	0.00	0.00	0.58
16	102	16	0.00	0.07	0.00	0.01	0.00	-0.58
		17	0.00	-0.07	0.00	-0.01	0.00	0.91

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	102	17	0.00	0.07	0.00	0.00	0.00	-0.91
		18	0.00	-0.07	0.00	0.00	0.00	1.25
18	102	18	0.00	0.07	0.00	0.01	0.00	-1.25
		19	0.00	-0.07	0.00	-0.01	0.00	1.58
19	102	19	0.00	0.07	0.00	0.01	0.00	-1.58
		20	0.00	-0.07	0.00	-0.01	0.00	1.91
20	102	20	0.00	0.07	0.00	0.01	0.00	-1.91
		21	0.00	-0.07	0.00	-0.01	0.00	2.25
21	102	21	0.00	0.07	0.00	0.01	0.00	-2.25
		22	0.00	-0.07	0.00	-0.01	0.00	2.52
22	102	22	0.00	0.07	0.00	0.02	0.00	-2.52
		23	0.00	-0.07	0.00	-0.02	0.00	2.58
23	102	23	0.00	-0.26	0.00	-0.05	0.00	-2.58
		24	0.00	0.26	0.00	0.05	0.00	2.38
24	102	24	0.00	-0.26	0.00	-0.03	0.00	-2.38
		25	0.00	0.26	0.00	0.03	0.00	1.43
25	102	25	0.00	-0.26	0.00	-0.03	0.00	-1.43
		26	0.00	0.26	0.00	0.03	0.00	0.28
26	102	26	0.00	-0.26	0.00	-0.03	0.00	-0.28
		27	0.00	0.26	0.00	0.03	0.00	-0.87
27	102	27	0.00	-0.26	0.00	-0.02	0.00	0.87
		28	0.00	0.26	0.00	0.02	0.00	-2.02
28	102	28	0.00	-0.26	0.00	-0.03	0.00	2.02
		29	0.00	0.26	0.00	0.03	0.00	-3.17
29	102	29	0.00	-0.26	0.00	-0.03	0.00	3.17
		30	0.00	0.26	0.00	0.03	0.00	-4.32
30	102	30	0.00	-0.26	0.00	-0.03	0.00	4.32
		31	0.00	0.26	0.00	0.03	0.00	-5.47
31	102	31	0.00	-0.26	0.00	-0.04	0.00	5.47
		32	0.00	0.26	0.00	0.04	0.00	-6.62
32	102	32	0.00	-0.26	0.00	-0.04	0.00	6.62
		33	0.00	0.26	0.00	0.04	0.00	-7.77
33	102	33	0.00	-0.26	0.00	-0.02	0.00	7.77
		34	0.00	0.26	0.00	0.02	0.00	-8.72

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	102	34	0.00	-0.26	0.00	-0.12	0.00	8.72
		35	0.00	0.26	0.00	0.12	0.00	-8.92
35	102	35	0.00	0.88	0.00	0.16	0.00	8.92
		36	0.00	-0.88	0.00	-0.16	0.00	-8.22
36	102	36	0.00	0.88	0.00	0.13	0.00	8.22
		37	0.00	-0.88	0.00	-0.13	0.00	-4.94
37	102	37	0.00	0.88	0.00	0.13	0.00	4.94
		38	0.00	-0.88	0.00	-0.13	0.00	-0.96
38	102	38	0.00	0.88	0.00	0.13	0.00	0.96
		39	0.00	-0.88	0.00	-0.13	0.00	3.02
39	102	39	0.00	0.88	0.00	0.13	0.00	-3.02
		40	0.00	-0.88	0.00	-0.13	0.00	7.00
40	102	40	0.00	0.88	0.00	0.15	0.00	-7.00
-		41	0.00	-0.88	0.00	-0.15	0.00	10.98
41	102	41	0.00	0.88	0.00	0.12	0.00	-10.98
		42	0.00	-0.88	0.00	-0.12	0.00	14.96
42	102	42	0.00	0.88	0.00	0.15	0.00	-14.96
		43	0.00	-0.88	0.00	-0.15	0.00	18.94
43	102	43	0.00	0.88	0.00	0.15	0.00	-18.94
		44	0.00	-0.88	0.00	-0.15	0.00	22.92
44	102	44	0.00	0.88	0.00	0.15	0.00	-22.92
		45	0.00	-0.88	0.00	-0.15	0.00	26.90
45	102	45	0.00	0.88	0.00	0.20	0.00	-26.90
		46	0.00	-0.88	0.00	-0.20	0.00	30.17
46	102	46	0.00	0.89	0.00	0.30	0.00	-30.17
		47	0.00	-0.89	0.00	-0.30	0.00	30.88
47	102	47	0.00	-3.06	0.00	-0.48	0.00	-30.90
		48	0.00	3.06	0.00	0.48	0.00	28.45
48	102	48	0.00	-3.06	0.00	-0.60	0.00	-28.45
		49	0.00	3.06	0.00	0.60	0.00	17.12
49	102	49	0.00	-3.06	0.00	-0.59	0.00	-17.12
		50	0.00	3.06	0.00	0.59	0.00	3.34
50	102	50	0.00	-3.06	0.00	-0.59	0.00	-3.34
		51	0.00	3.06	0.00	0.59	0.00	-10.44

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	102	51	0.00	-3.06	0.00	-0.61	0.00	10.44
		52	0.00	3.06	0.00	0.61	0.00	-24.22
52	102	52	0.00	-3.06	0.00	-0.62	0.00	24.22
		53	0.00	3.06	0.00	0.62	0.00	-38.01
53	102	53	0.00	-3.06	0.00	-0.62	0.00	38.01
		54	0.00	3.06	0.00	0.62	0.00	-51.78
54	102	54	0.00	-3.06	0.00	-0.61	0.00	51.79
		55	0.00	3.06	0.00	0.61	0.00	-65.57
55	102	55	0.00	-3.06	0.00	-0.76	0.00	65.57
		56	0.00	3.06	0.00	0.76	0.00	-79.34
56	102	56	0.00	-3.06	0.00	-0.76	0.00	79.34
		57	0.00	3.06	0.00	0.76	0.00	-93.13
57	102	57	0.00	-3.06	0.00	-0.55	0.00	93.13
		58	0.00	3.06	0.00	0.55	0.00	-104.46
58	102	58	0.00	-3.07	0.00	-1.84	0.00	104.45
		59	0.00	3.07	0.00	1.84	0.00	-106.89
59	102	59	0.00	10.60	0.00	2.70	0.00	106.99
		60	0.00	-10.60	0.00	-2.70	0.00	-98.51
60	102	60	0.00	10.60	0.00	2.58	0.00	98.51
		61	0.00	-10.60	0.00	-2.58	0.00	-59.27
61	102	61	0.00	10.60	0.00	2.47	0.00	59.28
		62	0.00	-10.60	0.00	-2.47	0.00	-11.56
62	102	62	0.00	10.60	0.00	2.50	0.00	11.55
		63	0.00	-10.60	0.00	-2.50	0.00	36.16
63	102	63	0.00	10.60	0.00	2.65	0.00	-36.15
		64	0.00	-10.60	0.00	-2.65	0.00	83.87
64	102	64	0.00	10.60	0.00	2.47	0.00	-83.88
		65	0.00	-10.60	0.00	-2.47	0.00	131.59
65	102	65	0.00	10.60	0.00	2.75	0.00	-131.59
		66	0.00	-10.60	0.00	-2.75	0.00	179.31
66	102	66	0.00	10.61	0.00	2.37	0.00	-179.31
		67	0.00	-10.61	0.00	-2.37	0.00	227.03
67	102	67	0.00	10.60	0.00	3.37	0.00	-227.02
		68	0.00	-10.60	0.00	-3.37	0.00	274.74

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	102	68	0.00	10.60	0.00	2.74	0.00	-274.75
		69	0.00	-10.60	0.00	-2.74	0.00	322.46
69	102	69	0.00	10.60	0.00	3.18	0.00	-322.46
		70	0.00	-10.60	0.00	-3.18	0.00	361.69
70	102	70	0.00	10.60	0.00	5.09	0.00	-361.67
		71	0.00	-10.60	0.00	-5.09	0.00	370.16
71	102	71	0.00	-36.72	0.00	-13.48	0.00	-370.54
		72	0.00	36.72	0.00	13.48	0.00	341.18
72	102	72	0.00	-36.73	0.00	-9.95	0.00	-341.30
		73	0.00	36.73	0.00	9.95	0.00	205.40
73	102	73	0.00	-36.73	0.00	-10.33	0.00	-205.38
		74	0.00	36.73	0.00	10.33	0.00	40.09
74	102	74	0.00	-36.73	0.00	-10.33	0.00	-40.09
		75	0.00	36.73	0.00	10.33	0.00	-125.17
75	102	75	0.00	-36.73	0.00	-10.61	0.00	125.15
		76	0.00	36.73	0.00	10.61	0.00	-290.45
76	102	76	0.00	-36.73	0.00	-10.56	0.00	290.46
		77	0.00	36.73	0.00	10.56	0.00	-455.73
77	102	77	0.00	-36.73	0.00	-10.64	0.00	455.73
		78	0.00	36.73	0.00	10.64	0.00	-620.99
78	102	78	0.00	-36.73	0.00	-10.53	0.00	621.00
		79	0.00	36.73	0.00	10.53	0.00	-786.27
79	102	79	0.00	-36.73	0.00	-12.34	0.00	786.24
		80	0.00	36.73	0.00	12.34	0.00	-951.52
80	102	80	0.00	-36.73	0.00	-12.50	0.00	951.52
		81	0.00	36.73	0.00	12.50	0.00	-1116.81
81	102	81	0.00	-36.73	0.00	-12.32	0.00	1116.81
		82	0.00	36.73	0.00	12.32	0.00	-1252.69
82	102	82	0.00	-36.69	0.00	-12.28	0.00	1252.70
		83	0.00	36.69	0.00	12.28	0.00	-1282.04
83	102	83	0.00	244.03	0.00	18.29	0.00	1283.21
		84	0.00	-236.03	0.00	-18.29	0.00	-1091.05
84	102	84	0.00	236.04	0.00	18.20	0.00	1091.04
		85	0.00	-199.05	0.00	-18.20	0.00	-286.21

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	102	85	0.00	199.04	0.00	17.54	0.00	286.25
		86	0.00	-154.05	0.00	-17.54	0.00	508.15
86	102	86	0.00	154.05	0.00	17.54	0.00	-508.15
		87	0.00	-109.05	0.00	-17.54	0.00	1100.19
87	102	87	0.00	109.05	0.00	17.55	0.00	-1100.18
		88	0.00	-58.05	0.00	-17.55	0.00	1480.62
88	102	88	0.00	58.05	0.00	20.68	0.00	-1480.57
		89	0.00	-4.05	0.00	-20.68	0.00	1620.30
89	102	89	0.00	4.05	0.00	17.24	0.00	-1620.34
		90	0.00	49.96	0.00	-17.24	0.00	1517.01
90	102	90	0.00	-49.96	0.00	20.46	0.00	-1516.98
		91	0.00	103.96	0.00	-20.46	0.00	1170.67
91	102	91	0.00	-103.96	0.00	20.47	0.00	-1170.66
		92	0.00	157.95	0.00	-20.47	0.00	581.51
92	102	92	0.00	-157.95	0.00	21.80	0.00	-581.46
		93	0.00	211.95	0.00	-21.80	0.00	-250.91
93	102	93	0.00	-211.96	0.00	22.08	0.00	250.88
		94	0.00	256.36	0.00	-22.08	0.00	-1117.37
94	102	94	0.00	-256.37	0.00	29.45	0.00	1117.20
		95	0.00	265.96	0.00	-29.45	0.00	-1325.98
95	102	95	0.00	34.52	0.00	-26.18	0.00	1324.39
		96	0.00	-34.52	0.00	26.18	0.00	-1296.77
96	102	96	0.00	34.52	0.00	-16.74	0.00	1296.92
		97	0.00	-34.52	0.00	16.74	0.00	-1169.19
97	102	97	0.00	34.52	0.00	-18.55	0.00	1169.17
		98	0.00	-34.52	0.00	18.55	0.00	-1000.03
98	102	98	0.00	34.52	0.00	-20.65	0.00	999.99
		99	0.00	-34.52	0.00	20.65	0.00	-830.85
99	102	99	0.00	34.52	0.00	-18.91	0.00	830.89
		100	0.00	-34.52	0.00	18.91	0.00	-661.79
100	102	100	0.00	34.52	0.00	-20.19	0.00	661.74
		101	0.00	-34.52	0.00	20.19	0.00	-492.60
101	102	101	0.00	34.52	0.00	-20.27	0.00	492.60
		102	0.00	-34.52	0.00	20.27	0.00	-323.49

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	102	102	0.00	34.52	0.00	-20.95	0.00	323.44
		103	0.00	-34.52	0.00	20.95	0.00	-154.28
103	102	103	0.00	34.52	0.00	-20.86	0.00	154.29
		104	0.00	-34.52	0.00	20.86	0.00	-26.60
104	102	104	0.00	34.52	0.00	-20.89	0.00	26.58
		105	0.00	-34.52	0.00	20.89	0.00	1.04

********** END OF LATEST ANALYSIS RESULT **********

138. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	102	0.00	-0.02	0.00	0.00	0.00	0.00
11	102	0.00	0.09	0.00	0.01	0.00	0.00
23	102	0.00	-0.33	0.00	-0.04	0.00	0.00
35	102	0.00	1.14	0.00	0.17	0.00	0.00
47	102	0.00	-3.95	0.00	-0.81	0.00	0.00
59	102	0.00	13.67	0.00	3.37	0.00	0.00
71	102	0.00	-47.32	0.00	-13.82	0.00	0.00
83	102	0.00	280.72	0.00	30.53	0.00	0.00
95	102	0.00	300.48	0.00	-37.27	0.00	0.00
105	102	0.00	-34.52	0.00	20.92	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

139. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 4:21:52 ****

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**********************************************************
*  FOR  QUESTIONS REGARDING THIS VERSION OF PROGRAM    *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
**********************************************************
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LOAD 204

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     2:51:40                    *
*                                                *
**************************************************

 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 201
131. MEMBER LOAD
132. 59 TO 64 UNI GY -15
133. 65 UNI GY -15 2 2.5
134. 67 UNI GY -15 .5 4.5
135. 68 TO 73 UNI GY -15
136. 74 UNI GY -15 0 3
137. *UIC
138. 64 CON GY -25 0.0001
139. 64 CON GY -25 1.6
140. 64 CON GY -25 3.2
141. 65 CON GY -25 .3
142. 59 TO 62 UNI GY -8
143. 63 UNI GY -8 0 3.7
144. 65 UNI GY -8 1.1 4.5
145. 66 TO 70 UNI GY -8
146. PERFORM ANALYSIS


      P R O B L E M   S T A T I S T I C S
      -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
  ORIGINAL/FINAL BAND-WIDTH =    1/    1
  TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
  SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              2:51:43
++ PROCESSING GLOBAL STIFFNESS MATRIX.               2:51:43
++ PROCESSING TRIANGULAR FACTORIZATION.              2:51:44
++ CALCULATING JOINT DISPLACEMENTS.                  2:51:44
++ CALCULATING MEMBER  FORCES.                       2:51:44

147. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	201	1	0.00	-0.43	0.00	0.00	0.00	0.00
		2	0.00	0.43	0.00	0.00	0.00	-0.34
2	201	2	0.00	-0.43	0.00	0.00	0.00	0.34
		3	0.00	0.43	0.00	0.00	0.00	-1.92
3	201	3	0.00	-0.43	0.00	-0.01	0.00	1.92
		4	0.00	0.43	0.00	0.01	0.00	-3.95
4	201	4	0.00	-0.43	0.00	0.00	0.00	3.95
		5	0.00	0.43	0.00	0.00	0.00	-5.97
5	201	5	0.00	-0.43	0.00	-0.01	0.00	5.97
		6	0.00	0.43	0.00	0.01	0.00	-8.00
6	201	6	0.00	-0.43	0.00	-0.01	0.00	8.00
		7	0.00	0.43	0.00	0.01	0.00	-10.02
7	201	7	0.00	-0.43	0.00	-0.03	0.00	10.02
		8	0.00	0.43	0.00	0.03	0.00	-12.05
8	201	8	0.00	-0.43	0.00	-0.03	0.00	12.05
		9	0.00	0.43	0.00	0.03	0.00	-14.08
9	201	9	0.00	-0.43	0.00	-0.01	0.00	14.08
		10	0.00	0.43	0.00	0.01	0.00	-15.66
10	201	10	0.00	-0.43	0.00	-0.16	0.00	15.65
		11	0.00	0.43	0.00	0.16	0.00	-16.00
11	201	11	0.00	1.57	0.00	0.17	0.00	16.00
		12	0.00	-1.57	0.00	-0.17	0.00	-14.74
12	201	12	0.00	1.57	0.00	0.09	0.00	14.74
		13	0.00	-1.57	0.00	-0.09	0.00	-8.94
13	201	13	0.00	1.57	0.00	0.08	0.00	8.94
		14	0.00	-1.57	0.00	-0.08	0.00	-1.87
14	201	14	0.00	1.57	0.00	0.08	0.00	1.87
		15	0.00	-1.57	0.00	-0.08	0.00	5.19
15	201	15	0.00	1.57	0.00	0.09	0.00	-5.19
		16	0.00	-1.57	0.00	-0.09	0.00	12.25
16	201	16	0.00	1.57	0.00	0.12	0.00	-12.25
		17	0.00	-1.57	0.00	-0.12	0.00	19.31

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	201	17	0.00	1.57	0.00	0.08	0.00	-19.31
		18	0.00	-1.57	0.00	-0.08	0.00	26.38
18	201	18	0.00	1.57	0.00	0.13	0.00	-26.37
		19	0.00	-1.57	0.00	-0.13	0.00	33.44
19	201	19	0.00	1.57	0.00	0.13	0.00	-33.44
		20	0.00	-1.57	0.00	-0.13	0.00	40.50
20	201	20	0.00	1.57	0.00	0.14	0.00	-40.50
		21	0.00	-1.57	0.00	-0.14	0.00	47.56
21	201	21	0.00	1.57	0.00	0.22	0.00	-47.56
		22	0.00	-1.57	0.00	-0.22	0.00	53.37
22	201	22	0.00	1.57	0.00	0.34	0.00	-53.37
		23	0.00	-1.57	0.00	-0.34	0.00	54.62
23	201	23	0.00	-5.41	0.00	-1.11	0.00	-54.62
		24	0.00	5.41	0.00	1.11	0.00	50.29
24	201	24	0.00	-5.41	0.00	-0.56	0.00	-50.30
		25	0.00	5.41	0.00	0.56	0.00	30.28
25	201	25	0.00	-5.41	0.00	-0.56	0.00	-30.28
		26	0.00	5.41	0.00	0.56	0.00	5.93
26	201	26	0.00	-5.41	0.00	-0.55	0.00	-5.94
		27	0.00	5.41	0.00	0.55	0.00	-18.41
27	201	27	0.00	-5.41	0.00	-0.51	0.00	18.42
		28	0.00	5.41	0.00	0.51	0.00	-42.76
28	201	28	0.00	-5.41	0.00	-0.60	0.00	42.76
		29	0.00	5.41	0.00	0.60	0.00	-67.11
29	201	29	0.00	-5.41	0.00	-0.61	0.00	67.11
		30	0.00	5.41	0.00	0.61	0.00	-91.46
30	201	30	0.00	-5.41	0.00	-0.61	0.00	91.46
		31	0.00	5.41	0.00	0.61	0.00	-115.81
31	201	31	0.00	-5.41	0.00	-0.85	0.00	115.81
		32	0.00	5.41	0.00	0.85	0.00	-140.16
32	201	32	0.00	-5.41	0.00	-0.86	0.00	140.16
		33	0.00	5.41	0.00	0.86	0.00	-164.51
33	201	33	0.00	-5.41	0.00	-0.52	0.00	164.51
		34	0.00	5.41	0.00	0.52	0.00	-184.53

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	201	34	0.00	-5.41	0.00	-2.61	0.00	184.51
		35	0.00	5.41	0.00	2.61	0.00	-188.84
35	201	35	0.00	18.73	0.00	3.32	0.00	188.91
		36	0.00	-18.73	0.00	-3.32	0.00	-173.94
36	201	36	0.00	18.73	0.00	2.77	0.00	173.95
		37	0.00	-18.73	0.00	-2.77	0.00	-104.66
37	201	37	0.00	18.73	0.00	2.81	0.00	104.66
		38	0.00	-18.73	0.00	-2.81	0.00	-20.40
38	201	38	0.00	18.73	0.00	2.77	0.00	20.41
		39	0.00	-18.73	0.00	-2.77	0.00	63.87
39	201	39	0.00	18.73	0.00	2.76	0.00	-63.87
		40	0.00	-18.73	0.00	-2.76	0.00	148.13
40	201	40	0.00	18.73	0.00	3.12	0.00	-148.12
		41	0.00	-18.73	0.00	-3.12	0.00	232.39
41	201	41	0.00	18.73	0.00	2.59	0.00	-232.39
		42	0.00	-18.73	0.00	-2.59	0.00	316.65
42	201	42	0.00	18.73	0.00	3.26	0.00	-316.65
		43	0.00	-18.73	0.00	-3.26	0.00	400.93
43	201	43	0.00	18.73	0.00	3.26	0.00	-400.93
		44	0.00	-18.73	0.00	-3.26	0.00	485.19
44	201	44	0.00	18.73	0.00	3.26	0.00	-485.19
		45	0.00	-18.73	0.00	-3.26	0.00	569.45
45	201	45	0.00	18.73	0.00	4.25	0.00	-569.45
		46	0.00	-18.73	0.00	-4.25	0.00	638.73
46	201	46	0.00	18.73	0.00	6.25	0.00	-638.71
		47	0.00	-18.73	0.00	-6.25	0.00	653.70
47	201	47	0.00	-64.84	0.00	-10.17	0.00	-654.13
		48	0.00	64.84	0.00	10.17	0.00	602.31
48	201	48	0.00	-64.83	0.00	-12.67	0.00	-602.27
		49	0.00	64.83	0.00	12.67	0.00	362.33
49	201	49	0.00	-64.83	0.00	-12.47	0.00	-362.34
		50	0.00	64.83	0.00	12.47	0.00	70.65
50	201	50	0.00	-64.83	0.00	-12.47	0.00	-70.65
		51	0.00	64.83	0.00	12.47	0.00	-221.10

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	201	51	0.00	-64.83	0.00	-12.94	0.00	221.08
		52	0.00	64.83	0.00	12.94	0.00	-512.84
52	201	52	0.00	-64.83	0.00	-13.03	0.00	512.83
		53	0.00	64.83	0.00	13.03	0.00	-804.60
53	201	53	0.00	-64.83	0.00	-13.03	0.00	804.61
		54	0.00	64.83	0.00	13.03	0.00	-1096.30
54	201	54	0.00	-64.83	0.00	-12.83	0.00	1096.31
		55	0.00	64.83	0.00	12.83	0.00	-1388.08
55	201	55	0.00	-64.83	0.00	-16.02	0.00	1388.04
		56	0.00	64.83	0.00	16.02	0.00	-1679.76
56	201	56	0.00	-64.83	0.00	-16.01	0.00	1679.76
		57	0.00	64.83	0.00	16.01	0.00	-1971.54
57	201	57	0.00	-64.83	0.00	-11.72	0.00	1971.58
		58	0.00	64.83	0.00	11.72	0.00	-2211.46
58	201	58	0.00	-64.84	0.00	-38.88	0.00	2211.16
		59	0.00	64.84	0.00	38.88	0.00	-2262.98
59	201	59	0.00	482.73	0.00	20.94	0.00	2264.19
		60	0.00	-464.32	0.00	-20.94	0.00	-1885.25
60	201	60	0.00	464.32	0.00	18.60	0.00	1885.27
		61	0.00	-379.21	0.00	-18.60	0.00	-324.59
61	201	61	0.00	379.21	0.00	18.04	0.00	324.62
		62	0.00	-275.71	0.00	-18.04	0.00	1148.93
62	201	62	0.00	275.72	0.00	15.81	0.00	-1148.95
		63	0.00	-172.23	0.00	-15.81	0.00	2156.73
63	201	63	0.00	172.22	0.00	24.94	0.00	-2156.64
		64	0.00	-75.12	0.00	-24.94	0.00	2701.34
64	201	64	0.00	75.11	0.00	19.22	0.00	-2701.38
		65	0.00	67.38	0.00	-19.22	0.00	2670.05
65	201	65	0.00	-67.38	0.00	24.87	0.00	-2670.02
		66	0.00	127.08	0.00	-24.87	0.00	2198.67
66	201	66	0.00	-127.08	0.00	20.22	0.00	-2198.73
		67	0.00	163.08	0.00	-20.22	0.00	1545.89
67	201	67	0.00	-163.08	0.00	27.03	0.00	-1545.78
		68	0.00	259.08	0.00	-27.03	0.00	610.82

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	201	68	0.00	-259.08	0.00	25.64	0.00	-610.88
		69	0.00	362.56	0.00	-25.64	0.00	-787.55
69	201	69	0.00	-362.56	0.00	24.58	0.00	787.59
		70	0.00	447.66	0.00	-24.58	0.00	-2286.49
70	201	70	0.00	-447.63	0.00	12.49	0.00	2286.61
		71	0.00	466.04	0.00	-12.49	0.00	-2652.32
71	201	71	0.00	225.24	0.00	10.01	0.00	2651.05
		72	0.00	-213.25	0.00	-10.01	0.00	-2475.82
72	201	72	0.00	213.24	0.00	-15.63	0.00	2475.80
		73	0.00	-157.73	0.00	15.63	0.00	-1789.45
73	201	73	0.00	157.73	0.00	-12.32	0.00	1789.47
		74	0.00	-90.23	0.00	12.32	0.00	-1231.50
74	201	74	0.00	90.23	0.00	-12.33	0.00	1231.50
		75	0.00	-45.23	0.00	12.33	0.00	-960.50
75	201	75	0.00	45.23	0.00	-14.53	0.00	960.48
		76	0.00	-45.23	0.00	14.53	0.00	-756.92
76	201	76	0.00	45.23	0.00	-14.40	0.00	756.92
		77	0.00	-45.23	0.00	14.40	0.00	-553.41
77	201	77	0.00	45.23	0.00	-14.50	0.00	553.41
		78	0.00	-45.23	0.00	14.50	0.00	-349.89
78	201	78	0.00	45.23	0.00	-14.44	0.00	349.89
		79	0.00	-45.23	0.00	14.44	0.00	-146.38
79	201	79	0.00	45.23	0.00	-14.77	0.00	146.35
		80	0.00	-45.23	0.00	14.77	0.00	57.18
80	201	80	0.00	45.23	0.00	-14.76	0.00	-57.18
		81	0.00	-45.23	0.00	14.76	0.00	260.71
81	201	81	0.00	45.23	0.00	-14.80	0.00	-260.71
		82	0.00	-45.23	0.00	14.80	0.00	428.03
82	201	82	0.00	45.23	0.00	-14.82	0.00	-428.03
		83	0.00	-45.23	0.00	14.82	0.00	464.19
83	201	83	0.00	-13.29	0.00	3.16	0.00	-463.51
		84	0.00	13.29	0.00	-3.16	0.00	452.87
84	201	84	0.00	-13.28	0.00	3.20	0.00	-452.88
		85	0.00	13.28	0.00	-3.20	0.00	403.73

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	201	85	0.00	-13.28	0.00	4.12	0.00	-403.72
		86	0.00	13.28	0.00	-4.12	0.00	343.95
86	201	86	0.00	-13.28	0.00	4.12	0.00	-343.95
		87	0.00	13.28	0.00	-4.12	0.00	284.16
87	201	87	0.00	-13.28	0.00	4.12	0.00	-284.16
		88	0.00	13.28	0.00	-4.12	0.00	224.38
88	201	88	0.00	-13.28	0.00	4.60	0.00	-224.37
		89	0.00	13.28	0.00	-4.60	0.00	164.59
89	201	89	0.00	-13.28	0.00	4.25	0.00	-164.60
		90	0.00	13.28	0.00	-4.25	0.00	104.82
90	201	90	0.00	-13.28	0.00	4.47	0.00	-104.81
		91	0.00	13.28	0.00	-4.47	0.00	45.02
91	201	91	0.00	-13.28	0.00	4.47	0.00	-45.03
		92	0.00	13.28	0.00	-4.47	0.00	-14.74
92	201	92	0.00	-13.28	0.00	4.44	0.00	14.75
		93	0.00	13.28	0.00	-4.44	0.00	-74.54
93	201	93	0.00	-13.28	0.00	4.52	0.00	74.53
		94	0.00	13.28	0.00	-4.52	0.00	-123.69
94	201	94	0.00	-13.29	0.00	5.34	0.00	123.66
		95	0.00	13.29	0.00	-5.34	0.00	-134.28
95	201	95	0.00	3.49	0.00	-2.65	0.00	134.03
		96	0.00	-3.49	0.00	2.65	0.00	-131.24
96	201	96	0.00	3.49	0.00	-1.69	0.00	131.25
		97	0.00	-3.49	0.00	1.69	0.00	-118.32
97	201	97	0.00	3.49	0.00	-1.88	0.00	118.32
		98	0.00	-3.49	0.00	1.88	0.00	-101.21
98	201	98	0.00	3.49	0.00	-2.09	0.00	101.20
		99	0.00	-3.49	0.00	2.09	0.00	-84.08
99	201	99	0.00	3.49	0.00	-1.91	0.00	84.09
		100	0.00	-3.49	0.00	1.91	0.00	-66.97
100	201	100	0.00	3.49	0.00	-2.04	0.00	66.97
		101	0.00	-3.49	0.00	2.04	0.00	-49.85
101	201	101	0.00	3.49	0.00	-2.05	0.00	49.85
		102	0.00	-3.49	0.00	2.05	0.00	-32.74

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	201	102	0.00	3.49	0.00	-2.12	0.00	32.73
		103	0.00	-3.49	0.00	2.12	0.00	-15.61
103	201	103	0.00	3.49	0.00	-2.11	0.00	15.61
		104	0.00	-3.49	0.00	2.11	0.00	-2.69
104	201	104	0.00	3.49	0.00	-2.11	0.00	2.69
		105	0.00	-3.49	0.00	2.11	0.00	0.10

********** END OF LATEST ANALYSIS RESULT **********

148. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	201	0.00	-0.43	0.00	0.00	0.00	0.00
11	201	0.00	2.00	0.00	0.13	0.00	0.00
23	201	0.00	-6.98	0.00	-0.75	0.00	0.00
35	201	0.00	24.14	0.00	3.69	0.00	0.00
47	201	0.00	-83.57	0.00	-17.09	0.00	0.00
59	201	0.00	547.57	0.00	35.05	0.00	0.00
71	201	0.00	691.28	0.00	-36.58	0.00	0.00
83	201	0.00	-58.52	0.00	18.02	0.00	0.00
95	201	0.00	16.78	0.00	-6.13	0.00	0.00
105	201	0.00	-3.49	0.00	2.12	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

149. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 2:51:48 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 202

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=     MAR 31, 1998                  *
*           Time=      2:53:18                      *
*                                                   *
*****************************************************
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  1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
  2. UNIT MET MTON
  3. JOINT COORDINATES
  4. 1 0 0 8000
  5. 2 0.799999998666667 0 7999.99996
  6. 3 4.49999976269532 0 7999.99873437503
  7. 4 9.24999793892429 0 7999.99465234435
  8. 5 13.9999928541678 0 7999.98775000313
  9. 6 18.749982833867 0 7999.97802735381
 10. 7 23.4999662034651 0 7999.96548439982
 11. 8 28.2499412884074 0 7999.95012114558
 12. 9 32.9999064141421 0 7999.93193759651
 13. 10 36.6998712739297 0 7999.91581952263
 14. 11 37.4998626710493 0 7999.91210953593
 15. 12 38.2998536931703 0 7999.90831955011
 16. 13 41.9998070627659 0 7999.88975025323
 17. 14 46.4997381654814 0 7999.86485975548
 18. 15 50.9996545553895 0 7999.83743805055
 19. 16 55.4995548086885 0 7999.80748514713
 20. 17 59.999437501582 0 7999.77500105469
 21. 18 64.499301210279 0 7999.7399857835
 22. 19 68.9991445109945 0 7999.70243934465
 23. 20 73.49896597995 0 7999.66236175002
 24. 21 77.998764193374 0 7999.61975301228
 25. 22 81.6985798550281 0 7999.58282300081
 26. 23 82.4985377275021 0 7999.57461314493
 27. 24 83.2984947749906 0 7999.5663232933
 28. 25 86.9982851585779 0 7999.52694216223
 29. 26 91.4980050628533 0 7999.47674007929
 30. 27 95.9976960165887 0 7999.42400691197
 31. 28 100.497356596054 0 7999.36874267696
 32. 29 104.996985377528 0 7999.31094739176
 33. 30 109.496580937301 0 7999.25062107464
 34. 31 113.996141851672 0 7999.1877637447
 35. 32 118.495666696953 0 7999.12237542182
 36. 33 122.995154049465 0 7999.0544561267
 37. 34 126.694703448814 0 7998.99671534612
 38. 35 127.494602485542 0 7998.98400588081
 39. 36 128.294500247324 0 7998.97121642567
 40. 37 131.994010581532 0 7998.91102470646
 41. 38 136.493376913792 0 7998.83551262674
 42. 39 140.992700058696 0 7998.75746966553
 43. 40 145.49197859263 0 7998.67689584754
 44. 41 149.991211091994 0 7998.59379119825
 45. 42 154.490396133202 0 7998.50815574396
 46. 43 158.989532292685 0 7998.41998951176
 47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 202
131. MEMBER LOAD
132. 64 CON GY -25 0.0001
133. 64 CON GY -25 1.6
134. 64 CON GY -25 3.2
135. 65 CON GY -25 .3
136. 59 TO 62 UNI GY -8
137. 63 UNI GY -8 0 3.7
138. 65 UNI GY -8 1.1 4.5
139. 66 TO 70 UNI GY -8
140. 64 CON GY -25 0.0001
141. 64 CON GY -25 1.6
142. 64 CON GY -25 3.2
143. 65 CON GY -25 .3
144. 59 TO 62 UNI GY -8
145. 63 UNI GY -8 0 3.7
146. 65 UNI GY -8 1.1 4.5
147. 66 TO 70 UNI GY -8
149. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
 ORIGINAL/FINAL BAND-WIDTH =    1/    1
 TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
 SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
 TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.              2:53:21
++ PROCESSING GLOBAL STIFFNESS MATRIX.               2:53:21
++ PROCESSING TRIANGULAR FACTORIZATION.              2:53:21
++ CALCULATING JOINT DISPLACEMENTS.                  2:53:22
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++ CALCULATING MEMBER  FORCES.                       2:53:22

 150. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	202	1	0.00	-0.41	0.00	0.00	0.00	0.00
		2	0.00	0.41	0.00	0.00	0.00	-0.33
2	202	2	0.00	-0.41	0.00	0.00	0.00	0.33
		3	0.00	0.41	0.00	0.00	0.00	-1.87
3	202	3	0.00	-0.41	0.00	-0.01	0.00	1.87
		4	0.00	0.41	0.00	0.01	0.00	-3.84
4	202	4	0.00	-0.41	0.00	0.00	0.00	3.84
		5	0.00	0.41	0.00	0.00	0.00	-5.81
5	202	5	0.00	-0.41	0.00	-0.01	0.00	5.81
		6	0.00	0.41	0.00	0.01	0.00	-7.78
6	202	6	0.00	-0.41	0.00	-0.01	0.00	7.78
		7	0.00	0.41	0.00	0.01	0.00	-9.75
7	202	7	0.00	-0.41	0.00	-0.03	0.00	9.75
		8	0.00	0.41	0.00	0.03	0.00	-11.72
8	202	8	0.00	-0.41	0.00	-0.03	0.00	11.72
		9	0.00	0.41	0.00	0.03	0.00	-13.69
9	202	9	0.00	-0.41	0.00	-0.01	0.00	13.69
		10	0.00	0.41	0.00	0.01	0.00	-15.22
10	202	10	0.00	-0.41	0.00	-0.15	0.00	15.22
		11	0.00	0.41	0.00	0.15	0.00	-15.55
11	202	11	0.00	1.53	0.00	0.16	0.00	15.55
		12	0.00	-1.53	0.00	-0.16	0.00	-14.33
12	202	12	0.00	1.53	0.00	0.08	0.00	14.33
		13	0.00	-1.53	0.00	-0.08	0.00	-8.69
13	202	13	0.00	1.53	0.00	0.07	0.00	8.69
		14	0.00	-1.53	0.00	-0.07	0.00	-1.82
14	202	14	0.00	1.53	0.00	0.08	0.00	1.82
		15	0.00	-1.53	0.00	-0.08	0.00	5.04
15	202	15	0.00	1.53	0.00	0.09	0.00	-5.04
		16	0.00	-1.53	0.00	-0.09	0.00	11.91
16	202	16	0.00	1.53	0.00	0.12	0.00	-11.91
		17	0.00	-1.53	0.00	-0.12	0.00	18.78

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	202	17	0.00	1.53	0.00	0.08	0.00	-18.78
		18	0.00	-1.53	0.00	-0.08	0.00	25.64
18	202	18	0.00	1.53	0.00	0.13	0.00	-25.64
		19	0.00	-1.53	0.00	-0.13	0.00	32.51
19	202	19	0.00	1.53	0.00	0.13	0.00	-32.51
		20	0.00	-1.53	0.00	-0.13	0.00	39.37
20	202	20	0.00	1.53	0.00	0.14	0.00	-39.37
		21	0.00	-1.53	0.00	-0.14	0.00	46.24
21	202	21	0.00	1.53	0.00	0.22	0.00	-46.24
		22	0.00	-1.53	0.00	-0.22	0.00	51.89
22	202	22	0.00	1.53	0.00	0.33	0.00	-51.88
		23	0.00	-1.53	0.00	-0.33	0.00	53.11
23	202	23	0.00	-5.26	0.00	-1.08	0.00	-53.11
		24	0.00	5.26	0.00	1.08	0.00	48.90
24	202	24	0.00	-5.26	0.00	-0.55	0.00	-48.91
		25	0.00	5.26	0.00	0.55	0.00	29.44
25	202	25	0.00	-5.26	0.00	-0.55	0.00	-29.44
		26	0.00	5.26	0.00	0.55	0.00	5.77
26	202	26	0.00	-5.26	0.00	-0.53	0.00	-5.77
		27	0.00	5.26	0.00	0.53	0.00	-17.90
27	202	27	0.00	-5.26	0.00	-0.49	0.00	17.90
		28	0.00	5.26	0.00	0.49	0.00	-41.57
28	202	28	0.00	-5.26	0.00	-0.58	0.00	41.57
		29	0.00	5.26	0.00	0.58	0.00	-65.25
29	202	29	0.00	-5.26	0.00	-0.59	0.00	65.25
		30	0.00	5.26	0.00	0.59	0.00	-88.92
30	202	30	0.00	-5.26	0.00	-0.59	0.00	88.92
		31	0.00	5.26	0.00	0.59	0.00	-112.59
31	202	31	0.00	-5.26	0.00	-0.83	0.00	112.59
		32	0.00	5.26	0.00	0.83	0.00	-136.27
32	202	32	0.00	-5.26	0.00	-0.83	0.00	136.27
		33	0.00	5.26	0.00	0.83	0.00	-159.94
33	202	33	0.00	-5.26	0.00	-0.51	0.00	159.94
		34	0.00	5.26	0.00	0.51	0.00	-179.40

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	202	34	0.00	-5.26	0.00	-2.53	0.00	179.39
		35	0.00	5.26	0.00	2.53	0.00	-183.60
35	202	35	0.00	18.21	0.00	3.23	0.00	183.66
		36	0.00	-18.21	0.00	-3.23	0.00	-169.11
36	202	36	0.00	18.21	0.00	2.70	0.00	169.12
		37	0.00	-18.21	0.00	-2.70	0.00	-101.75
37	202	37	0.00	18.21	0.00	2.73	0.00	101.75
		38	0.00	-18.21	0.00	-2.73	0.00	-19.84
38	202	38	0.00	18.21	0.00	2.69	0.00	19.84
		39	0.00	-18.21	0.00	-2.69	0.00	62.09
39	202	39	0.00	18.21	0.00	2.68	0.00	-62.10
		40	0.00	-18.21	0.00	-2.68	0.00	144.02
40	202	40	0.00	18.21	0.00	3.04	0.00	-144.01
		41	0.00	-18.21	0.00	-3.04	0.00	225.93
41	202	41	0.00	18.21	0.00	2.52	0.00	-225.94
		42	0.00	-18.21	0.00	-2.52	0.00	307.86
42	202	42	0.00	18.21	0.00	3.17	0.00	-307.85
		43	0.00	-18.21	0.00	-3.17	0.00	389.79
43	202	43	0.00	18.21	0.00	3.17	0.00	-389.79
		44	0.00	-18.21	0.00	-3.17	0.00	471.71
44	202	44	0.00	18.21	0.00	3.17	0.00	-471.71
		45	0.00	-18.21	0.00	-3.17	0.00	553.64
45	202	45	0.00	18.20	0.00	4.13	0.00	-553.63
		46	0.00	-18.20	0.00	-4.13	0.00	620.99
46	202	46	0.00	18.19	0.00	6.08	0.00	-620.98
		47	0.00	-18.19	0.00	-6.08	0.00	635.53
47	202	47	0.00	-63.03	0.00	-9.89	0.00	-635.96
		48	0.00	63.03	0.00	9.89	0.00	585.58
48	202	48	0.00	-63.03	0.00	-12.32	0.00	-585.54
		49	0.00	63.03	0.00	12.32	0.00	352.27
49	202	49	0.00	-63.03	0.00	-12.12	0.00	-352.28
		50	0.00	63.03	0.00	12.12	0.00	68.69
50	202	50	0.00	-63.03	0.00	-12.12	0.00	-68.69
		51	0.00	63.03	0.00	12.12	0.00	-214.95

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	202	51	0.00	-63.03	0.00	-12.58	0.00	214.93
		52	0.00	63.03	0.00	12.58	0.00	-498.59
52	202	52	0.00	-63.03	0.00	-12.66	0.00	498.59
		53	0.00	63.03	0.00	12.66	0.00	-782.26
53	202	53	0.00	-63.03	0.00	-12.67	0.00	782.25
		54	0.00	63.03	0.00	12.67	0.00	-1065.85
54	202	54	0.00	-63.03	0.00	-12.48	0.00	1065.86
		55	0.00	63.03	0.00	12.48	0.00	-1349.52
55	202	55	0.00	-63.03	0.00	-15.58	0.00	1349.48
		56	0.00	63.03	0.00	15.58	0.00	-1633.10
56	202	56	0.00	-63.03	0.00	-15.57	0.00	1633.10
		57	0.00	63.03	0.00	15.57	0.00	-1916.78
57	202	57	0.00	-63.03	0.00	-11.40	0.00	1916.81
		58	0.00	63.03	0.00	11.40	0.00	-2150.04
58	202	58	0.00	-62.98	0.00	-37.80	0.00	2149.74
		59	0.00	62.98	0.00	37.80	0.00	-2200.11
59	202	59	0.00	414.28	0.00	22.78	0.00	2201.35
		60	0.00	-401.48	0.00	-22.78	0.00	-1874.95
60	202	60	0.00	401.44	0.00	20.46	0.00	1875.00
		61	0.00	-342.23	0.00	-20.46	0.00	-499.07
61	202	61	0.00	342.24	0.00	19.60	0.00	499.11
		62	0.00	-270.24	0.00	-19.60	0.00	878.92
62	202	62	0.00	270.23	0.00	17.89	0.00	-878.95
		63	0.00	-198.24	0.00	-17.89	0.00	1932.93
63	202	63	0.00	198.25	0.00	26.07	0.00	-1932.84
		64	0.00	-139.05	0.00	-26.07	0.00	2668.09
64	202	64	0.00	139.04	0.00	20.43	0.00	-2668.13
		65	0.00	10.96	0.00	-20.43	0.00	2858.83
65	202	65	0.00	-10.95	0.00	26.47	0.00	-2858.79
		66	0.00	115.35	0.00	-26.47	0.00	2506.97
66	202	66	0.00	-115.36	0.00	21.17	0.00	-2507.03
		67	0.00	187.36	0.00	-21.17	0.00	1825.92
67	202	67	0.00	-187.35	0.00	29.22	0.00	-1825.81
		68	0.00	259.36	0.00	-29.22	0.00	820.60

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	202	68	0.00	-259.36	0.00	27.34	0.00	-820.66
		69	0.00	331.35	0.00	-27.34	0.00	-508.20
69	202	69	0.00	-331.35	0.00	26.66	0.00	508.24
		70	0.00	390.55	0.00	-26.66	0.00	-1843.74
70	202	70	0.00	-390.59	0.00	16.91	0.00	1843.86
		71	0.00	403.40	0.00	-16.91	0.00	-2161.63
71	202	71	0.00	61.87	0.00	3.68	0.00	2160.22
		72	0.00	-61.87	0.00	-3.68	0.00	-2110.76
72	202	72	0.00	61.88	0.00	-18.18	0.00	2110.69
		73	0.00	-61.88	0.00	18.18	0.00	-1881.70
73	202	73	0.00	61.88	0.00	-14.71	0.00	1881.73
		74	0.00	-61.88	0.00	14.71	0.00	-1603.22
74	202	74	0.00	61.88	0.00	-14.72	0.00	1603.22
		75	0.00	-61.88	0.00	14.72	0.00	-1324.78
75	202	75	0.00	61.88	0.00	-17.74	0.00	1324.74
		76	0.00	-61.88	0.00	17.74	0.00	-1046.21
76	202	76	0.00	61.88	0.00	-17.57	0.00	1046.21
		77	0.00	-61.88	0.00	17.57	0.00	-767.73
77	202	77	0.00	61.89	0.00	-17.70	0.00	767.74
		78	0.00	-61.89	0.00	17.70	0.00	-489.26
78	202	78	0.00	61.88	0.00	-17.62	0.00	489.27
		79	0.00	-61.88	0.00	17.62	0.00	-210.80
79	202	79	0.00	61.88	0.00	-18.10	0.00	210.76
		80	0.00	-61.88	0.00	18.10	0.00	67.73
80	202	80	0.00	61.88	0.00	-18.09	0.00	-67.74
		81	0.00	-61.88	0.00	18.09	0.00	346.23
81	202	81	0.00	61.88	0.00	-18.14	0.00	-346.23
		82	0.00	-61.88	0.00	18.14	0.00	575.18
82	202	82	0.00	61.88	0.00	-18.16	0.00	-575.17
		83	0.00	-61.88	0.00	18.16	0.00	624.66
83	202	83	0.00	-17.88	0.00	4.26	0.00	-623.81
		84	0.00	17.88	0.00	-4.26	0.00	609.49
84	202	84	0.00	-17.88	0.00	4.31	0.00	-609.49
		85	0.00	17.88	0.00	-4.31	0.00	543.35

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	202	85	0.00	-17.88	0.00	5.55	0.00	-543.34
		86	0.00	17.88	0.00	-5.55	0.00	462.89
86	202	86	0.00	-17.88	0.00	5.55	0.00	-462.89
		87	0.00	17.88	0.00	-5.55	0.00	382.43
87	202	87	0.00	-17.88	0.00	5.55	0.00	-382.43
		88	0.00	17.88	0.00	-5.55	0.00	301.98
88	202	88	0.00	-17.88	0.00	6.19	0.00	-301.97
		89	0.00	17.88	0.00	-6.19	0.00	221.52
89	202	89	0.00	-17.88	0.00	5.72	0.00	-221.53
		90	0.00	17.88	0.00	-5.72	0.00	141.06
90	202	90	0.00	-17.88	0.00	6.02	0.00	-141.05
		91	0.00	17.88	0.00	-6.02	0.00	60.60
91	202	91	0.00	-17.88	0.00	6.02	0.00	-60.60
		92	0.00	17.88	0.00	-6.02	0.00	-19.84
92	202	92	0.00	-17.88	0.00	5.97	0.00	19.85
		93	0.00	17.88	0.00	-5.97	0.00	-100.31
93	202	93	0.00	-17.88	0.00	6.08	0.00	100.31
		94	0.00	17.88	0.00	-6.08	0.00	-166.47
94	202	94	0.00	-17.88	0.00	7.18	0.00	166.42
		95	0.00	17.88	0.00	-7.18	0.00	-180.72
95	202	95	0.00	4.70	0.00	-3.57	0.00	180.38
		96	0.00	-4.70	0.00	3.57	0.00	-176.62
96	202	96	0.00	4.70	0.00	-2.28	0.00	176.64
		97	0.00	-4.70	0.00	2.28	0.00	-159.24
97	202	97	0.00	4.70	0.00	-2.53	0.00	159.24
		98	0.00	-4.70	0.00	2.53	0.00	-136.20
98	202	98	0.00	4.70	0.00	-2.81	0.00	136.20
		99	0.00	-4.70	0.00	2.81	0.00	-113.16
99	202	99	0.00	4.70	0.00	-2.58	0.00	113.17
		100	0.00	-4.70	0.00	2.58	0.00	-90.14
100	202	100	0.00	4.70	0.00	-2.75	0.00	90.13
		101	0.00	-4.70	0.00	2.75	0.00	-67.09
101	202	101	0.00	4.70	0.00	-2.76	0.00	67.09
		102	0.00	-4.70	0.00	2.76	0.00	-44.06

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	202	102	0.00	4.70	0.00	-2.85	0.00	44.05
		103	0.00	-4.70	0.00	2.85	0.00	-21.01
103	202	103	0.00	4.70	0.00	-2.84	0.00	21.01
		104	0.00	-4.70	0.00	2.84	0.00	-3.62
104	202	104	0.00	4.70	0.00	-2.85	0.00	3.62
		105	0.00	-4.70	0.00	2.85	0.00	0.14

********** END OF LATEST ANALYSIS RESULT **********

151. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	202	0.00	-0.41	0.00	0.00	0.00	0.00
11	202	0.00	1.94	0.00	0.13	0.00	0.00
23	202	0.00	-6.79	0.00	-0.73	0.00	0.00
35	202	0.00	23.47	0.00	3.58	0.00	0.00
47	202	0.00	-81.22	0.00	-16.62	0.00	0.00
59	202	0.00	477.27	0.00	36.51	0.00	0.00
71	202	0.00	465.27	0.00	-41.03	0.00	0.00
83	202	0.00	-79.76	0.00	22.47	0.00	0.00
95	202	0.00	22.58	0.00	-8.25	0.00	0.00
105	202	0.00	-4.70	0.00	2.85	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

152. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 2:53:26 ****

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**********************************************************
*  FOR  QUESTIONS REGARDING THIS VERSION OF PROGRAM   *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
**********************************************************
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LOAD 203

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**************************************************
*                                                *
*           S T A A D - III                      *
*           Revision 17.0                        *
*           Proprietary Program of               *
*           RESEARCH ENGINEERS, Inc.             *
*           Date=    MAR 31, 1998                *
*           Time=     3:25:19                    *
*                                                *
**************************************************
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 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
13. 10 36.6998712739297 0 7999.91581952263
14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
16. 13 41.9998070627659 0 7999.88975025323
17. 14 46.4997381654814 0 7999.86485975548
18. 15 50.9996545553895 0 7999.83743805055
19. 16 55.4995548086885 0 7999.80748514713
20. 17 59.999437501582 0 7999.77500105469
21. 18 64.499301210279 0 7999.7399857835
22. 19 68.9991445109945 0 7999.70243934465
23. 20 73.49896597995 0 7999.66236175002
24. 21 77.998764193374 0 7999.61975301228
25. 22 81.6985798550281 0 7999.58282300081
26. 23 82.4985377275021 0 7999.57461314493
27. 24 83.2984947749906 0 7999.5663232933
28. 25 86.9982851585779 0 7999.52694216223
29. 26 91.4980050628533 0 7999.47674007929
30. 27 95.9976960165887 0 7999.42400691197
31. 28 100.497356596054 0 7999.36874267696
32. 29 104.996985377528 0 7999.31094739176
33. 30 109.496580937301 0 7999.25062107464
34. 31 113.996141851672 0 7999.1877637447
35. 32 118.495666696953 0 7999.12237542182
36. 33 122.995154049465 0 7999.0544561267
37. 34 126.694703448814 0 7998.99671534612
38. 35 127.494602485542 0 7998.98400588081
39. 36 128.294500247324 0 7998.97121642567
40. 37 131.994010581532 0 7998.91102470646
41. 38 136.493376913792 0 7998.83551262674
42. 39 140.992700058696 0 7998.75746966553
43. 40 145.49197859263 0 7998.67689584754
44. 41 149.991211091994 0 7998.59379119825
45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 203
131. MEMBER LOAD
132. 89 TO 94 UNI GY -15
133. 88 UNI GY -15 2 4.5
134. 86 UNI GY -15 4 4.5
135. 80 TO 85 UNI GY -15
136. 79 UNI GY -15 1.5 4.5
137. *UIC
138. 88 CON GY -25 0.0001
139. 88 CON GY -25 1.6
140. 88 CON GY -25 3.2
141. 89 CON GY -25 .3
142. 83 TO 86 UNI GY -8
143. 87 UNI GY -8 0 3.7
144. 89 UNI GY -8 1.1 4.5
145. 90 TO 94 UNI GY -8
146. PERFORM ANALYSIS

      P R O B L E M   S T A T I S T I C S
      -----------------------------------

  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
  ORIGINAL/FINAL BAND-WIDTH =     1/    1
  TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =   589
  SIZE OF STIFFNESS MATRIX =     7068 DOUBLE PREC. WORDS
  TOTAL REQUIRED DISK SPACE =    12.28 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.                 3:25:22
++ PROCESSING GLOBAL STIFFNESS MATRIX.                  3:25:22
++ PROCESSING TRIANGULAR FACTORIZATION.                 3:25:23
++ CALCULATING JOINT DISPLACEMENTS.                     3:25:23
++ CALCULATING MEMBER  FORCES.                          3:25:23

147. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	203	1	0.00	-0.02	0.00	0.00	0.00	0.00
		2	0.00	0.02	0.00	0.00	0.00	-0.02
2	203	2	0.00	-0.02	0.00	0.00	0.00	0.02
		3	0.00	0.02	0.00	0.00	0.00	-0.11
3	203	3	0.00	-0.02	0.00	0.00	0.00	0.11
		4	0.00	0.02	0.00	0.00	0.00	-0.23
4	203	4	0.00	-0.02	0.00	0.00	0.00	0.23
		5	0.00	0.02	0.00	0.00	0.00	-0.34
5	203	5	0.00	-0.02	0.00	0.00	0.00	0.34
		6	0.00	0.02	0.00	0.00	0.00	-0.46
6	203	6	0.00	-0.02	0.00	0.00	0.00	0.46
		7	0.00	0.02	0.00	0.00	0.00	-0.57
7	203	7	0.00	-0.02	0.00	0.00	0.00	0.57
		8	0.00	0.02	0.00	0.00	0.00	-0.69
8	203	8	0.00	-0.02	0.00	0.00	0.00	0.69
		9	0.00	0.02	0.00	0.00	0.00	-0.81
9	203	9	0.00	-0.02	0.00	0.00	0.00	0.81
		10	0.00	0.02	0.00	0.00	0.00	-0.90
10	203	10	0.00	-0.02	0.00	-0.01	0.00	0.90
		11	0.00	0.02	0.00	0.01	0.00	-0.91
11	203	11	0.00	0.09	0.00	0.01	0.00	0.91
		12	0.00	-0.09	0.00	-0.01	0.00	-0.84
12	203	12	0.00	0.09	0.00	0.00	0.00	0.84
		13	0.00	-0.09	0.00	0.00	0.00	-0.51
13	203	13	0.00	0.09	0.00	0.00	0.00	0.51
		14	0.00	-0.09	0.00	0.00	0.00	-0.11
14	203	14	0.00	0.09	0.00	0.00	0.00	0.11
		15	0.00	-0.09	0.00	0.00	0.00	0.30
15	203	15	0.00	0.09	0.00	0.01	0.00	-0.30
		16	0.00	-0.09	0.00	-0.01	0.00	0.70
16	203	16	0.00	0.09	0.00	0.01	0.00	-0.70
		17	0.00	-0.09	0.00	-0.01	0.00	1.10

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	203	17	0.00	0.09	0.00	0.00	0.00	-1.10
		18	0.00	-0.09	0.00	0.00	0.00	1.51
18	203	18	0.00	0.09	0.00	0.01	0.00	-1.51
		19	0.00	-0.09	0.00	-0.01	0.00	1.91
19	203	19	0.00	0.09	0.00	0.01	0.00	-1.91
		20	0.00	-0.09	0.00	-0.01	0.00	2.32
20	203	20	0.00	0.09	0.00	0.01	0.00	-2.32
		21	0.00	-0.09	0.00	-0.01	0.00	2.72
21	203	21	0.00	0.09	0.00	0.01	0.00	-2.72
		22	0.00	-0.09	0.00	-0.01	0.00	3.05
22	203	22	0.00	0.09	0.00	0.02	0.00	-3.05
		23	0.00	-0.09	0.00	-0.02	0.00	3.12
23	203	23	0.00	-0.31	0.00	-0.06	0.00	-3.12
		24	0.00	0.31	0.00	0.06	0.00	2.88
24	203	24	0.00	-0.31	0.00	-0.03	0.00	-2.88
		25	0.00	0.31	0.00	0.03	0.00	1.73
25	203	25	0.00	-0.31	0.00	-0.03	0.00	-1.73
		26	0.00	0.31	0.00	0.03	0.00	0.34
26	203	26	0.00	-0.31	0.00	-0.03	0.00	-0.34
		27	0.00	0.31	0.00	0.03	0.00	-1.05
27	203	27	0.00	-0.31	0.00	-0.03	0.00	1.05
		28	0.00	0.31	0.00	0.03	0.00	-2.45
28	203	28	0.00	-0.31	0.00	-0.03	0.00	2.45
		29	0.00	0.31	0.00	0.03	0.00	-3.84
29	203	29	0.00	-0.31	0.00	-0.03	0.00	3.84
		30	0.00	0.31	0.00	0.03	0.00	-5.23
30	203	30	0.00	-0.31	0.00	-0.03	0.00	5.23
		31	0.00	0.31	0.00	0.03	0.00	-6.62
31	203	31	0.00	-0.31	0.00	-0.05	0.00	6.62
		32	0.00	0.31	0.00	0.05	0.00	-8.02
32	203	32	0.00	-0.31	0.00	-0.05	0.00	8.02
		33	0.00	0.31	0.00	0.05	0.00	-9.41
33	203	33	0.00	-0.31	0.00	-0.03	0.00	9.41
		34	0.00	0.31	0.00	0.03	0.00	-10.55

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	203	34	0.00	-0.31	0.00	-0.15	0.00	10.55
		35	0.00	0.31	0.00	0.15	0.00	-10.80
35	203	35	0.00	1.07	0.00	0.19	0.00	10.80
		36	0.00	-1.07	0.00	-0.19	0.00	-9.95
36	203	36	0.00	1.07	0.00	0.16	0.00	9.95
		37	0.00	-1.07	0.00	-0.16	0.00	-5.99
37	203	37	0.00	1.07	0.00	0.16	0.00	5.99
		38	0.00	-1.07	0.00	-0.16	0.00	-1.17
38	203	38	0.00	1.07	0.00	0.16	0.00	1.17
		39	0.00	-1.07	0.00	-0.16	0.00	3.65
39	203	39	0.00	1.07	0.00	0.16	0.00	-3.65
		40	0.00	-1.07	0.00	-0.16	0.00	8.47
40	203	40	0.00	1.07	0.00	0.18	0.00	-8.47
		41	0.00	-1.07	0.00	-0.18	0.00	13.29
41	203	41	0.00	1.07	0.00	0.15	0.00	-13.29
		42	0.00	-1.07	0.00	-0.15	0.00	18.11
42	203	42	0.00	1.07	0.00	0.19	0.00	-18.11
		43	0.00	-1.07	0.00	-0.19	0.00	22.93
43	203	43	0.00	1.07	0.00	0.19	0.00	-22.93
		44	0.00	-1.07	0.00	-0.19	0.00	27.75
44	203	44	0.00	1.07	0.00	0.19	0.00	-27.75
		45	0.00	-1.07	0.00	-0.19	0.00	32.56
45	203	45	0.00	1.07	0.00	0.24	0.00	-32.56
		46	0.00	-1.07	0.00	-0.24	0.00	36.53
46	203	46	0.00	1.07	0.00	0.36	0.00	-36.53
		47	0.00	-1.07	0.00	-0.36	0.00	37.38
47	203	47	0.00	-3.71	0.00	-0.58	0.00	-37.41
		48	0.00	3.71	0.00	0.58	0.00	34.44
48	203	48	0.00	-3.71	0.00	-0.72	0.00	-34.44
		49	0.00	3.71	0.00	0.72	0.00	20.72
49	203	49	0.00	-3.71	0.00	-0.71	0.00	-20.72
		50	0.00	3.71	0.00	0.71	0.00	4.04
50	203	50	0.00	-3.71	0.00	-0.71	0.00	-4.04
		51	0.00	3.71	0.00	0.71	0.00	-12.64

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	203	51	0.00	-3.71	0.00	-0.74	0.00	12.64
		52	0.00	3.71	0.00	0.74	0.00	-29.33
52	203	52	0.00	-3.71	0.00	-0.74	0.00	29.33
		53	0.00	3.71	0.00	0.74	0.00	-46.01
53	203	53	0.00	-3.71	0.00	-0.75	0.00	46.01
		54	0.00	3.71	0.00	0.75	0.00	-62.69
54	203	54	0.00	-3.71	0.00	-0.73	0.00	62.69
		55	0.00	3.71	0.00	0.73	0.00	-79.38
55	203	55	0.00	-3.71	0.00	-0.92	0.00	79.38
		56	0.00	3.71	0.00	0.92	0.00	-96.06
56	203	56	0.00	-3.71	0.00	-0.92	0.00	96.06
		57	0.00	3.71	0.00	0.92	0.00	-112.75
57	203	57	0.00	-3.71	0.00	-0.67	0.00	112.75
		58	0.00	3.71	0.00	0.67	0.00	-126.46
58	203	58	0.00	-3.70	0.00	-2.22	0.00	126.45
		59	0.00	3.70	0.00	2.22	0.00	-129.41
59	203	59	0.00	12.84	0.00	3.27	0.00	129.53
		60	0.00	-12.84	0.00	-3.27	0.00	-119.26
60	203	60	0.00	12.84	0.00	3.12	0.00	119.26
		61	0.00	-12.84	0.00	-3.12	0.00	-71.76
61	203	61	0.00	12.84	0.00	3.00	0.00	71.76
		62	0.00	-12.84	0.00	-3.00	0.00	-13.99
62	203	62	0.00	12.84	0.00	3.02	0.00	13.99
		63	0.00	-12.84	0.00	-3.02	0.00	43.78
63	203	63	0.00	12.84	0.00	3.21	0.00	-43.77
		64	0.00	-12.84	0.00	-3.21	0.00	101.54
64	203	64	0.00	12.84	0.00	2.99	0.00	-101.55
		65	0.00	-12.84	0.00	-2.99	0.00	159.31
65	203	65	0.00	12.84	0.00	3.33	0.00	-159.31
		66	0.00	-12.84	0.00	-3.33	0.00	217.08
66	203	66	0.00	12.84	0.00	2.87	0.00	-217.09
		67	0.00	-12.84	0.00	-2.87	0.00	274.86
67	203	67	0.00	12.84	0.00	4.08	0.00	-274.84
		68	0.00	-12.84	0.00	-4.08	0.00	332.62

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	203	68	0.00	12.84	0.00	3.32	0.00	-332.63
		69	0.00	-12.84	0.00	-3.32	0.00	390.39
69	203	69	0.00	12.84	0.00	3.85	0.00	-390.38
		70	0.00	-12.84	0.00	-3.85	0.00	437.88
70	203	70	0.00	12.83	0.00	6.16	0.00	-437.85
		71	0.00	-12.83	0.00	-6.16	0.00	448.14
71	203	71	0.00	-43.72	0.00	-17.91	0.00	-448.63
		72	0.00	43.72	0.00	17.91	0.00	413.69
72	203	72	0.00	-43.71	0.00	-13.63	0.00	-413.86
		73	0.00	43.71	0.00	13.63	0.00	252.12
73	203	73	0.00	-43.71	0.00	-14.09	0.00	-252.09
		74	0.00	43.71	0.00	14.09	0.00	55.38
74	203	74	0.00	-43.71	0.00	-14.09	0.00	-55.38
		75	0.00	43.71	0.00	14.09	0.00	-141.30
75	203	75	0.00	-43.71	0.00	-14.41	0.00	141.27
		76	0.00	43.71	0.00	14.41	0.00	-338.00
76	203	76	0.00	-43.71	0.00	-14.36	0.00	338.00
		77	0.00	43.71	0.00	14.36	0.00	-534.69
77	203	77	0.00	-43.71	0.00	-14.45	0.00	534.69
		78	0.00	43.71	0.00	14.45	0.00	-731.37
78	203	78	0.00	-43.71	0.00	-14.32	0.00	731.38
		79	0.00	43.71	0.00	14.32	0.00	-928.07
79	203	79	0.00	-43.71	0.00	-16.45	0.00	928.03
		80	0.00	88.71	0.00	16.45	0.00	-1192.25
80	203	80	0.00	-88.71	0.00	-16.66	0.00	1192.25
		81	0.00	156.21	0.00	16.66	0.00	-1743.35
81	203	81	0.00	-156.21	0.00	-16.38	0.00	1743.36
		82	0.00	211.71	0.00	16.38	0.00	-2423.95
82	203	82	0.00	-211.74	0.00	-16.29	0.00	2423.95
		83	0.00	223.73	0.00	16.29	0.00	-2597.99
83	203	83	0.00	445.13	0.00	29.30	0.00	2599.72
		84	0.00	-426.72	0.00	-29.30	0.00	-2250.75
84	203	84	0.00	426.75	0.00	29.11	0.00	2250.73
		85	0.00	-341.66	0.00	-29.11	0.00	-829.32

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	203	85	0.00	341.66	0.00	27.22	0.00	829.39
		86	0.00	-238.17	0.00	-27.22	0.00	475.12
86	203	86	0.00	238.17	0.00	27.21	0.00	-475.11
		87	0.00	-194.67	0.00	-27.21	0.00	1464.11
87	203	87	0.00	194.66	0.00	27.23	0.00	-1464.11
		88	0.00	-165.06	0.00	-27.23	0.00	2261.57
88	203	88	0.00	165.06	0.00	32.01	0.00	-2261.53
		89	0.00	-52.56	0.00	-32.01	0.00	2739.93
89	203	89	0.00	52.57	0.00	26.19	0.00	-2739.98
		90	0.00	67.14	0.00	-26.19	0.00	2673.37
90	203	90	0.00	-67.15	0.00	31.87	0.00	-2673.30
		91	0.00	170.65	0.00	-31.87	0.00	2138.27
91	203	91	0.00	-170.65	0.00	31.89	0.00	-2138.27
		92	0.00	274.12	0.00	-31.89	0.00	1137.75
92	203	92	0.00	-274.13	0.00	34.48	0.00	-1137.68
		93	0.00	377.64	0.00	-34.48	0.00	-328.93
93	203	93	0.00	-377.64	0.00	34.85	0.00	328.88
		94	0.00	462.75	0.00	-34.85	0.00	-1883.80
94	203	94	0.00	-462.77	0.00	47.29	0.00	1883.51
		95	0.00	481.16	0.00	-47.29	0.00	-2260.84
95	203	95	0.00	58.89	0.00	-44.64	0.00	2258.20
		96	0.00	-58.89	0.00	44.64	0.00	-2211.10
96	203	96	0.00	58.85	0.00	-28.55	0.00	2211.39
		97	0.00	-58.85	0.00	28.55	0.00	-1993.60
97	203	97	0.00	58.86	0.00	-31.62	0.00	1993.55
		98	0.00	-58.86	0.00	31.62	0.00	-1705.16
98	203	98	0.00	58.86	0.00	-35.21	0.00	1705.09
		99	0.00	-58.86	0.00	35.21	0.00	-1416.67
99	203	99	0.00	58.85	0.00	-32.24	0.00	1416.74
		100	0.00	-58.85	0.00	32.24	0.00	-1128.42
100	203	100	0.00	58.86	0.00	-34.42	0.00	1128.36
		101	0.00	-58.86	0.00	34.42	0.00	-839.93
101	203	101	0.00	58.86	0.00	-34.57	0.00	839.93
		102	0.00	-58.86	0.00	34.57	0.00	-551.58

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	203	102	0.00	58.86	0.00	-35.72	0.00	551.50
		103	0.00	-58.86	0.00	35.72	0.00	-263.06
103	203	103	0.00	58.85	0.00	-35.57	0.00	263.08
		104	0.00	-58.85	0.00	35.57	0.00	-45.35
104	203	104	0.00	58.84	0.00	-35.62	0.00	45.30
		105	0.00	-58.84	0.00	35.62	0.00	1.76

********** END OF LATEST ANALYSIS RESULT **********

148. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	203	0.00	-0.02	0.00	0.00	0.00	0.00
11	203	0.00	0.11	0.00	0.01	0.00	0.00
23	203	0.00	-0.40	0.00	-0.04	0.00	0.00
35	203	0.00	1.38	0.00	0.21	0.00	0.00
47	203	0.00	-4.78	0.00	-0.98	0.00	0.00
59	203	0.00	16.54	0.00	4.07	0.00	0.00
71	203	0.00	-56.54	0.00	-18.32	0.00	0.00
83	203	0.00	668.86	0.00	45.50	0.00	0.00
95	203	0.00	540.05	0.00	-60.62	0.00	0.00
105	203	0.00	-58.84	0.00	35.66	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

149. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 3:25:27 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

LOAD 204

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*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 17.0                           *
*           Proprietary Program of                  *
*           RESEARCH ENGINEERS, Inc.                *
*           Date=    MAR 31, 1998                   *
*           Time=     3: 1:50                       *
*                                                   *
*****************************************************
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  1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
  2. UNIT MET MTON
  3. JOINT COORDINATES
  4. 1 0 0 8000
  5. 2 0.799999998666667 0 7999.99996
  6. 3 4.49999976269532 0 7999.99873437503
  7. 4 9.24999793892429 0 7999.99465234435
  8. 5 13.9999928541678 0 7999.98775000313
  9. 6 18.749982833867 0 7999.97802735381
 10. 7 23.4999662034651 0 7999.96548439982
 11. 8 28.2499412884074 0 7999.95012114558
 12. 9 32.9999064141421 0 7999.93193759651
 13. 10 36.6998712739297 0 7999.91581952263
 14. 11 37.4998626710493 0 7999.91210953593
 15. 12 38.2998536931703 0 7999.90831955011
 16. 13 41.9998070627659 0 7999.88975025323
 17. 14 46.4997381654814 0 7999.86485975548
 18. 15 50.9996545553895 0 7999.83743805055
 19. 16 55.4995548086885 0 7999.80748514713
 20. 17 59.999437501582 0 7999.77500105469
 21. 18 64.499301210279 0 7999.7399857835
 22. 19 68.9991445109945 0 7999.70243934465
 23. 20 73.49896597995 0 7999.66236175002
 24. 21 77.998764193374 0 7999.61975301228
 25. 22 81.6985798550281 0 7999.58282300081
 26. 23 82.4985377275021 0 7999.57461314493
 27. 24 83.2984947749906 0 7999.5663232933
 28. 25 86.9982851585779 0 7999.52694216223
 29. 26 91.4980050628533 0 7999.47674007929
 30. 27 95.9976960165887 0 7999.42400691197
 31. 28 100.497356596054 0 7999.36874267696
 32. 29 104.996985377528 0 7999.31094739176
 33. 30 109.496580937301 0 7999.25062107464
 34. 31 113.996141851672 0 7999.1877637447
 35. 32 118.495666696953 0 7999.12237542182
 36. 33 122.995154049465 0 7999.0544561267
 37. 34 126.694703448814 0 7998.99671534612
 38. 35 127.494602485542 0 7998.98400588081
 39. 36 128.294500247324 0 7998.97121642567
 40. 37 131.994010581532 0 7998.91102470646
 41. 38 136.493376913792 0 7998.83551262674
 42. 39 140.992700058696 0 7998.75746966553
 43. 40 145.49197859263 0 7998.67689584754
 44. 41 149.991211091994 0 7998.59379119825
 45. 42 154.490396133202 0 7998.50815574396
 46. 43 158.989532292685 0 7998.41998951176
 47. 44 163.488618146887 0 7998.32929252956
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 48. 45 167.987652272271 0 7998.23606482605
 49. 46 171.686818353569 0 7998.15751510331
 50. 47 172.486633245312 0 7998.14030643072
 51. 48 173.286446412189 0 7998.12301777672
 52. 49 176.985559642506 0 7998.04201737388
 53. 50 181.484430040364 0 7997.94119768662
 54. 51 185.983243015416 0 7997.83784740085
 55. 52 190.481997144209 0 7997.73196654926
 56. 53 194.980691003309 0 7997.62355516536
 57. 54 199.479323169302 0 7997.51261328345
 58. 55 203.977892218791 0 7997.39914093863
 59. 56 208.476396728403 0 7997.28313816681
 60. 57 212.974835274781 0 7997.16460500468
 61. 58 216.67350099441 0 7997.06524882515
 62. 59 217.473206434592 0 7997.04354148976
 63. 60 218.272909700042 0 7997.02175418393
 64. 61 221.971508784523 0 7996.91994766034
 65. 62 226.469740901283 0 7996.79382355554
 66. 63 230.967901361604 0 7996.66516921527
 67. 64 235.465988742239 0 7996.53398468022
 68. 65 239.964001619965 0 7996.4002699919
 69. 66 244.461938571584 0 7996.26402519263
 70. 67 248.959798173919 0 7996.12525032551
 71. 68 253.457579003821 0 7995.98394543445
 72. 69 257.955279638162 0 7995.84011056417
 73. 70 261.653327968335 0 7995.71995107152
 74. 71 262.452898653843 0 7995.69374576016
 75. 72 263.252466714822 0 7995.66746049187
 76. 73 266.950434627788 0 7995.54485106875
 77. 74 271.44788613695 0 7995.39342653704
 78. 75 275.945251758306 0 7995.23947221295
 79. 76 280.442530068863 0 7995.08298814519
 80. 77 284.939719645652 0 7994.92397438326
 81. 78 289.436819065736 0 7994.76243097749
 82. 79 293.933826906203 0 7994.59835797898
 83. 80 298.430741744173 0 7994.43175543966
 84. 81 302.927562156794 0 7994.26262341223
 85. 82 306.624876089259 0 7994.12166440837
 86. 83 307.424286721243 0 7994.0909619502
 87. 84 308.223694278984 0 7994.06017955113
 88. 85 311.920914014729 0 7993.9167711079
 89. 86 316.417442614491 0 7993.74005094044
 90. 87 320.913871097799 0 7993.56080150373
 91. 88 325.410198041955 0 7993.3790228545
 92. 89 329.906422024294 0 7993.19471505024
 93. 90 334.402541622181 0 7993.00787814929
 94. 91 338.898555413017 0 7992.81851221076
 95. 92 343.394461974235 0 7992.62661729456
 96. 93 347.890259883301 0 7992.43219346141
 97. 94 351.586722433043 0 7992.27043940636
 98. 95 352.385947717718 0 7992.23524077283
 99. 96 353.185169478534 0 7992.19996221694
100. 97 356.881524055022 0 7992.03575929113
101. 98 361.77657870835 0 7991.81567024028
102. 99 366.671497638938 0 7991.59258300992
103. 100 371.566279010426 0 7991.36649768376
104. 101 376.460920986507 0 7991.1374143466
105. 102 381.355421730924 0 7990.90533308438
106. 103 386.249779407476 0 7990.67025398418
107. 104 389.945422957569 0 7990.49075884044
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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
110. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
129. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 204
131. MEMBER LOAD
132. 88 CON GY -25 0.0001
133. 88 CON GY -25 1.6
134. 88 CON GY -25 3.2
135. 89 CON GY -25 .3
136. 83 TO 86 UNI GY -8
137. 87 UNI GY -8 0 3.7
138. 89 UNI GY -8 1.1 4.5
139. 90 TO 94 UNI GY -8
140. 88 CON GY -25 0.0001
141. 88 CON GY -25 1.6
142. 88 CON GY -25 3.2
143. 89 CON GY -25 .3
144. 83 TO 86 UNI GY -8
145. 87 UNI GY -8 0 3.7
146. 89 UNI GY -8 1.1 4.5
147. 90 TO 94 UNI GY -8
149. PERFORM ANALYSIS
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P R O B L E M S T A T I S T I C S

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   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =    1/    1
   TOTAL PRIMARY LOAD CASES  =    1, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =   12.28 MEGA-BYTES

++ PROCESSING ELEMENT STIFFNESS MATRIX.              3: 1:53
++ PROCESSING GLOBAL STIFFNESS MATRIX.               3: 1:53
++ PROCESSING TRIANGULAR FACTORIZATION.              3: 1:53
++ CALCULATING JOINT DISPLACEMENTS.                  3: 1:54
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++ CALCULATING MEMBER  FORCES.                       3: 1:54

 150. PRINT MEMBER FORCES
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MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	204	1	0.00	-0.03	0.00	0.00	0.00	0.00
		2	0.00	0.03	0.00	0.00	0.00	-0.03
2	204	2	0.00	-0.03	0.00	0.00	0.00	0.03
		3	0.00	0.03	0.00	0.00	0.00	-0.16
3	204	3	0.00	-0.03	0.00	0.00	0.00	0.16
		4	0.00	0.03	0.00	0.00	0.00	-0.32
4	204	4	0.00	-0.03	0.00	0.00	0.00	0.32
		5	0.00	0.03	0.00	0.00	0.00	-0.48
5	204	5	0.00	-0.03	0.00	0.00	0.00	0.48
		6	0.00	0.03	0.00	0.00	0.00	-0.65
6	204	6	0.00	-0.03	0.00	0.00	0.00	0.65
		7	0.00	0.03	0.00	0.00	0.00	-0.81
7	204	7	0.00	-0.03	0.00	0.00	0.00	0.81
		8	0.00	0.03	0.00	0.00	0.00	-0.98
8	204	8	0.00	-0.03	0.00	0.00	0.00	0.98
		9	0.00	0.03	0.00	0.00	0.00	-1.14
9	204	9	0.00	-0.03	0.00	0.00	0.00	1.14
		10	0.00	0.03	0.00	0.00	0.00	-1.27
10	204	10	0.00	-0.03	0.00	-0.01	0.00	1.27
		11	0.00	0.03	0.00	0.01	0.00	-1.30
11	204	11	0.00	0.13	0.00	0.01	0.00	1.30
		12	0.00	-0.13	0.00	-0.01	0.00	-1.19
12	204	12	0.00	0.13	0.00	0.01	0.00	1.19
		13	0.00	-0.13	0.00	-0.01	0.00	-0.72
13	204	13	0.00	0.13	0.00	0.01	0.00	0.72
		14	0.00	-0.13	0.00	-0.01	0.00	-0.15
14	204	14	0.00	0.13	0.00	0.01	0.00	0.15
		15	0.00	-0.13	0.00	-0.01	0.00	0.42
15	204	15	0.00	0.13	0.00	0.01	0.00	-0.42
		16	0.00	-0.13	0.00	-0.01	0.00	0.99
16	204	16	0.00	0.13	0.00	0.01	0.00	-0.99
		17	0.00	-0.13	0.00	-0.01	0.00	1.56

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
17	204	17	0.00	0.13	0.00	0.01	0.00	-1.56
		18	0.00	-0.13	0.00	-0.01	0.00	2.14
18	204	18	0.00	0.13	0.00	0.01	0.00	-2.14
		19	0.00	-0.13	0.00	-0.01	0.00	2.71
19	204	19	0.00	0.13	0.00	0.01	0.00	-2.71
		20	0.00	-0.13	0.00	-0.01	0.00	3.28
20	204	20	0.00	0.13	0.00	0.01	0.00	-3.28
		21	0.00	-0.13	0.00	-0.01	0.00	3.85
21	204	21	0.00	0.13	0.00	0.02	0.00	-3.85
		22	0.00	-0.13	0.00	-0.02	0.00	4.32
22	204	22	0.00	0.13	0.00	0.03	0.00	-4.32
		23	0.00	-0.13	0.00	-0.03	0.00	4.42
23	204	23	0.00	-0.44	0.00	-0.09	0.00	-4.42
		24	0.00	0.44	0.00	0.09	0.00	4.07
24	204	24	0.00	-0.44	0.00	-0.05	0.00	-4.07
		25	0.00	0.44	0.00	0.05	0.00	2.45
25	204	25	0.00	-0.44	0.00	-0.05	0.00	-2.45
		26	0.00	0.44	0.00	0.05	0.00	0.48
26	204	26	0.00	-0.44	0.00	-0.04	0.00	-0.48
		27	0.00	0.44	0.00	0.04	0.00	-1.49
27	204	27	0.00	-0.44	0.00	-0.04	0.00	1.49
		28	0.00	0.44	0.00	0.04	0.00	-3.46
28	204	28	0.00	-0.44	0.00	-0.05	0.00	3.46
		29	0.00	0.44	0.00	0.05	0.00	-5.44
29	204	29	0.00	-0.44	0.00	-0.05	0.00	5.44
		30	0.00	0.44	0.00	0.05	0.00	-7.41
30	204	30	0.00	-0.44	0.00	-0.05	0.00	7.41
		31	0.00	0.44	0.00	0.05	0.00	-9.38
31	204	31	0.00	-0.44	0.00	-0.07	0.00	9.38
		32	0.00	0.44	0.00	0.07	0.00	-11.35
32	204	32	0.00	-0.44	0.00	-0.07	0.00	11.35
		33	0.00	0.44	0.00	0.07	0.00	-13.32
33	204	33	0.00	-0.44	0.00	-0.04	0.00	13.32
		34	0.00	0.44	0.00	0.04	0.00	-14.95

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
34	204	34	0.00	-0.44	0.00	-0.21	0.00	14.95
		35	0.00	0.44	0.00	0.21	0.00	-15.30
35	204	35	0.00	1.52	0.00	0.27	0.00	15.30
		36	0.00	-1.52	0.00	-0.27	0.00	-14.09
36	204	36	0.00	1.52	0.00	0.22	0.00	14.09
		37	0.00	-1.52	0.00	-0.22	0.00	-8.48
37	204	37	0.00	1.52	0.00	0.23	0.00	8.48
		38	0.00	-1.52	0.00	-0.23	0.00	-1.65
38	204	38	0.00	1.52	0.00	0.22	0.00	1.65
		39	0.00	-1.52	0.00	-0.22	0.00	5.17
39	204	39	0.00	1.52	0.00	0.22	0.00	-5.17
		40	0.00	-1.52	0.00	-0.22	0.00	12.00
40	204	40	0.00	1.52	0.00	0.25	0.00	-12.00
		41	0.00	-1.52	0.00	-0.25	0.00	18.82
41	204	41	0.00	1.52	0.00	0.21	0.00	-18.82
		42	0.00	-1.52	0.00	-0.21	0.00	25.65
42	204	42	0.00	1.52	0.00	0.26	0.00	-25.65
		43	0.00	-1.52	0.00	-0.26	0.00	32.47
43	204	43	0.00	1.52	0.00	0.26	0.00	-32.47
		44	0.00	-1.52	0.00	-0.26	0.00	39.30
44	204	44	0.00	1.52	0.00	0.26	0.00	-39.30
		45	0.00	-1.52	0.00	-0.26	0.00	46.13
45	204	45	0.00	1.52	0.00	0.34	0.00	-46.12
		46	0.00	-1.52	0.00	-0.34	0.00	51.74
46	204	46	0.00	1.52	0.00	0.51	0.00	-51.74
		47	0.00	-1.52	0.00	-0.51	0.00	52.95
47	204	47	0.00	-5.25	0.00	-0.82	0.00	-52.98
		48	0.00	5.25	0.00	0.82	0.00	48.79
48	204	48	0.00	-5.25	0.00	-1.03	0.00	-48.78
		49	0.00	5.25	0.00	1.03	0.00	29.35
49	204	49	0.00	-5.25	0.00	-1.01	0.00	-29.35
		50	0.00	5.25	0.00	1.01	0.00	5.72
50	204	50	0.00	-5.25	0.00	-1.01	0.00	-5.72
		51	0.00	5.25	0.00	1.01	0.00	-17.91

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
51	204	51	0.00	-5.25	0.00	-1.05	0.00	17.91
		52	0.00	5.25	0.00	1.05	0.00	-41.54
52	204	52	0.00	-5.25	0.00	-1.06	0.00	41.54
		53	0.00	5.25	0.00	1.06	0.00	-65.17
53	204	53	0.00	-5.25	0.00	-1.06	0.00	65.17
		54	0.00	5.25	0.00	1.06	0.00	-88.80
54	204	54	0.00	-5.25	0.00	-1.04	0.00	88.80
		55	0.00	5.25	0.00	1.04	0.00	-112.43
55	204	55	0.00	-5.25	0.00	-1.30	0.00	112.43
		56	0.00	5.25	0.00	1.30	0.00	-136.06
56	204	56	0.00	-5.25	0.00	-1.30	0.00	136.06
		57	0.00	5.25	0.00	1.30	0.00	-159.69
57	204	57	0.00	-5.25	0.00	-0.95	0.00	159.70
		58	0.00	5.25	0.00	0.95	0.00	-179.13
58	204	58	0.00	-5.25	0.00	-3.15	0.00	179.10
		59	0.00	5.25	0.00	3.15	0.00	-183.30
59	204	59	0.00	18.18	0.00	4.63	0.00	183.47
		60	0.00	-18.18	0.00	-4.63	0.00	-168.92
60	204	60	0.00	18.18	0.00	4.42	0.00	168.93
		61	0.00	-18.18	0.00	-4.42	0.00	-101.64
61	204	61	0.00	18.18	0.00	4.24	0.00	101.65
		62	0.00	-18.18	0.00	-4.24	0.00	-19.82
62	204	62	0.00	18.18	0.00	4.28	0.00	19.81
		63	0.00	-18.18	0.00	-4.28	0.00	62.01
63	204	63	0.00	18.18	0.00	4.54	0.00	-61.99
		64	0.00	-18.18	0.00	-4.54	0.00	143.82
64	204	64	0.00	18.18	0.00	4.24	0.00	-143.83
		65	0.00	-18.18	0.00	-4.24	0.00	225.65
65	204	65	0.00	18.18	0.00	4.72	0.00	-225.65
		66	0.00	-18.18	0.00	-4.72	0.00	307.48
66	204	66	0.00	18.18	0.00	4.07	0.00	-307.48
		67	0.00	-18.18	0.00	-4.07	0.00	389.31
67	204	67	0.00	18.18	0.00	5.78	0.00	-389.29
		68	0.00	-18.18	0.00	-5.78	0.00	471.12

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
68	204	68	0.00	18.18	0.00	4.71	0.00	-471.14
		69	0.00	-18.18	0.00	-4.71	0.00	552.95
69	204	69	0.00	18.18	0.00	5.45	0.00	-552.94
		70	0.00	-18.18	0.00	-5.45	0.00	620.22
70	204	70	0.00	18.19	0.00	8.73	0.00	-620.18
		71	0.00	-18.19	0.00	-8.73	0.00	634.75
71	204	71	0.00	-62.98	0.00	-23.12	0.00	-635.39
		72	0.00	62.98	0.00	23.12	0.00	585.05
72	204	72	0.00	-62.98	0.00	-17.06	0.00	-585.26
		73	0.00	62.98	0.00	17.06	0.00	352.21
73	204	73	0.00	-62.98	0.00	-17.71	0.00	-352.18
		74	0.00	62.98	0.00	17.71	0.00	68.74
74	204	74	0.00	-62.98	0.00	-17.71	0.00	-68.74
		75	0.00	62.98	0.00	17.71	0.00	-214.64
75	204	75	0.00	-62.98	0.00	-18.20	0.00	214.60
		76	0.00	62.98	0.00	18.20	0.00	-498.07
76	204	76	0.00	-62.98	0.00	-18.11	0.00	498.07
		77	0.00	62.98	0.00	18.11	0.00	-781.47
77	204	77	0.00	-62.98	0.00	-18.25	0.00	781.47
		78	0.00	62.98	0.00	18.25	0.00	-1064.87
78	204	78	0.00	-62.98	0.00	-18.06	0.00	1064.88
		79	0.00	62.98	0.00	18.06	0.00	-1348.27
79	204	79	0.00	-62.98	0.00	-21.15	0.00	1348.23
		80	0.00	62.98	0.00	21.15	0.00	-1631.66
80	204	80	0.00	-62.98	0.00	-21.44	0.00	1631.66
		81	0.00	62.98	0.00	21.44	0.00	-1915.09
81	204	81	0.00	-62.98	0.00	-21.13	0.00	1915.09
		82	0.00	62.98	0.00	21.13	0.00	-2148.09
82	204	82	0.00	-63.05	0.00	-21.05	0.00	2148.09
		83	0.00	63.05	0.00	21.05	0.00	-2198.45
83	204	83	0.00	414.12	0.00	30.60	0.00	2200.39
		84	0.00	-401.31	0.00	-30.60	0.00	-1874.00
84	204	84	0.00	401.30	0.00	30.44	0.00	1874.01
		85	0.00	-342.11	0.00	-30.44	0.00	-498.84

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
85	204	85	0.00	342.11	0.00	29.30	0.00	498.91
		86	0.00	-270.12	0.00	-29.30	0.00	878.47
86	204	86	0.00	270.11	0.00	29.29	0.00	-878.47
		87	0.00	-198.10	0.00	-29.29	0.00	1932.11
87	204	87	0.00	198.10	0.00	29.31	0.00	-1932.09
		88	0.00	-138.90	0.00	-29.31	0.00	2666.63
88	204	88	0.00	138.90	0.00	34.95	0.00	-2666.57
		89	0.00	11.10	0.00	-34.95	0.00	2856.63
89	204	89	0.00	-11.09	0.00	28.88	0.00	-2856.71
		90	0.00	115.49	0.00	-28.88	0.00	2504.21
90	204	90	0.00	-115.50	0.00	34.20	0.00	-2504.17
		91	0.00	187.50	0.00	-34.20	0.00	1822.41
91	204	91	0.00	-187.50	0.00	34.22	0.00	-1822.43
		92	0.00	259.48	0.00	-34.22	0.00	816.94
92	204	92	0.00	-259.48	0.00	36.08	0.00	-816.87
		93	0.00	331.49	0.00	-36.08	0.00	-512.95
93	204	93	0.00	-331.49	0.00	36.66	0.00	512.92
		94	0.00	390.69	0.00	-36.66	0.00	-1849.11
94	204	94	0.00	-390.68	0.00	48.86	0.00	1848.82
		95	0.00	403.47	0.00	-48.86	0.00	-2166.32
95	204	95	0.00	56.36	0.00	-42.77	0.00	2163.65
		96	0.00	-56.36	0.00	42.77	0.00	-2118.55
96	204	96	0.00	56.39	0.00	-27.35	0.00	2118.80
		97	0.00	-56.39	0.00	27.35	0.00	-1910.13
97	204	97	0.00	56.39	0.00	-30.30	0.00	1910.08
		98	0.00	-56.39	0.00	30.30	0.00	-1633.77
98	204	98	0.00	56.39	0.00	-33.74	0.00	1633.70
		99	0.00	-56.39	0.00	33.74	0.00	-1357.36
99	204	99	0.00	56.39	0.00	-30.89	0.00	1357.43
		100	0.00	-56.39	0.00	30.89	0.00	-1081.17
100	204	100	0.00	56.39	0.00	-32.98	0.00	1081.11
		101	0.00	-56.39	0.00	32.98	0.00	-804.77
101	204	101	0.00	56.39	0.00	-33.12	0.00	804.77
		102	0.00	-56.39	0.00	33.12	0.00	-528.48

MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
102	204	102	0.00	56.39	0.00	-34.23	0.00	528.41
		103	0.00	-56.39	0.00	34.23	0.00	-252.05
103	204	103	0.00	56.39	0.00	-34.08	0.00	252.07
		104	0.00	-56.39	0.00	34.08	0.00	-43.45
104	204	104	0.00	56.34	0.00	-34.13	0.00	43.40
		105	0.00	-56.34	0.00	34.13	0.00	1.69

********** END OF LATEST ANALYSIS RESULT **********

151. PRINT SUPPORTS REACTIONS

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = SPACE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	204	0.00	-0.03	0.00	0.00	0.00	0.00
11	204	0.00	0.16	0.00	0.01	0.00	0.00
23	204	0.00	-0.57	0.00	-0.06	0.00	0.00
35	204	0.00	1.96	0.00	0.30	0.00	0.00
47	204	0.00	-6.77	0.00	-1.38	0.00	0.00
59	204	0.00	23.44	0.00	5.77	0.00	0.00
71	204	0.00	-81.17	0.00	-23.69	0.00	0.00
83	204	0.00	477.17	0.00	51.58	0.00	0.00
95	204	0.00	459.83	0.00	-61.64	0.00	0.00
105	204	0.00	-56.34	0.00	34.17	0.00	0.00

********** END OF LATEST ANALYSIS RESULT **********

152. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 31,1998 TIME= 3: 1:57 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

2.1.2- Comprobación de EL fisuracion y ELU de agotamiento

COMPROBACION EN ESTADO LIMITE DE FISURACION Y DE AGOTAMIENTO (C.T.Y.R.)

COMPROBACION EN FLEXION DE TENSIONES Y A ROTURA

La comprobación de tensiones y de la seguridad a rotura del tablero se realiza mediante el programa *CTYR*, propiedad de esta oficina.

El prgrama sigue las prescripciones de la vigente Instrucción EP- 93.

Se definen las características mecánicas brutas de las secciones tipo, así como el número de tendones y recubrimiento inferior de los mismos en cada una de las secciones de comprobación. Con estos datos el programa calcula las características mecánicas netas y homogeneizadas de las secciones; para ello se emplea un coeficiente de equivalencia que se da como dato.

A partir de los datos de valores finales de retracción y fluencia, peso propio, resto de cargas permanentes y pretensado inicial de cada sección de comprobación, el programa determina las pérdidas diferidas por retracción y fluencia, aplicando la fórmula de Leonhardt, así como las debidas a la relajación del acero según la fórmula de la EP-93 y a partir del valor de relajación final para una tensión del 70%.

Las tensiones se determinan para las fibras superior e inferior de cada sección de comprobación, de acuerdo con las combinaciones y coeficientes de ponderación del pretensado que se indican el los listados.

Por lo que respecta a la comprobación a rotura, el programa calcula para cada sección los momentos de cálculo Md^+ y Md^- y los momentos últimos Mu^+ y Mu^-. La sección de hormigón se discretiza en rebanadas horizontales y se utiliza el diagrama parábola-rectángulo para el hormigón y el diagrama analítico de la EP- 93 para la armadura activa.

DATOS DE ENTRADA

DATOS GENERALES

- **Ep** Módulo de elasticidad de la armadura activa en Kp/mm^2
- **NACT** Coeficiente de equivalencia hormigón-armadura activa
- **ATEN** Area de un tendón en mm^2
- **DVAIN** Diámetro de una vaina en mm
- f_{cd} Resistencia de cálculo del hormigón en Kp/cm^2
- f_{pd} Límite elástico de cálculo de la armadura activa en Kp/mm^2

$$f_{pd} = \frac{P_{pu} \cdot 0{,}9}{S_t \cdot 1{,}15}$$

- $f_{max,d}$ Tensión última de cálculo de la armadura activa en Kp/mm^2

$$f_{max,d} = \frac{P_{pu}}{S_t \cdot 1{,}15}$$

- ϵ_t Coeficiente final de retracción
- φ_t Coeficiente final de fluencia
- ρ_t Relajación final de la armadura activa en %
- ICLAS Clase de pretensado (1 ó 2)
- NSEC N° de secciones de comprobación
- f_{yd} Límite elástico de cálculo de la armadura pasiva en Kp/cm^2
- NPAS Coeficiente de equivalencia hormigón-armadura pasiva

DATOS DE LAS SECCIONES DE COMPROBACION

- SECCION Número de orden de la sección
- TIPO Número del tipo de sección
- NTEN Número de tendones en la sección de comprobación
- RINF Distancia de la fibra inferior al c.d.g. de los tendones en m
- N_p Axil inicial de pretensado en Mp
- M_p Momento total inicial de pretensado en m.Mp
- P.P. Momento debido al peso propio en la sección considerada en m.Mp
- R.C.P. Momento debido al resto de cargas permanentes en la sección considerada en m.Mp
- SCF(+) Momento positivo debido a la sobrecarga frecuente en la sección considerada en m.Mp
- SCF(-) Momento negativo debido a la sobrecarga frecuente en la sección considerada en m.Mp
- SCT(+) Momento positivo debido a la sobrecarga total en la sección considerada en m.Mp

- **SCT(-)** Momento negativo debido a la sobrecarga total en la sección considerada en m.Mp
- **GRAD** Momento debido al gradiente de temperatura en la sección considerada en m.Mp
- A_p Area de armadura pasiva en la sección considerada en m^2
- Y_p Distancia a la fibra inferior de cada armadura pasiva en m
- Y_a Distancia a la fibra inferior de cada armadura activa en m

DATOS DE LAS SECCIONES TIPO

- **A** Area bruta de la sección de hormigón en m^2
- **I** Momento de inercia de la sección bruta de hormigón en m^4
- **VS** Distancia de la fibra neutra a la fibra superior en m
- **VI** Distancia de la fibra neutra a la fibra inferior en m

DATOS DE LAS REBANADAS DE LA SECCION DISCRETIZADA

- **A** Area de la rebanada en m^2
- **Y** Espesor de la rebanada en m

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

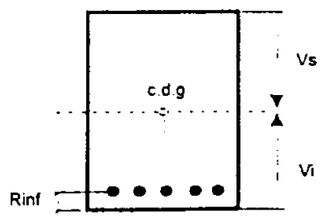
SECC. DE C.D.V. CENTRAL (vano 5) | 1APF/ER93

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2025,4	100	2667	148,7	165,2
φ	ε	ρ ‰	Clase 1 6 2	N° secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	3	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	N° Tendones	Rinf. m	Axil Mp	Momento m.Mp
50(2)	1	28	1,233	7274,6	-4060,6
52(2)	1	28	"	7274,6	-4060,4
54(1)	1	28	"	7274,6	-4060,2

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
841,0	571,4	1195,7	-64,6	2391,4	-129,2	1430,6
1202,7	1201,6	1703	-235,1	3405,9	-470,1	1430,5
1480,3	1043,7	1592,1	-329,3	3184,1	-658,6	1430,5

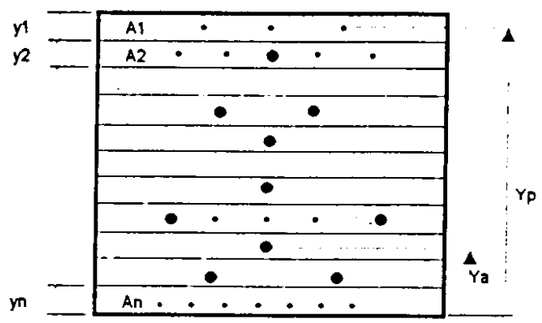
DATOS DE LAS SECCIONES TIPO			
A m²	I m².m²	Vs m	Vi m
8,80	12,03	1,14	1,96



COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

DATOS DE LAS SECCIONES DE COMPROBACION				
Arm.pasiva m²	Yp m	N°Tendones	Ya m	Axil Mp
0	0	28	1,233	7274,6
		28	1,233	7274,6
		28	1,233	7274,6

ELEMENTOS DE HORMIGON	
Area m²	Y m
2,160	0,20
1,174	0,10
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,2	0,2
0,15	0,15
0,35	0,20
1,624	0,25



COMPROBACION A FLEXION DEL E.L. DE FISURACION Y DEL E.L. DE AGOTAMIENTO

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
AITEN= 2025. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
1		8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
50	28.0	1.233	7275.	-4061.	.125	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954
52	28.0	1.233	7275.	-4060.	.118	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954
54	28.0	1.233	7275.	-4060.	.119	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
50	811.	571.	1196.	-65.	2391.	-129.	1431.
52	1703.	1202.	1703.	-235.	3406.	-470.	1431.
54	1480.	1044.	1392.	-320.	3184.	-641.	1431.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
50	S	588.	542.	750.	494.	863.	488.
	I	1540.	1112.	553.	989.	360.	999.
52	S	672.	688.	945.	625.	1106.	602.
	I	1392.	872.	230.	775.	-46.	813.
54	S	652.	652.	878.	580.	1049.	550.
	I	1429.	932.	341.	849.	50.	901.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	1.174	.250
	3	.700	.400
	4	.200	.600
	5	.200	.800
	6	.200	1.000
	7	.200	1.200
	8	.200	1.400
	9	.200	1.600
	10	.200	1.800
	11	.200	2.000
	12	.200	2.200
	13	.150	2.375
	14	.350	2.550
	15	1.624	2.775

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
50	28.0	1.233	7275.		
52	28.0	1.233	7275.		
54	28.0	1.233	7275.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
50	9035.	2278.	15552.	-7567.
52	12839.	3137.	15562.	-7577.
54	11936.	2539.	15560.	-7575.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

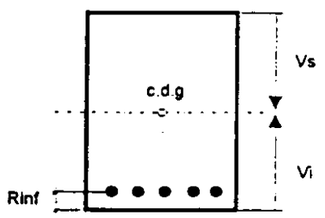
Secc. c d vano central (vano 5) EC-1

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
20000	5,26	2025,4	100	2667	148,7	165,2
φ	ε	ρ ‰	Clase 1 ó 2	N° secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	3	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	N° Tendones	Rinf. m	Axil Mp	Momento m.Mp
5(12)	1	28	1233	7274,6	-4060,6
5?(12)	1	28	1,233	7274,6	-4060,4
54(11)	1	28	1,233	7274,6	-4060,2

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
811	571,4	1205,3	-110,6	2410,6	-221,1	838
1702,4	1201,6	1642,2	-402,3	3284,3	-804,6	858
1480,3	1043,7	1490,4	-548,2	2980,7	-1096,3	858

DATOS DE LAS SECCIONES TIPO			
A m²	I m⁴.m²	Vs m	Vi m
8,80	12,03	1,14	1,96



COMPROBACION A FLEXION DEL [illegible]

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2025. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
50	28.0	1.233	7275.	-4061.	.125	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954
52	28.0	1.233	7275.	-4060.	.118	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954
54	28.0	1.233	7275.	-4060.	.119	1N	8.580	11.911	1.121	1.979
						1H	8.878	12.071	1.146	1.954

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
50	811.	571.	1205.	-111.	2411.	-221.	858.
52	1703.	1202.	1642.	-402.	3284.	-805.	858.
54	1480.	1044.	1490.	-548.	2981.	-1096.	858.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
50	S	588.	542.	696.	490.	811.	480.
	I	1540.	1112.	644.	996.	449.	1014.
52	S	672.	688.	884.	609.	1040.	571.
	I	1392.	872.	332.	802.	67.	867.
54	S	652.	652.	833.	558.	975.	506.
	I	1429.	932.	417.	886.	176.	975.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	1.174	.250
	3	.700	.400
	4	.200	.600
	5	.200	.800
	6	.200	1.000
	7	.200	1.200
	8	.200	1.400
	9	.200	1.600
	10	.200	1.800
	11	.200	2.000
	12	.200	2.200
	13	.150	2.375
	14	.350	2.550
	15	1.624	2.775

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
50	28.0	1.233	7275.		
52	28.0	1.233	7275.		
54	28.0	1.233	7275.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
50	8205.	2141.	15552.	-7567.
52	11798.	2635.	15562.	-7577.
54	10772.	1856.	15560.	-7575.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

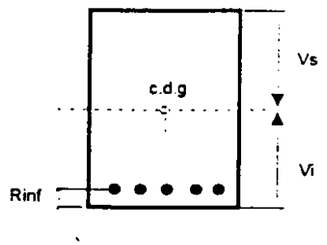
SECCIÓN CENTRO DE VANO LATERAL (JUNTA) EC-1

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2013,1	100	2667		
φ	ε	p ‰	Clase 1 ó 2	Nº secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	2	1435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	Nº Tendones	Rinf. m	Axil Mp	Momento m.Mp
99(2)	1	29	1,204	7279,6	-4424,4
101(2)	1	29	1,204	7279,6	-4687,4

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
2034,0	1412,9	1661,7	-564,2	3323,3	-1128,4	550,5
2056,7	1406,4	1183,6	-275,8	2367,1	-551,6	269,8

DATOS DE LAS SECCIONES TIPO			
A m²	I m⁴.m²	Vs m	Vi m
8,80	12,03	1,14	1,96



COMPROBACION A FLEXION DEL E.L. DE FISURACION Y DEL E.L. DE AGOTAMIENTO

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2013. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
99	29.0	1.204	7280.	-4424.	.117	1N	8.572	11.896	1.120	1.980
						1H	8.879	12.075	1.147	1.953
101	29.0	1.204	7280.	-4687.	.118	1N	8.572	11.896	1.120	1.980
						1H	8.879	12.075	1.147	1.953

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
99	2034.	1413.	1662.	-564.	3323.	-1128.	551.
101	2057.	1406.	1184.	-276.	2367.	-552.	270.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
99	S	667.	711.	883.	619.	1040.	565.
	I	1406.	840.	341.	790.	73.	882.
101	S	642.	690.	792.	628.	904.	602.
	I	1450.	874.	495.	774.	303.	819.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION	TIPO	REBANADA	AREA	Y
1		1	2.800	.100
		2	1.174	.250
		3	.700	.400
		4	.200	.600
		5	.200	.800
		6	.200	1.000
		7	.200	1.200
		8	.200	1.400
		9	.200	1.600
		10	.200	1.800
		11	.200	2.000
		12	.200	2.200
		13	.150	2.375
		14	.350	2.550
		15	1.624	2.775

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
99	28.0	1.233	7280.		
101	28.0	1.233	7280.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
99	12060.	2489.	15479.	-7541.
101	9966.	3105.	15477.	-7539.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

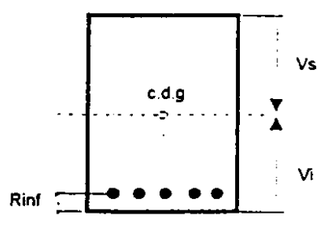
SECCION CENTRO VANO LATERAL (VANO ⑨) 1APF/EP-93

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2013,1	100	2667		
φ	ε	ρ ‰	Clase 162	Nº secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	2	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	Nº Tendones	Rinf. m	Axil Mp	Momento m.Mp
99(2)	1	29	1,204	72796	-4424,4
101(2)	1	29	1,204	72796	-4687,4

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
2034,0	1417,1	1659,6	-125,5	3319,1	-250,5	917,5
2056,7	1406,4	1354,4	-161,8	2708,8	-323,5	449,6

DATOS DE LAS SECCIONES TIPO			
A m²	I m².m²	Vs m	Vi m
1,39	12,03	1,14	1,96



COMPROBACION A FLEXION DEL ELU DE FISURACION Y DEL ELU DE AGOTAMIENTO

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2013. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
99	29.0	1.204	7280.	-4424.	.117	1N	8.572	11.896	1.120	1.980
						1H	8.879	12.075	1.147	1.953
101	29.0	1.204	7280.	-4687.	.118	1N	8.572	11.896	1.120	1.980
						1H	8.879	12.075	1.147	1.953

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
99	2035.	1413.	1660.	-126.	3319.	-251.	918.
101	2057.	1406.	1354.	-162.	2709.	-324.	450.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
99	S	668.	711.	917.	661.	1075.	649.
	I	1406.	840.	282.	719.	14.	740.
101	S	642.	690.	825.	639.	954.	623.
	I	1450.	874.	438.	756.	219.	782.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION	TIPO	REBANADA	AREA	Y
1		1	2.800	.100
		2	1.174	.250
		3	.700	.400
		4	.200	.600
		5	.200	.800
		6	.200	1.000
		7	.200	1.200
		8	.200	1.400
		9	.200	1.600
		10	.200	1.800
		11	.200	2.000
		12	.200	2.200
		13	.150	2.375
		14	.350	2.550
		15	1.624	2.775

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
99	28.0	1.233	7280.		
101	28.0	1.233	7280.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
99	12605.	3805.	15479.	-7541.
101	10748.	3448.	15477.	-7539.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

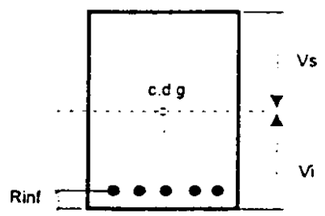
TRAMO DE PILA **EC-1**

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2442,4	100	2667		
φ	ε	ρ %	Clase 1 ó 2	Nº secc.	fyd Kp/cm²	N pasiva
2.1	13E-5	2.5	2	8	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	Nº Tendones	Rinf. m	Axil Mp	Momento m.Mp
47(2)	1	28	2.273	8488,5	4559,3
48(2)	2	28	"	8488.5	4559,5
57(1)	2	"	"	8488,6	4560,3
58(1)	1	"	"	8487,4	4560,3
95(2)	1	"	"	8493,7	4690,1
96(2)	2	"	"	8493,6	4590,5
97(2)	3	"	"	8493.5	4459
50(1)	3	"	"	8488,6	4559,6

MOMENTOS EXTERIORES						
	P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
T	-3537.5	-2462.9	301	-2093.4	602	-4186,8	858,4
PT	-1862,3	-1319.7	331,1	-1200	362,2	-2400,5	838,4
PT	-1800.2	-1321.8	222	-985,8	444	-1971,6	858,4
T	-3534,4	-2466,6	—	-1109,3	—	-2218,6	858,4
T	-3775,2	-2613,8	—	-1105,6	—	-2211,1	1077,2
PT	-1961,5	-1380,9	169,5	-998,8	339,0	-1997,6	971,6
CV	-101,5	-75,8	845,8	-832,6	+1691,6	-1702,2	831,2
CV	-303,1	-216,6	626,7	-3181	1253,3	-696,2	858,4

DATOS DE LAS SECCIONES TIPO			
A m²	I m⁴.m²	Vs m	Vi m
21,92	20,13	1,39	1,71
12,24	16.02	1,28	1,82
8.80	12,03	1,14	1,96



DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2442. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	21.920	1.390	1.710	20.130
	2	12.240	1.280	1.820	16.020
	3	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
47	28.0	2.273	8489.	4559.	.078	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
48	28.0	2.273	8489.	4560.	.107	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
50	28.0	2.273	8489.	4560.	.131	3N	8.580	12.008	1.148	1.952
						3H	8.940	12.043	1.135	1.965
57	28.0	2.273	8489.	4560.	.107	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
58	28.0	2.273	8487.	4560.	.078	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
95	28.0	2.273	8494.	4690.	.077	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
96	28.0	2.273	8494.	4591.	.106	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
97	28.0	2.273	8494.	4459.	.131	3N	8.580	12.008	1.148	1.952
						3H	8.940	12.043	1.135	1.965

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
47	-3538.	-2463.	301.	-2093.	602.	-4187.	858.
48	-1862.	-1320.	331.	-1200.	362.	-25.	858.
50	-303.	-217.	677.	-348.	1353.	-696.	858.
57	-1860.	-1322.	222.	-986.	444.	-1972.	858.
58	-3534.	-2467.	0.	-1109.	0.	-2219.	858.
95	-3775.	-2614.	0.	-1106.	0.	-2211.	1077.
96	-1962.	-1381.	170.	-997.	339.	-1994.	972.
97	-102.	-76.	846.	-853.	1692.	-1705.	831.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
47	S	533.	239.	253.	29.	274.	-114.
	I	305.	514.	415.	691.	389.	869.
48	S	1031.	707.	706.	516.	708.	609.
	I	419.	532.	380.	651.	376.	518.
50	S	1539.	1196.	1216.	1039.	1280.	1006.
	I	322.	305.	32.	340.	-78.	396.
57	S	1031.	707.	697.	533.	715.	455.
	I	419.	532.	392.	627.	367.	739.
58	S	533.	239.	232.	97.	232.	21.
	I	304.	513.	440.	607.	440.	702.
95	S	527.	221.	229.	79.	229.	3.
	I	313.	537.	446.	631.	446.	725.
96	S	1026.	697.	692.	522.	705.	443.
	I	427.	547.	401.	644.	382.	757.
97	S	1548.	1220.	1254.	1016.	1334.	935.
	I	308.	264.	-33.	379.	-171.	518.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	2.826	.350
	3	1.396	.600
	4	1.340	.800
	5	1.234	1.000
	6	1.208	1.200
	7	1.198	1.400
	8	1.188	1.600
	9	1.208	1.800
	10	1.302	2.000
	11	1.304	2.200
	12	1.300	2.400
	13	1.300	2.600
2	1	2.800	.100
	2	1.716	.275
	3	1.190	.425
	4	.400	.625
	5	.400	.875
	6	.400	1.125
	7	.400	1.375
	8	.400	1.625
	9	.400	1.875
	10	.400	2.125
	11	.320	2.350
	12	.240	2.525
	13	1.626	2.725
	14	1.624	2.975
3	1	1.174	.050
	2	.700	.200
	3	.200	.400
	4	.200	.600
	5	.200	.800
	6	.200	1.000
	7	.200	1.200
	8	.200	1.400
	9	.200	1.600
	10	.200	1.800
	11	.200	2.000
	12	.150	2.175
	13	.350	2.350
	14	1.624	2.575

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
47	28.0	2.273	8489.		
48	28.0	2.273	8489.		
50	28.0	2.273	8489.		
57	28.0	2.273	8489.		
58	28.0	2.273	8487.		
95	28.0	2.273	8494.		
96	28.0	2.273	8494.		
97	28.0	2.273	8494.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
47	-3429.	-15501.	7107.	-19036.
48	-1033.	-4810.	7073.	-23155.
50	4753.	-1824.	7508.	-18710.
57	-910.	-7730.	7073.	-23155.
58	-4331.	-12548.	7106.	-19035.
95	-4226.	-12992.	7110.	-19037.
96	-1042.	-8004.	7074.	-23156.
97	5425.	-2824.	7508.	-18710.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

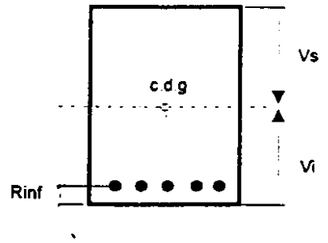
TRAVIESA DE PILA [I F / E P - 9 3]

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	4442,4	100	2667		
φ	ε	ρ %	Clase 162	N° secc.	fyd Kp/cm²	N pasiva
2,1	BE-5	2,5	2	8	4435	5,32

SECCIONES DE COMPROBACION					
Sección	Tipo	N° Tendones	Rinf. m	Axil Mp	Momento m.Mp
47(2)	1	28	2.233	8488,5	4554,3
48(2)	2	"	"	8488,5	4559,5
57(1)	2	"	"	8488.6	4560,3
58(1)	1	"	"	8487,4	4560,3
93(2)	1	"	"	8493,7	4690,1
96(2)	2	"	"	8493,6	4560.5
97(2)	3	"	"	8493,5	4459
50(1)	3	"	"	8488,6	4559,6

MOMENTOS EXTERIORES						
	P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
T	-3537,5	-2462,9	176	-2737,1	351,9	-4554,2	1430,6
PT	-1862,3	-1319,7	103,5	-1382,2	211,7	-2764,4	1430.6
PT	-1860,2	-1321,8	88,4	-1376,0	176,5	-1151,9	1430,4
T	-3534,4	-2466.6	871	-646	1742	-1291,9	1430.3
T	-3775.2	-2613.8	—	-851,6	←	-1703,1	1746,2
PT	-1961,5	-1380,9	99.5	-584,6	199,5	-1169,2	1430,3
(V	-101,5	-75,8	812,5	-500	1624,5	-1000	1355,4
(1	-303,1	-216.6	1178,2	-64,6	956,4	-129,2	1430,6

DATOS DE LAS SECCIONES TIPO			
A m²	I m².m²	Vs m	Vi m
21,92	20,13	1,35	1,71
12,24	16,02	1,38	1,42
8.80	12,03	1,14	1,46



COMPROBACION A FLEXION DEL E.L. DE FISURACION Y DEL E.L. DE AGOTAMIENTO

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2442. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	21.920	1.390	1.710	20.130
	2	12.240	1.280	1.820	16.020
	3	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL.	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
47	28.0	2.273	8489.	4559.	.078	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
48	28.0	2.273	8489.	4560.	.107	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
50	28.0	2.273	8489.	4560.	.131	3N	8.580	12.008	1.148	1.952
						3H	8.940	12.043	1.135	1.965
57	28.0	2.273	8489.	4560.	.107	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
58	28.0	2.273	8487.	4560.	.078	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
95	28.0	2.273	8494.	4690.	.077	1N	21.700	20.060	1.396	1.704
						1H	22.060	20.174	1.386	1.714
96	28.0	2.273	8494.	4591.	.106	2N	12.020	15.974	1.288	1.812
						2H	12.380	16.048	1.275	1.825
97	28.0	2.273	8494.	4459.	.131	3N	8.580	12.008	1.148	1.952
						3H	8.940	12.043	1.135	1.965

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
47	-3538.	-2463.	176.	-2277.	352.	-4554.	1431.
48	-1862.	-1320.	106.	-1382.	212.	-2764.	1431.
50	-303.	-217.	478.	-65.	756.	-129.	1431.
57	-1860.	-1322.	88.	-576.	177.	-1152.	1430.
58	-3534.	-2467.	871.	-646.	1742.	-1292.	1430.
95	-3775.	-2614.	0.	-852.	0.	-1703.	1796.
96	-1962.	-1381.	100.	-585.	199.	-1169.	1619.
97	-102.	-76.	812.	-500.	1625.	-1000.	1385.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
47	S	533.	239.	284.	17.	296.	-140.
	I	305.	514.	377.	707.	362.	900.
48	S	1031.	707.	733.	501.	742.	392.
	I	419.	532.	340.	672.	328.	829.
50	S	1539.	1196.	1251.	1065.	1277.	1059.
	I	322.	305.	-29.	293.	-74.	304.
57	S	1031.	707.	732.	565.	739.	520.
	I	419.	532.	342.	580.	332.	646.
58	S	533.	239.	332.	129.	391.	85.
	I	304.	513.	318.	568.	244.	623.
95	S	527.	221.	278.	96.	278.	38.
	I	313.	537.	385.	609.	385.	682.
96	S	1026.	697.	737.	554.	745.	508.
	I	427.	547.	335.	597.	324.	664.
97	S	1548.	1220.	1303.	1049.	1380.	1002.
	I	308.	264.	-118.	322.	-251.	403.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	2.826	.350
	3	1.396	.600
	4	1.340	.800
	5	1.234	1.000
	6	1.208	1.200
	7	1.198	1.400
	8	1.188	1.600
	9	1.208	1.800
	10	1.302	2.000
	11	1.304	2.200
	12	1.300	2.400
	13	1.300	2.600
2	1	2.800	.100
	2	1.716	.275
	3	1.190	.425
	4	.400	.625
	5	.400	.875
	6	.400	1.125
	7	.400	1.375
	8	.400	1.625
	9	.400	1.875
	10	.400	2.125
	11	.320	2.350
	12	.240	2.525
	13	1.626	2.725
	14	1.624	2.975
3	1	1.174	.050
	2	.700	.200
	3	.200	.400
	4	.200	.600
	5	.200	.800
	6	.200	1.000
	7	.200	1.200
	8	.200	1.400
	9	.200	1.600
	10	.200	1.800
	11	.200	2.000
	12	.150	2.175
	13	.350	2.350
	14	1.624	2.575

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
47	28.0	2.273	8489.		
48	28.0	2.273	8489.		
50	28.0	2.273	8489.		
57	28.0	2.273	8489.		
58	28.0	2.273	8487.		
95	28.0	2.273	8494.		
96	28.0	2.273	8494.		
97	28.0	2.273	8494.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
47	-2946.	-16052.	7107.	-19036.
48	-400.	-8920.	7073.	-23155.
50	4716.	-973.	7508.	-18710.
57	-453.	-6501.	7073.	-23155.
58	-861.	-11157.	7106.	-19035.
95	-3148.	-12230.	7110.	-19037.
96	-281.	-6767.	7074.	-23156.
97	6156.	-1766.	7508.	-18710.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

TRAVIESA PILA LATERAL

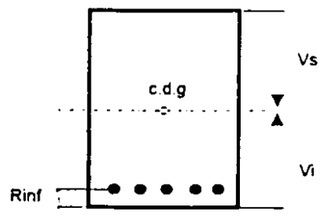
EC-1

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2293,5	100	2667		
φ	ε	ρ ‰	Clase 1 ó 2	N° secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	2	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	N° Tendones	Rinf. m	Axil Mp	Momento m.Mp
PT 103(2)	2	16	1,763	4653,5	-99,6
T 104(2)	1	16	1,365	2,22	2,63

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
-227,3	168,6	128	-22,7	256	-45,4	1151,1
-1,47	-5,2	6,4	-8,55	12,7	-17,1	0,4

DATOS DE LAS SECCIONES TIPO			
A m²	I m².m²	Vs m	Vi m
21,92	20,13	1,39	1,71
12,24	16,02	1,28	1,82



COMPROBACION A FLEXION DEL E.L. DE AGOTAMIENTO (C.T.Y.R.)

DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
AITEN= 2294. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	21.920	1.390	1.710	20.130
	2	12.240	1.280	1.820	16.020

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
103	16.0	1.765	4654.	-100.	.082	2N	12.114	16.020	1.279	1.821
						2H	12.307	16.020	1.280	1.820
104	16.0	1.765	2.	3.47.384		1N	21.794	20.130	1.390	1.710
						1H	21.987	20.130	1.390	1.710

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
103	-227.	169.	128.	-23.	256.	-45.	23.
104	-1.	-5.	6.	-9.	13.	-17.	0.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
103	S	396.	341.	319.	305.	329.	303.
	I	461.	370.	317.	336.	302.	339.
104	S	0.	-14.	-12.	-13.	-11.	-13.
	I	0.	6.	5.	6.	5.	7.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	2.826	.350
	3	1.396	.600
	4	1.340	.800
	5	1.234	1.000
	6	1.208	1.200
	7	1.198	1.400
	8	1.188	1.600
	9	1.208	1.800
	10	1.302	2.000
	11	1.304	2.200
	12	1.300	2.400
	13	1.300	2.600
2	1	2.800	.100
	2	1.716	.275
	3	1.190	.425
	4	.400	.625
	5	.400	.875
	6	.400	1.125
	7	.400	1.375
	8	.400	1.625
	9	.400	1.875
	10	.400	2.125
	11	.320	2.350
	12	.240	2.525
	13	1.626	2.725
	14	1.624	2.975

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
103	16.0	1.765	4654.		
104	16.0	1.765	2.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
103	523.	-156.	6822.	-9290.
104	16.	-36.	3578.	-4329.

COMPROBACION DE SECCIONES EN E.L.FISURACION Y EN E.L. AGOTAMIENTO (C.T.Y.R.)

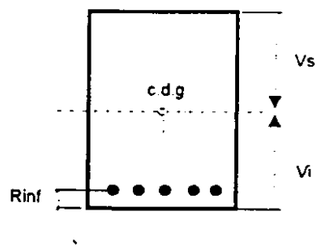
TRAVIESA PILA LATERAL — IAPF / EP-93

DATOS GENERALES						
Ep Kp/mm²	N activa	A tendón mm²	Øvaina mm	fcd Kp/cm²	fpd Kp/mm²	fmax,d Kp/mm²
2000	5,26	2293,5	100	2667		
φ	ε	ρ ‰	Clase 162	Nº secc.	fyd Kp/cm²	N pasiva
2,1	13E-5	2,5	2	2	4435	5,52

SECCIONES DE COMPROBACION					
Sección	Tipo	Nº Tendones	Rinf. m	Axil Mp	Momento m.Mp
PT 103(2)	2	16	1,765	4653,5	-99,6
T 103(2)	1	16	1,765	2,22	2,63

MOMENTOS EXTERIORES						
P.P.	R.C.P.	S.C.F.(+)	S.C.F.(-)	S.C.T.(+)	S.C.T.(-)	Gradiente
-22273	168,6	148,1	-15,3	296,2	-26,6	3894
-1,47	-5,2	0,52	-16,05	1,04	-32,1	0,74

DATOS DE LAS SECCIONES TIPO			
A m²	I m².m²	Vs m	Vi m



DATOS DEL HORMIGON

FCD= 2667.0 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2294. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
1		21.920	1.390	1.710	20.130
2		12.240	1.280	1.820	16.020

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
103	16.0	1.765	4654.	-100.	.082	2N	12.114	16.020	1.279	1.821
						2H	12.307	16.020	1.280	1.820
104	16.0	1.765	2.	3.47.384		1N	21.794	20.130	1.390	1.710
						1H	21.987	20.130	1.390	1.710

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
103	-227.	169.	148.	-13.	296.	-26.	39.
104	-1.	-5.	1.	-16.	1.	-32.	1.

SEC		TENSIONES HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
103	S	396.	341.	322.	306.	333.	304.
	I	461.	370.	313.	335.	296.	337.
104	S	0.	-14.	-12.	-13.	-12.	-14.
	I	0.	6.	6.	7.	6.	8.

DATOS DEL HORMIGON PARA COMPROBACION A ROTURA

SECCION TIPO	REBANADA	AREA	Y
1	1	2.800	.100
	2	2.826	.350
	3	1.396	.600
	4	1.340	.800
	5	1.234	1.000
	6	1.208	1.200
	7	1.198	1.400
	8	1.188	1.600
	9	1.208	1.800
	10	1.302	2.000
	11	1.304	2.200
	12	1.300	2.400
	13	1.300	2.600
2	1	2.800	.100
	2	1.716	.275
	3	1.190	.425
	4	.400	.625
	5	.400	.875
	6	.400	1.125
	7	.400	1.375
	8	.400	1.625
	9	.400	1.875
	10	.400	2.125
	11	.320	2.350
	12	.240	2.525
	13	1.626	2.725
	14	1.624	2.975

DATOS DE LAS ARMADURAS PARA COMPROBACION A ROTURA

SECCION	NTEN	YA	AXIL	APAS	YP
103	16.0	1.765	4654.		
104	16.0	1.765	2.		

COMPROBACION EN ROTURA

SECCION	MD(+)	MD(-)	MU(+)	MU(-)
103	606.	-127.	6822.	-9290.
104	-3.	-58.	3578.	-4329.

EN FASE DE CONSTRUCCIÓN

j. a. torroja oficina tecnica, s.a. madrid	ASUNTO:	FECHA:	HOJA:
		REALIZO:	

ESFUERZOS EN FASE DE LANZAMIENTO (M flexión)

Sección	PRETENSADO DE LANZAMIENTO		PP + LANZAM.
47 (2)	-0,56	(N = 4651,41)	1914 / -3508
48 (2)	-0,56	(N = 4651,5)	1946 / -3474,2
52 (1)	-0,56	(N 4651,5)	1957,5 / -3565
57 (1)	-0,56	(N = 4651,5)	+1960,8 / -3788
58 (1)	-0,56	(N = 4651,5)	+1968,3 / -3784
53 (2) (1)	-0,56	(N = 4651,5)	1998,3 / -3603,6
54 (1)	-0,56	(N = 4651,5	2007 / -3855
104 (2)	0,08	(N = 1,35)	+2388 -293,7
103 (2)	-120,3	(N = 4654,4)	+2890 -1340,3
99 (2)	-45,2	(N = 4654,4)	+3018 -5547
96 (2)	14,8	(N = 4654,4	+2003,5 -4978,5
95 (2)	29,9	(N = 4654,5)	+1941,8 -4919,2
101 (2)	-85,2	(N = 4654,4	+3311,6 -4466
97 (2)	-5,2	(N = 4654,4)	-2294 / -5287

COMPROBACION A FLEXION DEL E.L. DE FISURACION Y DEL E.L. DE AGOTAMIENTO

DATOS DEL HORMIGON

FCD= 266.7 KP/CM2
N= 5.3
FI= 2.10
EPS=.000130

DATOS DE LAS ARMADURAS

EP= 20000. KP/MM2
DVAIN= 100. MM
ATEN= 2294. MM2
FPD= 149. KP/MM2
FMAXD= 165. KP/MM2
REL= 2.5 %
FYD= 4435. KP/CM2
NPAS= 5.5

PRETENSADO EN CLASE II

CARACTERISTICAS MECANICAS BRUTAS

SEC.	TIPO	AREA	VSUP	VINF	INERCIA
	1	21.920	1.390	1.710	20.130
	2	12.240	1.280	1.820	16.020
	3	8.800	1.140	1.960	12.030

HIPOTESIS DE COMPROBACION DE TENSIONES

HIP 1 - PESO PROPIO + PRETENSADO INICIAL * 1.1
HIP 2 - PESO PROPIO + RESTO CARGA PERMANENTE + PRETENSADO FINAL
HIP 3 - CARGAS PERMANENTES + S.C.FRECUENTE(+) + GRADIENTE(+) + PRET.FIN*.9
HIP 4 - CARGAS PERMANENTES + S.C.FRECUENTE(-) + GRADIENTE(-) + PRET. FINAL * .9
HIP 5 - CARGAS PERMANENTES + S.C.TOTAL(+) + GRADIENTE(+) + PRET.FIN. * .9
HIP 6 - CARGAS PERMANENTES + S.C.TOTAL(-) + GRADIENTE(-) + PRET. FINAL * .9

PRETENSADO Y CARACTERISTICAS MECANICAS

SEC	NTEN	RINF	AXIL	MOMEN.	PERD	TIPO	AREA	INERCIA	VS	VI
47	16.0	1.934	5171.	-1.	.074	1N	21.794	20.124	1.391	1.709
						1H	21.987	20.133	1.389	1.711
48	16.0	1.934	5172.	-1.	.088	2N	12.114	16.018	1.281	1.819
						2H	12.307	16.021	1.279	1.821
50	16.0	1.934	5172.	-1.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
52	16.0	1.934	5172.	-1.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
54	16.0	1.934	5172.	-1.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
57	16.0	1.934	5172.	-1.	.088	2N	12.114	16.018	1.281	1.819
						2H	12.307	16.021	1.279	1.821
58	16.0	1.934	5171.	-1.	.074	1N	21.794	20.124	1.391	1.709
						1H	21.987	20.133	1.389	1.711
95	16.0	1.934	5172.	30.	.073	1N	21.794	20.124	1.391	1.709
						1H	21.987	20.133	1.389	1.711
96	16.0	1.934	5171.	15.	.087	2N	12.114	16.018	1.281	1.819
						2H	12.307	16.021	1.279	1.821
97	16.0	1.934	5171.	-5.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
99	16.0	1.934	5171.	-45.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
101	16.0	1.934	5171.	-85.	.101	3N	8.674	12.030	1.140	1.960
						3H	8.867	12.030	1.140	1.960
103	16.0	1.934	5171.	-120.	.091	2N	12.114	16.018	1.281	1.819
						2H	12.307	16.021	1.279	1.821
104	16.0	1.934	5171.	0.	.079	1N	21.794	20.124	1.391	1.709
						1H	21.987	20.133	1.389	1.711

MOMENTOS EXTERIORES

SECCION	P.PROP.	R.C.P.	S.C.F.+	S.C.F.-	S.C.T.+	S.C.T.-	GRAD.
47	-3508.	0.	0.	0.	0.	0.	0.
48	-3474.	0.	0.	0.	0.	0.	0.
50	-3604.	0.	0.	0.	0.	0.	0.
52	-3565.	0.	0.	0.	0.	0.	0.
54	-3855.	0.	0.	0.	0.	0.	0.
57	-3788.	0.	0.	0.	0.	0.	0.
58	-3784.	0.	0.	0.	0.	0.	0.
95	-4919.	0.	0.	0.	0.	0.	0.
96	-4979.	0.	0.	0.	0.	0.	0.
97	-5287.	0.	0.	0.	0.	0.	0.
99	-5547.	0.	0.	0.	0.	0.	0.
101	-4466.	0.	0.	0.	0.	0.	0.
103	2890.	0.	0.	0.	0.	0.	0.
104	2388.	0.	0.	0.	0.	0.	0.

SEC		TENSIONES					
		HIP 1	HIP 2	HIP 3	HIP 4	HIP 5	HIP 6
47	S	-8.	-45.	-65.	-65.	-65.	-65.
	I	533.	495.	476.	476.	476.	476.
48	S	144.	73.	38.	38.	38.	38.
	I	817.	745.	710.	710.	710.	710.
50	S	314.	196.	142.	142.	142.	142.
	I	1243.	1125.	1071.	1071.	1071.	1071.
52	S	318.	200.	146.	146.	146.	146.
	I	1237.	1118.	1065.	1065.	1065.	1065.
54	S	291.	172.	118.	118.	118.	118.
	I	1284.	1166.	1112.	1112.	1112.	1112.
57	S	119.	48.	13.	13.	13.	13.
	I	852.	781.	746.	746.	746.	746.
58	S	-27.	-64.	-84.	-84.	-84.	-84.
	I	556.	519.	499.	499.	499.	499.
95	S	-103.	-140.	-160.	-160.	-160.	-160.
	I	650.	613.	594.	594.	594.	594.
96	S	25.	-46.	-81.	-81.	-81.	-81.
	I	986.	915.	880.	880.	880.	880.
97	S	154.	36.	-18.	-18.	-18.	-18.
	I	1518.	1399.	1346.	1346.	1346.	1346.
99	S	126.	8.	-46.	-46.	-46.	-46.
	I	1568.	1448.	1393.	1393.	1393.	1393.
101	S	224.	107.	54.	54.	54.	54.
	I	1399.	1277.	1223.	1223.	1223.	1223.
103	S	643.	572.	538.	538.	538.	538.
	I	109.	34.	-3.	-3.	-3.	-3.
104	S	400.	362.	342.	342.	342.	342.
	I	32.	-6.	-26.	-26.	-26.	-26.

2.1.3- Comprobación y dimensionamiento a cortante

COMPROBACION EN ESTADO LIMITE ULTIMO DE ESFUERZO CORTANTE

COMPROBACION A CORTANTE Y DIMENSIONAMIENTO DE ARMADURAS

La comprobación del hormigón sometido a esfuerzo cortante se realiza mediante el programa CHP1 en un computador HEWLETT PACKARD 9000 propiedad de esta oficina. El programa sigue las prescripciones de la vigente instrucción EP-80.

Se definen las características de los materiales empleados, así como las características mecánicas brutas de las secciones tipo predefinidas.

A partir de las acciones exteriores y de los esfuerzos de pretensado inicial, el programa determina el esfuerzo cortante reducido de cálculo (Vrd), el esfuerzo cortante de agotamiento por compresión oblicua en el alma (Vu1), la contribución del hormigón a la resistencia a esfuerzo cortante (Vcu) y las armaduras necesaria y mínima.

VARIABLES DE ENTRADA

- ITIT: Título (máx 60 caracteres)
- FCK: Resistencia característica del hormigón (Kp/cm2)
  FYK: Límite elástico del acero pasivo (Kp/cm2)
  REC: Recubrimiento de la armadura pasiva (m)
  NSEC: Nº de secciones a calcular (max 60)
- IS: Nº de la sección
  RI: Recubrimiento a cara inferior de la armadura activa
  P: Fuerza de pretensado inicial (Mp)
  Mp: Momento total de pretensado (m Mp)
  Vp: Cortante de pretensado (con su signo) (Mp)
  PER: Factor de pérdidas diferidas $\Delta P/P$
  IT: Tipo de sección (igual al lugar que ocupa en la lista)
  BD: Ancho neto del alma descontando vainas (m)
  ME: Momento total concomitante debido a las cargas exteriores (m Mp)
  VE: Cortante total debido a las cargas exteriores (con su signo) (Mp)
  VC: Cortante debido a la variación de canto (con su signo) (Mp)
- A: Area bruta (m^2)
  IN: Inercia bruta (m^4)
  VS: Distancia de la fibra neutra a la cara superior (m)
  VI: Distancia de la fibra neutra a la cara inferior (m)

VARIABLES DE SALIDA

FCK: Resistencia característica del hormigón
FCTK: Resistencia de proyecto a tracción del hormigón
GAMC: Coeficiente de minoración del hormigón
FYK: Límite elástico del acero
RECUB: Recubrimiento de la armadura pasiva
GAMS: Coeficiente de minoración del acero
GAMF: Coeficiente de mayoración de las acciones
VSUP: VS
VINF: VI
SEC: IS
RINF: RI
P: Fuerza de pretensado inicial
M: MP
V: VP
PERD: PER
M: ME
V: VE
ZONA: Zona de comprobación

TETA: Angulo de las bielas (º)

VU1: Cortante de agotamiento por compresión oblicua del hormigón (Mp)

VRD: Cortante reducido de cálculo

VCU: Contribución del hormigón a la resistencia a esfuerzo cortante

A: Armadura transversal (cm2/m)

AMIN: Armadura transversal mínima (cm2/m)

COMPROBACION A CORTANTE

DATOS GENERALES			
FCK (Kp/cm2)	FYK (Kp/cm2)	REC (m)	NSEC
400	√100	0,05	2

DATOS DE LAS SECCIONES DE COMPROBACION

IS	RI (m)	P (Mp)	MP (mMp)	VP (Mp)	PER	IT	BO (m)	ME (mMp)	VE (Mp)	VC (Mp)
471	2,273	6514,4	4571,0	0	0,098	1	1,40	-9123,6	1362,9	0
472	2,273	6514,4	4521,0	0	0,098	1	1,40	-9328,8	1372,9	0

DATOS DE LAS SECCIONES TIPO

A (m2)	IN (m4)	VS (m)	VI (m)
12,24	16,02	1,28	1,82

AVE. CORTANTE PESIMO

HORMIGON: FCK= 400. KP/CM2
FCTK= 24.4 KP/CM2
GAMC= 1.50
ACERO: FYK= 5100. KP/CM2
RECUB= .05 M
GAMS= 1.15
ACCIONES: GAMF= 1.50

CARACTERISTICAS MECANICAS BRUTAS

SEC.TIPO	AREA	VSUP	VINF	INERCIA
1	12.240	1.280	1.820	16.0200

ACCIONES

SEC	RINF	PRETENSADO P	PRETENSADO M	PRETENSADO V	PRETENSADO PERD	SEC. TIPO	ANCHO NETO	ACC.EXTER. M	ACC.EXTER. V	VARIA CANTO
471	2.273	6514.	4571.0	.0	.902	1	1.400	-9123.6	1367.9	.0
472	2.273	6514.	4571.0	.0	.902	1	1.400	-9328.8	1372.9	.0

RESULTADOS

SEC	ZONA	TETA	VU1	VRD	VCU	A(CM2/M)	AMIN
471	C	30.15	2967.0	2051.9	.0	103.36	26.67
472	C	30.15	2967.0	2059.4	.0	103.73	26.67

2.1.4- Comprobación y dimensionamiento a torsión

COMPROBACIÓN A TORSOR

Valores característicos (PILA P-4)

PP + RCP: 124,4 mt : Balasto completo

301,5 mt : Balasto + -50% una vía, LONG. COMPLETA

302,6 mt : Desbalastado 1 vía al 100%, en 15m

Pretensado: 25,8 mt

SC IAPF → 1 vía: 655,7 mt

2 vías: 210,3 mt

SC EC-1 → 1 vía: 818,6 mt

2 vías: 480,1 mt

LIB: Lado + Emp barandilla: 9 mt

DESCENSO PILA P-4: 6,7 mt

VIENTO: 186 mt

COMBINACIONES: La prima será la opción 3 de PP.

EH-91: $1,5 \times (302,6 + 25,8 + 655,7 + 9 + 6,7) = 1499,7$ mt

$1,35 \times (302,6 + 25,8 + 655,7 + 9 + 6,7) + 1,35 \times 186 = 1600,83$ mt

EC-1: Sobrecarga dominante: Trafico

$1,35 \times 302,6 + 1,0 \times 25,8 + 1,45 \times 818,6 + 1,5 \times 15,7 + 9,6 \times 1,5 \times 186$

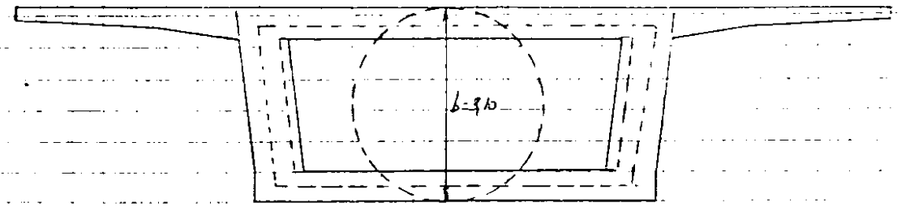
$T_{max} = 1812,2$ mt

J. A. Torroja
oficina tecnica, s.a.
madrid
REALIZO:

TORSION EN TUBO

- Comprobacion relativa al hormigón

$h_e = \frac{b-2c}{5} > \frac{c}{6}$ $\quad h_e = \frac{210-2\cdot 25}{5} = 32$ cm $\quad \frac{b}{6} = 0,517$ m



$T_{u1} = 350 \times 16,212 \times 0,50 = 2835,4$ mt

$T_d = 1812$ mt $< T_{u1} \rightarrow$ Ok

- Comprobacion relativa a la armadura

$T_d < T_{u2} = \frac{2A_e A_t}{s} f_{td} \rightarrow \frac{A_t}{s} = \frac{T_d}{2A_e f_{td}} = \frac{1812,0}{2 \times 16,212 \times 4,2} = 13,3$ cm²/m

$T_d < T_{u3} = \frac{2A_e A_l}{u} f_{td} \rightarrow \frac{A_l}{u} = \frac{T_d}{2A_e f_{td}} = \frac{1812,0}{2 \times 16,212 \times 4,435} = 12,6$ cm²/m

TORSION Y FLEXION

$$\frac{T_d}{T_{u1}} + \frac{V_{rd}}{V_{u1}} \leq 1$$

$\frac{1812,0}{2954} + \frac{2059,4}{2967,0} = 0,25 + 0,69 = 0,94 < 1 \rightarrow$ Cumple

2.1.5- Comprobación EL. Deformaciones

COMPROBACIÓN DEL
E.L.S DE DEFORMACIÓN

VIADUCTO1

NUDOS DE CENTRO DE VANO

VANO	1	2	3	4	5	6	7	8	9
NUDO	6	17	29	41	53	65	77	89	100
L vano	37.5	45	45	45	45	45	45	45	38.4

Se comprobará el cumplimiento del E.L.S. de deformaciones en los nudos señalados, centros de vano.

Los valores de flecha que aparecen en el cuadro siguiente vienen expresados en mm.,
siendo positivos las flechas verticales hacia abajo.

	NUDO								
SOLICITACION	6	17	29	41	53	65	77	89	100
PESO PROPIO	5.28	4.43	4.89	4.76	4.81	4.74	4.95	4.23	6
PRET. LANZAM.	-0.19	0.07	-0.02	0	0	0	-0.02	0.07	-0.19
total en lanzamiento	5.09	4.5	4.87	4.76	4.81	4.74	4.93	4.3	5.81

PP + BALASTO + R.C.P.		8.91	7.6	8.32	8.11	8.19	8.08	8.43	7.24	10.13
PRETENSADO TOTAL		-11.93	-11.34	-11.83	-11.69	-11.74	-11.69	-11.81	-11.41	-12.07
SC	SC, IAPF-75	11.5	14.6	14.6	14.6	14.6	14.6	14.6	14.6	11.5
	SC, EC-1	11	14	14	14	14	14	14	14	11
VIENTO		0.15	0.13	0.14	0.14	0.14	0.14	0.14	0.12	0.17
GRADIENTE DE 5ºC		-0.95	0.61	0.08	0.24	0.18	0.24	0.08	0.61	-0.99
DESCENSO PILA(1.25 cm)		5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	5
: flecha total [mm]		16.02	22.38	22.22	22.27	22.26	22.24	22.35	21.95	17.12

(L / K) K: 2341 2011 2025 2020 2022 2023 2014 2050 2243

*Los valores de flecha debidos a pretensado total (continuidad + lanzamiento) se han minorado por el coeficiente 0.9,
del lado de la seguridad. También han sido multiplicados dichos valores por el coeficiente reductor 0.8,
para considerar pérdidas diferidas a t infinito.

La comprobación se realizará con la combinación característica en lugar de con la combinación casi-permanente,
como se expresa en EC2.2, por resultar del lado de la seguridad.

VALORES ADMISIBLES

Según se indica en el EC1.3, el valor máximo admisible de deflexión, para alta velocidad, luces mayores de 30 m. y puentes continuos de más de 3 vanos, será de L /1700

Como se observa, todos los valores son ADMISIBLES.

COMPROBACIÓN DEL
E.L.S DE DEFORMACIÓN

VIADUCTO 2

NUDOS DE CENTRO DE VANO

VANO	1	2	3	4	5	6	7	8	9
NUDO	6	17	29	41	53	65	77	89	100
L vano	37.5	45	45	45	45	45	45	45	38.4

Se comprobará el cumplimiento del E.L.S. de deformaciones en los nudos señalados, centros de vano.

Los valores de flecha que aparecen en el cuadro siguiente vienen expresados en mm.,
siendo positivos las flechas verticales hacia abajo.

	NUDO								
SOLICITACION	6	17	29	41	53	65	77	89	100
PESO PROPIO	5.28	4.43	4.89	4.76	4.81	4.74	4.95	4.23	6
PRET. LANZAM.	-0.19	0.07	-0.02	0	0	0	-0.02	0.07	-0.19
total en lanzamiento	5.09	4.5	4.87	4.76	4.81	4.74	4.93	4.3	5.81

PP + BALASTO + R.C.P.		8.91	7.6	8.32	8.11	8.19	8.08	8.43	7.24	10.13
PRETENSADO TOTAL		-11.93	-11.34	-11.83	-11.69	-11.74	-11.69	-11.81	-11.41	-12.07
SC	SC, IAPF-75	11.5	14.6	14.6	14.6	14.6	14.6	14.6	14.6	11.5
	SC, EC-1	11	14	14	14	14	14	14	14	11
VIENTO		0.15	0.13	0.14	0.14	0.14	0.14	0.14	0.12	0.17
GRADIENTE DE 5ºC		-0.95	0.61	0.08	0.24	0.18	0.24	0.08	0.61	-0.99
DESCENSO PILA(1.25 cm)		5	7.6	7.6	7.6	7.6	7.6	7.6	7.6	5
: flecha total [mm]		16.02	22.38	22.22	22.27	22.26	22.24	22.35	21.95	17.12

(L / K) K: 2341 2011 2025 2020 2022 2023 2014 2050 2243

*Los valores de flecha debidos a pretensado total (continuidad + lanzamiento) se han minorado por el coeficiente 0.9,
del lado de la seguridad. También han sido multiplicados dichos valores por el coeficiente reductor 0.8,
para considerar pérdidas diferidas a t infinito.

La comprobación se realizará con la combinación característica en lugar de con la combinación casi-permanente,
como se expresa en EC2.2, por resultar del lado de la seguridad.

VALORES ADMISIBLES

Según se indica en el EC1.3, el valor máximo admisible de deflexión, para alta velocidad, luces mayores de 30 m. y puentes continuos de más de 3 vanos, será de L /1700

Como se observa, todos los valores son ADMISIBLES.

OINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	5	-0.26012	0.01869	0.00060	0.00000	0.00000	-0.00001
17	5	-0.83711	-0.00694	0.00128	0.00000	0.00000	0.00000
29	5	-1.47076	0.00202	0.00119	0.00000	0.00000	0.00000
41	5	-2.10451	-0.00063	0.00119	0.00000	0.00000	0.00000
53	5	-2.73838	0.00034	0.00124	0.00000	0.00001	0.00000
65	5	-3.37241	-0.00063	0.00122	0.00000	0.00001	0.00000
77	5	-4.00665	0.00203	0.00124	0.00000	0.00001	0.00000
89	5	-4.64111	-0.00700	0.00120	0.00000	0.00001	0.00000
100	5	-5.22593	0.01951	0.00057	0.00000	0.00001	0.00001

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	1	0.00000	-0.52823	0.00000	0.00000	0.00000	0.00015
17	1	0.00000	-0.44387	0.00000	0.00000	0.00000	-0.00001
29	1	0.00000	-0.48903	0.00000	0.00000	0.00000	0.00000
41	1	0.00000	-0.47550	0.00000	0.00000	0.00000	0.00000
53	1	0.00000	-0.48092	0.00000	0.00000	0.00000	0.00000
65	1	0.00000	-0.47396	0.00000	0.00000	0.00000	0.00000
77	1	0.00000	-0.49494	0.00000	0.00000	0.00000	0.00000
89	1	0.00000	-0.42290	0.00000	0.00000	0.00000	0.00001
100	1	0.00000	-0.59984	0.00000	-0.00002	0.00000	-0.00015

********** END OF LATEST ANALYSIS RESULT **********

141. FINISH

********** END OF STAAD-III **********

**** DATE= MAY 20,1998 TIME= 10:28: 6 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	14	0.00022	-0.01399	0.00000	0.00000	0.00000	0.00000
17	14	0.00070	0.04887	0.00000	0.00000	0.00000	0.00001
29	14	0.00124	-0.16983	0.00000	0.00000	0.00000	-0.00004
41	14	0.00177	0.58806	0.00000	0.00001	0.00000	0.00016
53	14	0.00233	-1.45586	0.00264	0.00008	0.00000	-0.00002
65	14	0.00270	0.92641	0.00023	0.00001	0.00000	-0.00001
77	14	0.00311	-1.35947	0.00227	0.00007	0.00000	0.00001
89	14	0.00329	0.81098	0.00023	0.00000	0.00000	-0.00002
100	14	0.00348	-1.01258	0.00119	0.00004	0.00000	-0.00006

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	15	0.00018	-0.46591	0.00054	0.00002	0.00000	0.00002
17	15	0.00056	0.39217	0.00011	0.00000	0.00000	0.00002
29	15	0.00099	-0.67201	0.00114	0.00003	0.00000	0.00000
41	15	0.00137	0.44680	0.00011	0.00000	0.00000	0.00000
53	15	0.00177	-0.69247	0.00114	0.00003	0.00000	0.00000
65	15	0.00209	0.46934	0.00011	0.00000	0.00000	0.00001
77	15	0.00242	-0.75688	0.00114	0.00003	0.00000	-0.00002
89	15	0.00264	0.68882	0.00012	0.00001	0.00000	0.00006
100	15	0.00286	-1.13028	0.00142	0.00005	0.00000	-0.00008

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	16	0.00025	0.03418	0.00000	0.00000	0.00000	0.00001
17	16	0.00082	-0.11937	0.00000	0.00000	0.00000	-0.00003
29	16	0.00144	0.41482	0.00000	0.00000	0.00000	0.00011
41	16	0.00208	-0.85629	0.00265	0.00009	0.00000	0.00014
53	16	0.00259	-0.72955	0.00227	0.00006	0.00000	-0.00017
65	16	0.00297	0.70587	0.00023	0.00001	0.00000	0.00005
77	16	0.00338	-1.29580	0.00227	0.00007	0.00000	-0.00001
89	16	0.00356	0.79261	0.00023	0.00000	0.00000	-0.00002
100	16	0.00375	-1.00716	0.00119	0.00004	0.00000	-0.00006

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	17	0.00016	0.23649	0.00000	0.00000	0.00000	0.00004
17	17	0.00053	-0.58385	0.00114	0.00003	0.00000	0.00000
29	17	0.00091	0.25695	0.00011	0.00000	0.00000	-0.00004
41	17	0.00130	-0.06849	0.00114	0.00004	0.00000	0.00016
53	17	0.00165	-1.15439	0.00264	0.00008	0.00000	-0.00008
65	17	0.00182	0.66970	0.00012	0.00000	0.00000	-0.00006
77	17	0.00203	-0.73936	0.00114	0.00004	0.00000	0.00002
89	17	0.00211	0.42270	0.00012	0.00000	0.00000	-0.00002
100	17	0.00221	-0.51137	0.00060	0.00002	0.00000	-0.00003

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	101	0.00000	0.00385	0.00000	0.00000	0.00000	0.00000
17	101	0.00000	-0.01343	0.00000	0.00000	0.00000	0.00000
29	101	0.00000	0.04668	0.00000	0.00000	0.00000	0.00001
41	101	0.00000	-0.16165	0.00000	0.00000	0.00000	-0.00004
53	101	0.00000	0.55964	0.00000	0.00001	0.00000	0.00015
65	101	0.00000	-1.35893	0.00000	0.00000	0.00000	0.00001
77	101	0.00000	0.54294	0.00000	-0.00001	0.00000	-0.00014
89	101	0.00000	-0.15666	0.00000	0.00000	0.00000	0.00004
100	101	0.00000	0.04623	0.00000	0.00000	0.00000	-0.00001

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	102	0.00000	0.00031	0.00000	0.00000	0.00000	0.00000
17	102	0.00000	-0.00109	0.00000	0.00000	0.00000	0.00000
29	102	0.00000	0.00377	0.00000	0.00000	0.00000	0.00000
41	102	0.00000	-0.01307	0.00000	0.00000	0.00000	0.00000
53	102	0.00000	0.04524	0.00000	0.00000	0.00000	0.00001
65	102	0.00000	-0.15666	0.00000	0.00000	0.00000	-0.00004
77	102	0.00000	0.54250	0.00000	0.00001	0.00000	0.00014
89	102	0.00000	-1.35738	0.00000	0.00000	0.00000	-0.00001
100	102	0.00000	0.57149	0.00000	-0.00001	0.00000	-0.00010

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	18	0.00010	0.00000	0.00026	0.00000	0.00000	0.00000
17	18	0.00032	0.00000	0.00054	0.00000	0.00000	0.00000
29	18	0.00055	0.00000	0.00054	0.00000	0.00000	0.00000
41	18	0.00077	0.00000	0.00054	0.00000	0.00000	0.00000
53	18	0.00096	0.00000	0.00054	0.00000	0.00000	0.00000
65	18	0.00113	0.00000	0.00054	0.00000	0.00000	0.00000
77	18	0.00127	0.00000	0.00054	0.00000	0.00000	0.00000
89	18	0.00136	0.00000	0.00054	0.00000	0.00000	0.00000
100	18	0.00139	-0.00001	0.00028	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN

6	28	0.00018	-0.78861	0.00000	0.00004	0.00000	0.00003
	29	0.00019	-0.78676	0.00087	0.00004	0.00000	0.00003
	30	0.00020	0.40093	0.00000	0.00000	0.00000	0.00007
	31	0.00020	0.40038	0.00000	0.00000	0.00000	0.00007
	32	0.00016	-0.40055	0.00000	-0.00008	0.00000	0.00002
	33	0.00018	-0.39323	0.00043	-0.00008	0.00000	0.00002
	34	0.00016	0.21129	0.00000	0.00000	0.00000	0.00004
	35	0.00016	0.21456	0.00000	0.00000	0.00000	0.00004
17	28	0.00059	0.73946	0.00000	0.00000	0.00000	0.00003
	29	0.00061	0.73302	0.00000	0.00000	0.00000	0.00003
	30	0.00065	-1.01293	0.00182	0.00006	0.00000	-0.00002
	31	0.00066	-1.01101	0.00182	0.00006	0.00000	-0.00002
	32	0.00052	0.39187	0.00000	0.00000	0.00000	0.00002
	33	0.00058	0.36632	0.00000	0.00000	0.00000	0.00001
	34	0.00051	-0.54494	0.00091	-0.00012	0.00000	-0.00002
	35	0.00051	-0.55636	0.00091	-0.00012	0.00000	-0.00002
29	28	0.00105	-1.17697	0.00182	0.00006	0.00000	-0.00001
	29	0.00108	-1.15460	0.00182	0.00006	0.00000	-0.00001
	30	0.00110	0.64607	0.00000	0.00000	0.00000	-0.00003
	31	0.00113	0.63939	0.00000	0.00000	0.00000	-0.00003
	32	0.00092	-0.66638	0.00091	-0.00012	0.00000	-0.00003
	33	0.00102	-0.57759	0.00091	-0.00012	0.00000	0.00000
	34	0.00088	0.45702	0.00000	0.00000	0.00000	0.00002
	35	0.00088	0.49672	0.00000	0.00000	0.00000	0.00003
41	28	0.00144	0.90706	0.00000	0.00000	0.00000	0.00002
	29	0.00148	0.82961	0.00000	0.00000	0.00000	0.00000
	30	0.00157	-0.63521	0.00182	0.00006	0.00000	0.00014
	31	0.00161	-0.61206	0.00182	0.00006	0.00000	0.00014
	32	0.00128	0.72382	0.00000	0.00000	0.00000	0.00008
	33	0.00142	0.41637	0.00000	0.00000	0.00000	0.00000
	34	0.00129	-0.66556	0.00305	0.00013	0.00000	0.00009
	35	0.00129	-0.74290	0.00331	0.00016	0.00000	0.00011
53	28	0.00187	-1.39637	0.00231	0.00007	0.00000	0.00000
	29	0.00191	-1.18213	0.00182	0.00006	0.00000	0.00000
	30	0.00196	-0.64666	0.00182	0.00005	0.00000	-0.00014
	31	0.00201	-0.67291	0.00184	0.00005	0.00000	-0.00014
	32	0.00168	-1.29001	0.00327	0.00014	0.00000	0.00005
	33	0.00184	-0.59752	0.00091	-0.00012	0.00000	0.00000
	34	0.00157	-0.67348	0.00305	0.00012	0.00000	-0.00010
	35	0.00155	-0.58213	0.00266	0.00008	0.00000	-0.00008
65	28	0.00213	0.90825	0.00000	0.00000	0.00000	-0.00002
	29	0.00220	0.83695	0.00000	0.00000	0.00000	0.00000
	30	0.00223	0.67623	0.00000	0.00000	0.00000	0.00004
	31	0.00228	0.68384	0.00000	0.00000	0.00000	0.00004
	32	0.00182	0.59043	0.00030	0.00004	0.00000	-0.00005
	33	0.00219	0.44137	0.00000	0.00000	0.00000	0.00001
	34	0.00166	0.47164	0.00000	0.00000	0.00000	-0.00002
	35	0.00165	0.43200	0.00000	0.00000	0.00000	-0.00001

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
77	28	0.00245	-1.18219	0.00182	0.00006	0.00000	0.00001
	29	0.00255	-1.18264	0.00182	0.00006	0.00000	0.00000
	30	0.00255	-1.11520	0.00182	0.00006	0.00000	-0.00001
	31	0.00260	-1.11740	0.00182	0.00006	0.00000	-0.00001
	32	0.00197	-0.62968	0.00091	-0.00012	0.00000	0.00002
	33	0.00257	-0.67156	0.00091	-0.00012	0.00000	-0.00002
	34	0.00182	-0.59621	0.00091	-0.00012	0.00000	0.00001
	35	0.00181	-0.58476	0.00091	-0.00012	0.00000	0.00001
89	28	0.00257	0.75916	0.00000	0.00000	0.00000	-0.00002
	29	0.00269	0.83215	0.00000	0.00000	0.00000	0.00000
	30	0.00267	0.73983	0.00000	0.00000	0.00000	-0.00002
	31	0.00272	0.74046	0.00000	0.00000	0.00000	-0.00002
	32	0.00203	0.39114	0.00000	0.00000	0.00000	-0.00002
	33	0.00284	0.69455	0.00000	0.00001	0.00000	0.00007
	34	0.00188	0.38148	0.00000	0.00000	0.00000	-0.00001
	35	0.00187	0.37818	0.00000	0.00000	0.00000	-0.00001
100	28	0.00272	-0.85403	0.00096	0.00004	0.00000	-0.00004
	29	0.00288	-1.04026	0.00126	0.00005	0.00000	-0.00005
	30	0.00282	-0.84832	0.00096	0.00004	0.00000	-0.00004
	31	0.00287	-0.84851	0.00096	0.00004	0.00000	-0.00004
	32	0.00211	-0.43142	0.00048	-0.00009	0.00000	-0.00001
	33	0.00314	-1.10273	0.00195	0.00009	0.00000	-0.00006
	34	0.00196	-0.42857	0.00048	-0.00009	0.00000	-0.00001
	35	0.00194	-0.42760	0.00048	-0.00009	0.00000	-0.00002

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	201	0.00000	0.00329	0.00000	0.00000	0.00000	0.00000
17	201	0.00000	-0.01150	0.00000	0.00000	0.00000	0.00000
29	201	0.00000	0.03995	0.00000	0.00000	0.00000	0.00001
41	201	0.00000	-0.13833	0.00000	0.00000	0.00000	-0.00004
53	201	0.00000	0.47892	0.00000	0.00001	0.00000	0.00013
65	201	0.00000	-1.10391	0.00000	0.00001	0.00000	0.00006
77	201	0.00000	0.34293	0.00000	-0.00001	0.00000	-0.00009
89	201	0.00000	-0.09798	0.00000	0.00000	0.00000	0.00003
100	201	0.00000	0.02892	0.00000	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	202	0.00000	0.00320	0.00000	0.00000	0.00000	0.00000
17	202	0.00000	-0.01118	0.00000	0.00000	0.00000	0.00000
29	202	0.00000	0.03884	0.00000	0.00000	0.00000	0.00001
41	202	0.00000	-0.13449	0.00000	0.00000	0.00000	-0.00004
53	202	0.00000	0.46561	0.00000	0.00001	0.00000	0.00012
65	202	0.00000	-1.15537	0.00000	0.00000	0.00000	0.00001
77	202	0.00000	0.45703	0.00000	-0.00001	0.00000	-0.00012

89	202	0.00000	-0.13187	0.00000	0.00000	0.00000	0.00003
100	202	0.00000	0.03892	0.00000	0.00000	0.00000	-0.00001

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	203	0.00000	0.00019	0.00000	0.00000	0.00000	0.00000
17	203	0.00000	-0.00066	0.00000	0.00000	0.00000	0.00000
29	203	0.00000	0.00228	0.00000	0.00000	0.00000	0.00000
41	203	0.00000	-0.00791	0.00000	0.00000	0.00000	0.00000
53	203	0.00000	0.02739	0.00000	0.00000	0.00000	0.00001
65	203	0.00000	-0.09483	0.00000	0.00000	0.00000	-0.00003
77	203	0.00000	0.33174	0.00000	0.00001	0.00000	0.00009
89	203	0.00000	-1.09970	0.00000	0.00000	0.00000	-0.00006
100	203	0.00000	0.48722	0.00000	-0.00001	0.00000	-0.00008

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	204	0.00000	0.00027	0.00000	0.00000	0.00000	0.00000
17	204	0.00000	-0.00093	0.00000	0.00000	0.00000	0.00000
29	204	0.00000	0.00324	0.00000	0.00000	0.00000	0.00000
41	204	0.00000	-0.01120	0.00000	0.00000	0.00000	0.00000
53	204	0.00000	0.03879	0.00000	0.00000	0.00000	0.00001
65	204	0.00000	-0.13432	0.00000	0.00000	0.00000	-0.00004
77	204	0.00000	0.46514	0.00000	0.00001	0.00000	0.00012
89	204	0.00000	-1.15410	0.00000	0.00000	0.00000	0.00001
100	204	0.00000	0.46682	0.00000	-0.00001	0.00000	-0.00008

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	40	0.00070	-0.01467	0.00181	0.00005	0.00000	0.00000
	41	-0.00070	-0.01471	-0.00181	-0.00005	0.00000	0.00000
17	40	0.00226	-0.01271	0.00380	0.00007	0.00000	0.00000
	41	-0.00226	-0.01287	-0.00380	-0.00007	0.00000	0.00000
29	40	0.00390	-0.01386	0.00380	0.00007	0.00000	0.00000
	41	-0.00390	-0.01394	-0.00380	-0.00007	0.00000	0.00000
41	40	0.00544	-0.01348	0.00380	0.00007	0.00000	0.00000
	41	-0.00544	-0.01365	-0.00380	-0.00007	0.00000	0.00000
53	40	0.00683	-0.01365	0.00380	0.00007	0.00000	0.00000
	41	-0.00683	-0.01375	-0.00380	-0.00007	0.00000	0.00000
65	40	0.00802	-0.01350	0.00380	0.00007	0.00000	0.00000
	41	-0.00802	-0.01354	-0.00380	-0.00007	0.00000	0.00000
77	40	0.00896	-0.01398	0.00380	0.00007	0.00000	0.00000
	41	-0.00896	-0.01415	-0.00380	-0.00007	0.00000	0.00000
89	40	0.00962	-0.01225	0.00380	0.00007	0.00000	0.00000
	41	-0.00962	-0.01213	-0.00380	-0.00007	0.00000	0.00000
100	40	0.00987	-0.01684	0.00200	0.00005	0.00000	-0.00001
	41	-0.00987	-0.01660	-0.00200	-0.00005	0.00000	0.00000

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	50	0.00000	0.19031	0.00000	0.00000	0.00000	-0.00007
17	50	0.00000	-0.12240	0.00000	0.00000	0.00000	0.00002
29	50	0.00000	-0.01477	0.00000	0.00000	0.00000	-0.00001
41	50	0.00000	-0.04656	0.00000	0.00000	0.00000	0.00000
53	50	0.00000	-0.03499	0.00000	0.00000	0.00000	0.00000
65	50	0.00000	-0.04658	0.00000	0.00000	0.00000	0.00000
77	50	0.00000	-0.01467	0.00000	0.00000	0.00000	0.00001
89	50	0.00000	-0.12283	0.00000	0.00000	0.00000	-0.00002
100	50	0.00000	0.19839	0.00000	0.00001	0.00000	0.00007

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	60	0.00000	0.01444	0.00000	0.00000	0.00000	0.00000
17	60	0.00000	-0.05042	0.00000	0.00000	0.00000	-0.00001
29	60	0.00000	0.17521	0.00000	0.00000	0.00000	0.00005
41	60	0.00000	-0.76096	0.00000	0.00000	0.00000	-0.00037
53	60	0.00000	-0.76096	0.00000	0.00001	0.00000	0.00037
65	60	0.00000	0.17524	0.00000	0.00000	0.00000	-0.00005
77	60	0.00000	-0.05060	0.00000	0.00000	0.00000	0.00001
89	60	0.00000	0.01460	0.00000	0.00000	0.00000	0.00000
100	60	0.00000	-0.00431	0.00000	0.00000	0.00000	0.00000

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	61	0.00000	-0.00002	0.00000	0.00000	0.00000	0.00000
17	61	0.00000	0.00007	0.00000	0.00000	0.00000	0.00000
29	61	0.00000	-0.00025	0.00000	0.00000	0.00000	0.00000
41	61	0.00000	0.00086	0.00000	0.00000	0.00000	0.00000
53	61	0.00000	-0.00298	0.00000	0.00000	0.00000	0.00000
65	61	0.00000	0.01033	0.00000	0.00000	0.00000	0.00000
77	61	0.00000	-0.03578	0.00000	0.00000	0.00000	-0.00001
89	61	0.00000	0.12392	0.00000	0.00000	0.00000	0.00003
100	61	0.00000	-0.49874	0.00000	0.00000	0.00000	-0.00035

2.1.6- Situaciones accidentales

DESCARRILAMIENTO

Para el siguiente estudio se tomarán:

$\gamma_f = 1,0$ — Mayoración de acciones

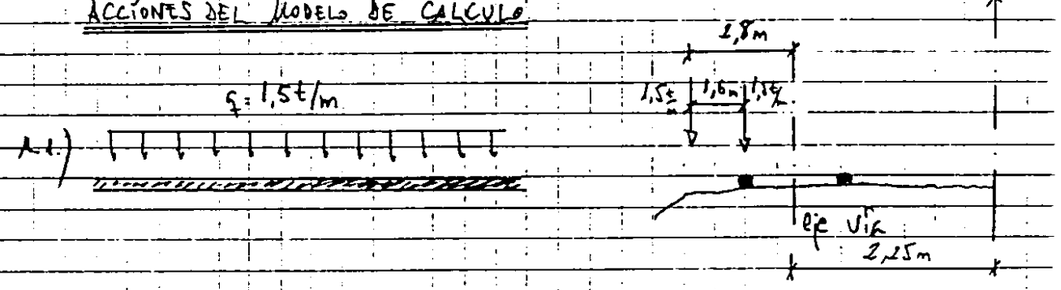
$\gamma = 1,1$ — Minoración de resistencia de materiales

Se distinguen los siguientes 3 casos, en función de la gravedad.

CASO A: Descarrilamiento de coches de viajeros o vagones ligeros, quedando los vehículos en la zona de vía sobre el tablero.

Bajo este caso, la sección no debe sufrir daños permanentes

ACCIONES DEL MODELO DE CÁLCULO



$q = 1,5\ t/m \times 2 = \underline{3,0\ t/m}$

$m_{motor} = 1,5 \times (5,05 + 3,45) = \underline{12,75\ mt/m}$

A.2) Carga puntual de 10t a 2,8m del eje de la vía

CASO B : Descarrilamiento de locomotoras o vagones pesados, quedando los vehículos descarrilados en la zona de la vía sobre el tablero.

Se debe evitar que partes importantes de la sección sufran daños irreversibles.

En concreto, se estudiará la sección de empotramiento de los voladizos del tablero.

Las acciones a introducir en el modelo serán similares al Caso A, pero en este caso:

- Carga puntual de 22t
- Cargas repartidas: 2 cuitillos de 5t/m. cada uno, separados 1,6m entre sí.

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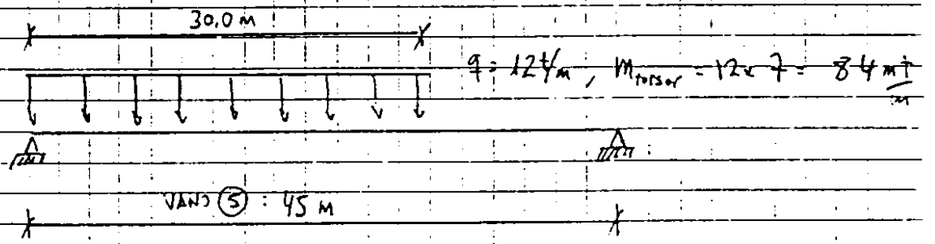
oficina tecnica, s.a.
madrid
REALIZO:

CASO C : Descarrilamiento de locomotoras o vagones pesados, apoyándose los vehículos descarrilados de la zona de la vía, no cayendo

En este caso se hará un estudio global del tablero (se cargará el vano ⑤), comprobando que el puente no se desploma

Se comprobará que la torsión obtenida del cálculo no es mayor que la admisible por la sección.

CARGA EN EL MODELO: $q = 12 t/m$ en 30m en el borde



El momento torsor que se obtiene en la sección de pila P-4 es de 1700 mt

El momento torsor por PP y RCI a añadir será de 1244mt y por pretensado será de 25,8mt más

$M_{TORSOR\ P-4} = 1850,2\ mT < 7295,2 = T_{ULTIM.}$

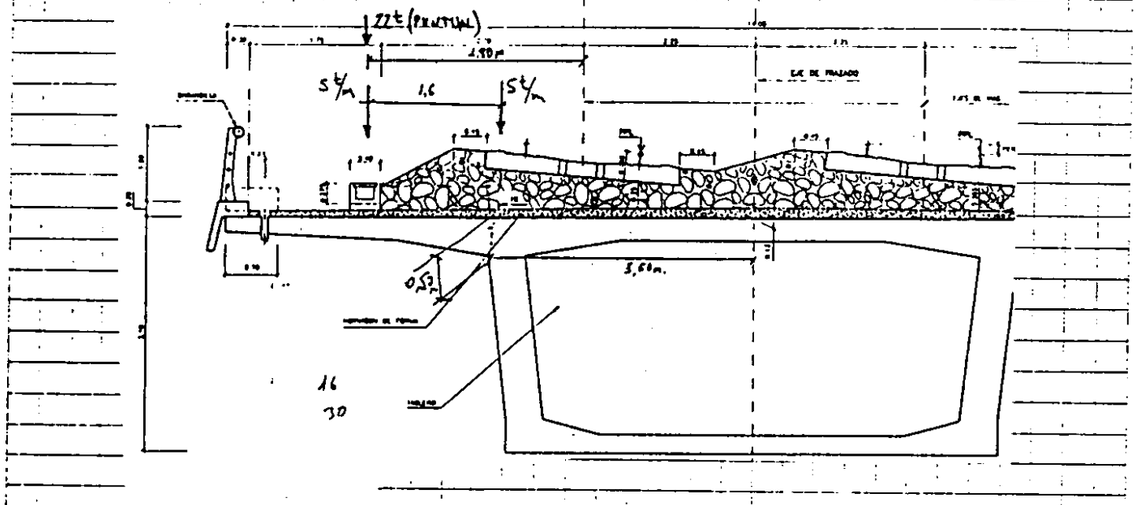
TORSIÓN Y FLEXIÓN:

$$\frac{T_d}{T_{u1}} + \frac{V_{rd}}{V_u} = \frac{1850}{7295,4} + \frac{(245,8+903)}{2467,0} = 0,34 \quad \text{o.k.}$$

V_{rd}: Vuelo: 245,8t
PP+RCI: 903t
1148,8

De donde se concluye que se cumple el caso C, puesto que la sección no rompe por el descarrilamiento

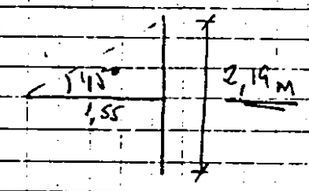
Caso B: Comprobación de la sección de retallito



Acciones: Momento flector en sección de arranque del retallito

$$M[mt/m] = 5 \times 1,55 + 22^{t} \times 1,55/2,19 = 23,32 mt$$

La carga puntual se reparte a 45°, con lo que actúa en una longitud de:



Debido al P.P. y R.C.P.: $M = 12,05 mt/m$

Zapata + Impuesta: $0,5 \times 3,48 = 2,75 mt/m$

Estatico: $0,8 mt/m$

Construcción: $2,05 \times 1,76 = 3,6 mt/m$

P.P. + Hormigón fresco = $4,9 mt/m$

Luego el momento total será:

$$23,32 + 12,05 = 35,37 mt/m$$

Para una sección de: $h = 0,50 m$ H-350

$d = 0,47 m$ AEH-5100

$d' = 0,05 m$

$\gamma_c = \gamma_s = 1,1$;

$f_{cd} = 318,2 kg/cm^2$

$f_{yd} = 4636 kg/cm^2$

$M_{lim} = 202,8 mt/m > M_d$

Diagrama rectangular: $M_1 = 81,31 Tn/m$ En flexión simple

$A_s = 17,5 cm^2/m \leq A_s$ dispuesta en servicio

En servicio: $1,35 \times 12,05 + 1,5 \times 0,864 = 17,6 mt/m$

(PP + RCP)

SC aceras: $(0,4 t/m^2 \times 0,8 m) \times 2,7 m = 0,864 mt/m$

El caso A queda cubierto, puesto que la armadura cubre el caso B, más desfavorable

2.1.7- Replanteo

```
AVE. VIADUCTOS 1 Y 2
700000 547937.383 4545566.803 34.3033 13
1 701585.303 0 0 0
3 702002.178 0 8000 1826.198
2 704535.371 8000 8000 0
4 704952.246 8000 0 1826.198
1 707852.940 0 0 0
-3 708269.815 0 8000 1826.198
-2 708729.220 8000 8000 0
-4 709146.095 8000 0 1826.198
1 710367.385 0 0 0
3 710537.385 0 20000 1843.909
2 711092.345 20000 20000 0
4 711262.345 20000 0 1843.909
1 713695.444 0 0 0
700000 0 0 1
1 714000 0
0 0 0 2
0 0
700000 0 0
714000 0 0
1 26 0
0 0
703053.200 703053.200 1
703090.700
703135.700
703180.700
703225.700
703270.700
703315.700
703360.700
703405.700
703444.100
703482.500
703527.500
703565.000
711258.200
711295.700
711340.700
711379.100
711417.500
711462.500
711507.500
711552.500
711597.500
711642.500
711687.500
711732.500
711777.500
711815.000
```

REPLANTEO DE BORDES PARALELOS

DENOMINACION: AVE. VIADUCTOS 1 Y 2

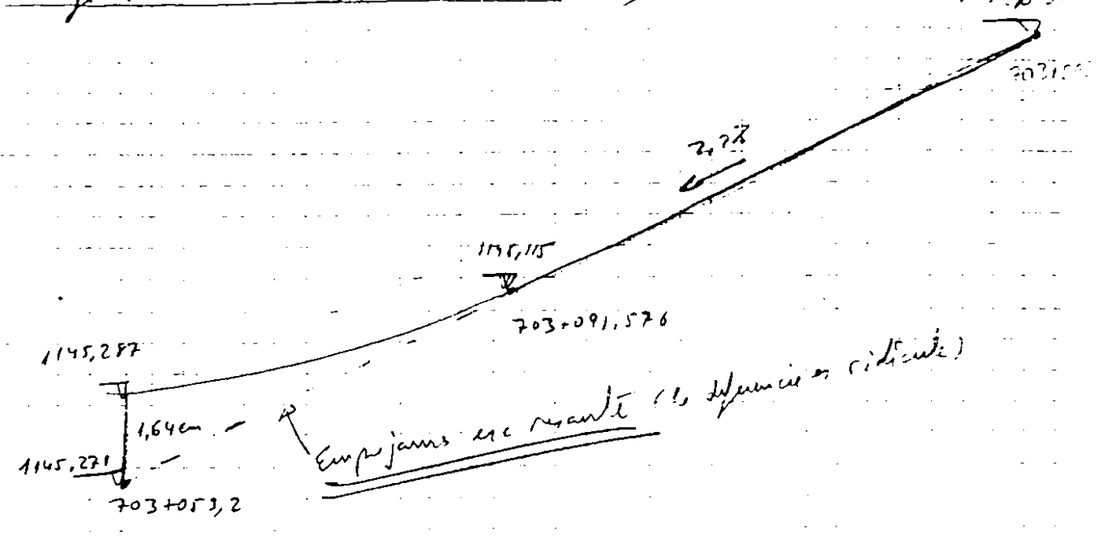
BORDE	DISTANCIA	INCRE. Z
1	.000	.000

RESULTADOS

PK	AZ	BORDE	X	Y	Z
703053.200	44.3258	1	549587.116	4548131.690	.000
703090.700	44.6242	1	549611.235	4548160.405	.000
703135.700	44.9823	1	549640.354	4548194.714	.000
703180.700	45.3404	1	549669.665	4548228.858	.000
703225.700	45.6985	1	549699.169	4548262.837	.000
703270.700	46.0566	1	549728.862	4548296.649	.000
703315.700	46.4147	1	549758.747	4548330.293	.000
703360.700	46.7728	1	549788.820	4548363.769	.000
703405.700	47.1309	1	549819.079	4548397.075	.000
703444.100	47.4364	1	549845.050	4548425.362	.000
703482.500	47.7420	1	549871.155	4548453.523	.000
703527.500	48.1001	1	549901.919	4548486.365	.000
703565.000	48.3985	1	549927.696	4548513.600	.000
711258.200	53.1134	1	555745.942	4553532.725	.000
711295.700	53.1136	1	555773.723	4553557.913	.000
711340.700	53.1136	1	555807.060	4553588.139	.000
711379.100	53.1136	1	555835.508	4553613.932	.000
711417.500	53.1136	1	555863.956	4553639.725	.000
711462.500	53.1136	1	555897.293	4553669.951	.000
711507.500	53.1136	1	555930.631	4553700.178	.000
711552.500	53.1136	1	555963.968	4553730.404	.000
711597.500	53.1136	1	555997.305	4553760.629	.000
711642.500	53.1136	1	556030.643	4553790.856	.000
711687.500	53.1136	1	556063.980	4553821.082	.000
711732.500	53.1136	1	556097.318	4553851.308	.000
711777.500	53.1136	1	556130.654	4553881.534	.000

711815.000 53.1136 1 556158.436 4553906.723 .000

- Encaje Viaducto nº1 - Alz vertical (III)



703,560 = 1158,62 / CRojo: 12,6 m
1146

+570 = 1158,84 / 1151 } ~CR: 7,8 m

+590 = 1159,06 / 1157 } CR = 1,0 m

En 1.000 - [illegible] ~6,0 m

Estructura · 511,8 m 703+565 / 703+053,2 } ✓ 511,8 m

E1: 33,5 + 7045 - 35,4 + 35,4 + 45 + 390,9 m + 120,= = 511,8 m

- En principio alzamos el puente junto a E1 (mismo estribo desde donde empujamos), pero en el que tiene quizá menos riesgo geológico.

2.2- PILAS

2.2.1- Fustes y aparatos de apoyo

VIADUCTO 1

FUSTE DE PILA

GEOMETRIA

La sección del viaducto es una sección rectangular maciza (cajón) con dimensiones exteriores de 7,0 x 2,0 m en cabeza, abriéndose en el plano Capitel-Fuste con faldones. La zona superior está macizada en 2,0 m de profundidad. El espesor de las paredes es de 0,50 m.

MODELO DE CALCULO

Para resolver la estructura, numéricamente se utiliza el sistema PIBACC, que resuelve pilas sometidas en teoría de 2º orden (no linealidad a flexocompresión esviada).

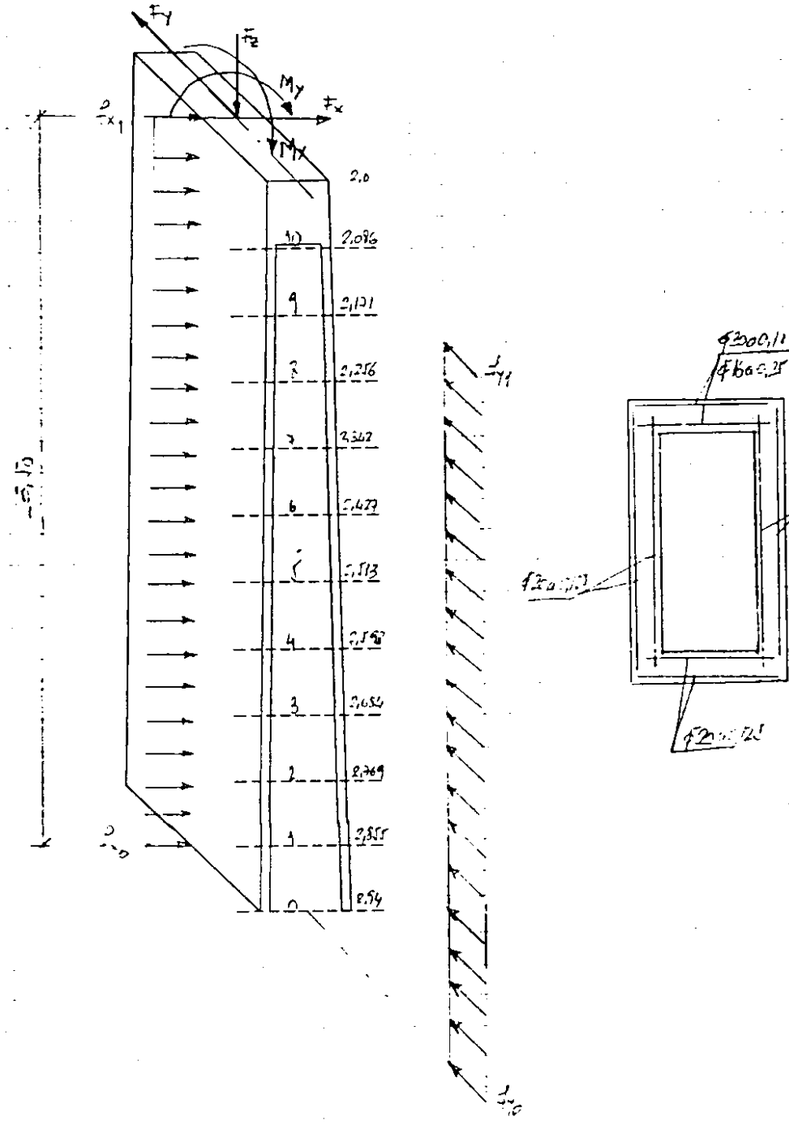
Por cuanto la flexibilidad de la pérdida y el giro que se produce en el empotramiento del fuste, se disponen muelles en la base y empotramiento del fuste, cuyo valor viene dado en la expresión:

$$K = \frac{E_0 \cdot A_p \cdot d^2}{2L}$$

$$K_x = \frac{268700 \times 3 \times 0{,}25 \times 1{,}80^2 \times 5{,}40^2}{2 \times \frac{6}{3} 30{,}0} = 1494239 \text{ tm} \quad \theta = \frac{1}{K_x} = 6{,}17 \cdot 10^{-8} \text{ rd/m/m}$$

$$K_y = \frac{268700 \times 2 \times 0{,}25 \times 1{,}50^2 \times 10{,}80^2}{2 \times \frac{6}{3} 30{,}0} = 2491666{,}3 \text{ tm} \quad \theta = \frac{1}{K_y} = 4{,}16 \cdot 10^{-8} \text{ rd/m/m}$$

Acciones



HIPOTESIS	F_x	F_y	F_z	M_x	M_y	f_{x0}	f_{y0}	f_{x1}	f_{y1}
1	140,4	26,89	4422,5	997,3	0	0	0	0	0
2	125,3	45,2	3961,7	3299,9	0	0	0	0	0
3	126,4	139,2	4027,7	1441,1	0	2,51	0,72	2,51	0,72
4	112,7	160,6	3627,0	3977,5	0	2,31	0,72	2,31	0,72

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 23.50

COEFICIENTES ELASTICOS DE MUELLE EN CABEZA Y EN PIE:

SECCION - MOVIMIENTO COEFICIENTE (unidades)	CABEZA-DIR x Kx (t/m)	CABEZA-DIR y Ky (t/m)	PIE- GIRO x Fx (rad/mt)	PIE- GIRO y Fy (rad/mt)
	000	000	6.7E-8	2.5E-8

DIMENSIONES EN 11 SECCIONES DE HORMIGON A DECIMOS DE LA ALTURA
DIRECCION LONGITUDINAL R/EJE DEL PUENTE:

Sec:	0	1	2	3	4	5	6	7	8	9	10
"h"	294	285.5	276.9	268.4	259.8	251.3	242.7	234.2	225.6	217.1	208.6
"e"	30	30	30	30	30	30	30	30	30	30	30

DIRECCION TRANSVERSAL R/EJE DEL PUENTE:

Sec:	0	1	2	3	4	5	6	7	8	9	10
"h"	700	700	700	700	700	700	700	700	700	700	700
"e"	30	30	30	30	30	30	30	30	30	30	30

"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
"Ax"	156	146	135	124	113	102	91.3	80.4	070	059	48
"Ay"	361	337	313	289	265	241	216	192	168	144	128

"ARMADURA INTERIOR: Recubrimiento r (cm):" 4
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec.:	0	1	2	3	4	5	6	7	8	9	10
"Ax"	156	146	135	124	113	102	91.3	80.4	070	059	48
"Ay"	361	337	313	289	265	241	216	192	168	144	128

"NUM. DE HIPOTESIS DE CARGA:" 4

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	140.40	076.90	4422.50	0997.30	000.00	0	0.00	0	0.00	1.50
2	125.30	45.20	3310.70	3759.90	000.00	0	0	0	0	1.50
3	126.40	159.2	4027.7	1441.1	000.0	2.51	0.72	2.51	0.72	1.35
4	112.7	130.6	3027.0	3927.5	000.0	2.51	0.72	2.51	0.72	1.35

VIADUCTO Nº 1.AVE.PILA PESIMA

HIPOTESIS 1 - TANTEO 1

Fpx = 140.400 t; Fpy = 76.900 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1808.84	3764.18	4893.76	0.361	3.132
1	0.001	0.000	1626.27	3429.01	4844.60	0.339	3.141
2	0.004	0.001	1442.85	3085.66	4795.90	0.311	3.098
3	0.008	0.002	1258.66	2734.50	4747.64	0.282	3.014
4	0.015	0.003	1073.82	2375.98	4699.83	0.249	2.887
5	0.022	0.004	888.43	2010.66	4652.48	0.215	2.700
6	0.032	0.005	702.58	1639.22	4605.58	0.177	2.445
7	0.042	0.006	516.40	1262.50	4559.13	0.136	2.096
8	0.054	0.007	329.99	881.54	4513.14	0.091	1.638
9	0.067	0.009	143.47	497.60	4467.59	0.041	1.039
10	0.080	0.010	-43.25	110.47	4422.50	-0.013	0.259

Exc. totales result. cabeza 0.02498 -0.00978
Exc. reales ler ord. cabeza 0.10430 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1858.31	4163.44	4893.76	0.375	3.495
1	0.001	0.000	1675.19	3823.74	4844.60	0.349	3.502
2	0.004	0.001	1491.16	3474.82	4795.90	0.321	3.486
3	0.009	0.002	1306.33	3116.93	4747.64	0.292	3.432
4	0.016	0.003	1120.77	2750.40	4699.83	0.260	3.337
5	0.025	0.004	934.59	2375.66	4652.48	0.225	3.184
6	0.036	0.005	747.89	1993.30	4605.58	0.188	2.966
7	0.048	0.006	560.78	1604.03	4559.13	0.147	2.657
8	0.062	0.008	373.36	1208.79	4513.14	0.102	2.240
9	0.077	0.009	185.77	808.75	4467.59	0.053	1.685
10	0.092	0.011	-1.68	406.89	4422.50	-0.001	0.951

Exc. totales result. cabeza 0.09200 -0.00038
Exc. reales ler ord. cabeza 0.10430 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1855.85	4189.68	4893.76	0.385	3.548
1	0.001	0.000	1673.18	3853.17	4844.60	0.353	3.551
2	0.004	0.001	1489.59	3507.28	4795.90	0.323	3.536
3	0.010	0.002	1305.17	3152.23	4747.64	0.293	3.488
4	0.017	0.003	1120.03	2788.34	4699.83	0.261	3.400
5	0.026	0.004	934.25	2416.02	4652.48	0.226	3.253
6	0.036	0.005	747.95	2035.82	4605.58	0.189	3.044
7	0.049	0.006	561.23	1648.43	4559.13	0.148	2.742
8	0.063	0.008	374.20	1254.76	4513.14	0.103	2.334
9	0.078	0.009	186.98	855.97	4467.59	0.054	1.788
10	0.094	0.011	-0.30	453.73	4422.50	0.054	1.062

Exc. totales result. cabeza 0.10260 -0.00007
Exc. reales ler ord. cabeza 0.10430 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1856.02	4192.73	4893.76	0.388	3.557
1	0.001	0.000	1673.36	3856.72	4844.60	0.355	3.558
2	0.004	0.001	1489.77	3511.31	4795.90	0.324	3.543
3	0.010	0.002	1305.36	3156.71	4747.64	0.293	3.495
4	0.017	0.003	1120.22	2793.25	4699.83	0.261	3.408
5	0.026	0.004	934.46	2421.32	4652.48	0.227	3.263
6	0.036	0.005	748.16	2041.47	4605.58	0.189	3.054
7	0.049	0.006	561.44	1654.40	4559.13	0.148	2.754

9	0.078	0.009	187.19	862.44	4467.59	0.054	1.805
10	0.094	0.011	-0.09	460.18	4422.50	0.054	1.077

Exc. totales result. cabeza 0.10405 -0.00002
Exc. reales ler ord. cabeza 0.10430 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1856.10	4193.20	4893.76	0.388	3.559
1	0.001	0.000	1673.44	3857.27	4844.60	0.355	3.560
2	0.004	0.001	1489.85	3511.91	4795.90	0.324	3.544
3	0.010	0.002	1305.44	3157.38	4747.64	0.293	3.496
4	0.017	0.003	1120.30	2793.97	4699.83	0.261	3.409
5	0.026	0.004	934.53	2422.10	4652.48	0.227	3.264
6	0.036	0.005	748.24	2042.30	4605.58	0.189	3.056
7	0.049	0.006	561.52	1655.28	4559.13	0.148	2.755
8	0.063	0.008	374.49	1261.93	4513.14	0.103	2.349
9	0.078	0.009	187.27	863.40	4467.59	0.054	1.805
10	0.094	0.011	-0.02	461.13	4422.50	0.054	1.079

Exc. totales result. cabeza 0.10427 -0.00000
Exc. reales ler ord. cabeza 0.10430 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	1856.11	4193.25	4893.76	0.388	3.559
1	0.001	0.000	1673.45	3857.32	4844.60	0.355	3.560
2	0.004	0.001	1489.86	3511.98	4795.90	0.324	3.544
3	0.010	0.002	1305.45	3157.45	4747.64	0.293	3.496
4	0.017	0.003	1120.31	2794.05	4699.83	0.261	3.409
5	0.026	0.004	934.55	2422.19	4652.48	0.227	3.264
6	0.036	0.005	748.25	2042.40	4605.58	0.189	3.056
7	0.049	0.006	561.53	1655.39	4559.13	0.148	2.755
8	0.063	0.008	374.50	1262.04	4513.14	0.103	2.349
9	0.078	0.009	187.28	863.51	4467.59	0.054	1.805
10	0.094	0.011	-0.00	461.25	4422.50	0.054	1.080

Exc. totales result. cabeza 0.10430 -0.00000
Exc. reales ler ord. cabeza 0.10430 0.00000

Convergencia del equilibrio sin agotamiento
Fpx = 140.400 t; Fpy = 76.900 t

VIADUCTO Nº 1.AVE.PILA PESIMA

HIPOTESIS 2.- TANTEO 1

Fpx = 125.300 t; Fpy = 45.200 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4826.52	2947.25	3781.96	0.934	2.351
1	0.001	0.001	4716.52	2649.74	3732.80	1.010	2.428
2	0.003	0.003	4604.58	2347.41	3684.10	1.029	2.380
3	0.006	0.005	4490.74	2040.53	3635.84	1.027	2.255
4	0.011	0.007	4375.07	1729.55	3588.03	1.016	2.075
5	0.017	0.011	4257.68	1414.97	3540.68	1.002	1.842
6	0.024	0.015	4138.67	1097.40	3493.78	0.989	1.554
7	0.032	0.019	4018.12	777.52	3447.33	0.981	1.202
8	0.040	0.024	3896.13	456.08	3401.34	0.981	0.777
9	0.049	0.029	3772.76	133.96	3355.79	0.990	0.255
10	0.058	0.035	3647.30	-189.13	3310.70	0.998	-0.402

Exc. totales result. cabeza -0.05713 1.10167
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4960.14	3171.55	3781.96	1.040	2.684
1	0.001	0.001	4848.24	2870.82	3732.80	1.058	2.679
2	0.003	0.003	4734.25	2564.68	3684.10	1.056	2.603
3	0.007	0.005	4618.23	2253.45	3635.84	1.044	2.474
4	0.012	0.008	4500.25	1937.52	3588.03	1.029	2.301
5	0.019	0.011	4380.40	1617.36	3540.68	1.014	2.079
6	0.026	0.015	4258.76	1293.52	3493.78	1.003	1.808
7	0.035	0.020	4135.41	966.65	3447.33	1.000	1.478
8	0.045	0.025	4010.39	637.44	3401.34	1.007	1.082
9	0.055	0.030	3883.75	306.73	3355.79	1.019	0.584
10	0.065	0.036	3756.24	-23.39	3310.70	1.027	-0.050

Exc. totales result. cabeza -0.00707 1.13458
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4949.32	3173.68	3781.96	1.092	2.788
1	0.001	0.001	4838.98	2875.29	3732.80	1.092	2.743
2	0.003	0.003	4726.47	2571.33	3684.10	1.082	2.653
3	0.007	0.005	4611.85	2262.14	3635.84	1.066	2.518
4	0.013	0.008	4495.22	1948.12	3588.03	1.048	2.344
5	0.019	0.011	4376.67	1629.76	3540.68	1.030	2.121
6	0.027	0.015	4256.28	1307.60	3493.78	1.016	1.850
7	0.036	0.020	4134.14	982.26	3447.33	1.008	1.517
8	0.046	0.025	4010.31	654.48	3401.34	1.009	1.115
9	0.056	0.031	3884.83	325.08	3355.79	1.020	0.619
10	0.066	0.037	3757.75	-4.87	3310.70	1.028	-0.010

Exc. totales result. cabeza -0.00147 1.13503
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4951.38	3176.29	3781.96	1.112	2.833
1	0.001	0.001	4841.05	2878.13	3732.80	1.104	2.772
2	0.003	0.003	4728.50	2574.33	3684.10	1.091	2.675
3	0.007	0.005	4613.84	2265.26	3635.84	1.074	2.538
4	0.013	0.008	4497.14	1951.31	3588.03	1.055	2.361
5	0.020	0.011	4378.51	1632.98	3540.68	1.036	2.135
6	0.027	0.015	4258.03	1310.82	3493.78	1.020	1.862
7	0.036	0.020	4135.79	985.46	3447.33	1.010	1.525
8	0.046	0.025	4011.84	657.63	3401.34	1.010	1.121
9	0.056	0.031	3886.26	328.16	3355.79	1.020	0.625
10	0.067	0.037	3759.06	-1.97	3310.70	1.029	-0.004

Exc. totales result. cabeza -0.00059 1.13543
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4952.09	3177.98	3781.96	1.120	2.851
1	0.001	0.001	4841.76	2879.84	3732.80	1.109	2.784
2	0.003	0.003	4729.22	2576.04	3684.10	1.095	2.685
3	0.007	0.005	4614.55	2266.94	3635.84	1.078	2.546
4	0.013	0.008	4497.83	1952.95	3588.03	1.058	2.368
5	0.020	0.011	4379.18	1634.56	3540.68	1.038	2.141
6	0.027	0.016	4258.67	1312.33	3493.78	1.022	1.866
7	0.036	0.020	4136.40	986.90	3447.33	1.011	1.529
8	0.046	0.025	4012.42	658.98	3401.34	1.010	1.123
9	0.057	0.031	3886.80	329.42	3355.79	1.021	0.627
10	0.067	0.037	3759.57	-0.82	3310.70	1.029	0.627

Exc. totales result. cabeza -0.00025 1.13558
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4952.37	3178.68	3781.96	1.123	2.858
1	0.001	0.001	4842.05	2880.55	3732.80	1.112	2.789
2	0.003	0.003	4729.50	2576.75	3684.10	1.097	2.689
3	0.007	0.005	4614.83	2267.64	3635.84	1.079	2.549
4	0.013	0.008	4498.11	1953.64	3588.03	1.059	2.371
5	0.020	0.011	4379.44	1635.22	3540.68	1.039	2.144
6	0.028	0.016	4258.92	1312.96	3493.78	1.022	1.868
7	0.036	0.020	4136.64	987.49	3447.33	1.011	1.530
8	0.046	0.025	4012.65	659.54	3401.34	1.010	1.124
9	0.057	0.031	3887.01	329.95	3355.79	1.021	0.628
10	0.067	0.037	3759.76	-0.33	3310.70	1.029	0.628

Exc. totales result. cabeza -0.00010 1.13564
Exc. reales 1er ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4952.49	3178.97	3781.96	1.125	2.862
1	0.001	0.001	4842.17	2880.84	3732.80	1.112	2.791
2	0.003	0.003	4729.62	2577.04	3684.10	1.098	2.691
3	0.007	0.005	4614.94	2267.93	3635.84	1.080	2.551
4	0.013	0.008	4498.22	1953.91	3588.03	1.060	2.372
5	0.020	0.012	4379.55	1635.49	3540.68	1.039	2.145
6	0.028	0.016	4259.02	1313.22	3493.78	1.023	1.869
7	0.036	0.020	4136.73	987.74	3447.33	1.011	1.530
8	0.046	0.025	4012.74	659.77	3401.34	1.010	1.125
9	0.057	0.031	3887.10	330.16	3355.79	1.021	0.629
10	0.067	0.037	3759.84	-0.14	3310.70	1.029	0.629

Exc. totales result. cabeza -0.00004 1.13566
Exc. reales 1er ord. cabeza 0.00000 1.13568

Convergencia del equilibrio sin agotamiento
Fpx = 125.300 t; Fpy = 45.200 t

VIADUCTO Nº 1.AVE.PILA PESIMA

HIPOTESIS 3 - TANTEO 1

Fpx = 126.400 t; Fpy = 159.200 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5386.15	3666.90	4451.84	1.081	3.034
1	0.001	0.001	4969.22	3233.56	4407.59	1.125	3.103
2	0.004	0.003	4553.68	2806.73	4363.76	1.067	2.958
3	0.008	0.005	4139.72	2386.97	4320.33	0.975	2.701
4	0.014	0.008	3727.65	1975.10	4277.30	0.875	2.394
5	0.021	0.012	3317.75	1572.02	4234.68	0.784	2.059
6	0.030	0.015	2910.31	1178.64	4192.47	0.710	1.702
7	0.039	0.020	2505.52	795.93	4150.67	0.636	1.277
8	0.049	0.024	2103.61	424.95	4109.27	0.557	0.762
9	0.059	0.029	1704.79	66.92	4068.28	0.472	0.135
10	0.070	0.034	1308.61	-278.12	4027.70	0.379	-0.627

Exc. totales result. cabeza -0.06905 0.32490
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5537.26	3983.46	4451.84	1.229	3.528
1	0.001	0.001	5118.56	3546.35	4407.59	1.173	3.437
2	0.004	0.003	4701.06	3114.88	4363.76	1.080	3.234
3	0.008	0.005	4285.31	2685.31	4320.33	1.000	3.000
4	0.016	0.009	3870.81	2271.57	4277.30	0.885	2.700
5	0.024	0.012	3458.62	1861.31	4234.68	0.809	2.418
6	0.033	0.016	3048.70	1459.70	4192.47	0.741	2.101
7	0.044	0.020	2641.22	1067.57	4150.67	0.669	1.708
8	0.055	0.025	2236.39	685.94	4109.27	0.591	1.226
9	0.067	0.030	1834.43	315.97	4068.28	0.507	0.635
10	0.080	0.035	1436.16	-39.77	4027.70	0.416	-0.090

Exc. totales result. cabeza -0.00987 0.35657
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5529.68	4000.80	4451.84	1.311	3.709
1	0.001	0.001	5112.28	3566.07	4407.59	1.218	3.536
2	0.004	0.003	4695.95	3136.70	4363.76	1.108	3.303
3	0.010	0.006	4281.04	2713.41	4320.33	0.997	3.036
4	0.016	0.009	3867.84	2297.02	4277.30	0.897	2.757
5	0.024	0.012	3456.64	1888.30	4234.68	0.814	2.466
6	0.034	0.016	3047.69	1488.07	4192.47	0.743	2.148
7	0.045	0.021	2641.17	1097.17	4150.67	0.670	1.759
8	0.057	0.026	2237.28	716.58	4109.27	0.592	1.283
9	0.069	0.031	1836.24	347.46	4068.28	0.508	0.698
10	0.082	0.036	1438.26	-8.68	4027.70	0.416	-0.020

Exc. totales result. cabeza -0.00215 0.35709
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5532.44	4006.72	4451.84	1.346	3.792
1	0.001	0.001	5115.01	3572.22	4407.59	1.236	3.582
2	0.005	0.003	4698.62	3142.96	4363.76	1.120	3.334
3	0.010	0.006	4283.60	2719.72	4320.33	1.006	3.059
4	0.016	0.009	3870.29	2303.31	4277.30	0.902	2.774
5	0.025	0.012	3458.96	1894.53	4234.68	0.815	2.476
6	0.034	0.016	3049.87	1494.21	4192.47	0.743	2.157
7	0.045	0.021	2643.22	1103.19	4150.67	0.671	1.769
8	0.057	0.026	2239.19	722.46	4109.27	0.592	1.294
9	0.070	0.031	1838.01	353.16	4068.28	0.509	0.710
10	0.083	0.036	1439.88	-3.31	4027.70	0.416	-0.007

Exc. totales result. cabeza -0.00082 0.35750
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5533.55	4009.63	4451.84	1.362	3.829
1	0.001	0.001	5116.12	3575.15	4407.59	1.244	3.602
2	0.005	0.003	4699.70	3145.86	4363.76	1.125	3.347
3	0.010	0.006	4284.65	2722.54	4320.33	1.009	3.069
4	0.017	0.009	3871.29	2306.03	4277.30	0.904	2.780
5	0.025	0.012	3459.92	1897.14	4234.68	0.816	2.480
6	0.035	0.017	3050.78	1496.70	4192.47	0.744	2.161
7	0.046	0.021	2644.07	1105.55	4150.67	0.671	1.772
8	0.057	0.026	2240.00	724.67	4109.27	0.593	1.298
9	0.070	0.031	1838.76	355.22	4068.28	0.509	0.714
10	0.083	0.036	1440.58	-1.44	4027.70	0.417	-0.003

Exc. totales result. cabeza -0.00036 0.35767
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5534.02	4010.95	4451.84	1.368	3.846
1	0.001	0.001	5116.59	3576.46	4407.59	1.248	3.611
2	0.005	0.003	4700.17	3147.14	4363.76	1.127	3.353

3	0.010	0.006	4285.10	2725.79	4320.33	1.010	3.075
4	0.017	0.009	3871.73	2307.24	4277.30	0.905	2.783
5	0.025	0.012	3460.33	1898.29	4234.68	0.816	2.482
6	0.035	0.017	3051.17	1497.79	4192.47	0.744	2.163
7	0.046	0.021	2644.44	1106.58	4150.67	0.671	1.774
8	0.058	0.026	2240.34	725.64	4109.27	0.593	1.300
9	0.070	0.031	1839.08	356.12	4068.28	0.509	0.716
10	0.083	0.037	1440.88	-0.62	4027.70	0.417	0.716

Exc. totales result. cabeza -0.00016 0.35774
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5534.23	4011.52	4451.84	1.371	3.853
1	0.001	0.001	5116.79	3577.03	4407.59	1.249	3.615
2	0.005	0.003	4700.37	3147.71	4363.76	1.128	3.356
3	0.010	0.006	4285.29	2724.34	4320.33	1.011	3.074
4	0.017	0.009	3871.91	2307.76	4277.30	0.905	2.784
5	0.025	0.012	3460.51	1898.79	4234.68	0.816	2.483
6	0.035	0.017	3051.34	1498.27	4192.47	0.744	2.163
7	0.046	0.021	2644.60	1107.03	4150.67	0.671	1.775
8	0.058	0.026	2240.49	726.06	4109.27	0.593	1.300
9	0.070	0.031	1839.22	356.51	4068.28	0.509	0.717
10	0.083	0.037	1441.00	-0.27	4027.70	0.417	0.717

Exc. totales result. cabeza -0.00007 0.35777
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	5534.32	4011.76	4451.84	1.373	3.855
1	0.001	0.001	5116.88	3577.27	4407.59	1.250	3.617
2	0.005	0.003	4700.45	3147.95	4363.76	1.129	3.357
3	0.010	0.006	4285.38	2724.57	4320.33	1.011	3.075
4	0.017	0.009	3871.99	2307.99	4277.30	0.905	2.784
5	0.025	0.012	3460.58	1899.01	4234.68	0.816	2.483
6	0.035	0.017	3051.41	1498.47	4192.47	0.744	2.163
7	0.046	0.021	2644.66	1107.22	4150.67	0.671	1.775
8	0.058	0.026	2240.55	726.24	4109.27	0.593	1.301
9	0.070	0.031	1839.28	356.67	4068.28	0.509	0.717
10	0.083	0.037	1441.06	-0.11	4027.70	0.417	0.717

Exc. totales result. cabeza -0.00003 0.35779
Exc. reales ler ord. cabeza 0.00000 0.35780

Convergencia del equilibrio sin agotamiento
Fpx = 126.400 t; Fpy = 159.200 t

VIADUCTO Nº 1.AVE.PILA PESIMA

HIPOTESIS 4 - TANTEO 1

Fpx = 112.700 t; Fpy = 130.600 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7202.01	3344.59	3451.14	1.530	2.921
1	0.001	0.002	6852.06	2944.66	3406.89	1.705	3.177
2	0.004	0.004	6503.07	2552.82	3363.06	1.726	3.136
3	0.008	0.008	6155.12	2169.37	3319.63	1.676	2.920
4	0.014	0.012	5808.42	1794.91	3276.60	1.590	2.604
5	0.022	0.017	5463.24	1430.20	3233.98	1.485	2.213
6	0.031	0.023	5119.86	1076.10	3191.77	1.372	1.768
7	0.040	0.030	4778.58	733.52	3149.97	1.259	1.272
8	0.051	0.038	4439.66	403.42	3108.57	1.153	0.737
9	0.062	0.046	4103.37	86.78	3067.58	1.067	0.267
10	0.073	0.054	3768.85	-216.90	3027.00	1.008	-0.451

Exc. totales result. cabeza -0.07165 1.24508
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7389.99	3601.32	3451.14	1.796	3.581
1	0.001	0.002	7037.31	3197.52	3406.89	1.821	3.604
2	0.004	0.004	6685.31	2800.96	3363.06	1.772	3.452
3	0.009	0.008	6334.16	2412.08	3319.63	1.686	3.193
4	0.016	0.013	5984.10	2031.53	3276.60	1.581	2.864
5	0.025	0.018	5635.40	1660.04	3233.98	1.465	2.475
6	0.035	0.024	5288.33	1298.47	3191.77	1.349	2.041
7	0.046	0.031	4943.17	947.66	3149.97	1.240	1.563
8	0.057	0.039	4600.16	608.56	3108.57	1.149	1.053
9	0.070	0.047	4259.52	282.09	3067.58	1.094	0.525
10	0.082	0.056	3922.39	-29.55	3027.00	1.049	-0.061

Exc. totales result. cabeza -0.00976 1.29580
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7375.05	3607.45	3451.14	1.942	3.852
1	0.001	0.002	7024.48	3206.12	3406.89	1.901	3.739
2	0.005	0.004	6674.40	2811.73	3363.06	1.824	3.528
3	0.010	0.008	6325.06	2424.85	3319.63	1.723	3.241
4	0.017	0.013	5976.73	2046.17	3276.60	1.610	2.898
5	0.026	0.018	5629.69	1676.46	3233.98	1.488	2.503
6	0.036	0.025	5284.23	1316.55	3191.77	1.367	2.071
7	0.047	0.032	4940.63	967.31	3149.97	1.255	1.600
8	0.059	0.040	4599.14	629.65	3108.57	1.161	1.102
9	0.072	0.048	4259.98	304.49	3067.58	1.097	0.571
10	0.085	0.058	3923.31	-7.09	3027.00	1.049	-0.015

Exc. totales result. cabeza -0.00234 1.29610
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7379.36	3611.96	3451.14	2.004	3.984
1	0.001	0.002	7028.74	3210.83	3406.89	1.934	3.813
2	0.005	0.004	6678.55	2816.50	3363.06	1.844	3.576
3	0.010	0.008	6329.06	2429.58	3319.63	1.738	3.277
4	0.017	0.013	5980.55	2050.79	3276.60	1.621	2.927
5	0.026	0.019	5633.31	1680.92	3233.98	1.497	2.527
6	0.036	0.025	5287.63	1320.81	3191.77	1.375	2.090
7	0.048	0.032	4943.79	971.33	3149.97	1.262	1.616
8	0.060	0.040	4602.06	633.41	3108.57	1.167	1.114
9	0.073	0.049	4262.64	307.96	3067.58	1.098	0.579
10	0.086	0.058	3925.72	-4.06	3027.00	1.050	-0.008

Exc. totales result. cabeza -0.00134 1.29690
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7380.93	3615.84	3451.14	2.033	4.044
1	0.001	0.002	7030.31	3214.70	3406.89	1.950	3.847
2	0.005	0.005	6680.10	2820.28	3363.06	1.855	3.600
3	0.010	0.008	6330.56	2433.24	3319.63	1.746	3.295
4	0.017	0.013	5981.99	2054.30	3276.60	1.627	2.942
5	0.026	0.019	5634.68	1684.24	3233.98	1.503	2.540
6	0.037	0.025	5288.92	1323.92	3191.77	1.379	2.101
7	0.048	0.033	4944.99	974.21	3149.97	1.265	1.625
8	0.060	0.041	4603.16	636.04	3108.57	1.168	1.121

10	0.087	0.058	3926.62	-1.95	3027.00	1.050	-0.004

Exc. totales result. cabeza -0.00064 1.29720
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7381.74	3617.62	3451.14	2.046	4.071
1	0.001	0.002	7031.12	3216.48	3406.89	1.958	3.864
2	0.005	0.005	6680.90	2822.04	3363.06	1.860	3.612
3	0.010	0.008	6331.34	2434.95	3319.63	1.750	3.305
4	0.018	0.013	5982.73	2055.93	3276.60	1.630	2.949
5	0.026	0.019	5635.38	1685.79	3233.98	1.505	2.546
6	0.037	0.025	5289.58	1325.38	3191.77	1.382	2.106
7	0.048	0.033	4945.61	975.57	3149.97	1.267	1.629
8	0.061	0.041	4603.73	637.29	3108.57	1.169	1.125
9	0.074	0.049	4264.16	311.47	3067.58	1.099	0.586
10	0.087	0.059	3927.08	-0.94	3027.00	1.050	0.586

Exc. totales result. cabeza -0.00031 1.29735
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7382.13	3618.48	3451.14	2.052	4.083
1	0.001	0.002	7031.51	3217.34	3406.89	1.961	3.871
2	0.005	0.005	6681.28	2822.89	3363.06	1.862	3.617
3	0.010	0.008	6331.71	2435.77	3319.63	1.752	3.309
4	0.018	0.013	5983.09	2056.73	3276.60	1.632	2.954
5	0.027	0.019	5635.72	1686.55	3233.98	1.507	2.550
6	0.037	0.025	5289.90	1326.09	3191.77	1.383	2.109
7	0.048	0.033	4945.90	976.24	3149.97	1.267	1.631
8	0.061	0.041	4604.00	637.90	3108.57	1.170	1.126
9	0.074	0.049	4264.41	312.02	3067.58	1.099	0.587
10	0.087	0.059	3927.30	-0.45	3027.00	1.051	0.587

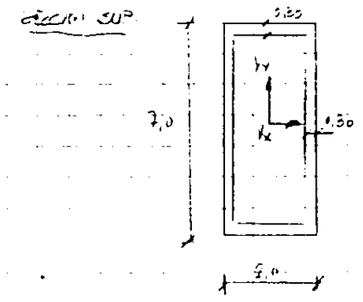
Exc. totales result. cabeza -0.00015 1.29742
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7382.31	3618.89	3451.14	2.054	4.088
1	0.001	0.002	7031.69	3217.75	3406.89	1.963	3.875
2	0.005	0.005	6681.46	2823.29	3363.06	1.864	3.620
3	0.010	0.008	6331.88	2436.17	3319.63	1.752	3.311
4	0.018	0.013	5983.26	2057.12	3276.60	1.633	2.956
5	0.027	0.019	5635.89	1686.92	3233.98	1.508	2.551
6	0.037	0.025	5290.05	1326.44	3191.77	1.383	2.110
7	0.048	0.033	4946.05	976.56	3149.97	1.268	1.632
8	0.061	0.041	4604.13	638.20	3108.57	1.170	1.127
9	0.074	0.049	4264.53	312.30	3067.58	1.099	0.588
10	0.087	0.059	3927.41	-0.21	3027.00	1.051	0.588

Exc. totales result. cabeza -0.00007 1.29746
Exc. reales ler ord. cabeza 0.00000 1.29749

Convergencia del equilibrio sin agotamiento
Fpx = 112.700 t; Fpy = 130.600 t

SECCIÓN



Dirección x-x

$V_{cu} = 5\sqrt{200} \times 0,60 \times 1,95 = 82,7$ Mp

$V_{u1} = 0,30 \times 200 \times 0,90 \times 1,95 = 702,0$ Mp > Vd

$Max\ (V_x)d = 140,4$ Mp

$A_s = \frac{140,4 - 82,7}{0,9 \times 1,95 \times 4,2} = 7,8\ cm^2 = 15,04\ cm^2/m$

$\phi 10\ a\ 0,20$ /cara

Plano Y-Y

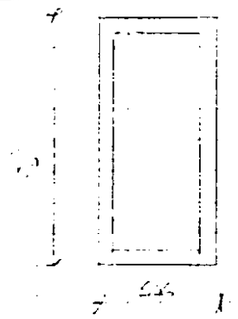
$V_{cu} = 5\sqrt{200} \times 0,60 \times 6,95 = 294,9$ Mp

$V_{u1} = 0,3 \times 200 \times 0,90 \times 6,95 = 2502$ Mp

$Max\ (V_y)d = 132,7$ Mp < V_{cu}

$A_{w\,min} = \frac{0,5 \times \ldots \times 0,60}{\ldots} = \ldots\ cm^2/m$

SEC. CENTRAL



Plano x-x

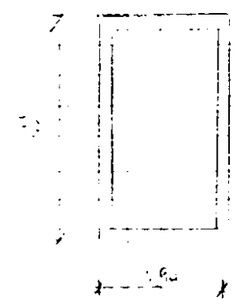
$V_{cu} = 5\sqrt{200} \times 2,00 \times \ldots = 141,5$ Mp

$V_{u1} = \ldots$ Mp > V_d

$Max\ (V_x)d = 140,4 + 2,5 \times \frac{33,5}{2} = 169,9$ Mp > V_{cu}

$A_s = \frac{169,9 - 141,5}{\ldots} = \ldots\ cm^2 = \ldots\ cm^2/m$

SEC. INTERIOR



Plano x-x

$V_{cu} = 5\sqrt{200} \times 2,00 \times 2,50 = 176,8$ Mp

$Max\ (V_x)d = \ldots = 199,\ldots$ Mp

$A_s = \frac{199,\ldots - 176,8}{\ldots} = 4,0\ cm^2 = 11,60\ cm^2/m$

SECCION CAJON A FLEXOCOMPRESION ESVIADA

Cantos : Hx =218.80 cm Hy =700.00 cm
Espesores : Ex = 30.00 cm Ey = 30.00 cm

Armaduras definidas por lineas :

Exterior : Axe = 39.62 cm² Aye =115.50 cm² recub.= 5.00 cm
Interior : Axe = 39.62 cm² Aye =115.50 cm² recub.= 4.00 cm

Caracteristicas de los materiales:

HORMIGON : Resistencia característica .. fck = 300 Kp/cm²
Coeficiente de minoración .... c = 1.50

ACERO : Resistencia característica .. fyk = 5100 Kp/cm²
Coeficiente de minoración .... s = 1.15

Esfuerzos:

Nz = 4677.00 t , Mx = 1035.00 txm , My = 3328.40 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.6824 mm/m
Curvaturas : Cx = 0.3362 Cy = 6.8651 Ctotal = 6.8734 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 87.20 °
Profundidad de la fibra neutra ..... X = 225.67 cm.
Excentricidad del eje neutro n-n' ..... exc = 99.28 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 1.55111 mm/m $\epsilon h'$=-0.18636 mm/m
σc = 161.44 kp/cm² Uc = 4209.12 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 1.43949 mm/m $\epsilon s'$=-0.07473 mm/m
σs = 3022.92 kp/cm² $\sigma s'$= -156.94 kp/cm²

Esfuerzos:

Nz = 3565.20 t , Mx = 4498.70 txm , My = 2069.60 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.4166 mm/m
Curvaturas : Cx = 1.4653 Cy = 4.4915 Ctotal = 4.7245 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 71.93 °
Profundidad de la fibra neutra ..... X = 300.73 cm.
Excentricidad del eje neutro n-n' ..... exc = 88.17 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 1.42080 mm/m $\epsilon h'$=-0.58764 mm/m
σc = 155.74 kp/cm² Uc = 3304.94 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 1.32847 mm/m $\epsilon s'$=-0.49531 mm/m
σs = 2789.79 kp/cm² $\sigma s'$=-1040.15 kp/cm²

Esfuerzos:

Nz = 4256.80 t , Mx = 3782.80 txm , My = 3255.20 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.5202 mm/m
Curvaturas : Cx = 1.7785 Cy = 8.4573 Ctotal = 8.6423 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 78.12 °
Profundidad de la fibra neutra ..... X = 239.27 cm.
Excentricidad del eje neutro n-n' ..... exc = 60.19 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 2.06787 mm/m $\epsilon h'$=-1.02753 mm/m
σc = 170.00 kp/cm² Uc = 3920.61 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 1.90922 mm/m $\epsilon s'$=-0.86888 mm/m
σs = 4009.36 kp/cm² $\sigma s'$=-1824.64 kp/cm²

Esfuerzos:

Nz = 3256.10 t , Mx = 5863.80 txm , My = 2419.70 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.2255 mm/m

Curvaturas : Cx = 2.7370 Cy = 7.5798 Ctotal = 8.0588 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 70.15 °
Profundidad de la fibra neutra ..... X = 249.75 cm.
Excentricidad del eje neutro n-n' ..... exc = 27.98 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 2.01267 mm/m $\epsilon h'$=-1.56169 mm/m
σc = 170.00 kp/cm² Uc = 3125.85 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 1.85276 mm/m $\epsilon s'$=-1.40178 mm/m
σs = 3890.80 kp/cm² $\sigma s'$=-2943.74 kp/cm²

VIADUCTO 2

FUSTE DE PILA

GEOMETRIA

Los ejes del modelo serán recibidos (capiteles) en dimensiones exteriores de 7,0 x 6,0 m en cabeza, abriéndose en el plano inferior (en fuste) hasta 4,0 x 4,0 m. La zona superior de fuste en una profundidad de 2,0 m. El espesor de la pared es de 0,85 m

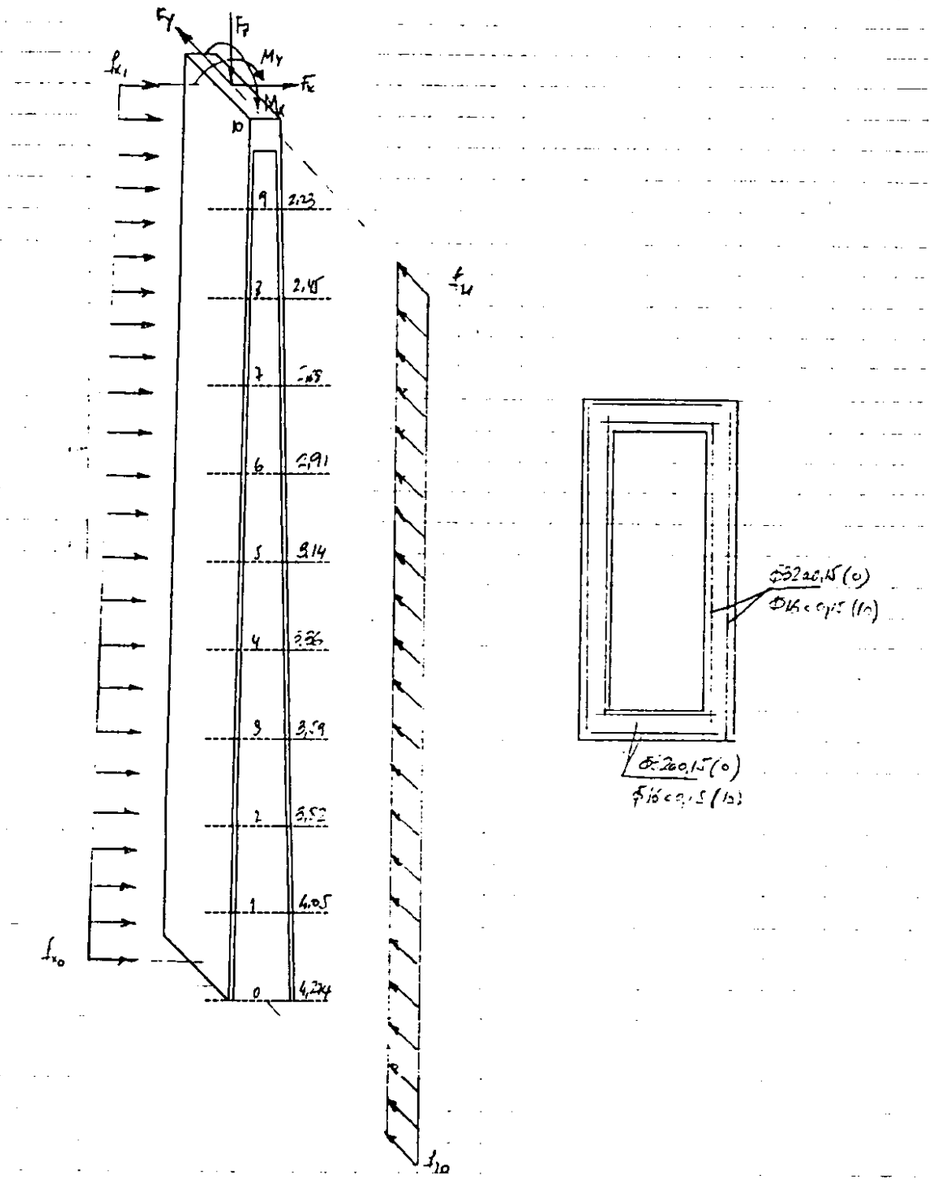
MODELO DE CALCULO

Para hacer los esfuerzos y deformaciones en el fuste de la pila se utiliza el programa PILAS, que analiza pilas de 2ª orden considerando la deformación cortante.

En cuanto a la flexibilidad de la pilote, el giro que se produce en el empotramiento en la cabeza por la acción de un momento flector se dispersa hasta en la base (empotramiento elástico) de la pila.

$$F_x = \frac{E_0 I_0 d_x^2}{2L} = \frac{2637000 \times 2,0 \times 0,785 \times 1,50^3 \times 10,80^2}{2 \times \frac{6}{3} 40,0} = 15\,523\,527 \text{ mt} \quad \theta = 5,3 \cdot 10^{-3} \text{ rd/m}$$

$$F_y = \frac{2637000 \times 1,5 \times 0,785 \times 1,50^3 \times 10,80^2}{2 \times \frac{6}{3} 40,0} = 14\,652\,974,9 \text{ mt} \quad \theta = 5,35 \cdot 10^{-3} \text{ rd/m}$$



HIPOTESIS	Fx	Fy	Fz	Mx	My	f_{x0}	f_{y0}	f_{x1}	f_{y1}
1	140,4	76,99	4422,5	997,3	0	0	0	0	0
2	125,5	45,2	3310,7	3759,9	0	0	0	0	0
3	126,4	159,2	4027,7	1441,1	0	2,51	0,72	2,51	0,72
4	112,7	130,6	3027,0	3927,5	0	2,51	0,72	2,51	0,72

VIADUCTO Nº 2.AVE.PILA PESIMA

MATERIALES:	HORMIGON	ACERO
"RESIST. CARACT. (kp/cm2):"	300	5100
"COEFICIENTE MINOR. GAMMA:"	1.5	1.15

"ALTURA DE LA PILA (m):" 56.85

COEFICIENTES ELASTICOS DE MUELLE EN CABEZA Y EN PIE:

SECCION - MOVIMIENTO COEFICIENTE (unidades)	CABEZA-DIR x Kx (t/m)	CABEZA-DIR y Ky (t/m)	PIE- GIRO x Fx (rad/mt)	PIE- GIRO y Fy (rad/mt)
	000	000	5.3E-8	5.3E-8

DIMENSIONES EN 11 SECCIONES DE HORMIGON A DECIMOS DE LA ALTURA
DIRECCION LONGITUDINAL R/EJE DEL PUENTE:

Sec:	0	1	2	3	4	5	6	7	8	9	10
"h"	427	405	382	359	336	314	291	268	245	223	200
"e"	35	35	35	35	35	35	35	35	35	35	35

DIRECCION TRANSVERSAL R/EJE DEL PUENTE:

Sec:	0	1	2	3	4	5	6	7	8	9	10
"h"	700	700	700	700	700	700	700	700	700	700	700
"e"	35	35	35	35	35	35	35	35	35	35	35

"ARMADURA EXTERIOR: Recubrimiento r (cm):" 6
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec.:	0	1	2	3	4	5	6	7	8	9	10
"Ax"	458	424	391	358	324	291	257	224	190	157	124
"Ay"	750	695	640	584	529	474	418	363	308	252	197

"ARMADURA INTERIOR: Recubrimiento r (cm):" 4
ARMADURAS TOTALES (cm2) EN 11 SECCIONES A DECIMOS DE LA ALTURA:

Sec.:	0	1	2	3	4	5	6	7	8	9	10
"Ax"	458	424	391	358	324	291	257	224	190	157	124
"Ay"	750	695	640	584	529	474	418	363	308	252	197

"NUM. DE HIPOTESIS DE CARGA:" 4

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	140.40	076.90	4422.50	0997.30	000.00	0	0.00	0	0.00	1.50
2	125.30	45.20	3310.70	3759.90	000.00	0	0	0	0	1.50
3	126.40	159.2	4027.7	1441.1	000.0	2.51	0.72	2.51	0.72	1.35
4	112.7	130.6	3027.0	3927.5	000.0	2.51	0.72	2.51	0.72	1.35

VIADUCTO Nº 2.AVE.PILA PESIMA

HIPOTESIS 1 - TANTEO 1

Fpx = 140.400 t; Fpy = 76.900 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4375.41	8431.02	5830.72	0.527	2.140
1	0.006	0.002	3926.09	7599.27	5674.62	0.507	2.265
2	0.019	0.006	3468.49	6729.43	5521.89	0.470	2.351
3	0.040	0.011	3003.94	5823.24	5372.58	0.423	2.396
4	0.069	0.018	2533.86	4883.06	5226.71	0.368	2.388
5	0.105	0.026	2059.65	3912.10	5084.19	0.309	2.292
6	0.149	0.035	1582.66	2914.76	4945.03	0.253	2.109
7	0.200	0.044	1104.07	1896.44	4809.31	0.191	1.729
8	0.256	0.055	625.04	865.03	4677.01	0.118	1.016
9	0.315	0.065	146.77	-167.50	4548.08	0.030	-0.257
10	0.374	0.076	-334.09	-1205.32	4422.50	-0.076	-2.533

Exc. totales result. cabeza -0.27254 -0.07554
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4849.83	10752.32	5830.72	0.611	2.793
1	0.008	0.002	4386.95	9852.28	5674.62	0.581	2.961
2	0.025	0.007	3914.27	8901.73	5521.89	0.538	3.118
3	0.052	0.013	3433.12	7901.12	5372.58	0.485	3.245
4	0.090	0.020	2944.96	6851.53	5226.71	0.423	3.335
5	0.139	0.029	2451.25	5754.74	5084.19	0.365	3.360
6	0.199	0.040	1953.32	4613.66	4945.03	0.312	3.333
7	0.269	0.051	1452.32	3431.97	4809.31	0.250	3.122
8	0.349	0.063	949.43	2216.03	4677.01	0.178	2.595
9	0.438	0.075	445.91	976.57	4548.08	0.092	1.499
10	0.532	0.088	-52.97	-255.02	4422.50	-0.012	-0.539

Exc. totales result. cabeza -0.05766 -0.01198
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4824.08	11228.34	5830.72	0.689	3.143
1	0.008	0.003	4370.31	10357.25	5674.62	0.662	3.360
2	0.028	0.007	3905.04	9427.51	5521.89	0.626	3.574
3	0.059	0.014	3429.60	8438.82	5372.58	0.579	3.751
4	0.102	0.023	2945.41	7391.69	5226.71	0.519	3.868
5	0.157	0.033	2454.02	6287.76	5084.19	0.438	3.874
6	0.225	0.045	1957.23	5130.51	4945.03	0.343	3.810
7	0.305	0.057	1456.88	3924.34	4809.31	0.255	3.607
8	0.397	0.071	954.57	2675.56	4677.01	0.180	3.156
9	0.500	0.085	451.58	1393.82	4548.08	0.093	2.145
10	0.609	0.100	-50.72	101.16	4422.50	-0.012	0.213

Exc. totales result. cabeza 0.02287 -0.01147
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4879.78	11495.46	5830.72	0.727	3.360
1	0.009	0.003	4425.63	10634.28	5674.62	0.702	3.620
2	0.029	0.008	3959.25	9709.43	5521.89	0.669	3.886
3	0.063	0.015	3481.93	8719.87	5372.58	0.625	4.114
4	0.109	0.024	2995.05	7665.49	5226.71	0.570	4.262
5	0.169	0.035	2500.11	6547.70	5084.19	0.494	4.249
6	0.243	0.047	1998.86	5370.56	4945.03	0.393	4.124
7	0.331	0.061	1493.30	4139.71	4809.31	0.275	3.852
8	0.430	0.076	988.30	2908.03	4677.01	0.156	3.284
9	0.541	0.091	477.07	1549.40	4548.08	0.099	2.390
10	0.659	0.107	-30.45	218.44	4422.50	-0.007	0.459

Exc. totales result. cabeza 0.04939 -0.00688
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4907.31	11706.26	5830.72	0.747	3.506
1	0.009	0.003	4453.63	10847.43	5674.62	0.724	3.799
2	0.031	0.008	3987.29	9921.60	5521.89	0.693	4.105
3	0.065	0.015	3509.57	8927.15	5372.58	0.651	4.376
4	0.114	0.024	3021.83	7863.38	5226.71	0.596	4.561
5	0.178	0.036	2525.58	6731.29	5084.19	0.523	4.551
6	0.256	0.049	2022.54	5535.15	4945.03	0.425	4.381
7	0.349	0.063	1514.67	4281.54	4809.31	0.293	4.030
8	0.454	0.078	1004.33	2979.40	4677.01	0.191	3.535
9	0.571	0.094	493.24	1639.23	4548.08	0.102	2.532
10	0.696	0.110	-17.03	278.98	4422.50	-0.004	0.586

Exc. totales result. cabeza 0.06308 -0.00385
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4922.06	11867.42	5830.72	0.760	3.609
1	0.009	0.003	4468.70	11009.46	5674.62	0.738	3.925
2	0.031	0.008	4002.43	10082.16	5521.89	0.708	4.261
3	0.067	0.015	3524.48	9083.46	5372.58	0.668	4.567
4	0.118	0.025	3036.22	8012.21	5226.71	0.614	4.786
5	0.184	0.036	2539.16	6868.96	5084.19	0.540	4.791
6	0.266	0.050	2035.02	5657.93	4945.03	0.445	4.596
7	0.362	0.064	1525.74	4386.28	4809.31	0.308	4.175
8	0.472	0.080	1013.78	3064.22	4677.01	0.193	3.641
9	0.594	0.096	501.04	1702.90	4548.08	0.104	2.632
10	0.724	0.113	-10.98	320.16	4422.50	-0.003	0.673

Exc. totales result. cabeza 0.07239 -0.00248
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4932.34	11989.00	5830.72	0.768	3.683
1	0.010	0.003	4479.09	11131.56	5674.62	0.748	4.017
2	0.032	0.008	4012.75	10203.10	5521.89	0.719	4.375
3	0.069	0.015	3534.54	9201.23	5372.58	0.680	4.707
4	0.121	0.025	3045.83	8124.43	5226.71	0.626	4.954
5	0.189	0.037	2548.10	6972.89	5084.19	0.552	4.980
6	0.273	0.050	2043.10	5750.64	4945.03	0.459	4.774
7	0.372	0.065	1532.76	4465.15	4809.31	0.321	4.294
8	0.485	0.081	1019.54	3127.67	4677.01	0.195	3.721
9	0.611	0.098	505.55	1750.02	4548.08	0.105	2.707
10	0.745	0.115	-7.75	350.02	4422.50	-0.002	0.736

Exc. totales result. cabeza 0.07915 -0.00175
Exc. reales 1er ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4939.91	12081.09	5830.72	0.775	3.738
1	0.010	0.003	4486.70	11224.03	5674.62	0.755	4.085
2	0.033	0.008	4020.27	10294.68	5521.89	0.727	4.459
3	0.070	0.015	3541.85	9290.45	5372.58	0.688	4.811
4	0.123	0.025	3052.76	8209.53	5226.71	0.635	5.081
5	0.192	0.037	2554.52	7051.82	5084.19	0.562	5.125
6	0.278	0.051	2048.86	5821.13	4945.03	0.469	4.920
7	0.379	0.066	1537.72	4525.05	4809.31	0.331	4.392

9	0.624	0.099	508.62	1785.40	4548.08	0.106	2.763
10	0.761	0.116	-5.66	372.12	4422.50	-0.001	0.782

Exc. totales result. cabeza 0.08414 -0.00128
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4945.50	12151.24	5830.72	0.779	3.779
1	0.010	0.003	4492.32	11294.44	5674.62	0.760	4.135
2	0.033	0.008	4025.82	10364.42	5521.89	0.732	4.522
3	0.071	0.016	3547.22	9358.41	5372.58	0.694	4.888
4	0.124	0.025	3057.86	8274.39	5226.71	0.642	5.175
5	0.194	0.037	2559.23	7112.05	5084.19	0.568	5.236
6	0.282	0.051	2053.08	5874.98	4945.03	0.476	5.037
7	0.385	0.066	1541.34	4570.77	4809.31	0.340	4.472
8	0.503	0.083	1026.47	3212.17	4677.01	0.198	3.830
9	0.633	0.100	510.81	1812.17	4548.08	0.106	2.804
10	0.773	0.117	-4.19	388.64	4422.50	-0.001	0.817

Exc. totales result. cabeza 0.08788 -0.00095
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4949.67	12204.93	5830.72	0.782	3.811
1	0.010	0.003	4496.49	11348.32	5674.62	0.763	4.174
2	0.033	0.008	4029.94	10417.78	5521.89	0.737	4.569
3	0.071	0.016	3551.21	9410.41	5372.58	0.699	4.947
4	0.125	0.025	3061.64	8324.05	5226.71	0.647	5.247
5	0.196	0.037	2562.72	7158.20	5084.19	0.574	5.321
6	0.285	0.051	2056.21	5916.29	4945.03	0.481	5.131
7	0.389	0.067	1544.02	4605.84	4809.31	0.346	4.538
8	0.509	0.083	1028.61	3240.11	4677.01	0.199	3.867
9	0.641	0.100	512.40	1832.57	4548.08	0.106	2.837
10	0.782	0.118	-3.14	401.11	4422.50	-0.001	0.843

Exc. totales result. cabeza 0.09070 -0.00071
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4952.80	12246.18	5830.72	0.785	3.834
1	0.010	0.003	4499.64	11389.71	5674.62	0.766	4.203
2	0.033	0.008	4033.03	10458.77	5521.89	0.740	4.605
3	0.072	0.016	3554.21	9450.37	5372.58	0.702	4.992
4	0.126	0.026	3064.48	8362.21	5226.71	0.651	5.302
5	0.198	0.038	2565.34	7193.69	5084.19	0.578	5.387
6	0.287	0.051	2058.55	5948.08	4945.03	0.485	5.205
7	0.393	0.067	1546.03	4632.84	4809.31	0.351	4.591
8	0.513	0.083	1030.21	3261.58	4677.01	0.200	3.895
9	0.647	0.101	513.58	1848.21	4548.08	0.107	2.861
10	0.789	0.118	-2.38	410.63	4422.50	-0.001	0.863

Exc. totales result. cabeza 0.09285 -0.00054
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4955.19	12277.89	5830.72	0.787	3.853
1	0.010	0.003	4502.02	11421.52	5674.62	0.768	4.225
2	0.034	0.008	4035.39	10490.28	5521.89	0.742	4.633
3	0.072	0.016	3556.48	9481.08	5372.58	0.705	5.026
4	0.127	0.026	3066.63	8391.56	5226.71	0.654	5.344
5	0.199	0.038	2567.33	7220.99	5084.19	0.581	5.437
6	0.289	0.052	2060.32	5972.55	4945.03	0.488	5.262
7	0.395	0.067	1547.55	4653.62	4809.31	0.355	4.633

8	0.517	0.084	1031.41	3278.09	4677.01	0.200	3.917
9	0.651	0.101	514.47	1860.18	4548.08	0.107	2.881
10	0.795	0.119	-1.81	417.85	4422.50	-0.000	0.879

Exc. totales result. cabeza 0.09448 -0.00041
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4957.01	12302.39	5830.72	0.788	3.867
1	0.010	0.003	4503.85	11446.10	5674.62	0.770	4.243
2	0.034	0.008	4037.18	10514.61	5521.89	0.744	4.654
3	0.072	0.016	3558.22	9504.81	5372.58	0.707	5.052
4	0.127	0.026	3068.28	8414.23	5226.71	0.656	5.376
5	0.200	0.038	2568.85	7242.08	5084.19	0.583	5.475
6	0.290	0.052	2061.68	5991.47	4945.03	0.490	5.307
7	0.397	0.067	1548.70	4669.69	4809.31	0.358	4.667
8	0.519	0.084	1032.33	3290.85	4677.01	0.202	3.934
9	0.655	0.101	515.14	1869.44	4548.08	0.107	2.895
10	0.799	0.119	-1.39	423.44	4422.50	-0.000	0.890

Exc. totales result. cabeza 0.09575 -0.00031
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4958.41	12321.27	5830.72	0.790	3.877
1	0.010	0.003	4505.25	11465.05	5674.62	0.771	4.256
2	0.034	0.008	4038.56	10533.38	5521.89	0.745	4.670
3	0.073	0.016	3559.55	9523.11	5372.58	0.709	5.072
4	0.128	0.026	3069.54	8431.73	5226.71	0.658	5.401
5	0.200	0.038	2570.02	7258.37	5084.19	0.585	5.505
6	0.291	0.052	2062.72	6006.09	4945.03	0.492	5.341
7	0.399	0.067	1549.59	4682.13	4809.31	0.361	4.694
8	0.522	0.084	1033.03	3300.72	4677.01	0.202	3.947
9	0.657	0.101	515.65	1876.60	4548.08	0.107	2.906
10	0.802	0.119	-1.06	427.77	4422.50	-0.000	0.899

Exc. totales result. cabeza 0.09672 -0.00024
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4959.48	12335.79	5830.72	0.790	3.886
1	0.010	0.003	4506.32	11479.61	5674.62	0.772	4.266
2	0.034	0.008	4039.62	10547.81	5521.89	0.746	4.682
3	0.073	0.016	3560.58	9537.21	5372.58	0.710	5.088
4	0.128	0.026	3070.51	8445.23	5226.71	0.659	5.420
5	0.201	0.038	2570.91	7270.96	5084.19	0.586	5.528
6	0.292	0.052	2063.52	6017.42	4945.03	0.493	5.368
7	0.400	0.067	1550.28	4691.78	4809.31	0.362	4.715
8	0.523	0.084	1033.58	3308.42	4677.01	0.203	3.958
9	0.659	0.102	516.05	1882.23	4548.08	0.107	2.915
10	0.805	0.119	-0.80	431.22	4422.50	0.107	0.907

Exc. totales result. cabeza 0.09751 -0.00018
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4960.28	12346.80	5830.72	0.791	3.892
1	0.010	0.003	4507.12	11490.67	5674.62	0.773	4.274
2	0.034	0.008	4040.41	10558.76	5521.89	0.747	4.692
3	0.073	0.016	3561.34	9547.87	5372.58	0.711	5.099
4	0.128	0.026	3071.24	8455.42	5226.71	0.660	5.433
5	0.201	0.038	2571.58	7280.47	5084.19	0.587	5.545
6	0.292	0.052	2064.12	6025.97	4945.03	0.494	5.389
7	0.401	0.067	1550.79	4699.07	4809.31	0.364	4.732

9	0.661	0.102	516.34	1886.41	4548.08	0.107	2.922
10	0.807	0.119	-0.63	433.71	4422.50	0.107	0.912

Exc. totales result. cabeza 0.09807 -0.00014
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4960.92	12355.38	5830.72	0.792	3.896
1	0.010	0.003	4507.76	11499.28	5674.62	0.774	4.280
2	0.034	0.008	4041.04	10567.30	5521.89	0.748	4.699
3	0.073	0.016	3561.95	9556.20	5372.58	0.711	5.108
4	0.128	0.026	3071.81	8463.39	5226.71	0.660	5.445
5	0.202	0.038	2572.11	7287.88	5084.19	0.588	5.558
6	0.293	0.052	2064.59	6032.63	4945.03	0.495	5.403
7	0.401	0.068	1551.20	4704.76	4809.31	0.365	4.744
8	0.525	0.084	1034.30	3318.76	4677.01	0.203	3.973
9	0.662	0.102	516.58	1889.75	4548.08	0.107	2.927
10	0.808	0.120	-0.47	435.78	4422.50	0.107	0.917

Exc. totales result. cabeza 0.09854 -0.00011
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4961.38	12361.83	5830.72	0.792	3.901
1	0.010	0.003	4508.23	11505.74	5674.62	0.774	4.284
2	0.034	0.008	4041.50	10573.70	5521.89	0.748	4.706
3	0.073	0.016	3562.40	9562.44	5372.58	0.712	5.115
4	0.129	0.026	3072.24	8469.36	5226.71	0.661	5.453
5	0.202	0.038	2572.50	7293.44	5084.19	0.589	5.569
6	0.293	0.052	2064.94	6037.62	4945.03	0.496	5.416
7	0.402	0.068	1551.49	4708.98	4809.31	0.366	4.754
8	0.526	0.084	1034.54	3322.08	4677.01	0.203	3.977
9	0.663	0.102	516.75	1892.12	4548.08	0.107	2.931
10	0.809	0.120	-0.36	437.16	4422.50	0.107	0.919

Exc. totales result. cabeza 0.09885 -0.00008
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4961.75	12366.97	5830.72	0.792	3.904
1	0.010	0.003	4508.60	11510.89	5674.62	0.774	4.288
2	0.034	0.008	4041.86	10578.79	5521.89	0.749	4.710
3	0.073	0.016	3562.74	9567.39	5372.58	0.712	5.120
4	0.129	0.026	3072.56	8474.09	5226.71	0.662	5.460
5	0.202	0.038	2572.81	7297.84	5084.19	0.589	5.576
6	0.293	0.052	2065.21	6041.56	4945.03	0.496	5.425
7	0.402	0.068	1551.72	4712.35	4809.31	0.366	4.762
8	0.526	0.084	1034.71	3324.74	4677.01	0.203	3.981
9	0.664	0.102	516.87	1894.04	4548.08	0.107	2.934
10	0.810	0.120	-0.29	438.30	4422.50	0.107	0.922

Exc. totales result. cabeza 0.09911 -0.00007
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4962.05	12370.94	5830.72	0.793	3.906
1	0.010	0.003	4508.90	11514.88	5674.62	0.775	4.291
2	0.034	0.008	4042.16	10582.74	5521.89	0.749	4.713
3	0.073	0.016	3563.03	9571.25	5372.58	0.712	5.125
4	0.129	0.026	3072.83	8477.77	5226.71	0.662	5.465
5	0.202	0.038	2573.05	7301.26	5084.19	0.589	5.581
6	0.294	0.052	2065.43	6044.65	4945.03	0.497	5.431
7	0.403	0.068	1551.91	4714.99	4809.31	0.367	4.768
8	0.527	0.084	1034.87	3326.80	4677.01	0.204	3.985
9	0.664	0.102	516.99	1895.61	4548.08	0.107	2.936
10	0.811	0.120	-0.22	439.28	4422.50	0.107	0.924

Exc. totales result. cabeza 0.09933 -0.00005
Exc. reales ler ord. cabeza 0.10000 0.00000

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	4962.27	12373.89	5830.72	0.793	3.907
1	0.010	0.003	4509.12	11517.84	5674.62	0.775	4.293
2	0.034	0.008	4042.37	10585.68	5521.89	0.749	4.715
3	0.073	0.016	3563.24	9574.13	5372.58	0.713	5.128
4	0.129	0.026	3073.03	8480.53	5226.71	0.662	5.469
5	0.202	0.038	2573.24	7303.85	5084.19	0.590	5.587
6	0.294	0.052	2065.60	6046.97	4945.03	0.497	5.438
7	0.403	0.068	1552.06	4716.95	4809.31	0.367	4.773
8	0.527	0.084	1034.98	3328.39	4677.01	0.204	3.986
9	0.665	0.102	517.07	1896.69	4548.08	0.107	2.938
10	0.811	0.120	-0.16	439.89	4422.50	0.107	0.925

Exc. totales result. cabeza 0.09947 -0.00004
Exc. reales ler ord. cabeza 0.10000 0.00000

Convergencia del equilibrio sin agotamiento
Fpx = 140.400 t; Fpy = 76.900 t

VIADUCTO Nº 2.AVE.PILA PESIMA

HIPOTESIS 2 - TANTEO 1

Fpx = 125.300 t; Fpy = 45.200 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	6334.55	7128.97	4718.92	0.777	1.851
1	0.005	0.003	6063.39	6393.58	4562.82	0.806	1.979
2	0.017	0.009	5781.89	5632.01	4410.09	0.816	2.062
3	0.035	0.017	5491.02	4845.90	4260.78	0.817	2.102
4	0.060	0.028	5191.85	4037.50	4114.91	0.810	2.086
5	0.092	0.042	4885.50	3209.69	3972.39	0.794	1.974
6	0.130	0.058	4573.13	2366.36	3833.23	0.768	1.756
7	0.174	0.077	4255.93	1512.29	3697.51	0.737	1.368
8	0.222	0.098	3935.05	653.73	3565.21	0.710	0.734
9	0.272	0.121	3611.52	-201.18	3436.28	0.703	-0.291
10	0.322	0.147	3277.14	-1060.86	3310.70	0.704	-2.081

Exc. totales result. cabeza -0.32043 0.98986
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7080.94	8770.29	4718.92	0.908	2.362
1	0.006	0.004	6784.82	7978.71	4562.82	0.923	2.510
2	0.021	0.010	6476.48	7153.27	4410.09	0.927	2.641
3	0.044	0.020	6156.82	6294.84	4260.78	0.922	2.740
4	0.076	0.032	5826.79	5404.79	4114.91	0.907	2.786
5	0.117	0.048	5487.45	4485.26	3972.39	0.877	2.729
6	0.167	0.066	5140.00	3539.69	3833.23	0.840	2.578
7	0.225	0.087	4785.64	2572.48	3697.51	0.802	2.268
8	0.290	0.111	4425.48	1589.60	3565.21	0.789	1.761
9	0.362	0.137	4060.28	598.81	3436.28	0.790	0.865
10	0.435	0.166	3698.40	-375.92	3310.70	0.807	-0.748

Exc. totales result. cabeza -0.11355 1.11710
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	6982.43	8918.64	4718.92	0.977	2.563
1	0.007	0.004	6705.52	8157.14	4562.82	0.996	2.733
2	0.022	0.011	6414.84	7357.61	4410.09	1.008	2.900
3	0.048	0.021	6111.24	6520.49	4260.78	1.012	3.037
4	0.082	0.034	5795.62	5646.74	4114.91	1.006	3.119
5	0.127	0.051	5469.01	4738.19	3972.39	0.979	3.087
6	0.182	0.071	5132.67	3798.08	3833.23	0.936	2.956
7	0.247	0.094	4787.96	2830.73	3697.51	0.877	2.652
8	0.320	0.119	4436.34	1842.19	3565.21	0.824	2.122
9	0.400	0.148	4079.06	840.58	3436.28	0.795	1.216
10	0.483	0.179	3717.38	-158.63	3310.70	0.799	-0.312

Exc. totales result. cabeza -0.04791 1.12284
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7022.98	9009.78	4718.92	1.012	2.657
1	0.007	0.004	6746.63	8257.56	4562.82	1.033	2.845
2	0.023	0.011	6455.97	7465.41	4410.09	1.050	3.036
3	0.049	0.021	6151.74	6633.48	4260.78	1.061	3.201
4	0.086	0.035	5834.82	5762.43	4114.91	1.060	3.310
5	0.133	0.053	5506.17	4853.82	3972.39	1.039	3.298
6	0.190	0.073	5167.02	3910.77	3833.23	0.998	3.176
7	0.258	0.097	4818.75	2937.61	3697.51	0.933	2.859
8	0.336	0.124	4462.92	1940.68	3565.21	0.857	2.291
9	0.420	0.154	4101.11	928.62	3436.28	0.803	1.354
10	0.509	0.186	3734.84	-85.34	3310.70	0.803	-0.168

Exc. totales result. cabeza -0.02578 1.12811
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7044.30	9076.27	4718.92	1.027	2.709
1	0.007	0.004	6768.62	8326.97	4562.82	1.051	2.907
2	0.024	0.011	6478.32	7536.75	4410.09	1.071	3.113
3	0.050	0.022	6174.15	6705.57	4260.78	1.086	3.296
4	0.087	0.036	5856.91	5833.90	4114.91	1.090	3.424
5	0.136	0.053	5527.54	4923.11	3972.39	1.072	3.425
6	0.195	0.075	5187.22	3976.22	3833.23	1.034	3.311
7	0.265	0.099	4837.31	2997.54	3697.51	0.966	2.985
8	0.345	0.127	4479.45	1993.61	3565.21	0.879	2.391
9	0.432	0.157	4115.37	973.44	3436.28	0.810	1.427
10	0.524	0.190	3746.65	-50.07	3310.70	0.805	-0.098

Exc. totales result. cabeza -0.01512 1.13168
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7054.47	9118.34	4718.92	1.035	2.738
1	0.007	0.004	6779.26	8370.40	4562.82	1.060	2.943
2	0.024	0.011	6489.29	7580.98	4410.09	1.083	3.158
3	0.051	0.022	6185.27	6749.92	4260.78	1.099	3.352
4	0.088	0.036	5867.98	5877.58	4114.91	1.106	3.491
5	0.137	0.054	5538.32	4965.22	3972.39	1.091	3.502
6	0.198	0.075	5197.46	4015.76	3833.23	1.056	3.394
7	0.269	0.100	4846.75	3033.50	3697.51	0.985	3.063
8	0.350	0.128	4487.85	2025.07	3565.21	0.892	2.452
9	0.439	0.159	4122.58	999.76	3436.28	0.814	1.470
10	0.533	0.192	3752.53	-29.62	3310.70	0.806	-0.058

Exc. totales result. cabeza -0.00895 1.13346
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7060.39	9143.36	4718.92	1.040	2.754
1	0.007	0.004	6785.41	8396.21	4562.82	1.066	2.964
2	0.024	0.011	6495.59	7607.25	4410.09	1.089	3.184
3	0.051	0.022	6191.61	6776.27	4260.78	1.107	3.384
4	0.089	0.036	5874.26	5903.55	4114.91	1.116	3.530
5	0.138	0.054	5544.41	4990.25	3972.39	1.103	3.547
6	0.199	0.076	5203.21	4039.28	3833.23	1.068	3.443
7	0.271	0.101	4852.01	3054.90	3697.51	0.997	3.111
8	0.353	0.129	4492.48	2043.80	3565.21	0.900	2.489
9	0.444	0.160	4126.48	1015.40	3436.28	0.816	1.497
10	0.539	0.194	3755.64	-17.48	3310.70	0.807	-0.034

Exc. totales result. cabeza -0.00528 1.13440
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7063.92	9158.07	4718.92	1.042	2.764
1	0.007	0.004	6789.07	8411.40	4562.82	1.069	2.976
2	0.024	0.011	6499.31	7622.73	4410.09	1.093	3.200
3	0.051	0.022	6195.36	6791.79	4260.78	1.112	3.403
4	0.089	0.036	5877.95	5918.85	4114.91	1.121	3.554
5	0.139	0.054	5547.99	5005.03	3972.39	1.109	3.574
6	0.200	0.076	5206.58	4053.18	3833.23	1.075	3.473
7	0.273	0.101	4855.07	3067.55	3697.51	1.004	3.139
8	0.355	0.129	4495.16	2054.87	3565.21	0.905	2.512
9	0.446	0.161	4128.73	1024.64	3436.28	0.818	1.512
10	0.542	0.194	3757.41	-10.31	3310.70	0.808	-0.020

Exc. totales result. cabeza -0.00311 1.13493
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7066.00	9166.75	4718.92	1.044	2.769
1	0.007	0.004	6791.22	8420.36	4562.82	1.070	2.983
2	0.024	0.011	6501.51	7631.86	4410.09	1.095	3.208
3	0.051	0.022	6197.56	6800.96	4260.78	1.114	3.414
4	0.090	0.036	5880.13	5927.90	4114.91	1.124	3.567
5	0.139	0.054	5550.09	5013.77	3972.39	1.113	3.590
6	0.201	0.076	5208.56	4061.40	3833.23	1.080	3.490
7	0.274	0.101	4856.88	3075.05	3697.51	1.009	3.156
8	0.356	0.130	4496.74	2061.43	3565.21	0.908	2.525
9	0.448	0.161	4130.05	1030.13	3436.28	0.819	1.522
10	0.543	0.195	3758.45	-6.05	3310.70	0.808	-0.012

Exc. totales result. cabeza -0.00183 1.13524
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7067.21	9171.82	4718.92	1.045	2.772
1	0.007	0.004	6792.47	8425.60	4562.82	1.071	2.986
2	0.024	0.011	6502.78	7637.19	4410.09	1.096	3.213
3	0.051	0.022	6198.84	6806.34	4260.78	1.116	3.420
4	0.090	0.036	5881.40	5933.23	4114.91	1.126	3.575
5	0.140	0.054	5551.32	5018.94	3972.39	1.115	3.600
6	0.201	0.076	5209.73	4066.29	3833.23	1.082	3.501
7	0.274	0.101	4857.95	3079.52	3697.51	1.011	3.166
8	0.357	0.130	4497.68	2065.38	3565.21	0.909	2.534
9	0.448	0.161	4130.84	1033.45	3436.28	0.820	1.528
10	0.545	0.195	3759.08	-3.44	3310.70	0.808	-0.007

Exc. totales result. cabeza -0.00104 1.13543

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7067.87	9174.62	4718.92	1.045	2.774
1	0.007	0.004	6793.15	8428.50	4562.82	1.072	2.989
2	0.024	0.011	6503.48	7640.16	4410.09	1.097	3.216
3	0.051	0.022	6199.54	6809.32	4260.78	1.117	3.424
4	0.090	0.036	5882.09	5936.16	4114.91	1.127	3.579
5	0.140	0.054	5551.99	5021.77	3972.39	1.116	3.604
6	0.201	0.076	5210.36	4068.96	3833.23	1.084	3.506
7	0.274	0.101	4858.52	3081.96	3697.51	1.013	3.172
8	0.357	0.130	4498.18	2067.52	3565.21	0.911	2.539
9	0.449	0.161	4131.26	1035.23	3436.28	0.820	1.531
10	0.545	0.195	3759.40	-2.07	3310.70	0.808	-0.004

Exc. totales result. cabeza -0.00063 1.13553
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7068.30	9176.39	4718.92	1.045	2.775
1	0.007	0.004	6793.59	8430.32	4562.82	1.072	2.990
2	0.024	0.011	6503.93	7642.02	4410.09	1.097	3.218
3	0.051	0.022	6199.99	6811.18	4260.78	1.117	3.427
4	0.090	0.036	5882.53	5938.00	4114.91	1.128	3.582
5	0.140	0.054	5552.42	5023.56	3972.39	1.117	3.608
6	0.201	0.076	5210.76	4070.65	3833.23	1.085	3.510
7	0.274	0.101	4858.89	3083.49	3697.51	1.014	3.176
8	0.358	0.130	4498.50	2068.86	3565.21	0.911	2.541
9	0.449	0.161	4131.53	1036.35	3436.28	0.820	1.533
10	0.546	0.195	3759.61	-1.20	3310.70	0.808	-0.002

Exc. totales result. cabeza -0.00036 1.13559
Exc. reales ler ord. cabeza 0.00000 1.13568

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	7068.53	9177.38	4718.92	1.045	2.776
1	0.007	0.004	6793.84	8431.35	4562.82	1.072	2.991
2	0.024	0.011	6504.18	7643.07	4410.09	1.097	3.219
3	0.051	0.022	6200.24	6812.24	4260.78	1.117	3.428
4	0.090	0.036	5882.78	5939.05	4114.91	1.128	3.584
5	0.140	0.054	5552.66	5024.57	3972.39	1.118	3.610
6	0.202	0.076	5210.99	4071.60	3833.23	1.085	3.512
7	0.275	0.101	4859.10	3084.37	3697.51	1.014	3.178
8	0.358	0.130	4498.69	2069.62	3565.21	0.911	2.543
9	0.449	0.161	4131.68	1036.99	3436.28	0.820	1.534
10	0.546	0.195	3759.74	-0.70	3310.70	0.808	1.534

Exc. totales result. cabeza -0.00021 1.13563
Exc. reales ler ord. cabeza 0.00000 1.13568

Convergencia del equilibrio sin agotamiento
Fpx = 125.300 t; Fpy = 45.200 t

VIADUCTO Nº 2.AVE.PILA PESIMA

HIPOTESIS 3 - TANTEO 1

Fpx = 126.400 t; Fpy = 159.200 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	11664.86	11251.30	5295.10	1.657	3.350
1	0.009	0.006	10507.24	9717.29	5154.61	1.697	3.652
2	0.029	0.018	9347.43	8208.36	5017.15	1.619	3.674
3	0.062	0.035	8188.75	6728.77	4882.77	1.461	3.586
4	0.106	0.056	7035.22	5285.22	4751.49	1.307	3.217
5	0.160	0.082	5891.07	3886.28	4623.22	1.100	2.714
6	0.223	0.112	4760.63	2542.63	4497.98	0.869	2.037
7	0.293	0.144	3648.16	1266.36	4375.83	0.644	1.171
8	0.366	0.179	2557.43	70.98	4256.76	0.471	0.082
9	0.440	0.214	1491.15	-1028.46	4140.72	0.301	-1.543
10	0.509	0.251	438.00	-2039.54	4027.70	0.098	-4.184

Exc. totales result. cabeza -0.50638 0.10875
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13081.87	14128.70	5295.10	2.028	4.601
1	0.012	0.007	11883.56	12508.41	5154.61	1.974	4.791
2	0.039	0.021	10678.11	10894.54	5017.15	1.851	4.842
3	0.082	0.040	9469.28	9290.95	4882.77	1.684	4.754
4	0.140	0.065	8261.27	7703.48	4751.49	1.477	4.504
5	0.213	0.095	7058.63	6140.23	4623.22	1.230	4.036
6	0.298	0.129	5866.17	4612.02	4497.98	0.975	3.427
7	0.395	0.166	4688.43	3131.01	4375.83	0.793	2.789
8	0.501	0.205	3528.67	1708.95	4256.76	0.649	1.957
9	0.613	0.247	2389.33	359.44	4140.72	0.482	0.540
10	0.727	0.290	1284.58	-881.36	4027.70	0.291	-1.832

Exc. totales result. cabeza -0.21882 0.31894
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13004.67	14751.03	5295.10	2.230	5.256
1	0.013	0.008	11833.89	13163.96	5154.61	2.147	5.449
2	0.043	0.022	10652.38	11571.36	5017.15	2.028	5.567
3	0.092	0.043	9463.98	9976.41	4882.77	1.876	5.559
4	0.159	0.070	8272.80	8384.19	4751.49	1.686	5.372
5	0.242	0.103	7083.32	6802.35	4623.22	1.441	4.916
6	0.342	0.140	5900.52	5242.11	4497.98	1.156	4.281
7	0.456	0.181	4729.57	3716.50	4375.83	0.880	3.518
8	0.581	0.224	3575.12	2239.37	4256.76	0.662	2.583
9	0.714	0.270	2440.67	825.84	4140.72	0.492	1.239
10	0.851	0.318	1329.38	-499.48	4027.70	0.298	-1.025

Exc. totales result. cabeza -0.12401 0.33006
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13114.76	15185.97	5295.10	2.345	5.635
1	0.014	0.008	11944.38	13608.12	5154.61	2.257	5.866
2	0.046	0.023	10761.40	12017.54	5017.15	2.143	6.055
3	0.099	0.045	9569.65	10416.51	4882.77	2.000	6.135
4	0.171	0.073	8373.22	8809.09	4751.49	1.821	6.027
5	0.262	0.107	7176.46	7202.15	4623.22	1.587	5.605
6	0.372	0.147	5984.27	5606.84	4497.98	1.303	4.938
7	0.497	0.191	4801.94	4037.15	4375.83	0.981	4.026
8	0.636	0.237	3634.87	2509.42	4256.76	0.690	2.939
9	0.784	0.286	2487.62	1041.13	4140.72	0.502	1.564
10	0.937	0.337	1363.48	-345.69	4027.70	0.305	-0.708

Exc. totales result. cabeza -0.08583 0.33853
Exc. reales ler ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13190.16	15519.38	5295.10	2.412	5.883
1	0.014	0.008	12020.25	13944.18	5154.61	2.327	6.152
2	0.048	0.023	10836.56	12351.41	5017.15	2.219	6.400

4	0.179	0.075	8443.19	9120.98	4751.49	1.910	6.517
5	0.276	0.111	7241.84	7492.52	4623.22	1.685	6.141
6	0.393	0.152	6043.64	5868.07	4497.98	1.407	5.463
7	0.527	0.197	4853.87	4262.13	4375.83	1.062	4.440
8	0.676	0.246	3678.33	2692.97	4256.76	0.720	3.205
9	0.835	0.297	2522.31	1180.34	4140.72	0.510	1.775
10	1.000	0.350	1389.33	-253.69	4027.70	0.311	-0.520

Exc. totales result. cabeza -0.06299 0.34494
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13239.42	15769.83	5295.10	2.458	6.058
1	0.015	0.008	12069.94	14195.92	5154.61	2.375	6.358
2	0.050	0.024	10885.86	12600.97	5017.15	2.272	6.648
3	0.106	0.047	9690.93	10985.98	4882.77	2.141	6.852
4	0.185	0.076	8489.11	9353.50	4751.49	1.973	6.880
5	0.286	0.113	7284.68	7708.82	4623.22	1.752	6.553
6	0.408	0.155	6082.46	6062.29	4497.98	1.480	5.879
7	0.549	0.201	4887.64	4428.63	4375.83	1.125	4.777
8	0.706	0.252	3706.24	2827.52	4256.76	0.747	3.416
9	0.873	0.305	2544.08	1280.64	4140.72	0.514	1.928
10	1.047	0.359	1404.85	-189.42	4027.70	0.314	-0.388

Exc. totales result. cabeza -0.04703 0.34880
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13274.63	15957.91	5295.10	2.490	6.186
1	0.015	0.008	12105.35	14384.82	5154.61	2.411	6.511
2	0.051	0.024	10920.88	12788.13	5017.15	2.310	6.833
3	0.109	0.047	9724.92	11168.46	4882.77	2.182	7.075
4	0.189	0.077	8521.45	9527.86	4751.49	2.019	7.149
5	0.293	0.114	7314.69	7871.06	4623.22	1.800	6.865
6	0.419	0.157	6109.46	6207.99	4497.98	1.533	6.207
7	0.566	0.205	4910.94	4553.34	4375.83	1.174	5.048
8	0.728	0.256	3725.19	2927.80	4256.76	0.771	3.585
9	0.902	0.310	2558.44	1354.64	4140.72	0.518	2.040
10	1.083	0.366	1414.57	-142.95	4027.70	0.316	-0.293

Exc. totales result. cabeza -0.03549 0.35121
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13300.89	16100.33	5295.10	2.515	6.283
1	0.015	0.008	12131.69	14527.80	5154.61	2.438	6.627
2	0.051	0.024	10946.85	12929.73	5017.15	2.340	6.972
3	0.110	0.048	9750.06	11306.45	4882.77	2.213	7.242
4	0.193	0.078	8545.28	9659.67	4751.49	2.053	7.350
5	0.299	0.116	7336.72	7993.73	4623.22	1.836	7.101
6	0.428	0.159	6129.19	6318.17	4497.98	1.570	6.464
7	0.578	0.207	4927.86	4647.53	4375.83	1.212	5.266
8	0.745	0.259	3738.81	3003.26	4256.76	0.791	3.720
9	0.924	0.314	2568.56	1409.87	4140.72	0.520	2.125
10	1.110	0.371	1421.18	-108.85	4027.70	0.318	-0.223

Exc. totales result. cabeza -0.02703 0.35285
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13320.80	16209.12	5295.10	2.534	6.356
1	0.015	0.008	12151.64	14636.96	5154.61	2.459	6.716
2	0.052	0.024	10966.49	13037.79	5017.15	2.362	7.079

4	0.195	0.079	8563.22	9760.15	4751.49	2.078	7.502
5	0.303	0.116	7353.27	8087.22	4623.22	1.862	7.279
6	0.434	0.160	6143.97	6402.12	4497.98	1.598	6.663
7	0.587	0.209	4940.50	4719.25	4375.83	1.242	5.438
8	0.758	0.262	3748.94	3060.54	4256.76	0.807	3.828
9	0.941	0.317	2575.99	1451.52	4140.72	0.522	2.188
10	1.130	0.374	1425.92	-83.50	4027.70	0.319	-0.171

Exc. totales result. cabeza -0.02073 0.35403
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13336.08	16292.78	5295.10	2.549	6.413
1	0.015	0.008	12166.93	14720.88	5154.61	2.475	6.784
2	0.052	0.024	10981.53	13120.83	5017.15	2.380	7.161
3	0.113	0.048	9783.54	11492.53	4882.77	2.256	7.467
4	0.197	0.079	8576.91	9837.29	4751.49	2.097	7.618
5	0.306	0.117	7365.87	8158.95	4623.22	1.883	7.416
6	0.439	0.161	6155.21	6466.52	4497.98	1.619	6.818
7	0.595	0.210	4950.08	4774.22	4375.83	1.264	5.575
8	0.768	0.264	3756.59	3104.34	4256.76	0.821	3.913
9	0.953	0.320	2581.56	1483.20	4140.72	0.523	2.236
10	1.146	0.377	1429.42	-64.42	4027.70	0.319	-0.132

Exc. totales result. cabeza -0.01599 0.35490
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13347.87	16357.46	5295.10	2.560	6.458
1	0.015	0.008	12178.72	14785.75	5154.61	2.488	6.837
2	0.053	0.024	10993.12	13184.98	5017.15	2.393	7.225
3	0.114	0.048	9794.71	11554.96	4882.77	2.270	7.543
4	0.199	0.080	8587.44	9896.83	4751.49	2.111	7.707
5	0.309	0.118	7375.55	8214.29	4623.22	1.898	7.520
6	0.443	0.162	6163.82	6516.19	4497.98	1.635	6.938
7	0.600	0.211	4957.42	4816.60	4375.83	1.282	5.683
8	0.775	0.265	3762.44	3138.05	4256.76	0.832	3.981
9	0.963	0.321	2585.79	1507.48	4140.72	0.524	2.274
10	1.159	0.379	1432.04	-49.95	4027.70	0.320	-0.102

Exc. totales result. cabeza -0.01240 0.35555
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13357.05	16407.71	5295.10	2.569	6.492
1	0.015	0.008	12187.90	14836.12	5154.61	2.497	6.879
2	0.053	0.024	11002.13	13234.79	5017.15	2.404	7.275
3	0.114	0.048	9803.39	11603.41	4882.77	2.281	7.603
4	0.200	0.080	8595.61	9943.02	4751.49	2.123	7.777
5	0.311	0.118	7383.05	8257.20	4623.22	1.910	7.601
6	0.446	0.163	6170.48	6554.69	4497.98	1.647	7.030
7	0.605	0.212	4963.09	4849.43	4375.83	1.295	5.768
8	0.781	0.266	3766.94	3164.12	4256.76	0.840	4.034
9	0.971	0.323	2589.04	1526.20	4140.72	0.525	2.302
10	1.168	0.381	1434.04	-38.86	4027.70	0.320	-0.080

Exc. totales result. cabeza -0.00965 0.35604
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13364.21	16446.85	5295.10	2.576	6.519
1	0.015	0.008	12195.06	14875.35	5154.61	2.505	6.911
2	0.053	0.024	11009.16	13273.57	5017.15	2.413	7.314

4	0.201	0.080	8601.98	9978.96	4751.49	2.132	7.831
5	0.312	0.118	7388.89	8290.57	4623.22	1.919	7.663
6	0.449	0.163	6175.67	6584.61	4497.98	1.657	7.102
7	0.608	0.213	4967.50	4874.93	4375.83	1.305	5.835
8	0.786	0.267	3770.44	3184.35	4256.76	0.847	4.076
9	0.977	0.324	2591.56	1540.68	4140.72	0.525	2.325
10	1.176	0.383	1435.57	-30.36	4027.70	0.321	-0.062

Exc. totales result. cabeza -0.00754 0.35643
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13369.83	16477.47	5295.10	2.582	6.540
1	0.016	0.008	12200.68	14906.04	5154.61	2.511	6.936
2	0.053	0.025	11014.67	13303.91	5017.15	2.419	7.344
3	0.115	0.049	9815.45	11670.63	4882.77	2.297	7.685
4	0.202	0.080	8606.95	10007.08	4751.49	2.139	7.873
5	0.314	0.119	7393.44	8316.69	4623.22	1.926	7.712
6	0.451	0.163	6179.71	6608.04	4497.98	1.664	7.159
7	0.611	0.213	4970.93	4894.92	4375.83	1.313	5.887
8	0.790	0.268	3773.16	3200.21	4256.76	0.853	4.110
9	0.982	0.325	2593.50	1552.04	4140.72	0.526	2.342
10	1.182	0.384	1436.75	-23.67	4027.70	0.321	-0.048

Exc. totales result. cabeza -0.00588 0.35672
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13374.27	16501.32	5295.10	2.586	6.557
1	0.016	0.008	12205.11	14929.94	5154.61	2.516	6.956
2	0.054	0.025	11019.02	13327.52	5017.15	2.425	7.367
3	0.115	0.049	9819.63	11693.58	4882.77	2.303	7.714
4	0.202	0.080	8610.89	10028.94	4751.49	2.144	7.906
5	0.315	0.119	7397.05	8336.98	4623.22	1.932	7.750
6	0.452	0.164	6182.91	6626.23	4497.98	1.670	7.202
7	0.613	0.214	4973.66	4910.41	4375.83	1.320	5.929
8	0.792	0.268	3775.33	3212.47	4256.76	0.857	4.136
9	0.986	0.326	2595.07	1560.79	4140.72	0.526	2.355
10	1.186	0.384	1437.72	-18.56	4027.70	0.321	-0.038

Exc. totales result. cabeza -0.00461 0.35696
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13377.69	16520.08	5295.10	2.590	6.570
1	0.016	0.008	12208.53	14948.73	5154.61	2.520	6.972
2	0.054	0.025	11022.37	13346.10	5017.15	2.428	7.387
3	0.116	0.049	9822.86	11711.63	4882.77	2.307	7.735
4	0.203	0.080	8613.92	10046.13	4751.49	2.148	7.932
5	0.315	0.119	7399.82	8352.94	4623.22	1.936	7.780
6	0.453	0.164	6185.37	6640.54	4497.98	1.674	7.236
7	0.614	0.214	4975.74	4922.60	4375.83	1.324	5.962
8	0.795	0.269	3776.98	3222.14	4256.76	0.860	4.157
9	0.989	0.326	2596.24	1567.69	4140.72	0.526	2.366
10	1.190	0.385	1438.42	-14.53	4027.70	0.321	-0.030

Exc. totales result. cabeza -0.00361 0.35713
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13380.43	16534.75	5295.10	2.592	6.580
1	0.016	0.008	12211.27	14963.43	5154.61	2.523	6.984
2	0.054	0.025	11025.06	13360.62	5017.15	2.432	7.401

4	0.203	0.081	8616.35	10059.56	4751.49	2.152	7.951
5	0.316	0.119	7402.05	8365.40	4623.22	1.939	7.803
6	0.454	0.164	6187.34	6651.71	4497.98	1.678	7.263
7	0.616	0.214	4977.41	4932.12	4375.83	1.328	5.988
8	0.796	0.269	3778.31	3229.68	4256.76	0.863	4.173
9	0.991	0.327	2597.20	1573.06	4140.72	0.526	2.374
10	1.193	0.386	1439.01	-11.40	4027.70	0.322	-0.023

Exc. totales result. cabeza -0.00283 0.35728
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13382.55	16546.27	5295.10	2.594	6.588
1	0.016	0.008	12213.39	14974.97	5154.61	2.525	6.994
2	0.054	0.025	11027.13	13372.01	5017.15	2.434	7.413
3	0.116	0.049	9827.44	11736.80	4882.77	2.313	7.767
4	0.203	0.081	8618.23	10070.09	4751.49	2.155	7.967
5	0.316	0.119	7403.77	8375.15	4623.22	1.942	7.820
6	0.455	0.164	6188.87	6660.45	4497.98	1.680	7.284
7	0.617	0.215	4978.71	4939.57	4375.83	1.331	6.008
8	0.798	0.269	3779.34	3235.58	4256.76	0.865	4.186
9	0.993	0.327	2597.95	1577.27	4140.72	0.527	2.380
10	1.195	0.386	1439.47	-8.95	4027.70	0.322	-0.018

Exc. totales result. cabeza -0.00222 0.35739
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13384.21	16555.31	5295.10	2.596	6.595
1	0.016	0.008	12215.05	14984.03	5154.61	2.527	7.001
2	0.054	0.025	11028.76	13380.96	5017.15	2.436	7.422
3	0.116	0.049	9829.00	11745.51	4882.77	2.315	7.778
4	0.204	0.081	8619.69	10078.37	4751.49	2.157	7.979
5	0.317	0.119	7405.10	8382.84	4623.22	1.944	7.835
6	0.455	0.164	6190.05	6667.33	4497.98	1.683	7.298
7	0.617	0.215	4979.71	4945.44	4375.83	1.333	6.022
8	0.799	0.270	3780.13	3240.26	4256.76	0.867	4.196
9	0.994	0.327	2598.51	1580.63	4140.72	0.527	2.385
10	1.197	0.386	1439.80	-6.94	4027.70	0.322	-0.014

Exc. totales result. cabeza -0.00172 0.35748
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13385.53	16562.30	5295.10	2.598	6.600
1	0.016	0.008	12216.37	14991.03	5154.61	2.529	7.007
2	0.054	0.025	11030.06	13387.89	5017.15	2.438	7.429
3	0.116	0.049	9830.24	11752.25	4882.77	2.317	7.786
4	0.204	0.081	8620.85	10084.79	4751.49	2.158	7.990
5	0.317	0.119	7406.17	8388.80	4623.22	1.945	7.845
6	0.456	0.164	6190.99	6672.67	4497.98	1.684	7.312
7	0.618	0.215	4980.51	4949.98	4375.83	1.335	6.036
8	0.800	0.270	3780.77	3243.83	4256.76	0.868	4.204
9	0.995	0.327	2598.96	1583.14	4140.72	0.527	2.389
10	1.198	0.387	1440.08	-5.53	4027.70	0.322	-0.011

Exc. totales result. cabeza -0.00137 0.35754
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13386.58	16567.92	5295.10	2.599	6.603
1	0.016	0.008	12217.41	14996.66	5154.61	2.530	7.012
2	0.054	0.025	11031.08	13393.44	5017.15	2.439	7.434

4	0.204	0.081	8621.79	10089.92	4751.49	2.160	7.997
5	0.317	0.119	7407.02	8393.55	4623.22	1.947	7.855
6	0.456	0.165	6191.75	6676.92	4497.98	1.685	7.322
7	0.618	0.215	4981.16	4953.61	4375.83	1.337	6.045
8	0.800	0.270	3781.28	3246.70	4256.76	0.869	4.210
9	0.996	0.327	2599.34	1585.20	4140.72	0.527	2.392
10	1.199	0.387	1440.31	-4.32	4027.70	0.322	-0.009

Exc. totales result. cabeza -0.00107 0.35760
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13387.38	16572.27	5295.10	2.599	6.606
1	0.016	0.008	12218.21	15001.02	5154.61	2.531	7.016
2	0.054	0.025	11031.86	13397.75	5017.15	2.440	7.438
3	0.116	0.049	9831.98	11761.82	4882.77	2.319	7.797
4	0.204	0.081	8622.49	10093.92	4751.49	2.161	8.003
5	0.317	0.120	7407.66	8397.27	4623.22	1.948	7.861
6	0.456	0.165	6192.31	6680.27	4497.98	1.686	7.330
7	0.619	0.215	4981.63	4956.47	4375.83	1.338	6.052
8	0.801	0.270	3781.66	3248.98	4256.76	0.870	4.215
9	0.997	0.328	2599.60	1586.85	4140.72	0.527	2.395
10	1.200	0.387	1440.47	-3.33	4027.70	0.322	-0.007

Exc. totales result. cabeza -0.00083 0.35764
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13388.03	16575.61	5295.10	2.600	6.609
1	0.016	0.008	12218.86	15004.37	5154.61	2.531	7.019
2	0.054	0.025	11032.50	13401.06	5017.15	2.441	7.442
3	0.116	0.049	9832.59	11765.03	4882.77	2.320	7.801
4	0.204	0.081	8623.06	10096.96	4751.49	2.162	8.007
5	0.318	0.120	7408.19	8400.09	4623.22	1.948	7.866
6	0.456	0.165	6192.78	6682.80	4497.98	1.687	7.336
7	0.619	0.215	4982.03	4958.63	4375.83	1.339	6.059
8	0.801	0.270	3781.98	3250.68	4256.76	0.870	4.219
9	0.997	0.328	2599.83	1588.04	4140.72	0.527	2.397
10	1.201	0.387	1440.61	-2.66	4027.70	0.322	-0.005

Exc. totales result. cabeza -0.00066 0.35768
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13388.51	16578.31	5295.10	2.601	6.611
1	0.016	0.008	12219.35	15007.07	5154.61	2.532	7.021
2	0.054	0.025	11032.98	13403.73	5017.15	2.441	7.445
3	0.116	0.049	9833.05	11767.62	4882.77	2.321	7.805
4	0.204	0.081	8623.50	10099.41	4751.49	2.162	8.012
5	0.318	0.120	7408.59	8402.34	4623.22	1.949	7.870
6	0.457	0.165	6193.14	6684.79	4497.98	1.688	7.340
7	0.619	0.215	4982.34	4960.31	4375.83	1.339	6.064
8	0.802	0.270	3782.23	3251.99	4256.76	0.871	4.222
9	0.998	0.328	2600.02	1588.95	4140.72	0.527	2.398
10	1.201	0.387	1440.74	-2.16	4027.70	0.322	-0.004

Exc. totales result. cabeza -0.00054 0.35771
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13388.88	16580.53	5295.10	2.601	6.612
1	0.016	0.008	12219.71	15009.29	5154.61	2.532	7.023
2	0.054	0.025	11033.34	13405.92	5017.15	2.442	7.447

3	0.117	0.049	9833.40	11769.78	4882.77	2.321	7.808
4	0.204	0.081	8623.82	10101.43	4751.49	2.163	8.015
5	0.318	0.120	7408.88	8404.21	4623.22	1.949	7.874
6	0.457	0.165	6193.39	6686.45	4497.98	1.688	7.344
7	0.620	0.215	4982.55	4961.71	4375.83	1.340	6.067
8	0.802	0.270	3782.39	3253.10	4256.76	0.871	4.224
9	0.998	0.328	2600.13	1589.73	4140.72	0.527	2.399
10	1.202	0.387	1440.79	-1.71	4027.70	0.322	-0.004

Exc. totales result. cabeza -0.00043 0.35772
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13389.21	16582.27	5295.10	2.601	6.613
1	0.016	0.008	12220.04	15011.03	5154.61	2.533	7.024
2	0.054	0.025	11033.65	13407.64	5017.15	2.442	7.449
3	0.117	0.049	9833.70	11771.42	4882.77	2.322	7.810
4	0.204	0.081	8624.10	10103.03	4751.49	2.163	8.017
5	0.318	0.120	7409.13	8405.69	4623.22	1.950	7.877
6	0.457	0.165	6193.62	6687.78	4497.98	1.689	7.346
7	0.620	0.215	4982.74	4962.85	4375.83	1.340	6.070
8	0.802	0.270	3782.53	3254.02	4256.76	0.871	4.226
9	0.998	0.328	2600.23	1590.41	4140.72	0.527	2.400
10	1.202	0.387	1440.85	-1.28	4027.70	0.322	-0.003

Exc. totales result. cabeza -0.00032 0.35774
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13389.46	16583.54	5295.10	2.602	6.614
1	0.016	0.008	12220.29	15012.31	5154.61	2.533	7.025
2	0.054	0.025	11033.90	13408.91	5017.15	2.443	7.450
3	0.117	0.049	9833.94	11772.65	4882.77	2.322	7.812
4	0.204	0.081	8624.33	10104.21	4751.49	2.163	8.019
5	0.318	0.120	7409.34	8406.79	4623.22	1.950	7.879
6	0.457	0.165	6193.80	6688.77	4497.98	1.689	7.350
7	0.620	0.215	4982.89	4963.68	4375.83	1.340	6.072
8	0.802	0.270	3782.66	3254.66	4256.76	0.872	4.228
9	0.998	0.328	2600.32	1590.84	4140.72	0.527	2.401
10	1.202	0.387	1440.90	-1.07	4027.70	0.322	-0.002

Exc. totales result. cabeza -0.00027 0.35775
Exc. reales 1er ord. cabeza 0.00000 0.35780

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13389.67	16584.65	5295.10	2.602	6.615
1	0.016	0.008	12220.50	15013.42	5154.61	2.533	7.026
2	0.054	0.025	11034.11	13410.00	5017.15	2.443	7.451
3	0.117	0.049	9834.14	11773.71	4882.77	2.322	7.813
4	0.204	0.081	8624.51	10105.22	4751.49	2.164	8.020
5	0.318	0.120	7409.51	8407.73	4623.22	1.950	7.880
6	0.457	0.165	6193.95	6689.61	4497.98	1.689	7.352
7	0.620	0.215	4983.02	4964.40	4375.83	1.341	6.073
8	0.802	0.270	3782.76	3255.24	4256.76	0.872	4.229
9	0.999	0.328	2600.39	1591.26	4140.72	0.527	2.402
10	1.203	0.387	1440.94	-0.82	4027.70	0.322	2.402

Exc. totales result. cabeza -0.00020 0.35776
Exc. reales 1er ord. cabeza 0.00000 0.35780

Convergencia del equilibrio sin agotamiento
Fpx = 126.400 t; Fpy = 159.200 t

Fpx = 112.700 t; Fpy = 130.600 t;

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	12525.59	10471.41	4294.40	1.817	3.245
1	0.008	0.007	11534.65	9025.74	4153.91	1.913	3.571
2	0.028	0.020	10544.37	7617.89	4016.45	1.883	3.625
3	0.060	0.039	9557.53	6251.71	3882.07	1.799	3.530
4	0.103	0.063	8577.36	4932.69	3750.79	1.683	3.296
5	0.157	0.094	7607.23	3667.59	3622.52	1.537	2.882
6	0.220	0.129	6650.55	2464.54	3497.28	1.361	2.290
7	0.290	0.168	5710.72	1332.75	3375.13	1.157	1.459
8	0.365	0.212	4791.06	282.85	3256.06	0.942	0.362
9	0.442	0.258	3894.65	-673.24	3140.02	0.753	-0.987
10	0.515	0.307	3007.21	-1551.05	3027.00	0.637	-3.003

Exc. totales result. cabeza -0.51241 0.99346
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13945.54	12865.98	4294.40	2.211	4.388
1	0.011	0.008	12907.07	11337.44	4153.91	2.199	4.588
2	0.037	0.023	11865.11	9833.33	4016.45	2.126	4.674
3	0.078	0.044	10822.61	8356.98	3882.07	2.017	4.655
4	0.134	0.073	9782.75	6912.93	3750.79	1.876	4.508
5	0.204	0.107	8748.88	5507.15	3622.52	1.693	4.162
6	0.288	0.147	7724.62	4147.55	3497.28	1.476	3.639
7	0.384	0.191	6713.64	2843.47	3375.13	1.233	2.867
8	0.489	0.240	5719.58	1606.12	3256.06	1.017	1.830
9	0.600	0.292	4745.44	448.45	3140.02	0.915	0.643
10	0.713	0.347	3807.42	-598.99	3027.00	0.886	-1.224

Exc. totales result. cabeza -0.19788 1.25782
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13767.82	13165.77	4294.40	2.370	4.849
1	0.012	0.008	12765.11	11677.18	4153.91	2.329	5.031
2	0.040	0.023	11756.23	10205.84	4016.45	2.262	5.166
3	0.085	0.046	10744.13	8754.61	3882.07	2.171	5.215
4	0.146	0.076	9731.86	7327.45	3750.79	2.054	5.134
5	0.224	0.113	8722.65	5929.77	3622.52	1.891	4.827
6	0.318	0.155	7720.02	4569.34	3497.28	1.683	4.321
7	0.426	0.203	6727.74	3255.62	3375.13	1.417	3.529
8	0.545	0.256	5749.91	2000.34	3256.06	1.133	2.483
9	0.672	0.312	4790.39	816.82	3140.02	0.930	1.199
10	0.803	0.371	3852.71	-274.67	3027.00	0.833	-0.549

Exc. totales result. cabeza -0.09074 1.27278
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13834.28	13346.74	4294.40	2.446	5.048
1	0.012	0.008	12833.03	11871.39	4153.91	2.401	5.244
2	0.041	0.024	11824.61	10410.04	4016.45	2.339	5.420
3	0.088	0.047	10811.92	8965.11	3882.07	2.257	5.527
4	0.152	0.078	9797.97	7539.97	3750.79	2.151	5.509
5	0.235	0.116	8785.86	6139.46	3622.52	2.001	5.256
6	0.334	0.160	7779.05	4770.95	3497.28	1.806	4.791
7	0.449	0.210	6781.21	3443.72	3375.13	1.542	3.989
8	0.577	0.265	5796.48	2169.92	3256.06	1.233	2.860

Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13872.34	13474.91	4294.40	2.481	5.154
1	0.012	0.008	12872.19	12004.08	4153.91	2.437	5.365
2	0.042	0.024	11864.35	10545.51	4016.45	2.379	5.569
3	0.090	0.048	10851.69	9101.33	3882.07	2.303	5.712
4	0.156	0.079	9837.14	7674.52	3750.79	2.205	5.736
5	0.241	0.118	8823.75	6269.53	3622.52	2.065	5.522
6	0.343	0.163	7814.89	4893.42	3497.28	1.881	5.089
7	0.462	0.214	6814.13	3555.24	3375.13	1.622	4.291
8	0.595	0.270	5825.61	2267.28	3256.06	1.299	3.112
9	0.738	0.330	4853.77	1044.68	3140.02	0.989	1.614
10	0.886	0.394	3902.84	-94.57	3027.00	0.826	-0.183

Exc. totales result. cabeza -0.03124 1.28934
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13892.16	13556.28	4294.40	2.499	5.213
1	0.013	0.008	12892.77	12087.76	4153.91	2.456	5.436
2	0.043	0.024	11885.40	10630.48	4016.45	2.401	5.657
3	0.091	0.048	10872.89	9186.39	3882.07	2.330	5.822
4	0.158	0.080	9858.16	7758.26	3750.79	2.236	5.873
5	0.244	0.118	8844.19	6350.25	3622.52	2.102	5.686
6	0.349	0.164	7834.31	4969.20	3497.28	1.926	5.277
7	0.470	0.216	6832.03	3623.98	3375.13	1.672	4.486
8	0.606	0.273	5841.44	2326.92	3256.06	1.342	3.277
9	0.753	0.334	4867.09	1093.60	3140.02	1.007	1.714
10	0.905	0.399	3913.32	-57.71	3027.00	0.828	-0.111

Exc. totales result. cabeza -0.01906 1.29281
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13903.88	13606.13	4294.40	2.509	5.248
1	0.013	0.008	12904.88	12139.00	4153.91	2.468	5.478
2	0.043	0.024	11897.74	10682.50	4016.45	2.415	5.709
3	0.092	0.048	10885.28	9238.47	3882.07	2.345	5.888
4	0.159	0.080	9870.39	7809.55	3750.79	2.254	5.956
5	0.246	0.119	8856.05	6399.74	3622.52	2.123	5.786
6	0.352	0.165	7845.54	5015.70	3497.28	1.953	5.393
7	0.475	0.217	6842.32	3666.21	3375.13	1.703	4.609
8	0.613	0.274	5850.47	2363.58	3256.06	1.370	3.383
9	0.762	0.336	4874.57	1123.63	3140.02	1.018	1.778
10	0.917	0.402	3919.06	-35.14	3027.00	0.829	-0.068

Exc. totales result. cabeza -0.01161 1.29470
Exc. reales ler ord. cabeza 0.00000 1.29749

Sec.	flch.x	flch.y	Mom.x	Mom.y	Axil	curv.x	curv.y
0	0.000	0.000	13911.04	13636.39	4294.40	2.515	5.268
1	0.013	0.008	12912.26	12170.12	4153.91	2.475	5.503
2	0.043	0.025	11905.23	10714.11	4016.45	2.422	5.741
3	0.092	0.049	10892.78	9270.14	3882.07	2.354	5.928
4	0.160	0.080	9877.78	7840.77	3750.79	2.265	6.006
5	0.248	0.119	8863.20	6429.89	3622.52	2.136	5.848
6	0.354	0.165	7852.28	5044.07	3497.28	1.969	5.464
7	0.478	0.217	6848.48	3691.99	3375.13	1.721	4.685
8	0.617	0.275	5855.85	2385.97	3256.06	1.388	3.450

Curvaturas : Cx = 2.2760 Cy = 6.5917 Ctotal = 6.9735 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... ∝ = 70.95 °
Profundidad de la fibra neutra ..... X = 248.20 cm.
Excentricidad del eje neutro n-n' ..... exc = 14.87 cm.

Tensiones y deformaciones máximas en el hormigón:

Eh = 1.73081 mm/m Eh'=-1.52347 mm/m
σc = 166.92 kp/cm² Uc = 3240.13 t.

Tensiones y deformaciones máximas en la armadura:

Es = 1.57119 mm/m Es'=-1.36386 mm/m
σs = 3299.50 kp/cm² σs'=-2864.10 kp/cm²

SECCION CAJON A FLEXOCOMPRESION ESVIADA

Cantos : Hx =217.60 cm Hy =700.00 cm
Espesores : Ex = 35.00 cm Ey = 35.00 cm

Armaduras definidas por lineas :

Exterior : Axe = 55.48 cm² Aye =156.50 cm² recub.= 5.00 cm
Interior : Axe = 55.48 cm² Aye =156.50 cm² recub.= 4.00 cm

Caracteristicas de los materiales:

HORMIGON : Resistencia característica .. fck = 300 Kp/cm²
Coeficiente de minoración .... c = 1.50

ACERO : Resistencia característica .. fyk = 5100 Kp/cm²
Coeficiente de minoración .... s = 1.15

Esfuerzos:

Nz = 4548.10 t , Mx = 517.10 txm , My = 1896.70 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... Eg = 0.4834 mm/m
Curvaturas : Cx = 0.1136 Cy = 3.0930 Ctotal = 3.0951 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... ∝ = 87.90 °
Profundidad de la fibra neutra ..... X = 277.77 cm.
Excentricidad del eje neutro n-n' ..... exc = 156.19 cm.

Tensiones y deformaciones máximas en el hormigón:

Eh = 0.85971 mm/m Eh'= 0.10714 mm/m
σc = 114.74 kp/cm² Uc = 4111.64 t.

Tensiones y deformaciones máximas en la armadura:

Es = 0.80199 mm/m Es'= 0.16486 mm/m
σs = 1684.18 kp/cm² σs'= 346.20 kp/cm²

Esfuerzos:

Nz = 3436.30 t , Mx = 4131.70 txm , My = 1037.00 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.3512 mm/m
Curvaturas : Cx = 0.8620 Cy = 1.6125 Ctotal = 1.8284 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 61.87 °
Profundidad de la fibra neutra ..... X = 453.02 cm.
Excentricidad del eje neutro n-n' ..... exc = 192.07 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 0.82831 mm/m $\epsilon h'$=-0.12594 mm/m
σc = 111.65 kp/cm² Uc = 3128.19 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 0.78377 mm/m $\epsilon s'$=-0.08140 mm/m
σs = 1645.91 kp/cm² $\sigma s'$= -170.95 kp/cm²

Esfuerzos:

Nz = 4140.70 t , Mx = 2600.40 txm , My = 1591.30 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.4325 mm/m
Curvaturas : Cx = 0.5548 Cy = 2.5120 Ctotal = 2.5725 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 77.55 °
Profundidad de la fibra neutra ..... X = 349.84 cm.
Excentricidad del eje neutro n-n' ..... exc = 168.12 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 0.89998 mm/m $\epsilon h'$=-0.03500 mm/m
σc = 118.57 kp/cm² Uc = 3738.31 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 0.84478 mm/m $\epsilon s'$= 0.02020 mm/m
σs = 1774.04 kp/cm² $\sigma s'$= 42.43 kp/cm²

Esfuerzos:

Nz = 3140.20 t , Mx = 4885.50 txm , My = 1169.30 txm

Plano de deformación de la sección:

Deformación c.d.g de la sección ..... ϵg = 0.3056 mm/m

Curvaturas : Cx = 1.1203 Cy = 2.0358 Ctotal = 2.3237 (1/1000m)
Angulo del eje neutro n-n' con el eje x ..... α = 61.18 °
Profundidad de la fibra neutra ..... X = 395.58 cm.
Excentricidad del eje neutro n-n' ..... exc = 131.52 cm.

Tensiones y deformaciones máximas en el hormigón:

ϵh = 0.91922 mm/m $\epsilon h'$=-0.30800 mm/m
σc = 120.36 kp/cm² Uc = 2885.79 t.

Tensiones y deformaciones máximas en la armadura:

ϵs = 0.86241 mm/m $\epsilon s'$=-0.25119 mm/m
σs = 1811.06 kp/cm² $\sigma s'$= -527.50 kp/cm²

2.2.2- Encepados y pilotes

VIADUCTO 1

Combinación de esfuerzos

Para el cálculo 1, las hipótesis de combinación serán:

I: $1,0 \times (PP + CP) + 1,0 \times SC$

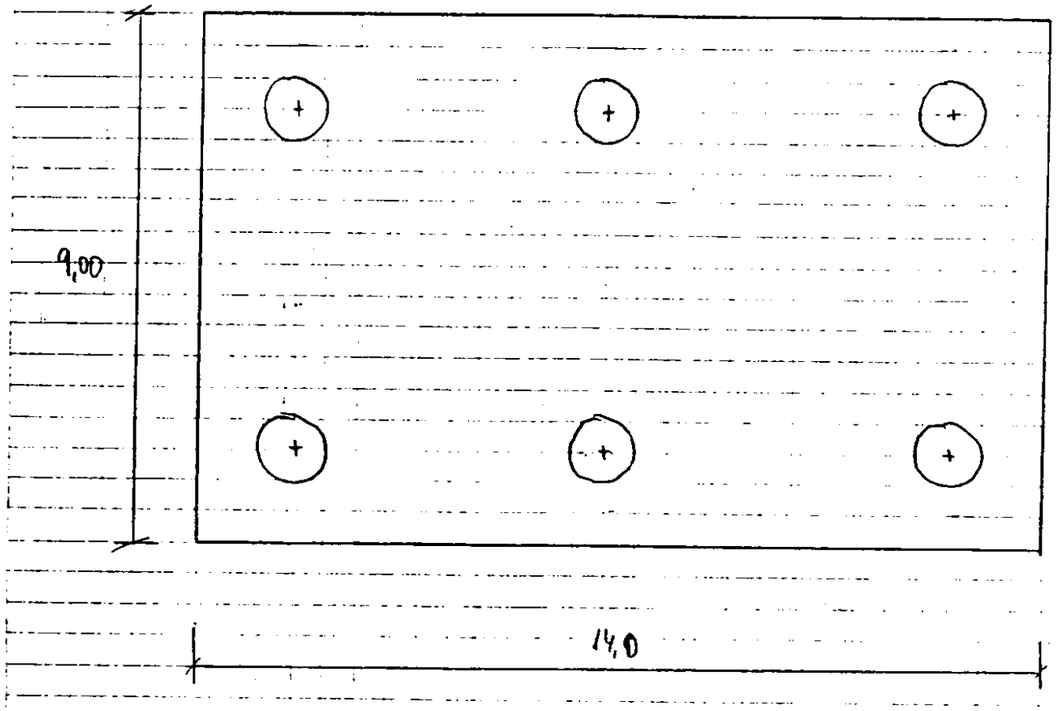
II: $0,9 \times (PP + CP) + 0,9 \times SC + 0,9 \times W$

Se tendrá pues — ESFUERZOS EN CABEZA DE PILA

Hip I:	1a	1b
V =	2948,3	2271,3
H_L =	93,6	83,5
H_T =	51,26	30,13
M_L =	0	0
M_T =	664,86	2013,3

Hip II	1a	1b
V =	2679,0	2069,7
H_L =	84,24	75,15
$W_{pila} = 0,387$ t/m lineal → H_T =	99,45	80,48
M_L =	0	0
M_T =	932,37	2146

ESQUEMA DEL ENCEPADO:



CANTO : 2,5m

Ø pilotes : 1,80m

Distancia entre pilotes : 3Ø = 5,4m

PILOTES.XLS
HIP I a)

VIADUCTO:
PILA:
ALTURA DE PILA: 23.5 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

- PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el coeficien
  VIENTO TRANSVERSAL: 0.00 Mp/m de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3248.63 Mp	93.60 Mp	51.26 Mp	2200 Mp*m	1869 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3248.63 Mp	93.60 Mp	51.26 Mp	2200 Mp*m	1869 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 787.5 Mp
CANTO : 2.5 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 113.4 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4149.53 Mp	93.60 Mp	51.26 Mp	2434 Mp*m	1998 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 6 Inercia trans: 21.6 Inercia long: 16.2

P_{MAX} = N/6+MT/21.6+ML/16.2 = 691.6 + 92.5 + 150.2 = **934.293 Mp**

P_{MIN} = N/6-MT/21.6-ML/16.2 = 691.6 - 92.5 - 150.2 = **448.884 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción:
DEPOSITOS ALUVIALES	KEUPER ALTERADO	KEUPER SANO
Potencia: 8.2 m	Potencia: 3.3 m	Potencia: 50 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 30 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3		
Long. pilote	5.2 m	Long. pilote	3.3 m	Long. pilote	21.5 m	ok: 21.5<50
Por fuste:	0.0 Mp	Por fuste:	93.3 Mp	Por fuste:	607.9 Mp	
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp	
total:	0.0 Mp	total:	93.3 Mp	total:	913.3 Mp	

RESISTENCIA TOTAL DEL PILOTE: **1 006.6 Mp**

ALTURA DE PILA: 23.5 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2571.63 Mp	83.50 Mp	30.13 Mp	1962 Mp*m	2721 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2571.63 Mp	83.50 Mp	30.13 Mp	1962 Mp*m	2721 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 787.50 Mp
CANTO : 2.5 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 113.40 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracteristicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
3472.53 Mp	83.50 Mp	30.13 Mp	2171 Mp*m	2797 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 6 Inercia trans: 21.6 Inercia long: 16.2

P_{MAX} = N/6+MT/21.6+ML/16.2 = 578.8 + 129.5 + 134.0 = **842.243 Mp**

P_{MIN} = N/6-MT/21.6-ML/16.2 = 578.8 - 129.5 - 134.0 = **315.267 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

PILOTES.XLS
HIP II a)

ALTURA DE PILA: 23.5 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2679 Mp	84.24 Mp	99.45 Mp	0 Mp*m	932.4 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 10.80 Mp/m
VIENTO TRANSVERSAL: 0.39 Mp/m
> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2932.8 Mp	84.24 Mp	108.54 Mp	1980 Mp*m	3376 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2932.8 Mp	84.24 Mp	108.54 Mp	1980 Mp*m	3376 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 787.50 Mp
CANTO : 2.5 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 113.40 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3833.7 Mp	84.24 Mp	108.54 Mp	2190 Mp*m	3648 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 6 Inercia trans: 21.6 Inercia long: 16.2

P MAX = N/6+MT/21.6+ML/16.2 = 639.0 + 168.9 + 135.2 = **943.023 Mp**

P MIN = N/6-MT/21.6-ML/16.2 = 639.0 - 168.9 - 135.2 = **334.877 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

PILOTES.XLS
HIP II b)

ALTURA DE PILA: 23.5 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2069.7 Mp	75.15 Mp	80.48 Mp	0 Mp*m	2146 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 10.80 Mp/m
VIENTO TRANSVERSAL: 0.39 Mp/m
> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2323.5 Mp	75.15 Mp	89.57 Mp	1766 Mp*m	4144 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2323.5 Mp	75.15 Mp	89.57 Mp	1766 Mp*m	4144 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 787.50 Mp
CANTO : 2.5 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 113.40 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3224.4 Mp	75.15 Mp	89.57 Mp	1954 Mp*m	4368 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 6 Inercia trans: 21.6 Inercia long: 16.2

P MAX = N/6+MT/21.6+ML/16.2 = 537.4 + 202.2 + 120.6 = **860.237 Mp**

P MIN = N/6-MT/21.6-ML/16.2 = 537.4 - 202.2 - 120.6 = **214.563 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

j. a. torroja oficina tecnica, s.a. madrid	ASUNTO:	FECHA:	HOJA:
		REALIZO:	

j. a. torroja oficina tecnica, s.a. madrid	ASUNTO: CVE VIADUCTO 1	FECHA:	HOJA:
		REALIZO:	

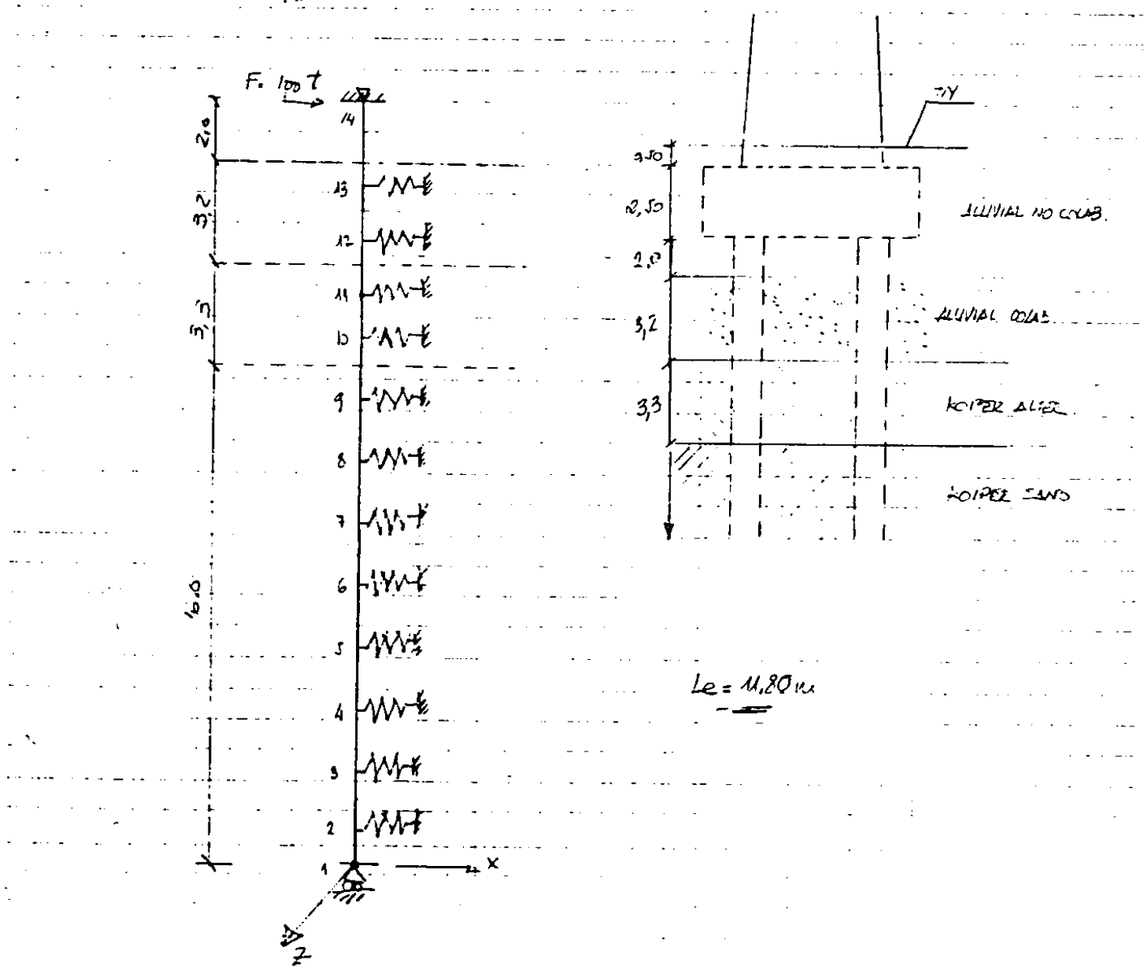
CALCULO DE LA LONGITUD DE EMPOTRAMIENTO DE LOS PILOTES

Modelo de cálculo

Se modeliza el pilote como una barra de hormigón, de $\phi = 1{,}50$ m. y longitud 46,0 m., perfectamente empotrada en cabeza (encepado) y articulada en su base.

A lo largo de toda la barra se disponen muelles cuya constante elástica representa linealmente el terreno circundante a la pilote.

La cte elástica de un muelle no es más que el coeficiente de balasto del terreno (grado de reacción del suelo) multiplicado por la otra dimensión.



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*                                               *
*           S T A A D - III                     *
*           Revision 22.3                       *
*           Proprietary Program of              *
*           Research Engineers, Inc.            *
*           Date=    MAR 26, 1998               *
*           Time=    16:49:41                   *
*                                               *
*      USER ID: JATOTSA                         *
*************************************************

 1. STAAD PLANE PILOTE VIADUCTO Nš 1
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 0
 5. 2 0 1 0
 6. 3 0 3 0
 7. 4 0 5 0
 8. 5 0 7 0
 9. 6 0 9 0
10. 7 0 11 0
11. 8 0 13 0
12. 9 0 15 0
13. 10 0 16.825 0
14. 11 0 18.475 0
15. 12 0 20.1 0
16. 13 0 21.7 0
17. 14 0 24.5 0
18. MEMBER INCIDENCES
19. 1 1 2 13
20. MEMBER PROPERTIES
21. 1 TO  13 PRI YD  1.8 IX 0.515299735005066 IZ 0.515299735005066
22. SUPPORT
23. 1 PINNED
24. 2 FIXED BUT MZ KFX 15840
25. 3 FIXED BUT MZ KFX 15840
26. 4 FIXED BUT MZ KFX 15840
27. 5 FIXED BUT MZ KFX 15840
28. 6 FIXED BUT MZ KFX 15840
29. 7 FIXED BUT MZ KFX 15840
30. 8 FIXED BUT MZ KFX 15840
31. 9 FIXED BUT MZ KFX 15840
32. 10 FIXED BUT MZ KFX 4752
33. 11 FIXED BUT MZ KFX 4752
34. 12 FIXED BUT MZ KFX 1152
35. 13 FIXED BUT MZ KFX 384
36. 14 FIXED BUT FX
37. CONSTANT
38. E 3000000 ALL
39. POISSON 0.2 ALL
40. DENSITY 2.5 ALL
41. ALPHA 0.00001 ALL
```

42. SECTION 0.25 0.5 0.75 MEMB 1 TO 13
43. LOAD 1 CARGA UNITARIA 100 MP
44. JOINT LOAD
45. 14 FX 100
46. PERFORM ANALYSIS

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 14/ 13/ 14
ORIGINAL/FINAL BAND-WIDTH = 1/ 1
TOTAL PRIMARY LOAD CASES = 1, TOTAL DEGREES OF FREEDOM = 26
SIZE OF STIFFNESS MATRIX = 104 DOUBLE PREC. WORDS
REQRD/AVAIL. DISK SPACE = 12.02/ 113.3 MB, EXMEM = 1975.4 MB

++ Processing Element Stiffness Matrix. 16:49:42
++ Processing Global Stiffness Matrix. 16:49:42
++ Processing Triangular Factorization. 16:49:42
++ Calculating Joint Displacements. 16:49:42
++ Calculating Member Forces. 16:49:42

47. PRINT ANALYSIS RESULT

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	.0000	.0000	.0000	.0000	.0000	.0001
2	1	-.0080	.0000	.0000	.0000	.0000	.0001
3	1	-.0226	.0000	.0000	.0000	.0000	.0001
4	1	-.0325	.0000	.0000	.0000	.0000	.0000
5	1	-.0325	.0000	.0000	.0000	.0000	.0000
6	1	-.0148	.0000	.0000	.0000	.0000	-.0002
7	1	.0309	.0000	.0000	.0000	.0000	-.0003
8	1	.1164	.0000	.0000	.0000	.0000	-.0005
9	1	.2502	.0000	.0000	.0000	.0000	-.0008
10	1	.4144	.0000	.0000	.0000	.0000	-.0010
11	1	.5845	.0000	.0000	.0000	.0000	-.0010
12	1	.7547	.0000	.0000	.0000	.0000	-.0010
13	1	.9012	.0000	.0000	.0000	.0000	-.0008
14	1	1.0289	.0000	.0000	.0000	.0000	.0000

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	5.11	.00	.00	.00	.00	.00
2	1	1.26	.00	.00	.00	.00	.00
3	1	3.58	.00	.00	.00	.00	.00
4	1	5.15	.00	.00	.00	.00	.00
5	1	5.15	.00	.00	.00	.00	.00
6	1	2.35	.00	.00	.00	.00	.00
7	1	-4.90	.00	.00	.00	.00	.00
8	1	-18.43	.00	.00	.00	.00	.00
9	1	-39.64	.00	.00	.00	.00	.00
10	1	-19.69	.00	.00	.00	.00	.00
11	1	-27.78	.00	.00	.00	.00	.00
12	1	-8.69	.00	.00	.00	.00	.00
13	1	-3.46	.00	.00	.00	.00	.00
14	1	.00	.00	.00	.00	.00	562.50

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- MTON MET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	.00	-5.11	.00	.00	.00	.00
		2	.00	5.11	.00	.00	.00	-5.11
2	1	2	.00	-6.37	.00	.00	.00	5.11
		3	.00	6.37	.00	.00	.00	-17.84
3	1	3	.00	-9.95	.00	.00	.00	17.84
		4	.00	9.95	.00	.00	.00	-37.74
4	1	4	.00	-15.09	.00	.00	.00	37.74
		5	.00	15.09	.00	.00	.00	-67.93
5	1	5	.00	-20.24	.00	.00	.00	67.93
		6	.00	20.24	.00	.00	.00	-108.42
6	1	6	.00	-22.59	.00	.00	.00	108.42
		7	.00	22.59	.00	.00	.00	-153.60
7	1	7	.00	-17.69	.00	.00	.00	153.60
		8	.00	17.69	.00	.00	.00	-188.99
8	1	8	.00	.74	.00	.00	.00	188.99
		9	.00	-.74	.00	.00	.00	-187.51
9	1	9	.00	40.38	.00	.00	.00	187.51
		10	.00	-40.38	.00	.00	.00	-113.83
10	1	10	.00	60.07	.00	.00	.00	113.83
		11	.00	-60.07	.00	.00	.00	-14.71
11	1	11	.00	87.85	.00	.00	.00	14.71
		12	.00	-87.85	.00	.00	.00	128.04
12	1	12	.00	96.54	.00	.00	.00	-128.04
		13	.00	-96.54	.00	.00	.00	282.50
13	1	13	.00	100.00	.00	.00	.00	-282.50
		14	.00	-100.00	.00	.00	.00	562.50

********** END OF LATEST ANALYSIS RESULT **********

48. PRINT SECTION FORCES

MEMBER FORCES AT INTERMEDIATE SECTIONS

ALL UNITS ARE -- MTON MET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
1	1	.25	-5.11	.00	.00	1.28
		.50	-5.11	.00	.00	2.55
		.75	-5.11	.00	.00	3.83
2	1	.25	-6.37	.00	.00	8.29
		.50	-6.37	.00	.00	11.48
		.75	-6.37	.00	.00	14.66
3	1	.25	-9.95	.00	.00	22.82
		.50	-9.95	.00	.00	27.79
		.75	-9.95	.00	.00	32.77
4	1	.25	-15.09	.00	.00	45.29
		.50	-15.09	.00	.00	52.83
		.75	-15.09	.00	.00	60.38
5	1	.25	-20.24	.00	.00	78.05
		.50	-20.24	.00	.00	88.17
		.75	-20.24	.00	.00	98.29
6	1	.25	-22.59	.00	.00	119.71
		.50	-22.59	.00	.00	131.01
		.75	-22.59	.00	.00	142.31
7	1	.25	-17.69	.00	.00	162.45
		.50	-17.69	.00	.00	171.30
		.75	-17.69	.00	.00	180.14
8	1	.25	.74	.00	.00	188.62
		.50	.74	.00	.00	188.25
		.75	.74	.00	.00	187.88
9	1	.25	40.38	.00	.00	169.09
		.50	40.38	.00	.00	150.67
		.75	40.38	.00	.00	132.25
10	1	.25	60.07	.00	.00	89.05
		.50	60.07	.00	.00	64.27
		.75	60.07	.00	.00	39.49
11	1	.25	87.85	.00	.00	-20.98
		.50	87.85	.00	.00	-56.66
		.75	87.85	.00	.00	-92.35
12	1	.25	96.54	.00	.00	-166.65
		.50	96.54	.00	.00	-205.27
		.75	96.54	.00	.00	-243.88

MEMBER FORCES AT INTERMEDIATE SECTIONS

ALL UNITS ARE -- MTON MET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
13	1	.25	100.00	.00	.00	-352.50
		.50	100.00	.00	.00	-422.50
		.75	100.00	.00	.00	-492.50

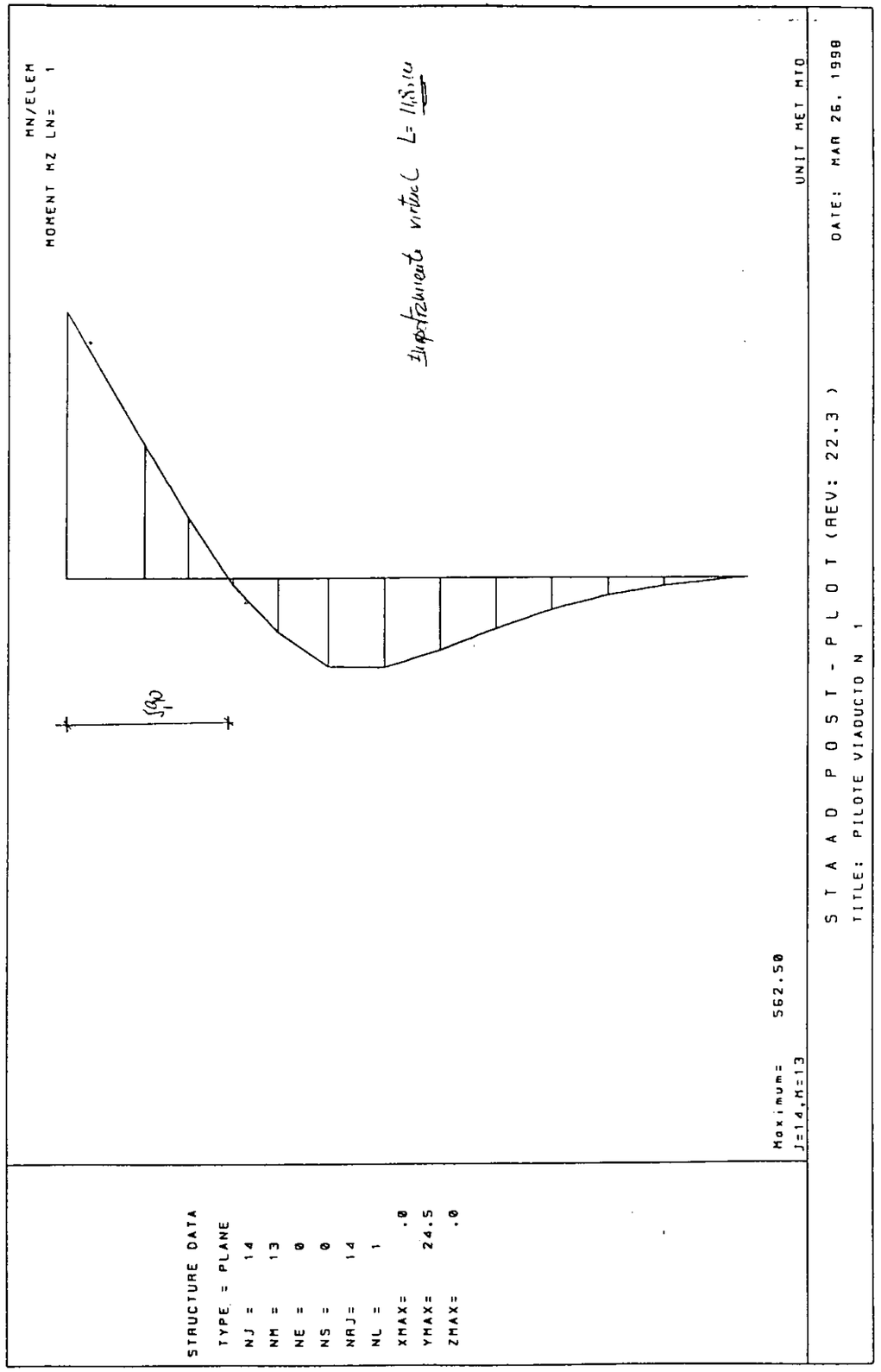
********** END OF LATEST ANALYSIS RESULT **********

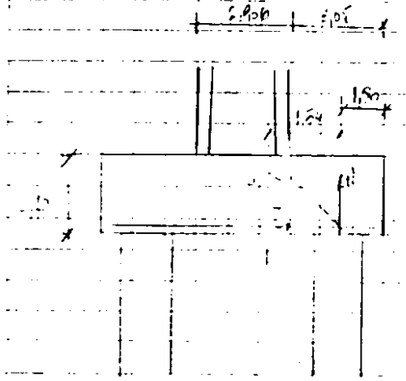
49. PLOT BENDING FILE
50. PLOT DISPLACEMENT FILE
51. FINISH

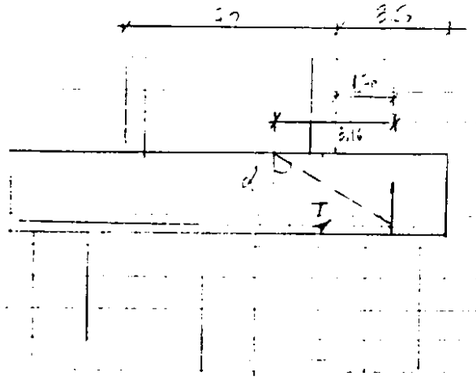
********** END OF STAAD-III **********

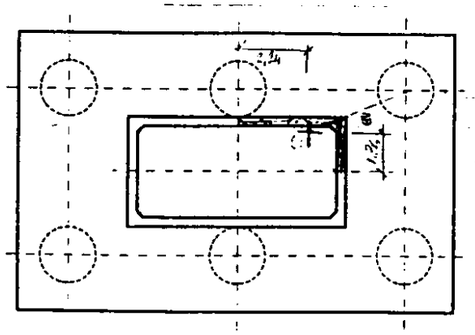
**** DATE= MAR 26,1998 TIME= 16:49:42 ****

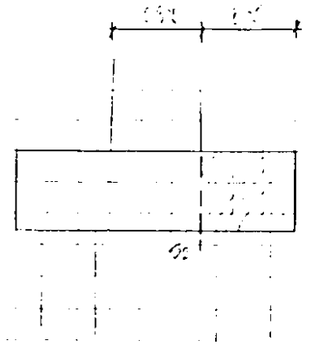
* For questions on STAAD-III, contact: *
* Research Engineers(Europe) Ltd *
* Draycott House, Almondsbury Business Centre, Bristol *
* BS12 4QH, England. *
* Tel: +44 1454 207003 Fax: +44 1454 207001 *

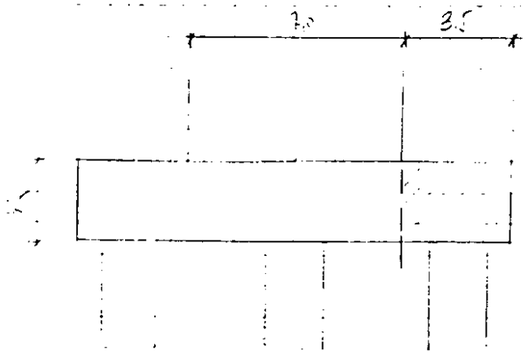












ARMADO DE PILOTES.

Flexión

Esfuerzos en cabeza

HIP.	HL	HT	Nmax	Nmin	Nd max	Nd min	Md
1	15,6	8,55	934,3	548,9	1401,5	673,4	26,7
2	13,9	7,0	842,2	315,2	1263,3	472,8	22,2
3	20,6	19,6	943,0	334,9	1414,5	502,4	42,6
4	19,1	16,4	860,1	214,6	1290,3	321,9	37,7

$l_{ef} = 11,80$ m

Esfuerzos en empotramiento virtual

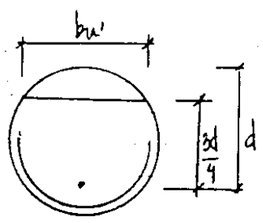
$T_p = 0,785 \times 1,10^2 \times 2,5 \times 11,80 = 37,0$ Mp

HIP. I y II $(P_p)_d = 37,0 \times 1,5 = 112,5$ Mp

HIP. III y IV $(P_p)_d = 37,0 \times 0,9 \times 1,5 = 101,3$ Mp

HIP.	Md	Nd min	Nd max	ν	μ	ω	A_s (cm²)
1	315,1	783,9	1514,0	0,257	0,06	—	Amin
2	262,0	585,3	1321,8	0,19	0,05	—	Amin
3	502,7	603,7	1515,8	0,20	0,09	0,09	61,9
4	444,9	423,2	1391,6	0,14	0,08	0,09	61,9

$A_{min} = 6‰\ A_c = \frac{6}{1000} \times 0,785 \times 180^2 = 152,6\ cm^2 \rightarrow 32\phi 25$



Cortante

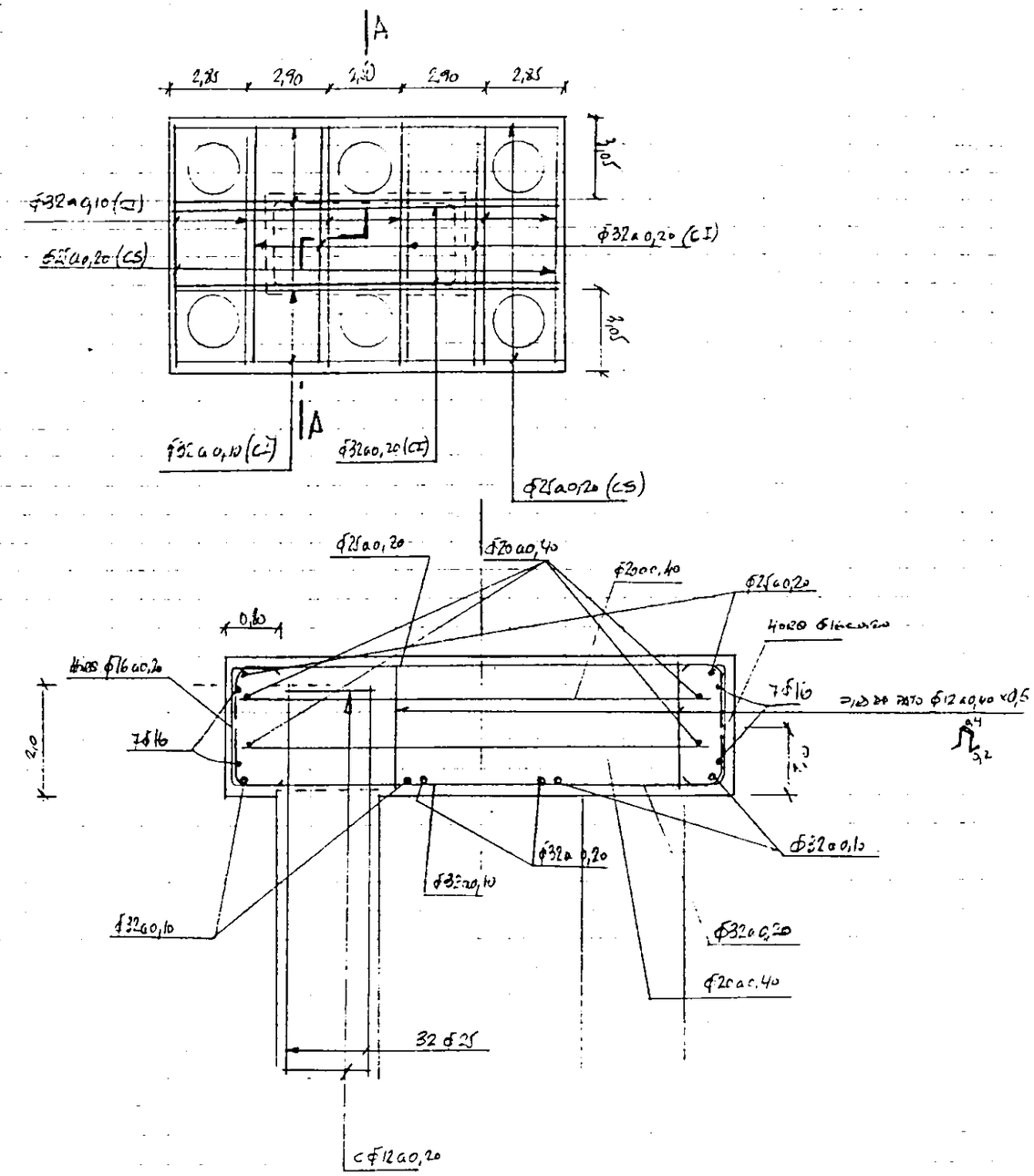
$V_{d\,max} = 426$ Mp

$d = 0,8182 \times 1,80 - 0,6366 \times 0,06 = 1,435$ m

$b_w = \sqrt{1,80 \times 1,435 - \frac{1,435^2}{4}} = 1,438$ m

$V_{cu} = 5\sqrt{120} \times 1,435 \times 1,438 = 113,1$ Mp $> V_d$

$A_{min} = \frac{0,02 \times 1200 \times 1,438}{42} = 8,2\ cm^2 \rightarrow c\phi 12\ a\ 0,20$



Sección A-A

VIADUCTO 2

COMBINACIÓN DE ESFUERZOS

Para el cálculo 1, las hipótesis de combinación serán:

I: $1,0 \times (PP + CP) + 1,0 \times SC$

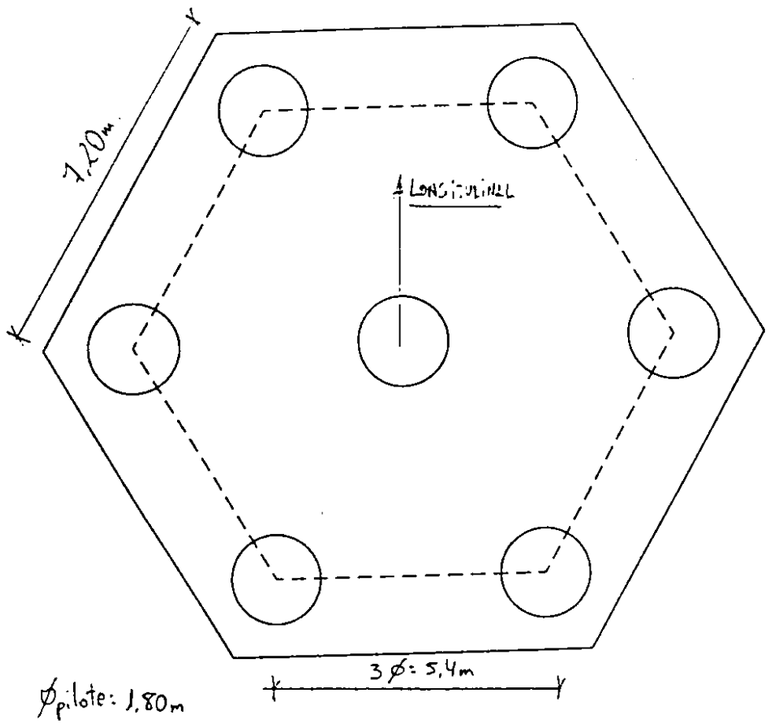
II: $0,9 \times (PP + CP) + 0,9 \times SC + 0,9 \times W$

Se tendrá pues: ESFUERZOS EN CABEZA DE PILA

Hip I:	(a	(b
V =	2948,3	2271,3
H_L =	93,6	83,5
H_T =	51,26	30,13
M_L =	0	0
M_T =	664,86	2013,3

Hip II:	(a	(b	
V =	2685,1	2075,7	
H_L =	84,24	75,15	
H_T =	106,1	87,04	← 0,477 sobre flote (t/m)
M_L =	0	0	
M_T =	960,7	2174,3	

Esf. en cara inferior del encepado:



ϕ_{pilote}: 1,80m

CANTO DEL ENCEPADO: 3m

PESO ENCEPADO: 1010,1 N_t

PILA 1

HIP I a)

ALTURA DE PILA: 28.814 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores caracteristicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3316.54 Mp	93.60 Mp	51.26 Mp	2697 Mp*m	2142 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3316.54 Mp	93.60 Mp	51.26 Mp	2697 Mp*m	2142 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4447.85 Mp	93.60 Mp	51.26 Mp	2978 Mp*m	2296 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	635.4 +	159.2 +	70.9 =	**865.433 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	635.4 +		141.7 =	**777.114 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	635.4 -	159.2 -	70.9 =	**405.383 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción:
DEPOSITOS ALUVIALES	KEUPER ALTERADO	KEUPER SANO
Potencia: 0 m	Potencia: 0 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 29 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	0 m	Long. pilote	0 m	Long. pilote	25.5 m
Por fuste:	0.0 Mp	Por fuste:	0.0 Mp	Por fuste:	721.0 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	0.0 Mp	total:	1 026.4 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 026.4 Mp**

ALTURA DE PILA:	28.814 m	(LONGITUD DE FUSTE)			
ESFUERZOS CABEZA DE PILA:		(Valores característicos)			
	N	**H,Longitud**	**H,Transv**	**M,Longitud**	**M.Transv**
	2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m
ACCIONES SOBRE EL FUSTE					
	PESO PROPIO:		12.78 Mp/m	> ojo: multiplicar este valor por el	
	VIENTO TRANSVERSAL:		0.00 Mp/m	coeficiente de combinacion de acciones	
ESFUERZOS EN BASE DE FUSTE:				(Valores característicos)	
(VALORES EN PRIMER ORDEN)					
	N	**H,Longitud**	**H,Transv**	**M, Longitud**	**M.Transv**
	2639.54 Mp	83.50 Mp	30.13 Mp	2406 Mp*m	2881 Mp*m
	ESFUERZOS EN BASE DE FUSTE:			**M, Longitud**	**M.Transv**
	(INCREMENTOS POR 2º ORDEN)			0 Mp*m	0 Mp*m
TOTALES:					
	N	**H,Longitud**	**H,Transv**	**M,Longitud**	**M.Transv**
	2639.54 Mp	83.50 Mp	30.13 Mp	2406 Mp*m	2881 Mp*m
PROYECTO DE LA CIMENTACION PROFUNDA:					
	PESO DEL ENCEPADO:		1 010.10 Mp		
	CANTO :	3 m			
	DIAMETRO DE PILOTES:		1.8 m		
	RESGUARDO DE ENCEP:		0.5 m	---> PESO TIERRAS:	121.21 Mp
ESFUERZOS EN CARA INFERIOR DE ENCEPADO:				(Valores característicos)	
	N	**H,Longitud**	**H,Transv**	**M,Longitud**	**M.Transv**
	3770.85 Mp	83.50 Mp	30.13 Mp	2656 Mp*m	2972 Mp*m
CARGA SOBRE EL PILOTE MÁS CARGADO:					
	nº de pilotes:	7	Inercia trans:	32.4	Inercia long: 18.708
P MAX,1 =	N/7+ML/18.708+MT/32.4 =		538.7 +	142.0 +	91.7 = **772.414 Mp**
P MAX ,3=	N/7+MT/16.2 =		538.7 +		183.4 = **722.141 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =		538.7 -	142.0 -	91.7 = **304.973 Mp**
	TOPE ESTRUCTURAL:		**1017.85 Mp**		

PILA-1.XLS
HIP II a)

ALTURA DE PILA: 28.814 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv.	M, Longitud	M.Transv.
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3053.92 Mp	84.24 Mp	119.84 Mp	2427 Mp*m	4216 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv.	M, Longitud	M.Transv.
3053.92 Mp	84.24 Mp	119.84 Mp	2427 Mp*m	4216 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4185.23 Mp	84.24 Mp	119.84 Mp	2680 Mp*m	4575 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	597.9 +	143.3 +	141.2 =	**882.361 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	597.9 +		282.4 =	**880.323 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	597.9 -	143.3 -	141.2 =	**313.419 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

HIP II b)

ALTURA DE PILA: 28.814 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2444.52 Mp	75.15 Mp	100.80 Mp	2165 Mp*m	4881 Mp*m

ESFUERZOS EN BASE DE FUSTE: **M, Longitud** **M.Transv**
(INCREMENTOS POR 2º ORDEN) 0 Mp*m 0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2444.52 Mp	75.15 Mp	100.80 Mp	2165 Mp*m	4881 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3575.83 Mp	75.15 Mp	100.80 Mp	2391 Mp*m	5183 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	510.8 +	127.8 +	160.0 =	**798.607 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	510.8 +		320.0 =	**830.788 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	510.8 -	127.8 -	160.0 =	**223.059 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

PILA 2

HIP I a)

ALTURA DE PILA: 44.061 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3511.4 Mp	93.60 Mp	51.26 Mp	4124 Mp*m	2923 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M.Transv
3511.4 Mp	93.60 Mp	51.26 Mp	4124 Mp*m	2923 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
4642.71 Mp	93.60 Mp	51.26 Mp	4405 Mp*m	3077 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	663.2 +	235.5 +	95.0 =	**993.676 Mp**
P MAX ,3=	N/7+MT/16.2 =	663.2 +		190.0 =	**853.196 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	663.2 -	235.5 -	95.0 =	**332.813 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

HIP I a)

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción:
DEPOSITOS ALUVIALES	KEUPER ALTERADO	KEUPER SANO
Potencia: 2 m	Potencia: 6 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 30 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	0 m	Long. pilote	4.5 m	Long. pilote	25.5 m
Por fuste:	0.0 Mp	Por fuste:	127.2 Mp	Por fuste:	721.0 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	127.2 Mp	total:	1 026.4 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 153.6 Mp**

HIP I b)

ALTURA DE PILA: 44.061 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud:	H,Transv	M, Longitud	M.Transv.
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2834.4 Mp	83.50 Mp	30.13 Mp	3679 Mp*m	3341 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2834.4 Mp	83.50 Mp	30.13 Mp	3679 Mp*m	3341 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3965.71 Mp	83.50 Mp	30.13 Mp	3930 Mp*m	3431 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ = N/7+ML/18.708+MT/32.4 = 566.5 + 210.0 + 105.9 = **882.482 Mp**
$P_{MAX,3}$ = N/7+MT/16.2 = 566.5 + 211.8 = **778.336 Mp**
P_{MIN} = N/7-ML/18.708-MT/32.4 = 566.5 - 210.0 - 105.9 = **250.579 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-2.XLS
HIP II a)

ALTURA DE PILA: 44.061 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3249.08 Mp	84.24 Mp	127.12 Mp	3712 Mp*m	6099 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3249.08 Mp	84.24 Mp	127.12 Mp	3712 Mp*m	6099 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4380.39 Mp	84.24 Mp	127.12 Mp	3964 Mp*m	6480 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	625.8 +	211.9 +	200.0 =	**1037.68 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	625.8 +		400.0 =	**1025.77 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	625.8 -	211.9 -	200.0 =	**213.862 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

HIP II b)

ALTURA DE PILA: 44.061 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2639.68 Mp	75.15 Mp	108.08 Mp	3311 Mp*m	6473 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2639.68 Mp	75.15 Mp	108.08 Mp	3311 Mp*m	6473 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3770.99 Mp	75.15 Mp	108.08 Mp	3537 Mp*m	6797 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	538.7 +	189.0 +	209.8 =	**937.557 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	538.7 +		419.6 =	**958.312 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	538.7 -	189.0 -	209.8 =	**139.87 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 3

HIP I a)

ALTURA DE PILA: 56.26 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2211.23 Mp	70.2 Mp	38.445 Mp	0 Mp*m	498.6 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2930.23 Mp	70.20 Mp	38.45 Mp	3949 Mp*m	2662 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2930.23 Mp	70.20 Mp	38.45 Mp	3949 Mp*m	2662 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracteristicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4061.54 Mp	70.20 Mp	38.45 Mp	4160 Mp*m	2777 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	580.2 +	222.4 +	85.7 =	**888.294 Mp**
P MAX ,3=	N/7+MT/16.2 =	580.2 +		171.4 =	**751.633 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	580.2 -	222.4 -	85.7 =	**272.146 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

HIP I a)

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción:
DEPOSITOS ALUVIALES	KEUPER ALTERADO	KEUPER SANO
Potencia: 6 m	Potencia: 2 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 28 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	2.5 m	Long. pilote	2 m	Long. pilote	23.5 m
Por fuste:	0.0 Mp	Por fuste:	56.5 Mp	Por fuste:	664.4 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	56.5 Mp	total:	969.8 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 026.4 Mp**

HIP I b)

ALTURA DE PILA: 56.26 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M; Longitud	M.Transv
1703.48 Mp	62.625 Mp	22.5975 Mp	0 Mp*m	1510 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2422.48 Mp	62.63 Mp	22.60 Mp	3523 Mp*m	2781 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M.Transv
2422.48 Mp	62.63 Mp	22.60 Mp	3523 Mp*m	2781 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M.Transv
3553.79 Mp	62.63 Mp	22.60 Mp	3711 Mp*m	2849 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	507.7 +	198.4 +	87.9 =	**793.992 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	507.7 +		175.9 =	**683.555 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	507.7 -	198.4 -	87.9 =	**221.376 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

PILA-3.XLS
HIP II a)

ALTURA DE PILA: 56.26 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2013.83 Mp	63.18 Mp	79.575 Mp	0 Mp*m	720.5 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2733.95 Mp	63.18 Mp	106.41 Mp	3555 Mp*m	5952 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2733.95 Mp	63.18 Mp	106.41 Mp	3555 Mp*m	5952 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
3865.27 Mp	63.18 Mp	106.41 Mp	3744 Mp*m	6272 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	552.2 +	200.1 +	193.6 =	**945.878 Mp**
P MAX ,3=	N/7+MT/16.2 =	552.2 +		387.1 =	**939.313 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	552.2 -	200.1 -	193.6 =	**158.484 Mp**

TOPE ESTRUCTURAL: **1017 Mp**

HIP II b)

ALTURA DE PILA: 56.26 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
1556.78 Mp	56.3625 Mp	65.295 Mp	0 Mp*m	1631 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2276.9 Mp	56.36 Mp	92.13 Mp	3171 Mp*m	6059 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2276.9 Mp	56.36 Mp	92.13 Mp	3171 Mp*m	6059 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
3408.22 Mp	56.36 Mp	92.13 Mp	3340 Mp*m	6336 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	486.9 +	178.5 +	195.5 =	**860.964 Mp**
P MAX ,3=	N/7+MT/16.2 =	486.9 +		391.1 =	**877.969 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	486.9 -	178.5 -	195.5 =	**112.812 Mp**

TOPE ESTRUCTURAL: **1017.85 Mp**

PILA 4

HIP I a)

ALTURA DE PILA: 55.7 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3660.15 Mp	93.60 Mp	51.26 Mp	5214 Mp*m	3520 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3660.15 Mp	93.60 Mp	51.26 Mp	5214 Mp*m	3520 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracterIsticos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4791.46 Mp	93.60 Mp	51.26 Mp	5494 Mp*m	3674 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

1

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	684.5	+ 293.7	+ 113.4 =	**1091.57 Mp**
P MAX ,3=	N/7+MT/16.2 =	684.5	+	226.8 =	**911.273 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	684.5	- 293.7	- 113.4 =	**277.416 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

HIP I a)

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB.	ALUVIAL COLABORANTE	Prof. sano: 4
Potencia: 14 m	Potencia: 4 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 45 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	10.5 m	Long. pilote	4 m	Long. pilote	30.5 m
Por fuste:	0.0 Mp	Por fuste:	33.9 Mp	Por fuste:	862.4 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	33.9 Mp	total:	1 167.7 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 201.7 Mp**

HIP I b)

ALTURA DE PILA: 55.7 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m
VIENTO TRANSVERSAL: 0.00 Mp/m

> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2983.15 Mp	83.50 Mp	30.13 Mp	4651 Mp*m	3692 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2983.15 Mp	83.50 Mp	30.13 Mp	4651 Mp*m	3692 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4114.46 Mp	83.50 Mp	30.13 Mp	4901 Mp*m	3782 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	587.8 +	262.0 +	116.7 =	**966.504 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	587.8 +		233.5 =	**821.232 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	587.8 -	262.0 -	116.7 =	**209.056 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-4.XLS
HIP II a)

ALTURA DE PILA: 55.7 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3398.06 Mp	84.24 Mp	132.67 Mp	4692 Mp*m	7610 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M.Transv
3398.06 Mp	84.24 Mp	132.67 Mp	4692 Mp*m	7610 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4529.37 Mp	84.24 Mp	132.67 Mp	4945 Mp*m	8008 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	647.1 +	264.3 +	247.2 =	**1158.55 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	647.1 +		494.3 =	**1141.4 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	647.1 -	264.3 -	247.2 =	**135.56 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

ALTURA DE PILA: 55.7 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2788.66 Mp	75.15 Mp	113.63 Mp	4186 Mp*m	7763 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2788.66 Mp	75.15 Mp	113.63 Mp	4186 Mp*m	7763 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3919.97 Mp	75.15 Mp	113.63 Mp	4411 Mp*m	8104 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	560.0 +	235.8 +	250.1 =	**1045.93 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	560.0 +		500.3 =	**1060.27 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	560.0 -	235.8 -	250.1 =	**74.0633 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 5

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	CAPA Nº 2	CAPA Nº 3
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB	ALUVIAL COLABORANTE	Potencia alt: 2
Potencia: 10 m	Potencia: 13.5 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 48 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	6.5 m	Long. pilote	13.5 m	Long. pilote	28 m
Por fuste:	0.0 Mp	Por fuste:	114.5 Mp	Por fuste:	791.7 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	114.5 Mp	total:	1 097.0 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 211.6 Mp**

ALTURA DE PILA: 56.82 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv.	M,Longitud	M,Transv.
2271.7 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2997.86 Mp	83.50 Mp	30.13 Mp	4744 Mp*m	3725 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2997.86 Mp	83.50 Mp	30.13 Mp	4744 Mp*m	3725 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4129.17 Mp	83.50 Mp	30.13 Mp	4995 Mp*m	3816 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	589.9 +	267.0 +	117.8 =	**974.646 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	589.9 +		235.5 =	**825.417 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	589.9 -	267.0 -	117.8 =	**205.117 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 6

PILA-6.XLSHIP I a)

ALTURA DE PILA: 56.455 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3669.79 Mp	93.60 Mp	51.26 Mp	5284 Mp*m	3559 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3669.79 Mp	93.60 Mp	51.26 Mp	5284 Mp*m	3559 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4801.11 Mp	93.60 Mp	51.26 Mp	5565 Mp*m	3713 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

1

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	685.9 +	297.5 +	114.6 =	**1097.92 Mp**
P MAX ,3=	N/7+MT/16.2 =	685.9 +		229.2 =	**915.041 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	685.9 -	297.5 -	114.6 =	**273.823 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB	ALUVIAL COLABORANTE	Potencia alt: 2
Potencia: 10 m	Potencia: 13.5 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 48 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	6.5 m	Long. pilote	13.5 m	Long. pilote	28 m
Por fuste:	0.0 Mp	Por fuste:	114.5 Mp	Por fuste:	791.7 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	114.5 Mp	total:	1 097.0 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 211.6 Mp**

ALTURA DE PILA: 56.455 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2992.79 Mp	83.50 Mp	30.13 Mp	4714 Mp*m	3714 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2992.79 Mp	83.50 Mp	30.13 Mp	4714 Mp*m	3714 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4124.11 Mp	83.50 Mp	30.13 Mp	4964 Mp*m	3805 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	589.2 +	265.4 +	117.4 =	**971.954 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	589.2 +		234.9 =	**824.015 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	589.2 -	265.4 -	117.4 =	**206.362 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-6.XLS
HIP II a)

ALTURA DE PILA: 56.455 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3407.72 Mp	84.24 Mp	133.03 Mp	4756 Mp*m	7711 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3407.72 Mp	84.24 Mp	133.03 Mp	4756 Mp*m	7711 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4539.04 Mp	84.24 Mp	133.03 Mp	5008 Mp*m	8110 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	648.4 +	267.7 +	250.3 =	**1166.46 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	648.4 +		500.6 =	**1149.04 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	648.4 -	267.7 -	250.3 =	**130.412 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-6.XLS
HIP II b)

ALTURA DE PILA: 56.455 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2798.32 Mp	75.15 Mp	113.99 Mp	4243 Mp*m	7849 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2798.32 Mp	75.15 Mp	113.99 Mp	4243 Mp*m	7849 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3929.64 Mp	75.15 Mp	113.99 Mp	4468 Mp*m	8191 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	561.4 +	238.8 +	252.8 =	**1053.03 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	561.4 +		505.6 =	**1067.02 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	561.4 -	238.8 -	252.8 =	**69.7256 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 7

PILA-7.XLS
HIP I a)

ALTURA DE PILA: 55.493 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3657.5 Mp	93.60 Mp	51.26 Mp	5194 Mp*m	3509 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3657.5 Mp	93.60 Mp	51.26 Mp	5194 Mp*m	3509 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
4788.81 Mp	93.60 Mp	51.26 Mp	5475 Mp*m	3663 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	684.1 +	292.7 +	113.1 =	**1089.83 Mp**
P MAX ,3=	N/7+MT/16.2 =	684.1 +		226.1 =	**910.24 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	684.1 -	292.7 -	113.1 =	**278.401 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	**CAPA Nº 2**	**CAPA Nº 3**
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB	ALUVIAL COLABORANTE	Potencia alt: 10
Potencia: 10 m	Potencia: 13.2 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 48 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	6.5 m	Long. pilote	13.2 m	Long. pilote	28.3 m
Por fuste:	0.0 Mp	Por fuste:	112.0 Mp	Por fuste:	800.2 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	112.0 Mp	total:	1 105.5 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 217.5 Mp**

ALTURA DE PILA: 55.493 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

[redacted]	H,Longitud	H,Transv	M,Longitud	M,Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2980.5 Mp	83.50 Mp	30.13 Mp	4634 Mp*m	3685 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

[redacted]	H,Longitud	H,Transv	M,Longitud	M,Transv
2980.5 Mp	83.50 Mp	30.13 Mp	4634 Mp*m	3685 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

[redacted]	H,Longitud	H,Transv	M,Longitud	M,Transv
4111.81 Mp	83.50 Mp	30.13 Mp	4884 Mp*m	3776 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	587.4 +	261.1 +	116.5 =	**965.009 Mp**
P MAX ,3=	N/7+MT/16.2 =	587.4 +		233.1 =	**820.469 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	587.4 -	261.1 -	116.5 =	**209.794 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-7.XLS
HIP II a)

ALTURA DE PILA: 55.493 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3395.41 Mp	84.24 Mp	132.57 Mp	4675 Mp*m	7583 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3395.41 Mp	84.24 Mp	132.57 Mp	4675 Mp*m	7583 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4526.72 Mp	84.24 Mp	132.57 Mp	4927 Mp*m	7981 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	646.7 +	263.4 +	246.3 =	**1156.38 Mp**
P MAX ,3=	N/7+MT/16.2 =	646.7 +		492.6 =	**1139.31 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	646.7 -	263.4 -	246.3 =	**136.97 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-7.XLS
HIP II b)

ALTURA DE PILA: 55.493 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2786.01 Mp	75.15 Mp	113.53 Mp	4170 Mp*m	7740 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2786.01 Mp	75.15 Mp	113.53 Mp	4170 Mp*m	7740 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3917.32 Mp	75.15 Mp	113.53 Mp	4396 Mp*m	8081 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	559.6 +	235.0 +	249.4 =	**1043.98 Mp**
P MAX ,3=	N/7+MT/16.2 =	559.6 +		498.8 =	**1058.42 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	559.6 -	235.0 -	249.4 =	**75.2511 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 8

PILA-8.XLS
HIP I a)

ALTURA DE PILA: 54.531 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3645.21 Mp	93.60 Mp	51.26 Mp	5104 Mp*m	3460 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M.Transv
3645.21 Mp	93.60 Mp	51.26 Mp	5104 Mp*m	3460 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
4776.52 Mp	93.60 Mp	51.26 Mp	5385 Mp*m	3614 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	682.4	+ 287.8	+ 111.5 =	**1081.74 Mp**
P MAX ,3=	N/7+MT/16.2 =	682.4	+	223.1 =	**905.44 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	682.4	- 287.8	- 111.5 =	**282.98 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	CAPA Nº 2	CAPA Nº 3
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB	ALUVIAL COLABORANTE	Potencia alt: 15
Potencia: 10 m	Potencia: 13.2 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 48 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	6.5 m	Long. pilote	13.2 m	Long. pilote	28.3 m
Por fuste:	0.0 Mp	Por fuste:	112.0 Mp	Por fuste:	800.2 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	112.0 Mp	total:	1 105.5 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 217.5 Mp**

ALTURA DE PILA: 54.531 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M; Longitud	M.Transv.
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2968.21 Mp	83.50 Mp	30.13 Mp	4553 Mp*m	3656 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2968.21 Mp	83.50 Mp	30.13 Mp	4553 Mp*m	3656 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracteristicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
4099.52 Mp	83.50 Mp	30.13 Mp	4804 Mp*m	3747 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	585.6 +	256.8 +	115.6 =	**958.065 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	585.6 +		231.3 =	**816.924 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	585.6 -	256.8 -	115.6 =	**213.226 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-8.XLS
HIP II a)

ALTURA DE PILA: 54.531 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m
VIENTO TRANSVERSAL: 0.48 Mp/m
> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3383.1 Mp	84.24 Mp	132.11 Mp	4594 Mp*m	7456 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M;Transv
3383.1 Mp	84.24 Mp	132.11 Mp	4594 Mp*m	7456 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
4514.41 Mp	84.24 Mp	132.11 Mp	4846 Mp*m	7852 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	644.9 +	259.1 +	242.3 =	**1146.32 Mp**
P MAX ,3=	N/7+MT/16.2 =	644.9 +		484.7 =	**1129.61 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	644.9 -	259.1 -	242.3 =	**143.515 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

ALTURA DE PILA: 54.531 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m
VIENTO TRANSVERSAL: 0.48 Mp/m
> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2773.7 Mp	75.15 Mp	113.07 Mp	4098 Mp*m	7631 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H;Longitud	H;Transv	M;Longitud	M;Transv
2773.7 Mp	75.15 Mp	113.07 Mp	4098 Mp*m	7631 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H;Longitud	H;Transv	M;Longitud	M;Transv
3905.01 Mp	75.15 Mp	113.07 Mp	4323 Mp*m	7970 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	557.9 +	231.1 +	246.0 =	**1034.95 Mp**
P MAX ,3=	N/7+MT/16.2 =	557.9 +		492.0 =	**1049.85 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	557.9 -	231.1 -	246.0 =	**80.7629 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 9

ALTURA DE PILA: 53.805 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3635.93 Mp	93.60 Mp	51.26 Mp	5036 Mp*m	3423 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3635.93 Mp	93.60 Mp	51.26 Mp	5036 Mp*m	3423 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4767.24 Mp	93.60 Mp	51.26 Mp	5317 Mp*m	3577 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

1

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	681.0 +	284.2 +	110.4 =	**1075.63 Mp**
P MAX ,3=	N/7+MT/16.2 =	681.0 +		220.8 =	**901.817 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	681.0 -	284.2 -	110.4 =	**286.436 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-9.XLS
HIP I a)

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	CAPA Nº 2	CAPA Nº 3
Descripción:	Descripción:	Descripción: KEUPER
ALUVIAL NO COLAB	ALUVIAL COLABORANTE	Potencia alt: 6
Potencia: 10 m	Potencia: 8.4 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 1.5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 44 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	6.5 m	Long. pilote	8.4 m	Long. pilote	29.1 m
Por fuste:	0.0 Mp	Por fuste:	71.3 Mp	Por fuste:	822.8 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	71.3 Mp	total:	1 128.1 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 199.4 Mp**

PILA-9.XLS
HIP I b)

ALTURA DE PILA: 53.805 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2958.93 Mp	83.50 Mp	30.13 Mp	4493 Mp*m	3634 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2958.93 Mp	83.50 Mp	30.13 Mp	4493 Mp*m	3634 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4090.24 Mp	83.50 Mp	30.13 Mp	4743 Mp*m	3725 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	584.3	+ 253.5	+ 115.0 =	**952.824 Mp**
P MAX ,3=	N/7+MT/16.2 =	584.3	+	229.9 =	**814.248 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	584.3	- 253.5	- 115.0 =	**215.816 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-9.XLS
HIP II a)

ALTURA DE PILA: 53.805 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3373.8 Mp	84.24 Mp	131.76 Mp	4533 Mp*m	7360 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3373.8 Mp	84.24 Mp	131.76 Mp	4533 Mp*m	7360 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
4505.12 Mp	84.24 Mp	131.76 Mp	4785 Mp*m	7755 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	643.6 +	255.8 +	239.4 =	**1138.73 Mp**
P MAX ,3=	N/7+MT/16.2 =	643.6 +		478.7 =	**1122.3 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	643.6 -	255.8 -	239.4 =	**148.445 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

ALTURA DE PILA: 53.805 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2764.4 Mp	75.15 Mp	112.72 Mp	4043 Mp*m	7549 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2764.4 Mp	75.15 Mp	112.72 Mp	4043 Mp*m	7549 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3895.72 Mp	75.15 Mp	112.72 Mp	4269 Mp*m	7887 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	556.5 +	228.2 +	243.4 =	**1028.15 Mp**
P MAX ,3=	N/7+MT/16.2 =	556.5 +		486.9 =	**1043.39 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	556.5 -	228.2 -	243.4 =	**84.9135 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA 10

PILA-10.XLS
HIP I a)

ALTURA DE PILA: 52.053 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3613.54 Mp	93.60 Mp	51.26 Mp	4872 Mp*m	3333 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3613.54 Mp	93.60 Mp	51.26 Mp	4872 Mp*m	3333 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1010.1 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.212 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
4744.85 Mp	93.60 Mp	51.26 Mp	5153 Mp*m	3487 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

1

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	677.8	+ 275.4	+ 107.6 =	**1060.9 Mp**
P MAX ,3=	N/7+MT/16.2 =	677.8	+	215.2 =	**893.075 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	677.8	- 275.4	- 107.6 =	**294.774 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

LONGITUD DE LOS PILOTES:

NÚMERO DE CAPAS GEOTÉCNICAS DIFERENTES: 3

CAPAS POR ORDEN DE MÁS A MENOS SUPERFICIALES		
CAPA Nº 1	CAPA Nº 2	CAPA Nº 3
Descripción:	Descripción:	Descripción:
ALUVIAL	KEUPER ALTERADO	KEUPER SANO
Potencia: 4.2 m	Potencia: 24.2 m	Potencia: 100 m
Resistencias unitarias:	Resistencias unitarias:	Resistencias unitarias:
Fuste: 0 Mp/m2	Fuste: 5 Mp/m2	Fuste: 5 Mp/m2
Punta: 0 Mp/m2	Punta: 0 Mp/m2	Punta: 120 Mp/m2

COEFICIENTES DE SEGURIDAD: Por fuste: 1
Por punta: 1

LONGITUD TOTAL DEL PILOTE: 32 m

RESISTENCIA DEL PILOTE (Valores ya reducidos por el cef. de seguridad)

CAPA Nº 1		CAPA Nº 2		CAPA Nº 3	
Long. pilote	0.7 m	Long. pilote	24.2 m	Long. pilote	7.1 m
Por fuste:	0.0 Mp	Por fuste:	684.2 Mp	Por fuste:	200.7 Mp
Por punta:	0.0 Mp	Por punta:	0.0 Mp	Por punta:	305.4 Mp
total:	0.0 Mp	total:	684.2 Mp	total:	506.1 Mp

RESISTENCIA TOTAL DEL PILOTE: **1 190.4 Mp**

ALTURA DE PILA: 52.053 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2936.54 Mp	83.50 Mp	30.13 Mp	4346 Mp*m	3582 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2936.54 Mp	83.50 Mp	30.13 Mp	4346 Mp*m	3582 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
4067.85 Mp	83.50 Mp	30.13 Mp	4597 Mp*m	3672 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

$P_{MAX,1}$ =	N/7+ML/18.708+MT/32.4 =	581.1 +	245.7 +	113.3 =	**940.176 Mp**
$P_{MAX,3}$ =	N/7+MT/16.2 =	581.1 +		226.7 =	**807.791 Mp**
P_{MIN} =	N/7-ML/18.708-MT/32.4 =	581.1 -	245.7 -	113.3 =	**222.067 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-10.XLS
HIP II a)

ALTURA DE PILA: 52.053 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3351.38 Mp	84.24 Mp	130.93 Mp	4385 Mp*m	7130 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M.Transv
3351.38 Mp	84.24 Mp	130.93 Mp	4385 Mp*m	7130 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracteristicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
4482.69 Mp	84.24 Mp	130.93 Mp	4638 Mp*m	7523 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	640.4 +	247.9 +	232.2 =	**1120.46 Mp**
P MAX ,3=	N/7+MT/16.2 =	640.4 +		464.4 =	**1104.74 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	640.4 -	247.9 -	232.2 =	**160.31 Mp**

TOPE ESTRUCTURAL: **1170.52 Mp**

PILA-10.XLS
HIP II b)

ALTURA DE PILA: 52.053 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)
(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2741.98 Mp	75.15 Mp	111.89 Mp	3912 Mp*m	7352 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M.Transv
2741.98 Mp	75.15 Mp	111.89 Mp	3912 Mp*m	7352 Mp*m

PROYECTO DE LA CIMENTACION PROFUNDA:

PESO DEL ENCEPADO: 1 010.10 Mp
CANTO : 3 m
DIAMETRO DE PILOTES: 1.8 m
RESGUARDO DE ENCEP: 0.5 m ---> PESO TIERRAS: 121.21 Mp

ESFUERZOS EN CARA INFERIOR DE ENCEPADO: (Valores caracteristicos)

N	H,Longitud	H,Transv	M,Longitud.	M.Transv
3873.29 Mp	75.15 Mp	111.89 Mp	4137 Mp*m	7688 Mp*m

CARGA SOBRE EL PILOTE MÁS CARGADO:

nº de pilotes: 7 Inercia trans: 32.4 Inercia long: 18.708

P MAX,1 =	N/7+ML/18.708+MT/32.4 =	553.3 +	221.1 +	237.3 =	**1011.76 Mp**
P MAX ,3=	N/7+MT/16.2 =	553.3 +		474.6 =	**1027.89 Mp**
P MIN =	N/7-ML/18.708-MT/32.4 =	553.3 -	221.1 -	237.3 =	**94.8979 Mp**

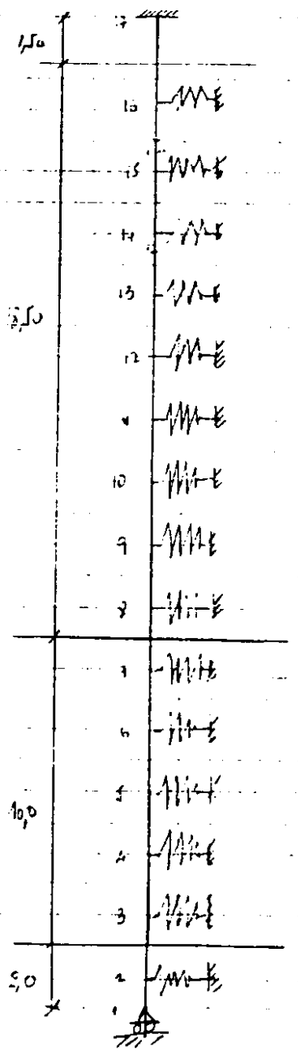
TOPE ESTRUCTURAL: **1170.52 Mp**

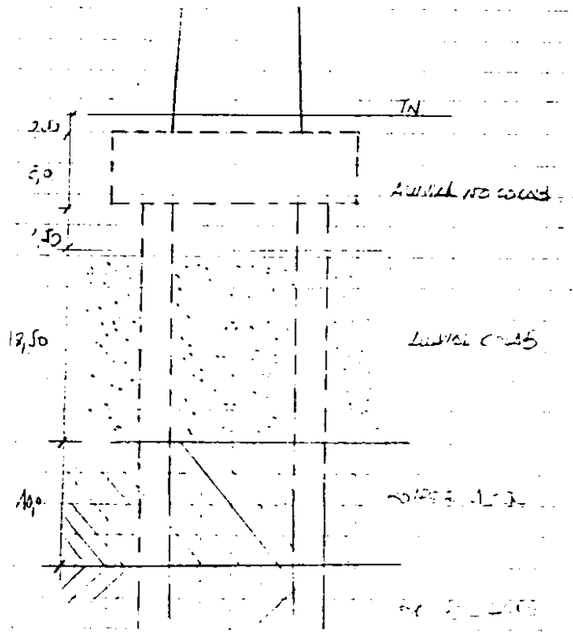
CÁLCULO DE LA LONGITUD DE ANCLAJE DE LAS PILAS

Modelo de cálculo

Se analiza un pilar como una barra de hormigón, de $f_{ck} = 150$ kg/cm², empotrada en cabeza y articulada en la base.

A la vista de esta hipótesis se observa, mediante una sencilla comprobación, que el momento flector en la base es nulo.





$L_e = 13,0$ m

```
*****************************************************
*                                                   *
*           S T A A D - III                         *
*           Revision 22.3                           *
*           Proprietary Program of                  *
*           Research Engineers, Inc.                *
*           Date=    MAR 26, 1998                   *
*           Time=    17:30:12                       *
*                                                   *
*      USER ID: JATOTSA                             *
*****************************************************
```

```
 1. STAAD PLANE PILOTE VIADUCTO Nš 2
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 0
 5. 2 0 1 0
 6. 3 0 3 0
 7. 4 0 5 0
 8. 5 0 7 0
 9. 6 0 9 0
10. 7 0 11 0
11. 8 0 13 0
12. 9 0 15 0
13. 10 0 17 0
14. 11 0 19 0
15. 12 0 21 0
16. 13 0 23 0
17. 14 0 25 0
18. 15 0 27 0
19. 16 0 29.25 0
20. 17 0 32 0
21. MEMBER INCIDENCES
22. 1 1 2 16
23. MEMBER PROPERTIES
24. 1 TO  16 PRI YD  1.8 IX 0.515299735005066 IZ 0.515299735005066
25. SUPPORT
26. 1 PINNED
27. 2 FIXED BUT MZ KFX 15840
28. 3 FIXED BUT MZ KFX 4320
29. 4 FIXED BUT MZ KFX 4320
30. 5 FIXED BUT MZ KFX 4320
31. 6 FIXED BUT MZ KFX 4320
32. 7 FIXED BUT MZ KFX 4320
33. 8 FIXED BUT MZ KFX 10500
34. 9 FIXED BUT MZ KFX 9300
35. 10 FIXED BUT MZ KFX 8100
36. 11 FIXED BUT MZ KFX 6900
37. 12 FIXED BUT MZ KFX 5700
38. 13 FIXED BUT MZ KFX 4500
39. 14 FIXED BUT MZ KFX 3300
40. 15 FIXED BUT MZ KFX 2100
41. 16 FIXED BUT MZ KFX 937.5
```



```
42. 17 FIXED BUT FX
43. CONSTANT
44. E 3000000 ALL
45. POISSON 0.2 ALL
46. DENSITY 2.5 ALL
47. ALPHA 0.00001 ALL
48. SECTION 0.25 0.5 0.75 MEMB 1 TO  16
49. LOAD  1 CARGA UNITARIA 100 MP
50. JOINT LOAD
51. 17 FX 100
52. PERFORM ANALYSIS
```

```
      P R O B L E M   S T A T I S T I C S
      -----------------------------------

 NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    17/   16/   17
 ORIGINAL/FINAL BAND-WIDTH =     1/    1
 TOTAL PRIMARY LOAD CASES  =     1, TOTAL DEGREES OF FREEDOM =    32
 SIZE OF STIFFNESS MATRIX =      128 DOUBLE PREC. WORDS
 REQRD/AVAIL. DISK SPACE =  12.02/  112.3 MB,  EXMEM = 1975.4 MB

++ Processing Element Stiffness Matrix.              17:30:13
++ Processing Global Stiffness Matrix.               17:30:13
++ Processing Triangular Factorization.              17:30:13
++ Calculating Joint Displacements.                  17:30:14
++ Calculating Member  Forces.                       17:30:14
```

```
53. PRINT ANALYSIS RESULT
```

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	.0000	.0000	.0000	.0000	.0000	.0001
2	1	-.0085	.0000	.0000	.0000	.0000	.0001
3	1	-.0252	.0000	.0000	.0000	.0000	.0001
4	1	-.0404	.0000	.0000	.0000	.0000	.0001
5	1	-.0525	.0000	.0000	.0000	.0000	.0000
6	1	-.0587	.0000	.0000	.0000	.0000	.0000
7	1	-.0552	.0000	.0000	.0000	.0000	-.0001
8	1	-.0369	.0000	.0000	.0000	.0000	-.0001
9	1	.0025	.0000	.0000	.0000	.0000	-.0003
10	1	.0715	.0000	.0000	.0000	.0000	-.0004
11	1	.1781	.0000	.0000	.0000	.0000	-.0006
12	1	.3273	.0000	.0000	.0000	.0000	-.0009
13	1	.5180	.0000	.0000	.0000	.0000	-.0010
14	1	.7393	.0000	.0000	.0000	.0000	-.0011
15	1	.9683	.0000	.0000	.0000	.0000	-.0011
16	1	1.1906	.0000	.0000	.0000	.0000	-.0008
17	1	1.3187	.0000	.0000	.0000	.0000	.0000

SUPPORT REACTIONS -UNIT MTON MET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	.93	.00	.00	.00	.00	.00
2	1	1.34	.00	.00	.00	.00	.00
3	1	1.09	.00	.00	.00	.00	.00
4	1	1.75	.00	.00	.00	.00	.00
5	1	2.27	.00	.00	.00	.00	.00
6	1	2.54	.00	.00	.00	.00	.00
7	1	2.39	.00	.00	.00	.00	.00
8	1	3.88	.00	.00	.00	.00	.00
9	1	-.24	.00	.00	.00	.00	.00
10	1	-5.79	.00	.00	.00	.00	.00
11	1	-12.29	.00	.00	.00	.00	.00
12	1	-18.66	.00	.00	.00	.00	.00
13	1	-23.31	.00	.00	.00	.00	.00
14	1	-24.40	.00	.00	.00	.00	.00
15	1	-20.33	.00	.00	.00	.00	.00
16	1	-11.16	.00	.00	.00	.00	.00
17	1	.00	.00	.00	.00	.00	579.84

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- MTON MET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	.00	-.93	.00	.00	.00	.00
		2	.00	.93	.00	.00	.00	-.93
2	1	2	.00	-2.27	.00	.00	.00	.93
		3	.00	2.27	.00	.00	.00	-5.48
3	1	3	.00	-3.36	.00	.00	.00	5.48
		4	.00	3.36	.00	.00	.00	-12.20
4	1	4	.00	-5.11	.00	.00	.00	12.20
		5	.00	5.11	.00	.00	.00	-22.42
5	1	5	.00	-7.38	.00	.00	.00	22.42
		6	.00	7.38	.00	.00	.00	-37.17
6	1	6	.00	-9.91	.00	.00	.00	37.17
		7	.00	9.91	.00	.00	.00	-57.00
7	1	7	.00	-12.30	.00	.00	.00	57.00
		8	.00	12.30	.00	.00	.00	-81.60
8	1	8	.00	-16.18	.00	.00	.00	81.60
		9	.00	16.18	.00	.00	.00	-113.95
9	1	9	.00	-15.94	.00	.00	.00	113.95
		10	.00	15.94	.00	.00	.00	-145.83
10	1	10	.00	-10.15	.00	.00	.00	145.83
		11	.00	10.15	.00	.00	.00	-166.13
11	1	11	.00	2.14	.00	.00	.00	166.13
		12	.00	-2.14	.00	.00	.00	-161.85
12	1	12	.00	20.79	.00	.00	.00	161.85
		13	.00	-20.79	.00	.00	.00	-120.26
13	1	13	.00	44.11	.00	.00	.00	120.26
		14	.00	-44.11	.00	.00	.00	-32.05
14	1	14	.00	68.50	.00	.00	.00	32.05
		15	.00	-68.50	.00	.00	.00	104.96
15	1	15	.00	88.84	.00	.00	.00	-104.96
		16	.00	-88.84	.00	.00	.00	304.84

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- MTON MET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
16	1	16	.00	100.00	.00	.00	.00	-304.84
		17	.00	-100.00	.00	.00	.00	579.84

********** END OF LATEST ANALYSIS RESULT **********

54. PRINT SECTION FORCES

MEMBER FORCES AT INTERMEDIATE SECTIONS

ALL UNITS ARE -- MTON MET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
1	1	.25	-.93	.00	.00	.23
		.50	-.93	.00	.00	.47
		.75	-.93	.00	.00	.70
2	1	.25	-2.27	.00	.00	2.07
		.50	-2.27	.00	.00	3.20
		.75	-2.27	.00	.00	4.34
3	1	.25	-3.36	.00	.00	7.16
		.50	-3.36	.00	.00	8.84
		.75	-3.36	.00	.00	10.52
4	1	.25	-5.11	.00	.00	14.76
		.50	-5.11	.00	.00	17.31
		.75	-5.11	.00	.00	19.87
5	1	.25	-7.38	.00	.00	26.11
		.50	-7.38	.00	.00	29.80
		.75	-7.38	.00	.00	33.49
6	1	.25	-9.91	.00	.00	42.13
		.50	-9.91	.00	.00	47.09
		.75	-9.91	.00	.00	52.04
7	1	.25	-12.30	.00	.00	63.15
		.50	-12.30	.00	.00	69.30
		.75	-12.30	.00	.00	75.45
8	1	.25	-16.18	.00	.00	89.68
		.50	-16.18	.00	.00	97.77
		.75	-16.18	.00	.00	105.86
9	1	.25	-15.94	.00	.00	121.92
		.50	-15.94	.00	.00	129.89
		.75	-15.94	.00	.00	137.86
10	1	.25	-10.15	.00	.00	150.91
		.50	-10.15	.00	.00	155.98
		.75	-10.15	.00	.00	161.05
11	1	.25	2.14	.00	.00	165.06
		.50	2.14	.00	.00	163.99
		.75	2.14	.00	.00	162.92
12	1	.25	20.79	.00	.00	151.46
		.50	20.79	.00	.00	141.06
		.75	20.79	.00	.00	130.66

MEMBER FORCES AT INTERMEDIATE SECTIONS

ALL UNITS ARE -- MTON MET

MEMB	LOAD	SEC	SHEAR-Y	SHEAR-Z	MOM-Y	MOM-Z
13	1	.25	44.11	.00	.00	98.21
		.50	44.11	.00	.00	76.16
		.75	44.11	.00	.00	54.10
14	1	.25	68.50	.00	.00	-2.20
		.50	68.50	.00	.00	-36.45
		.75	68.50	.00	.00	-70.70
15	1	.25	88.84	.00	.00	-154.93
		.50	88.84	.00	.00	-204.90
		.75	88.84	.00	.00	-254.87
16	1	.25	100.00	.00	.00	-373.59
		.50	100.00	.00	.00	-442.34
		.75	100.00	.00	.00	-511.09

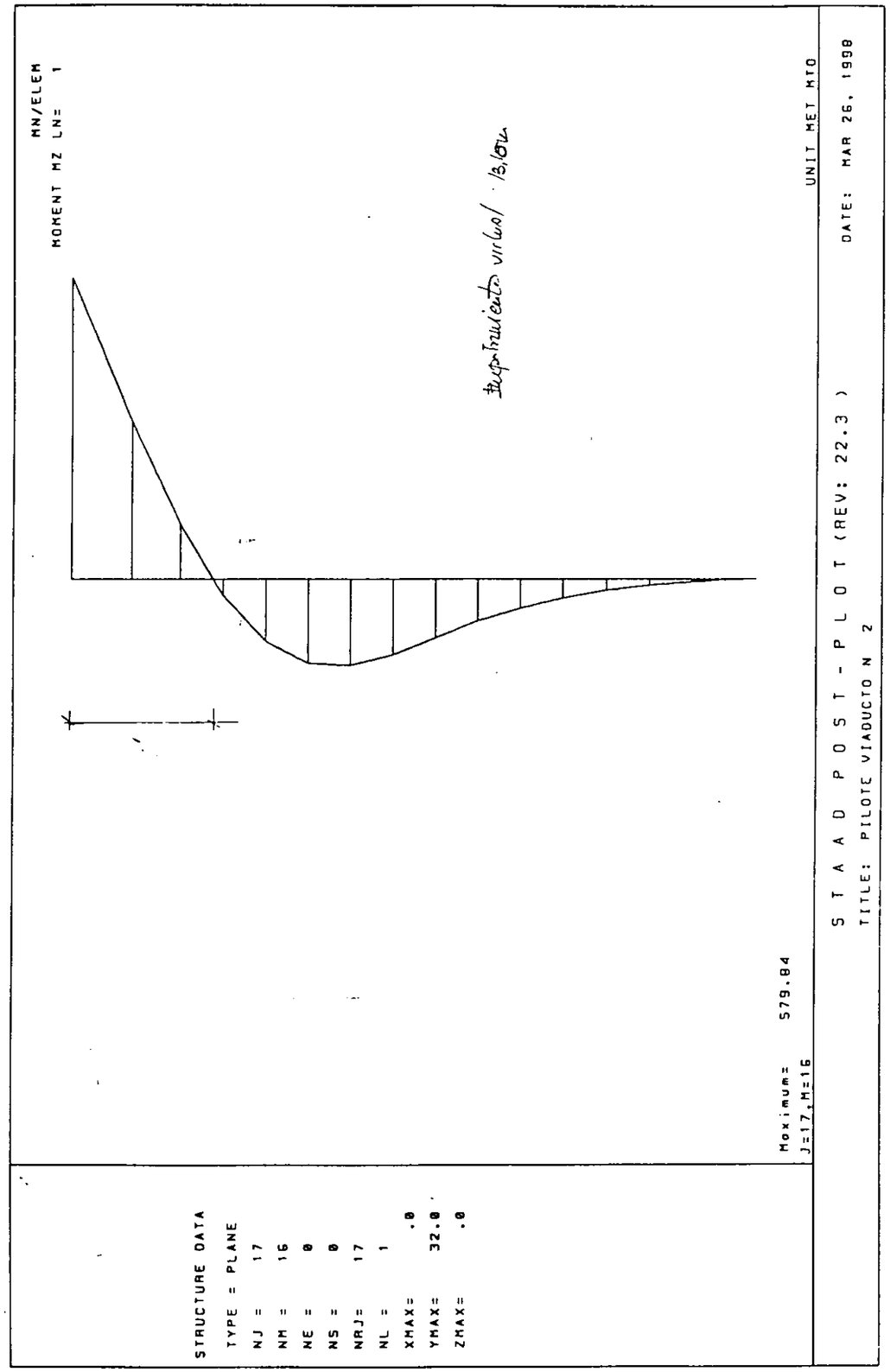
********** END OF LATEST ANALYSIS RESULT **********

55. PLOT BENDING FILE
56. PLOT DISPLACEMENT FILE
57. FINISH

********** END OF STAAD-III **********

**** DATE= MAR 26,1998 TIME= 17:30:14 ****

For questions on STAAD-III, contact:
Research Engineers(Europe) Ltd
Draycott House, Almondsbury Business Centre, Bristol
BS12 4QH, England.
Tel: +44 1454 207003 Fax: +44 1454 207001



Tanteo empotramiento virtual pilote con fórmula OTEO

Viaducto 2

- Arcillas - $L' = 1{,}2 \sqrt[4]{\frac{E_p I_p}{6{,}3}} = 1{,}2\, L_e$

  Arenas - $L' = 1{,}7\, \beta L_e$

$E_p I_p$: $E = 3 \cdot 10^5$ T/m²

$I = \frac{\pi D^4}{64} = 0{,}393$ m⁴

$E_p I_p = 1{,}546 \cdot 10^6$ m²·T

Aluvial (supuesto granular) - Profundidad empotramiento = 23,5 m

$K_h = 167\, z_{(m)} \cdot T/m^3$ Para $z = 6$ m → $K_h = 667$ T/m³

$K_h = 0{,}75 \frac{E}{D}$ - $E = \frac{D}{0{,}75} K_h = 1{,}333\, D \cdot K_h = 2{,}14 K_h$ (L)

$D = 1{,}5$

Luego $E = 1600$ T/m² (medio de los 10 primeros de pilote en el aluvial)

Granular - $\beta = 1{,}70$ ($x = 0$ en superficie)

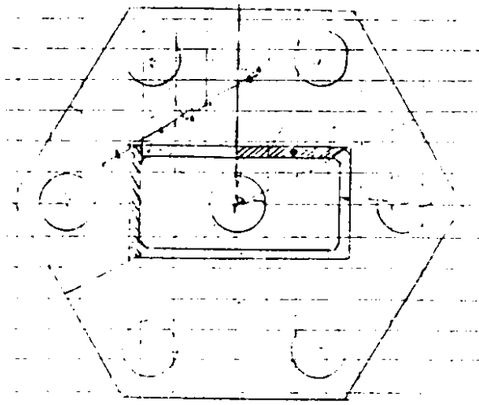
El supuesto de la capa alterada - 1200 T/m²

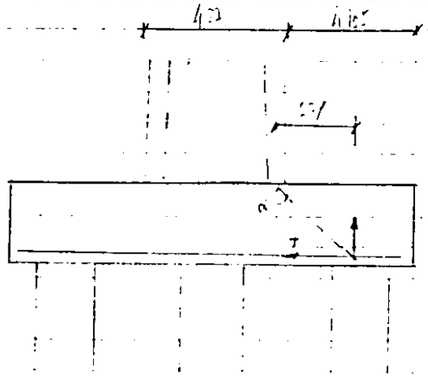
$L e_L = 7{,}9$ m → $L' = 1{,}2 \cdot \beta \cdot 7{,}9 =$ **16,0 m**

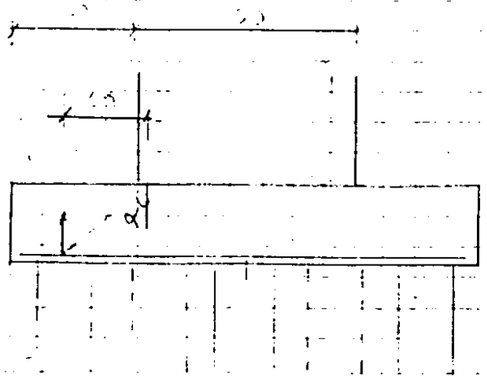
Contando el 1,5 m de sacrificio → Empotramiento virtual a 16,5 m de profundidad.

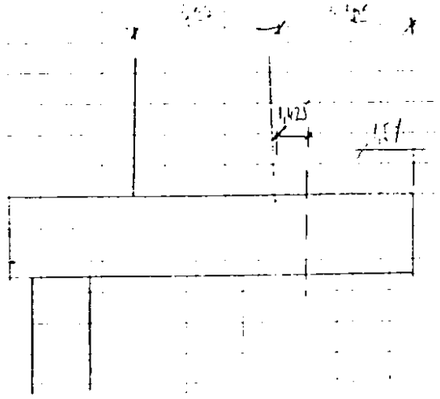
- Con $\beta = 1{,}75$ y $E_L = 700$ T/m² → $e_L = 9{,}0$ - $L' = 13{,}5$ m

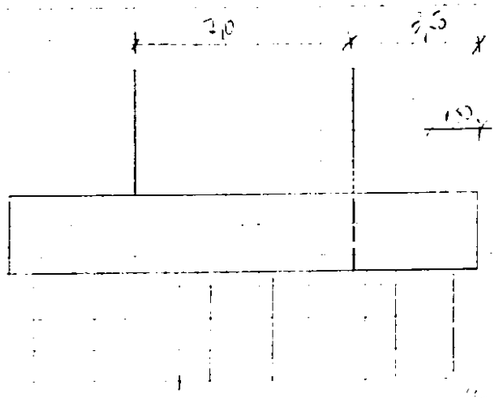
$13{,}5 + 1{,}5 =$ **15,0 m**











ARMADO DE PILOTES

Flexión

Esfuerzo en cabeza

HIP.	γL	γT	Nmax	Nmin	Ndmax	Ndmin	γd
1	13,4	3,3	1101,0	272,1	1651,5	408,3	22,9
2	11,9	4,3	974,6	267,1	1461,9	800,7	19,0
3	25,6	19,0	1170,3	127,9	1755,5	191,9	27,8
4	24,3	16,3	1070,3	67,6	1605,5	101,4	29,3

Lef = 13,10 m

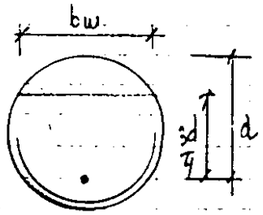
Esfuerzo en empotramiento virtual

$P_p = 0{,}295 \times 1.80^2 \times 2{,}5 \times 13{,}10 = 83{,}3$ Mp HIP. 1,2 $(P_p)d = 83{,}3 \times 1{,}5 = 124{,}9$ Mp

HIP. 3,4 $(P_p)d = 124{,}8 \times 0{,}9 = 112{,}4$ Mp

HIP.	Md	Ndmin	Ndmax	ω	μ	ω	As
1	500,0	383,2	1276,4	0,17	0,05	–	Dmin
2	248,9	432,6	1586,8	0,14	0,05		
3	626,2	804,3	1867,9	0,10	0,11	0,22	151,4
4	555,8	713,8	1717,9	0,07	0,07	0,14	96,3

$A_{min} = 6‰\, A_c = \frac{6}{1000} \times 1{,}225 \times 150^2 = 152{,}6\ cm^2$ — 22 ϕ25



Cortante

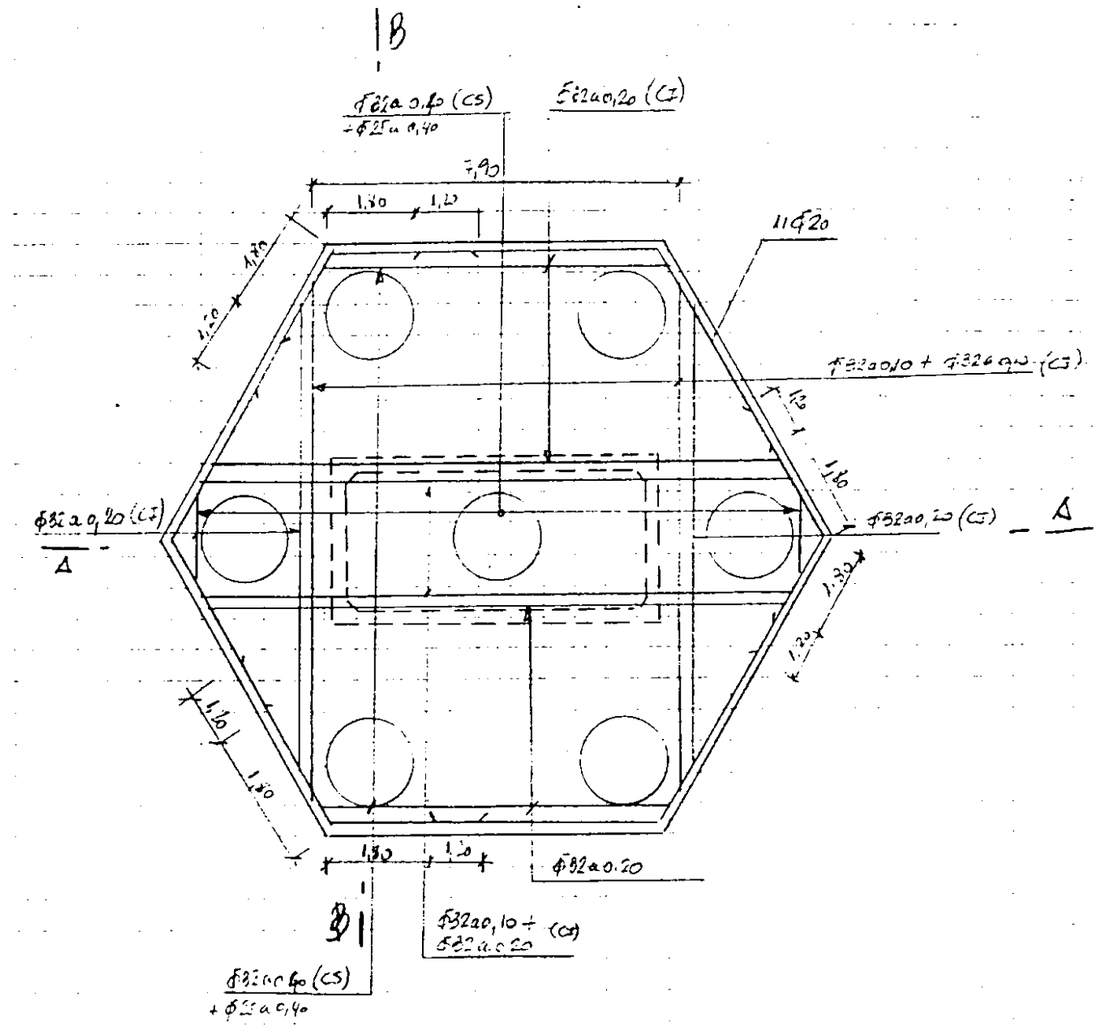
$V_{dmax} = 47{,}8$ Mp

$d = 1{,}435$ m

$b_w = 1{,}488$ m

$V_{cu} = 8\sqrt{120} \times 1{,}435 \times 1{,}438 = 113{,}1$ Mp > Vd

$A_{min} = \frac{0{,}02 \times 1{,}438 \times 1200}{4{,}2} = 8{,}2\ cm^2$ — c ϕ12 a 0,20


B
ϕ32a0,40 (CS)
+ϕ25a0,40
ϕ32a0,20 (CI)
7,90
1,30
1,20
1,70
1,20
1,46
1,32
1,20
1,46
1,30
1,30
1,20
1,30
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1,30
1,20
1,30
1,20
1,46

2.2.3- Zapatas

VIADUCTO 2

PILA 11

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-11
ALTURA DE PILA: 38.164 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3436.04 Mp	93.60 Mp	51.26 Mp	3572 Mp*m	2621 Mp*m

ESFUERZOS EN BASE DE FUSTE: (INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

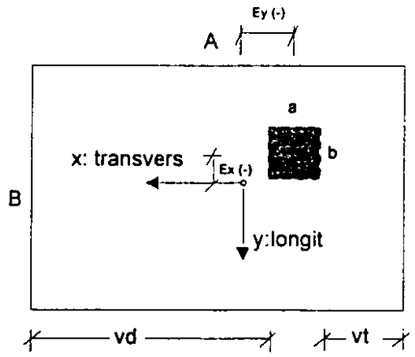
TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
3436.04 Mp	93.60 Mp	51.26 Mp	3572 Mp*m	2621 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	3436.036 t
H x =	51.260 t
H y =	93.600 t
My** =	2621.147 mt
Mx **=	3572.150 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.500 m			
B =	10.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	3.25	3.25	longitud.
m³ hormigón=	262.5	1.75	1.75	transversal

HIP I a)

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	656.25 t

ESFUERZOS DE CÁLCULO	En el centro de gravedad
V = 4092.29 t	
Hx = 51.26 t	
Hy = 93.60 t	
My = 2749.30 mt	---------->ex = 0.641 m
Mx = 3338.15 mt	---------->ey = 0.873 m

COMPROBACIÓN DE TENSIONES		
σ,adm =	7.00 kg/cm2	
σ,media =	3.90 kg/cm2	<7 OK.
σ,cobar. =	5.36 kg/cm2	<7 OK.
σ,max. =	7.29 kg/cm2	<8.75 OK.
σ,min. =	0.51 kg/cm2	>0 OK.

tensión en esquinas				caso
7.29 kg/cm2	0.51 kg/cm2	4.14 kg/cm2	3.65 kg/cm2	I

COMPROBACIÓN A CORTANTE

fck (kp/cm²) = 250

Cara paralela al lado a			Cara paralela al lado b	
Area =	22.560 m2		Area =	14.160 m2
Vd =	278.80 t/m		Vd =	150.12 t/m
Vcu =	2912.48 t/m		Vcu =	1828.05 t/m
Vu =	11280.00 t/m	--> ok	Vu =	7080.00 t/m --> ok
Vs =	innecesaria		Vs =	innecesaria
As,v =	7.94 cm2/m		As,v =	7.94 cm2/m
	mínima			mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 3089.25 t/m²
Vpu = 17183.7 t/m² --> ok

HIP I a)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.450 m	<-(Sección de referencia a 0.10*a o b)->	v = 3.600 m
s = 0.85 kg/cm2		s = 1.131 kg/cm2
t = 6.44 kg/cm2	distrib. uniforme	t = 6.15 kg/cm2
a= diagrama 1	t. cobaricént.	a= diagrama 1
M= 210.16 mt/m	160.91 mt/m	M = 447.64 mt/m
Md = 336.26 mt/m	257.46 mt/m	Md = 716.23 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 143.12 t/m		Us = 312.82 t/m
As = 36.08 cm2/m		**As = 70.61 cm2/m**
MINIMA		

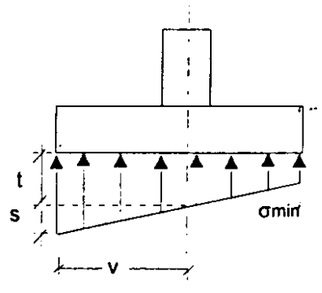


DIAGRAMA 1

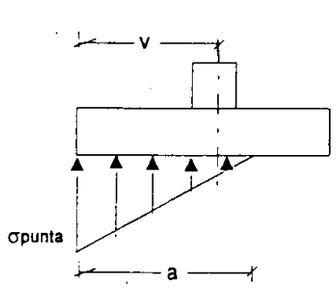


DIAGRAMA 2

HIP I b)

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-11
ALTURA DE PILA: 38.164 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

[redacted]N	H,Longitud	H,Transv	M, Longitud	M,Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO:	12.78 Mp/m	> ojo: multiplicar este valor por el
VIENTO TRANSVERSAL:	0.00 Mp/m	coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2759.04 Mp	83.50 Mp	30.13 Mp	3187 Mp*m	3163 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

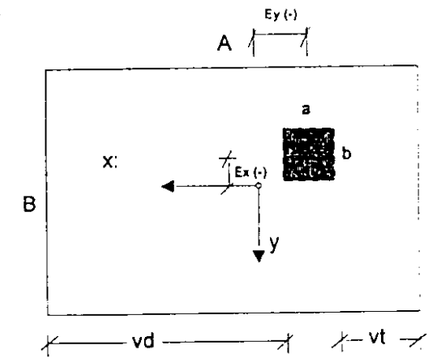
TOTALES:

[redacted]N	H,Longitud	H,Transv	M, Longitud	M,Transv
2759.04 Mp	83.50 Mp	30.13 Mp	3187 Mp*m	3163 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	2759.036 t
H x =	30.130 t
H y =	83.500 t
My** =	3163.181 mt
Mx **=	3186.694 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.500 m			
B =	10.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	3.25	3.25	longitud.
m^3 hormigón= 262.5		1.75	1.75	transversal

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	656.25 t

ESFUERZOS DE CÁLCULO (En el centro de gravedad)

V = 3415.29 t
Hx = 30.13 t
Hy = 83.50 t
My = 3238.51 mt ——————>ex = 0.926 m
Mx = 2977.94 mt ——————>ey = 0.933 m

COMPROBACIÓN DE TENSIONES

σ,adm =	7.00 kg/cm2	
σ,media =	3.25 kg/cm2	<7 OK.
σ,cobar. =	4.86 kg/cm2	<7 OK.
σ,max. =	6.72 kg/cm2	<8.75 OK.
σ,min. =	-0.22 kg/cm2	<0:redistrib.->

tensión en esquinas				caso
6.72 kg/cm2	-0.22 kg/cm2	3.02 kg/cm2	3.48 kg/cm2	II

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= 0.089 **yb=** 0.59 m
ex/B= 0.093 **xa2=** 0.71 m
λ= 2.120

σ_{max} = 6.90 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck (kp/cm²) = 250

Cara paralela al lado a		Cara paralela al lado b	
Area =	22.560 m2	Area =	14.160 m2
Vd =	252.46 t/m	Vd =	135.94 t/m
Vcu =	2912.48 t/m	Vcu =	1828.05 t/m
Vu =	11280.00 t/m --> ok	Vu =	7080.00 t/m --> ok
Vs =	innecesaria	Vs =	innecesaria
As,v =	7.94 cm2/m	As,v =	7.94 cm2/m
	mínima		mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 2578.18 t/m²
Vpu = 17183.7 t/m² --> ok

HIP I b)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.450 m	<-(Sección de referencia a 0.10*a o b)->	v = 3.600 m
s = 0.78 kg/cm2		s = 1.366 kg/cm2
t = 6.12 kg/cm2	distrib. uniforme	t = 5.53 kg/cm2
a= diagrama 1	t cobaricént.	a= diagrama 1
M= 199.20 mt/m	145.71 mt/m	M = 417.32 mt/m
Md = 318.71 mt/m	233.14 mt/m	Md = 667.71 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 135.50 t/m		Us = 290.64 t/m
As = 36.08 cm2/m		**As = 65.61 cm2/m**
MÍNIMA		

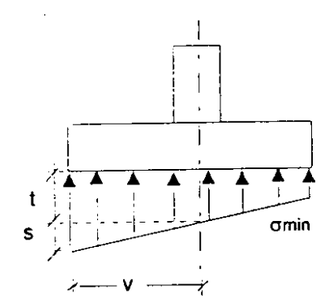


DIAGRAMA 1

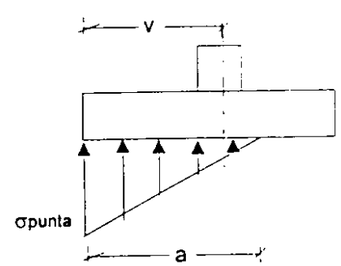


DIAGRAMA 2

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-11
ALTURA DE PILA: 38.164 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2685.1 Mp	84.24 Mp	.106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3173.6 Mp	84.24 Mp	124.30 Mp	3215 Mp*m	5357 Mp*m

ESFUERZOS EN BASE DE FUSTE: (INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

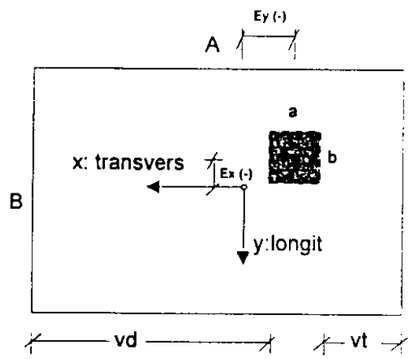
TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3173.6 Mp	84.24 Mp	124.30 Mp	3215 Mp*m	5357 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	3173.599 t
H x =	124.304 t
H y =	84.240 t
My** =	5357.273 mt
Mx **=	3214.935 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.500 m			
B =	10.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	3.25	3.25	longitud.
m^3 hormigón= 262.5		1.75	1.75	transversal

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	656.25 t

ESFUERZOS DE CÁLCULO:	En el centro de gravedad
V = 3829.85 t	
Hx = 124.30 t	
Hy = 84.24 t	
My = 5668.03 mt	---------->ex = 1.399 m
Mx = 3004.34 mt	---------->ey = 0.839 m

COMPROBACIÓN DE TENSIONES		
σ,adm =	7.00 kg/cm2	
σ,media =	3.65 kg/cm2	<7 OK.
σ,cobar. =	6.03 kg/cm2	<7 OK.
σ,max. =	8.52 kg/cm2	<8.75 OK.
σ,min. =	-1.23 kg/cm2	<0:redistrib.->

tensión en esquinas				caso
8.52 kg/cm2	-1.23 kg/cm2	2.04 kg/cm2	5.25 kg/cm2	II

redistribución (caso II)
Aplicando la teoria de M.Hahn

ey/A= 0.080 **yb=** 1.89 m
ex/B= 0.140 **xa2=** 3.94 m
λ= 2.360

σ_{max}= 8.61 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm^2] = 250

Cara paralela al lado a	Cara paralela al lado b
Area = 22.560 m2	Area = 14.160 m2
Vd = 313.46 t/m	Vd = 168.79 t/m
Vcu = 2912.48 t/m	Vcu = 1828.05 t/m
Vu = 11280.00 t/m --> ok	Vu = 7080.00 t/m --> ok
Vs = innecesaria	Vs = innecesaria
As,v = 7.94 cm2/m	As,v = 7.94 cm2/m
mínima	mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 2891.13 t/m^2
Vpu = 17183.7 t/m^2 --> ok

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.450 m	<-(Sección de referencia a 0.10*a o b)->	v = 3.600 m
s = 0.77 kg/cm2		s = 2.356 kg/cm2
t = 7.84 kg/cm2	distrib. uniforme	t = 6.25 kg/cm2
a= diagrama 1	t. cobaricént.	a= diagrama 1
M= 250.64 mt/m	180.92 mt/m	M = 506.92 mt/m
Md = 401.02 mt/m	289.47 mt/m	Md = 811.07 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 171.41 t/m		Us = 356.65 t/m
As = 38.69 cm2/m		**As = 80.51 cm2/m**

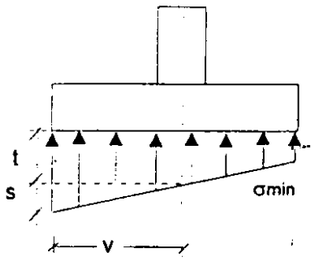


DIAGRAMA 1

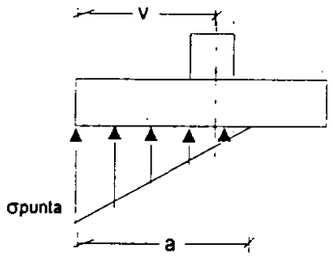


DIAGRAMA 2

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-11
ALTURA DE PILA: 38.164 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2018 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2618 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m
VIENTO TRANSVERSAL: 0.48 Mp/m
> ojo: multiplicar este valor por el coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2506.5 Mp	75.15 Mp	105.26 Mp	2868 Mp*m	6288 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

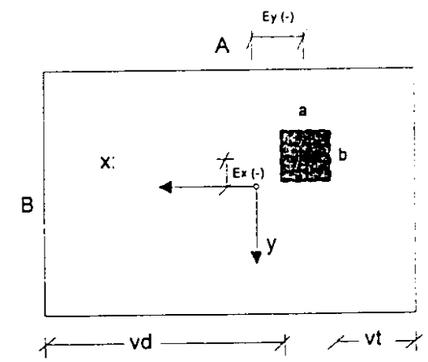
TOTALES:

N	H,Longitud	H,TransV	M,Longitud	M,TransV
2506.5 Mp	75.15 Mp	105.26 Mp	2868 Mp*m	6288 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	2506.499 t
H x =	105.264 t
H y =	75.150 t
My** =	6288.231 mt
Mx **=	2868.025 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.500 m			
B =	10.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	3.25	3.25	longitud.
m^3 hormigón= 262.5		1.75	1.75	transversal

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	656.25 t

ESFUERZOS DE CÁLCULO En el centro de gravedad

V = 3162.75 t
Hx = 105.26 t
Hy = 75.15 t
My = 6551.39 mt ——————>ex = 1.988 m
Mx = 2680.15 mt ——————>ey = 0.907 m

COMPROBACIÓN DE TENSIONES

σ,adm = 7.00 kg/cm2
σ,media = 3.01 kg/cm2 <7 OK.
σ,cobar. = 6.04 kg/cm2 <7 OK.
σ,max. = 8.21 kg/cm2 <8.75 OK.
σ,min. = -2.19 kg/cm2 <0:redistrib.-

tensión en esquinas				caso
8.21 kg/cm2	-2.19 kg/cm2	0.73 kg/cm2	5.30 kg/cm2	II

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= 0.086 yb= 2.93 m
ex/B= 0.199 xa2= 7.88 m
λ= 2.830

σ_{max}= 8.52 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a	Cara paralela al lado b
Area = 22.560 m2	Area = 14.160 m2
Vd = 314.32 t/m	Vd = 169.25 t/m
Vcu = 2912.48 t/m	Vcu = 1828.05 t/m
Vu = 11280.00 t/m --> ok	Vu = 7080.00 t/m --> ok
Vs = innecesaria	Vs = innecesaria
As,v = 7.94 cm2/m mínima	As,v = 7.94 cm2/m mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 2387.54 t/m²
Vpu = 17183.7 t/m² --> ok

HIP II b)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.450 m	<-(Sección de referencia a 0.10*a o b)->	v = 3.600 m
s = 0.71 kg/cm2		s = 2.797 kg/cm2
t = 7.82 kg/cm2	distrib. uniforme	t = 5.73 kg/cm2
a= diagrama 1	t cobaricént.	a= diagrama 1
M= 248.77 mt/m	181.42 mt/m	M = 491.96 mt/m
Md = 398.03 mt/m	290.27 mt/m	Md = 787.14 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 170.10 t/m		Us = 345.53 t/m
As = 38.40 cm2/m		**As = 78.00 cm2/m**

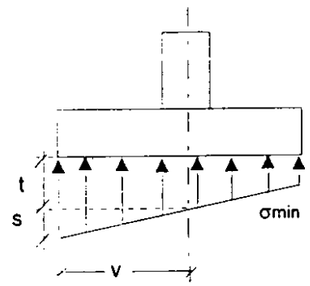


DIAGRAMA 1

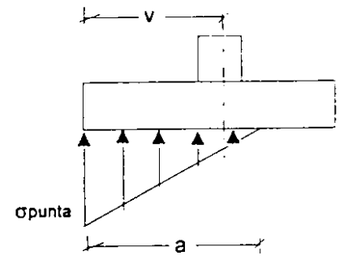


DIAGRAMA 2

PILA 12

HIP I a)

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-12
ALTURA DE PILA: 24.24 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2948.3 Mp	93.6 Mp	51.26 Mp	0 Mp*m	664.9 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3258.09 Mp	93.60 Mp	51.26 Mp	2269 Mp*m	1907 Mp*m

ESFUERZOS EN BASE DE FUSTE: (INCREMENTOS POR 2º ORDEN)	M, Longitud	M.Transv
	0 Mp*m	0 Mp*m

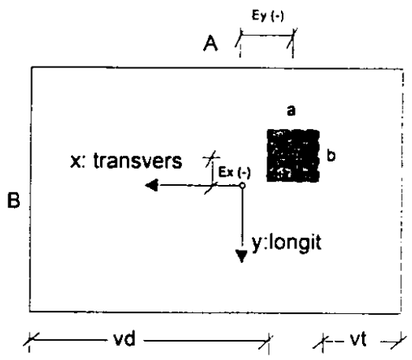
TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M.Transv
3258.09 Mp	93.60 Mp	51.26 Mp	2269 Mp*m	1907 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	3258.087 t
H x =	51.260 t
H y =	93.600 t
My** =	1907.402 mt
Mx **=	2268.864 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.000 m			
B =	9.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	1.5	1.5	transversal
m³ hormigón=	225	2.75	2.75	longitud.

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	562.50 t

ESFUERZOS DE CÁLCULO En el centro de gravedad

V =	3820.59 t
Hx =	51.26 t
Hy =	93.60 t
My =	2035.55 mt ----------> ex = 0.499 m
Mx =	2034.86 mt ----------> ey = 0.594 m

COMPROBACIÓN DE TENSIONES

σ,adm =	7.00 kg/cm2	
σ,media =	4.25 kg/cm2	<7 OK.
σ,cobar. =	5.42 kg/cm2	<7 OK.
σ,max. =	7.11 kg/cm2	<8.75 OK.
σ,min. =	1.38 kg/cm2	>0 OK.

tensión en esquinas				caso
7.11 kg/cm2	1.38 kg/cm2	4.09 kg/cm2	4.40 kg/cm2	I

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a		Cara paralela al lado b	
Area =	22.560 m2	Area =	14.160 m2
Vd =	130.04 t/m	Vd =	238.41 t/m
Vcu =	2912.48 t/m	Vcu =	1828.05 t/m
Vu =	11280.00 t/m --> ok	Vu =	7080.00 t/m --> ok
Vs =	innecesaria	Vs =	innecesaria
As,v =	7.94 cm2/m mínima	As,v =	7.94 cm2/m mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2

Vp= 2346.01 t/m²

Vpu = 17183.7 t/m² --> ok

HIP I a)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a			Armadura paralela al lado b	
v =	2.550 m		v =	3.275 m
s =	0.69 kg/cm2		s =	1.097 kg/cm2
t =	6.42 kg/cm2	distrib. uniforme	t =	6.01 kg/cm2
a=	diagrama 1	t. cobaricént.	a=	diagrama 1
M=	223.65 mt/m	176.16 mt/m	M =	361.65 mt/m
Md =	357.84 mt/m	281.86 mt/m	Md =	578.64 mt/m
Uc =	4000.00 t/m		Uc =	4000.00 t/m
Us =	152.52 t/m		Us =	250.32 t/m
As =	**36.08 cm2/m** MÍNIMA		**As =**	**56.50 cm2/m**

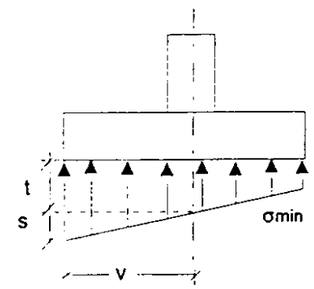


DIAGRAMA 1

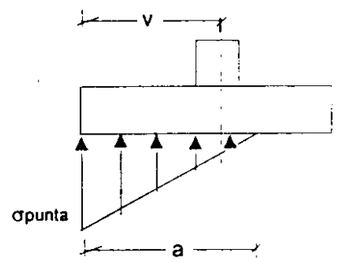


DIAGRAMA 2

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-12
ALTURA DE PILA: 24.24 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2271.3 Mp	83.5 Mp	30.13 Mp	0 Mp*m	2013 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.78 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.00 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2581.09 Mp	83.50 Mp	30.13 Mp	2024 Mp*m	2744 Mp*m

ESFUERZOS EN BASE DE FUSTE: (INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

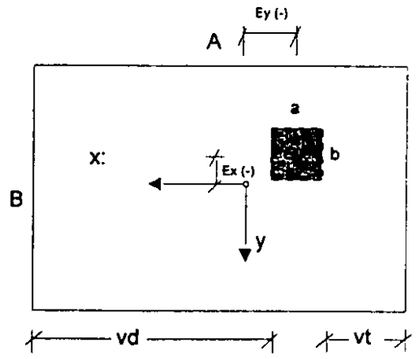
TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2581.09 Mp	83.50 Mp	30.13 Mp	2024 Mp*m	2744 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	2581.087 t
H x =	30.130 t
H y =	83.500 t
My** =	2743.651 mt
Mx **=	2024.040 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.000 m			
B =	9.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	1.5	1.5	transversal
m³ hormigón=	225	2.75	2.75	longitud.

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	562.50 t

ESFUERZOS:DE CÁLCULO:	En el centro de gravedad
V = 3143.59 t	
Hx = 30.13 t	
Hy = 83.50 t	
My = 2818.98 mt	----------->ex = 0.873 m
Mx = 1815.29 mt	----------->ey = 0.644 m

COMPROBACIÓN DE TENSIONES		
σ,adm =	7.00 kg/cm2	
σ,media =	3.49 kg/cm2	<7 OK.
σ,cobar. =	4.97 kg/cm2	<7 OK.
σ,max. =	6.79 kg/cm2	<8.75 OK.
σ,min. =	0.19 kg/cm2	>0 OK.

tensión en esquinas				caso
6.79 kg/cm2	0.19 kg/cm2	2.61 kg/cm2	4.37 kg/cm2	I

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= 0.064 yb= 0.42 m
ex/B= 0.097 xa2= 0.80 m
λ= 2.150

σ_{max}= 7.51 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a	Cara paralela al lado b
Area = 22.560 m2	Area = 14.160 m2
Vd = 119.37 t/m	Vd = 218.85 t/m
Vcu = 2912.48 t/m	Vcu = 1828.05 t/m
Vu = 11280.00 t/m --> ok	Vu = 7080.00 t/m --> ok
Vs = innecesaria	Vs = innecesaria
As,v = 7.94 cm2/m	As,v = 7.94 cm2/m
mínima	mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 1930.30 t/m²
Vpu = 17183.7 t/m² --> ok

HIP I b)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.550 m		v = 3.275 m
s = 0.62 kg/cm2		s = 1.520 kg/cm2
t = 6.17 kg/cm2	distrib. uniforme	t = 5.27 kg/cm2
a= diagrama 1	t. cobaricént.	a= diagrama 1
M= 214.11 mt/m	161.71 mt/m	M = 337.03 mt/m
Md = 342.58 mt/m	258.74 mt/m	Md = 539.25 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 145.87 t/m		Us = 232.65 t/m
As = 36.08 cm2/m		**As = 52.52 cm2/m**
MÍNIMA		

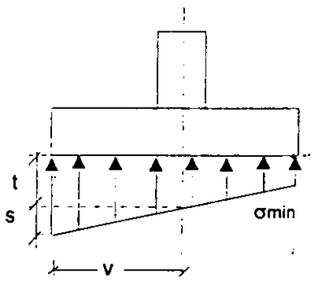


DIAGRAMA 1

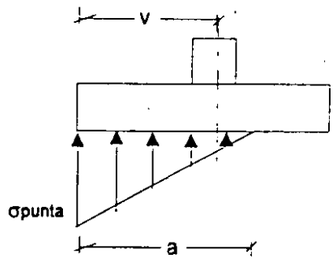


DIAGRAMA 2

HIP II a)

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-12
ALTURA DE PILA: 24.24 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2685.1 Mp	84.24 Mp	106.1 Mp	0 Mp*m	960.7 Mp*m

ACCIONES SOBRE EL FUSTE

- PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el coeficiente de combinacion de acciones
- VIENTO TRANSVERSAL: 0.48 Mp/m

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2995.37 Mp	84.24 Mp	117.66 Mp	2042 Mp*m	3673 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

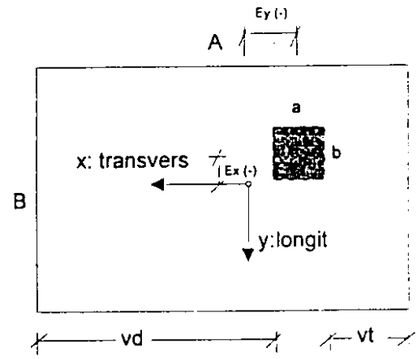
TOTALES:

N	H,Longitud	H,Transv	M,Longitud	M,Transv
2995.37 Mp	84.24 Mp	117.66 Mp	2042 Mp*m	3673 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	2995.372 t
H x =	117.662 t
H y =	84.240 t
My** =	3672.701 mt
Mx **=	2041.978 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.000 m			
B =	9.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	1.5	1.5	transversal
m^3 hormigón= 225		2.75	2.75	longitud.

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	562.50 t

ESFUERZOS DE CÁLCULO En el centro de gravedad

V = 3557.87 t
Hx = 117.66 t
Hy = 84.24 t
My = 3966.86 mt ——————>ex = 1.032 m
Mx = 1831.38 mt ——————>ey = 0.574 m

COMPROBACIÓN DE TENSIONES

σ,adm =	7.00 kg/cm2	
σ,media =	3.95 kg/cm2	<7 OK.
σ,cobar. =	5.80 kg/cm2	<7 OK.
σ,max. =	8.11 kg/cm2	<8.75 OK.
σ,min. =	-0.21 kg/cm2	<0:redistrib.->

tensión en esquinas				caso
8.11 kg/cm2	-0.21 kg/cm2	2.24 kg/cm2	5.67 kg/cm2	II

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= 0.057 **yb=** 0.32 m
ex/B= 0.115 **xa2=** 0.84 m
λ= 2.100

σ_{max}= 8.30 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a		Cara paralela al lado b	
Area =	22.560 m2	Area =	14.160 m2
Vd =	139.08 t/m	Vd =	254.99 t/m
Vcu =	2912.48 t/m	Vcu =	1828.05 t/m
Vu =	11280.00 t/m --> ok	Vu =	7080.00 t/m --> ok
Vs =	innecesaria	Vs =	innecesaria
As,v =	7.94 cm2/m mínima	As,v =	7.94 cm2/m mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 2184.69 t/m²
Vpu = 17183.7 t/m² --> ok

HIP II a)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a			Armadura paralela al lado b	
v =	2.550 m		v =	3.275 m
s =	0.64 kg/cm2		s =	2.188 kg/cm2
t =	7.66 kg/cm2	distrib. uniforme	t =	6.11 kg/cm2
a=	diagrama 1	t. cobaricént.	a=	diagrama 1
M=	263.00 mt/m	188.42 mt/m	M =	406.09 mt/m
Md =	420.81 mt/m	301.47 mt/m	Md =	649.74 mt/m
Uc =	4000.00 t/m		Uc =	4000.00 t/m
Us =	180.11 t/m		Us =	282.46 t/m
As =	**40.66 cm2/m**		**As =**	**63.76 cm2/m**

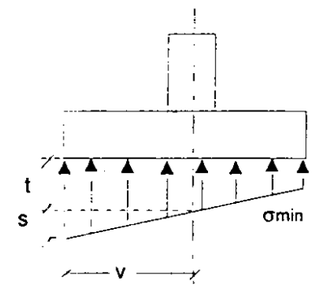


DIAGRAMA 1

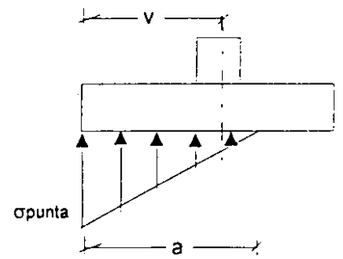


DIAGRAMA 2

VIADUCTO: VIADUCTO SOBRE EL RIO BLANCO
PILA: P-12
ALTURA DE PILA: 24.24 m (LONGITUD DE FUSTE)

ESFUERZOS CABEZA DE PILA: (Valores característicos)

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2075.7 Mp	75.15 Mp	87.06 Mp	0 Mp*m	2174 Mp*m

ACCIONES SOBRE EL FUSTE

PESO PROPIO: 12.80 Mp/m > ojo: multiplicar este valor por el
VIENTO TRANSVERSAL: 0.48 Mp/m coeficiente de combinacion de acciones

ESFUERZOS EN BASE DE FUSTE: (Valores característicos)

(VALORES EN PRIMER ORDEN)

N	H,Longitud	H,Transv	M, Longitud	M.Transv
2385.97 Mp	75.15 Mp	98.62 Mp	1822 Mp*m	4425 Mp*m

ESFUERZOS EN BASE DE FUSTE:
(INCREMENTOS POR 2º ORDEN)

M, Longitud	M.Transv
0 Mp*m	0 Mp*m

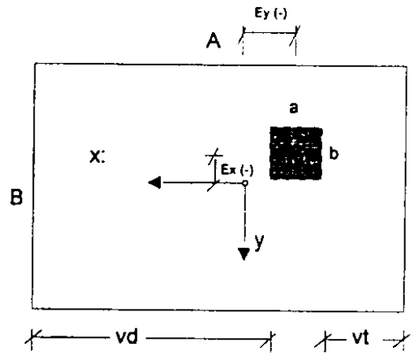
TOTALES:

N	H,Longitud	H,Transv	M, Longitud	M,Transv
2385.97 Mp	75.15 Mp	98.62 Mp	1822 Mp*m	4425 Mp*m

ESFUERZOS EN CIMENTACIÓN

N* =	2385.972 t
H x =	98.622 t
H y =	75.150 t
My** =	4424.772 mt
Mx **=	1821.636 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	10.000 m			
B =	9.000 m			
canto =	2.500 m			
a =	7.000 m			
b =	3.500 m			
Ey =	0.000 m	Vd	Vt	
Ex =	0.000 m	1.5	1.5	transversal
m³ hormigón=	225	2.75	2.75	longitud.

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	562.50 t

ESFUERZOS DE CÁLCULO	
V =	2948.47 t
Hx =	98.62 t
Hy =	75.15 t
My =	4671.33 mt
Mx =	1633.76 mt

En el centro de gravedad
——————>ex = 1.501 m
——————>ey = 0.618 m

COMPROBACIÓN DE TENSIONES		
σ,adm =	7.00 kg/cm2	
σ,media =	3.28 kg/cm2	<7 OK.
σ,cobar. =	5.61 kg/cm2	<7 OK.
σ,max. =	7.83 kg/cm2	<8.75 OK.
σ,min. =	-1.27 kg/cm2	<0:redistrib.->

tensión en esquinas				caso
7.83 kg/cm2	-1.27 kg/cm2	0.91 kg/cm2	5.65 kg/cm2	II

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= 0.062 yb= 1.66 m
ex/B= 0.167 xa2= 5.85 m
λ= 2.420

σ_{max}= 7.93 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a		Cara paralela al lado b	
Area =	22.560 m2	Area =	14.160 m2
Vd =	134.60 t/m	Vd =	246.76 t/m
Vcu =	2912.48 t/m	Vcu =	1828.05 t/m
Vu =	11280.00 t/m --> ok	Vu =	7080.00 t/m --> ok
Vs =	innecesaria	Vs =	innecesaria
As,v =	7.94 cm2/m mínima	As,v =	7.94 cm2/m mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 133.104 m2
Vp= 1810.49 t/m²
Vpu = 17183.7 t/m² --> ok

HIP II b)

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b
v = 2.550 m		v = 3.275 m
s = 0.56 kg/cm2		s = 2.551 kg/cm2
t = 7.37 kg/cm2	distrib. uniforme	t = 5.38 kg/cm2
a= diagrama 1	t. cobaricént.	a= diagrama 1
M= 251.66 mt/m	182.34 mt/m	M = 379.56 mt/m
Md = 402.66 mt/m	291.74 mt/m	Md = 607.30 mt/m
Uc = 4000.00 t/m		Uc = 4000.00 t/m
Us = 172.13 t/m		Us = 263.23 t/m
As = 38.86 cm2/m		**As = 59.42 cm2/m**

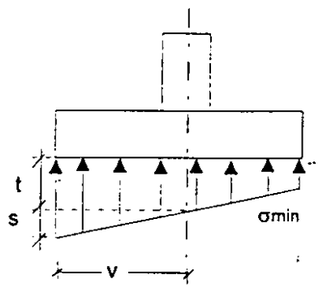


DIAGRAMA 1

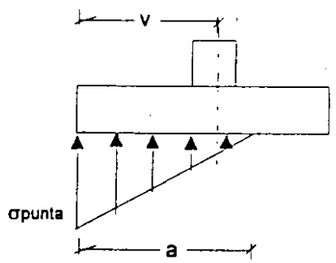


DIAGRAMA 2

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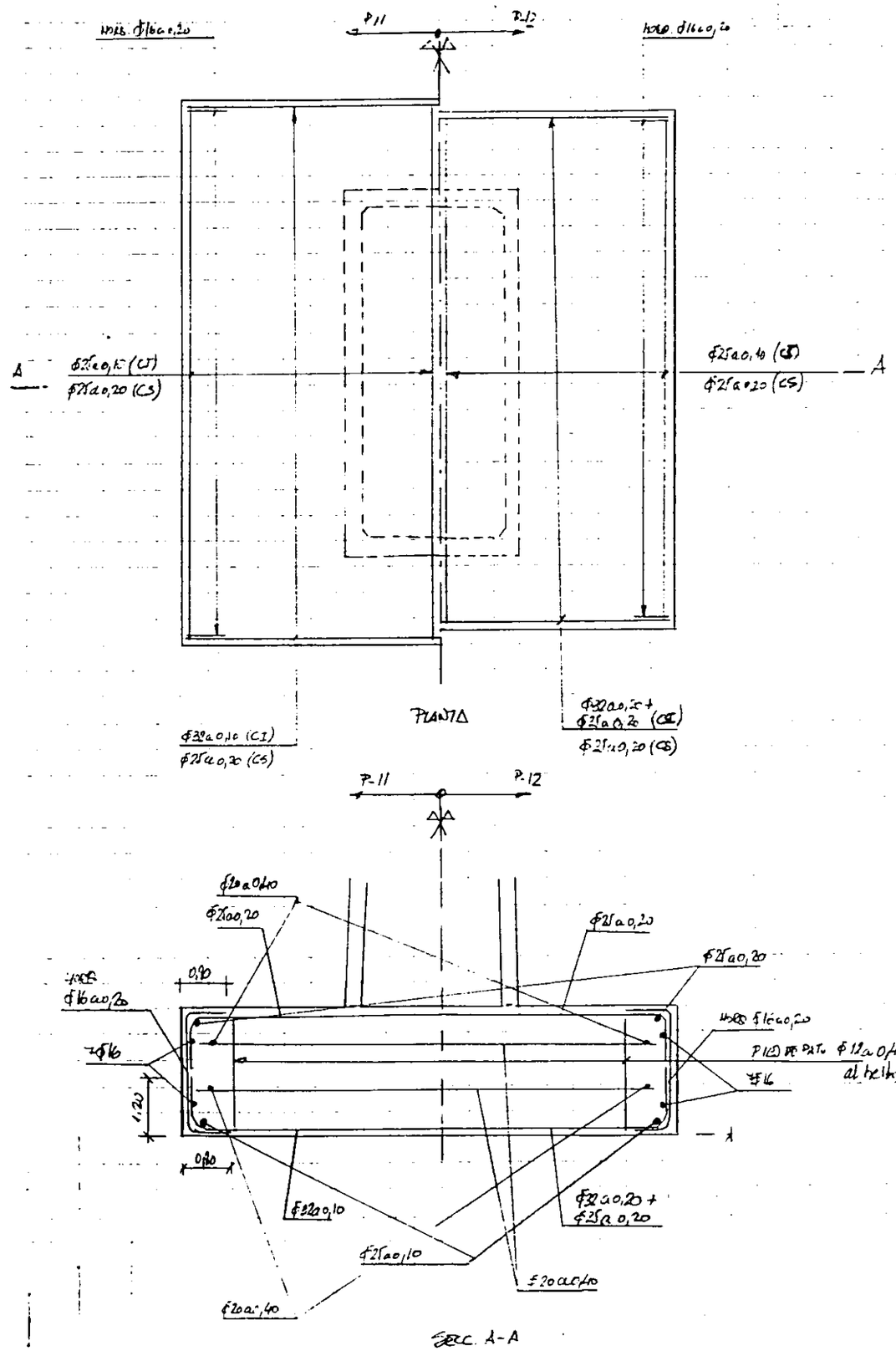
madrid

ASUNTO:

FECHA:

HOJA

REALIZO:



2.3- ESTRIBOS

VIADUCTO 1

ESTRIBO

ACCIONES

*Frenado:

- Según IAPF-75: $F = \frac{1}{6}$ Peso tren Tipo

Peso tren tipo: $30 \times 12\ t/m + (L-30) \times 10\ t/m$

Tramo E1-Junta: $L = 390{,}9 + 0{,}6 \Rightarrow P_{TREN} = 3975\ Mp$

Tramo Junta-E2: $L = 120{,}9 + 0{,}4 \Rightarrow P_{TREN} = 1273\ Mp$

$F_{frenado}$: E1-Junta: $F = 496{,}88\ Mp$

E2-Junta: $F = 159{,}13\ Mp$

Al valor de frenado se debe sumar una fuerza de arranque en la 2ª vía:

$$F_{arranque} = \frac{P_{LOCOMOTORA}}{6} = \frac{30 \times 12}{5} = 45\ Mp$$

$F_{TOTAL\ SOBRE\ E-1}$: $54{,}88\ Mp$

$F_{TOTAL\ SOBRE\ E-2}$: $204{,}13\ Mp$

-Según EC-1: $Q = 25 \times 4 + (L - 6{,}11) \cdot 3$

E-1: $F_{frenado} = \frac{Q}{4} = \frac{3180}{4} = 795{,}2 \neq \underline{600\ M_p}$

o bien $2 \times L = 2 \times (391{,}5) = 783\ M_p$

$F_{arranque} = Q/4 \neq 100 M_p$

$3{,}5\ L \neq 100\ M_p$

$F_{ESTRIBO\ E-1} = 700\ M_p \times 0{,}9 = \underline{630 M_p}$

E-2 $F_{frenado} = \frac{Q}{4} = \frac{1016{,}0}{4} = \underline{254{,}0 M_p} < 600$

o bien: $2L = 2 \times (320{,}9) = 241{,}8$

$F_{arranque}: Q/4 = 254{,}0 \neq 100 M_p$

o bien $3.5L > 100 M_p$

$F_{ESTRIBO\ E-2} = 354{,}0\ M_p \times 0{,}7 = \underline{247{,}8 M_p}$

- Interacción vía - tablero / Efecto térmico)

$F_T = (40{,}0 + 0{,}5L) \times 2 \neq 110 \times 2 = 220\ M_p$

E-1: $L = 391{,}5_m \rightarrow F_T = 471{,}5 \neq \underline{220 M_p}$

E-2: $L = 121{,}3_m \rightarrow F_T = \underline{201{,}3}$

- Esfuerzo longitudinal por deflexión del tablero.

No se han tenido en cuenta en este cálculo

Interacción tablero-estribo (Resumen de esfuerzos)

	E-1	E-2
* F frenado + arranque: (máximo según EC-1)	630	247,8
* F rozamiento 15% cp tramo: (cp tramo: 11,85 t/m x L tramo)	78,93 (L: 391,5 - 0,5 x 37,5)	219,74 (L: 120 - 0,5 x 37,5)
* Interacción vía-tablero (L>100m): (Por efecto térmico)	220	201,3

Combinación: Máximo longitudinal gr13:

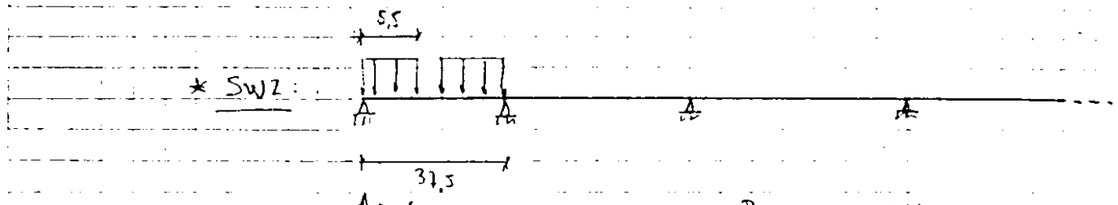
gr13: 1,0 x SC sin ferrov + 1,0 x Frenado-arranque + 0,5 x Viento (sobre tablero)

Combinación global de acciones:

ELS: $1,0 \times cp + 1,0 \times gr13 + 0,6\ F_W + 0,6\ F_{TS}$

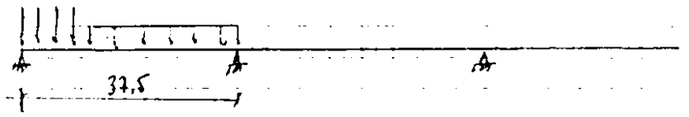
Reacciones máximas por sc vertical, sobre estribos

* SW2:



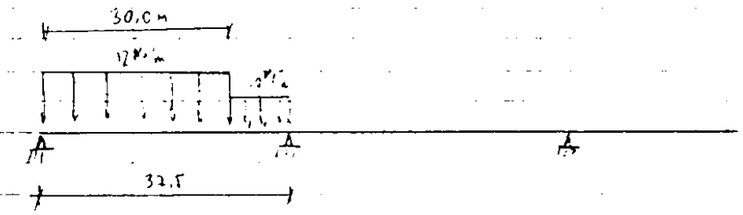
Rmáx = 172,8 Mp

* LM UIC-71



Rmáx = 168,2 Mp

* IAPF-75:



Rmáx = 196,5 Mp

Como Rmín concomitante con las acciones de frenado se tomará R=0 Mp

Estat. Combinados (Según EC-1)

E-1

$V = 784,8\,(cp) \times 1,0 + 1,0 \times (172,8 + 168,2) + 0,6 \times 11,8 = 1132,9\ Mp$ (791,9 sin SC vertical)
(SC ferrov.) (viaducto vial)

$H_L = 1,0 \times 787,93 + 1,0 \times 630 + 0,6 \times 220 = 1549,9\ Mp$

$H_T = 0,5 \times (10 + 16,9) + 0,6 \times 24,75 = 28,30\ Mp$
(tracción centrífuga) (viento)

$M_T = 1,0 \times 205,9 + 1,0 \times (186,1 + 315,7) + 0,5\,(21,4 + 47) + 0,6 \times 154,6 = 834,7\ Mp\,m$
(cp) (SC vertical) (tracc. centrif.) (viento)

$M_L = 0\ Mp\,m$

E-2

$V = 1132,9\ Mp$ (791,9 con $R_{sc} = 0$)

$H_L = 1 \times 219,74 + 1,0 \times 247,8 + 0,6 \times 201,3 = 588,32\ Mp$

$H_T = 28,30\ Mp$

$M_T = 834,7\ Mp\,m$

$M_L = 0\ Mp\,m$

Esf. combinados (ELS) Según IAPF-75, EH-91

ELS: $1,0 \times cp + 1,0\,\{(Sc.(p) + frenado + tracción\}$

Interacción vía-tablero: 0 Mp (No se expresa en el resto)

Hip I (sin viento): **E-1**

$V = 784,8\,(cp) + 1,0 \times 2 \times 196,5 = 1177,8\ Mp$ (784,8 sin SC)

$H_L = 1,0 \times 787,93 + 1,0 \times 541,88 = 1329,8\ Mp$

$H_T = 10 + 16,9 + 24,75 = 51,65\ Mp$

$M_T = 1,0 \times 205,9 + 1,0 \times (186,1 + 315,7) + 1,0 \times (21,4 + 47) =$
$= 776,1\ m\,Mp$

$M_L = 0\ Mp\,m$

E-2

$V = 1177,8\ Mp$ (784,8 sin SC vertical)

$H_L = 1,0 \times 219,74 + 1,0 \times 204,13 = 423,9\ Mp$

$H_T = 51,65\ Mp$

$M_T = 776,1\ m\,Mp$

$M_L = 0\ Mp\,m$

VIADUCTO 2

ESTRIBO

ACCIONES

* Frenado:

- Según IAPF-75: $F = \frac{1}{8}$ Peso tren Tipo

Peso tren tipo = 12 t/m + 80 + 1L-30 x 10 t/m

Viaducto sobre el río Blanco:

- Tramo E-1 – Junta: L = 120,9 + 0,6 → P tren: 1275 Mp
- Tramo Junta – E2: L = 135,1 + 0,4 → P tren: 4423 Mp

F frenado:
- E-1 – Junta: F = 159,38 Mp
- Junta – E-2: F = 552,875 Mp

Al valor de frenado, se debe sumar una fuerza de arranque en la 2ª vía:

$$F_{arranque} = \frac{P_{LOCOMOTORA}}{8} = \frac{30 \times 12}{8} = 45\ Mp$$

- F TOTAL SOBRE ESTRIBO E2: 597,875 Mp (Junta-E2) (frenado + arranque)
- F TOTAL SOBRE ESTRIBO E1: 204,38 Mp

- Según EC-1: Q = 25 t/m + 1L-6,4 x 8

E2 (L = 456,3 m): F frenado: $\frac{Q}{4} = \frac{5529,2}{4} = 384,5 + 600\ Mp$

o bien $F_f = 2L = 872,6 + 600$

Farranque: Q/4 + 100 Mp ; o bien 3,5L + 100 Mp

F estribo E-2: 700 Mp x 0,9 = 630 Mp

E1 (L = 121,3 m): F frenado: $\frac{1019,2}{4} = 254,8\ Mp$ o bien: F = 2L = 242,6 Mp

Farranque: $\frac{Q}{4} = 254,8 + 100\ Mp$; o bien 3,5L + 100

F estribo E-2: 354,8 x 0,7 = 248,36 Mp

- Interacción vía - tablero: (TÉRMICO)

$$F_T = (400 + 0{,}5L) \times 2 \neq 110 \times 2 = 220\ N_p$$

- E-2: $L = 436{,}3\ m \rightarrow F_T = 514{,}3 \neq 220\ N_p$

- E-1: $L = 121{,}5\ m \rightarrow F_T = 201{,}5\ N_p$

- Acciones longitudinales debidas a la deformación de la estructura

- NO SE HAN CONSIDERADO EN EL CÁLCULO -

Interacción tablero - vía: (RESUMEN)

	E-2	E-1
* F frenado + arranque:	630	248,36
* F rozamiento 15% (c_p tramo):	861,7	222,9
(c_p tramo $= L \times 41{,}855 \frac{t}{m}$)	(L: 436,3 - 0,4 = 436,3)	(L: 121,5 - 0,4 = 121,5)
* Interacción vía-tablero (L/100):	220	201,5
(Por efecto térmico)		

COMBINACIÓN DE ESFUERZOS: Máximo longitudinal (gr 13)

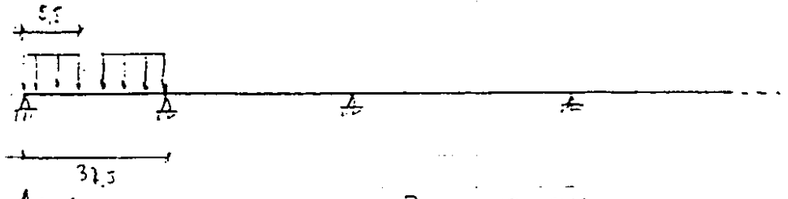
$$g_r = 1{,}10 \times [SC\ vert.\ (arran)] + 1{,}0 \times [frenado + arranque] + 0{,}5 \times [Sismo + Centrif.]$$

Combinación global de acciones:

$$1{,}0 \times [c_p] + 1{,}0 \times [g_r 13] + 0{,}6 \times F_W + 0{,}6\ F_T$$

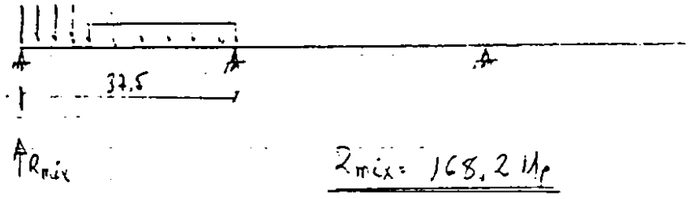
REACCIONES MÁXIMAS POR SC Vertical (SOBRE ESTRIBO)

* SU/2:



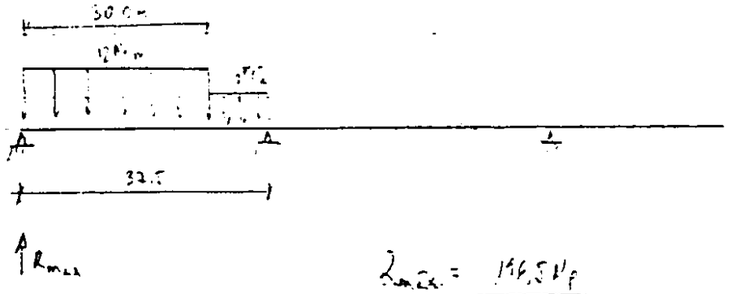
$R_{max} = 172,8\ M_p$

* LM UIC-71:



$R_{max} = 168,2\ M_p$

* IAPF-75:



$R_{max} = 146,5\ M_p$

Esfuerzos combinados (Según EC-1)

E-1

- $V = 1132,9\ M_p$ (791,9 sin sc vertical ferroviaria)
- $H_L = 1,0 \times 881,7 + 1,0 \times 630 + 0,6 \times 220 = 1643,7\ M_p$
- $H_T = 28,30\ M_p$
- $M_f = 834,7\ M_p\,m$
- $M_t = 0\ M_p\,m$

E-2

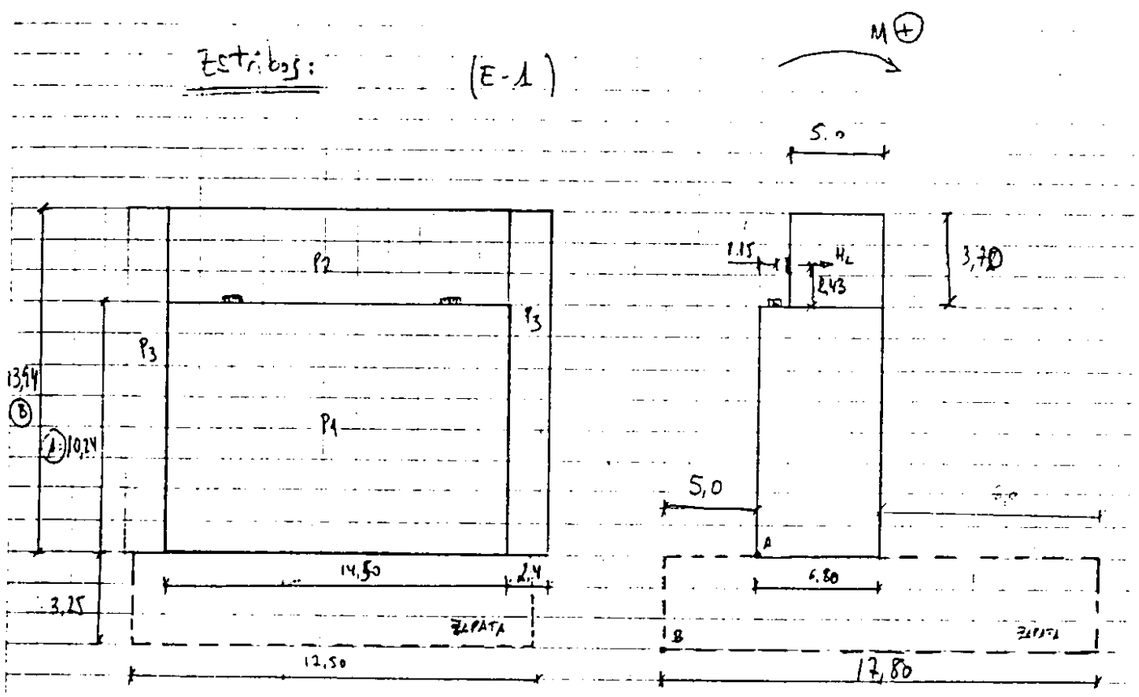
- $V = 1132,9\ M_p$
- $H_L = 1,0 \times 222,9 + 1,0 \times 248,36 + 0,6 \times 201,5 = 592,2\ M_p$
- $H_T = 28,30\ M_p$
- $M_f = 834,7\ M_p\,m$
- $M_t = 0\ M_p\,m$

2.3.1- Estribos de lanzamiento

VIADUCTO 1

ESTRIBO E-1

Estribos: (E-1)



P_1: $2,5 \times 6,80 \times 14,50 \times 10,24 = 2524,16$

$M^A_{P_1} = P_1 \times \frac{6,8}{2} = 8582,1$ Mpm ; $M^B_{P_1} = P_1 \times (\frac{6,8}{2} + 5,0) = 21202,9$ Mpm

P_2: $2,5 \times 5,0 \times 3,7 \times 14,5 = 674,3$ Mp

$M^A_{P_2} = 674,3 \times (1,8 + 2,5) = 2899,3$ Mpm

$M^B_{P_2} = 674,3 \times (1,8 + 2,5 + 5,0) = 6271$ Mpm

P_3: $2 \times (\frac{1}{2} \times 2,4 \times 18,94 \times 5,0) \times 2,5 = 418,2$ Mp

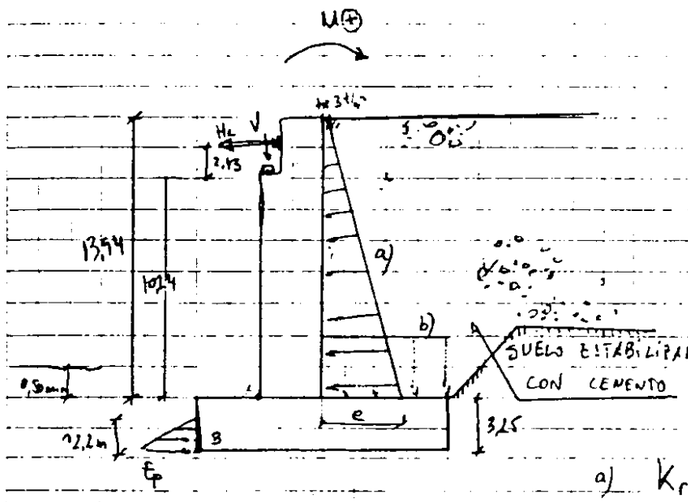
$M^A_{P_3} = 418,2 \times (1,8 + 2,5) = 1798,3$ Mpm

$M^B_{P_3} = M^A_{P_3} + 418,2 \times 5,0 = 3889,3$ Mpm

ZAPATA: $2,5 \times 17,5 \times 16,8 \times 3,25 = 2388,8$ Mp.

$M^B_{ZAP} = 2388,8 \times 17,8/2 = 21260,3$ Mpm

ZAPATILLAS: $2,5 \times 3,25 \times (5 + 2 \times \frac{1}{2}) \times 2 = 365,6$ Mp → $M^B_{ZAPATILLAS} = P \times 10 = 3650$ Mpm



Suelo estab. con cemento:

$\phi = 35°$

$\gamma = 2{,}0\ t/m^3$

a) $K_r = 1 - \operatorname{sen}\phi = 0{,}4264$

(E_p: se despreciará en el cálculo por resultar más desfavorable)

$e = (3 + 2{,}0 \times 13{,}94) K_r = 30{,}9 K_r = 13{,}17\ Mp/m^2$

$E_H = \left(3 \times 13{,}94 + \frac{1}{2} \times 2 \times 13{,}94^2\right) K_r \times 1{,}5 = \underline{1460{,}0\ Mp}$

$M^A_{E_H} = \left(3 \times \frac{13{,}94^2}{2} + \frac{1}{6} \times 2 \times 13{,}94^3\right) K_r \times 1{,}5 = 12791{,}6\ Mpm$

$M^B_{E_H} = M^A_{E_H} + E_H \times 3{,}25 = \underline{-17536{,}6\ Mpm}$

$E_V = (3 + 2{,}0 \times 13{,}94) \times 6 \times 1{,}75 = \underline{8242{,}45\ Mp}$

$M^B_{E_V} = E_V \times \left(4{,}8 + 5{,}0 + \frac{6{,}0}{2}\right) = \underline{47988{,}2\ Mpm}$

Acciones transmitidas por el pilón:

$V = 1132{,}9\ Mp$ (791,9 Mp sin SC)

$M^A_V = V \times (1{,}15) = 1302{,}8$ (910,7); $M^B_V = V \times (1{,}15 - 5{,}0) = 6961{,}8\ Mpm$ (4870,2)

$H_L = 1549{,}9\ Mp$

$M^A_{H_L} = H_L \times (2{,}43 + 10{,}24) = -19637{,}2$

$M^B_{H_L} = M^A_{H_L} + H_L \times 3{,}25 = \underline{-24674{,}4\ Mpm}$

Comprobación al deslizamiento:

$F = E_H + H_L = 3009{,}9\ Mp$

Acción estabilizadora

$V_{máx} = \Sigma P_i + V^{(*)}_{sinSC} + E_V = 10547{,}6\ Mp$

(*) Del lado de la seguridad; $tg\,\delta = 0{,}4 \Rightarrow \gamma = 1{,}40 > 1{,}35$ OK

Considerando que el ángulo entre el hormigón ciclópeo y la roca sea tal que $tg\,\delta = 0{,}5$, se tendrá

$\gamma = \frac{F_{ESTAB}}{F} = \frac{0{,}5 \times V_{máx}}{F} = 1{,}75$ OK

Contacto h. ciclópeo - terreno

Debe añadirse el peso del h. ciclópeo, que, del lado de la seguridad, será:

$2{,}4 \times 2{,}0 \times 21{,}5 \times 21{,}8 = 2250\ Mp$

$tg\,\delta = 0{,}4$ (Roca alterada)

$\gamma = \frac{2{,}4 \times (2250 + 10547{,}6)}{3009{,}9} = 1{,}70$ OK

— Comprobación al vuelco:

$$M^B_{ESTABILIZADOR} = \Sigma M^B_{P.} + M^B_{EV} + M^B_V =$$

$$M^B_{ESTAB} = 56273,5 + 47988,2 + 4870,2 = 109131,9 \text{ Mpm}$$

($V_{con\ sc} = 111273,5$ Mpm)

$$M^B_{VOLCADOR} = M_{HL} + M_{HE} = 24674,4 + 17536,6 = 42211 \text{ Mpm}$$

$$\gamma_{VOLCO} = \frac{M_{EST}}{M_{VOLC}} = 2,58 > 1,50 \quad \text{OK}$$

TENSIONES EN EL TERRENO

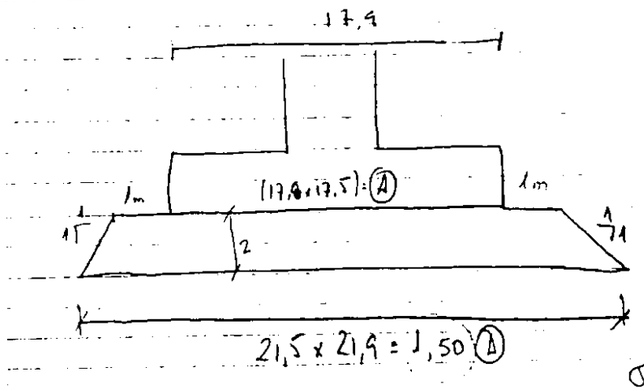
$N_{máximo} = 10547,6$ Mp

$M^B_{máx} = M_{ESTAB} - M_{VOLCADOR} = 109132,9 - 42211 = 66921,9$ Mpm

$$e = \frac{M}{N} = 6,34 \text{ m}$$

$3 \times e = 19,03 > 17,8$ m → No despega

$$\sigma_{max} = \left\{ \begin{matrix} \\ \sigma_{min} = \end{matrix} \right. \frac{1}{(17,8 \times 17,5)} N \pm \left[\frac{3N}{17,8 \times 17,5} - \frac{6 \times M^B}{17,8^2 \times 17,5} \right] = \begin{cases} 63,0 \text{ t/m}^2 \\ 0,5 \text{ t/m}^2 \end{cases}$$



$\sigma_{adm} = 5,0$ Kg/cm²

$\sigma_{adm\ punta} = 1,25 \times 5 = 6,25$ Kg/cm²

BAJO ZAPATA:

$\sigma_{adm\ sobre\ cimiento} = 5 \times 1,50 = 7,51$

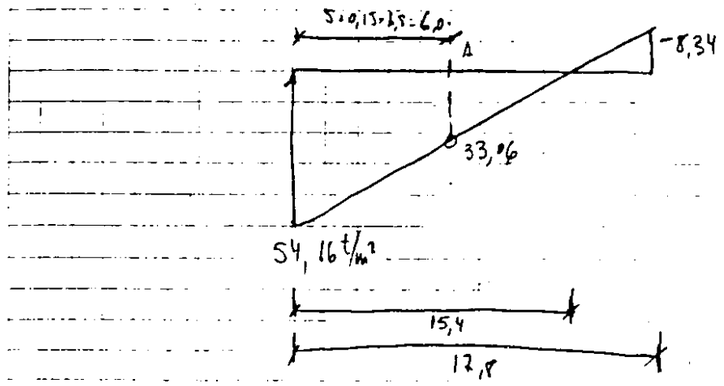
$\times 1,25$

$\sigma_{adm\ punta} = 9,39$ Kg/cm²

$6,46 < 9,39$ OK

$\sigma_{adm} = 4$ Kg/cm² ——— sobre cimiento

ARMADURA: $\sigma_{punta} = 63 - \frac{-[illegible] \times 36[illegible],6}{12,5 \times 17,5} = 54,16\ t/m^2$



$M^A = \frac{1}{3}(54,16 - 33,06) \times 6^2 + 33,06 \times \frac{6^2}{2} = 848,3\ M_p/m.$

$M_d^A = 1,5 M^A = 1272,4\ M_p/m$

$d = 31,5 cm \rightarrow A_s = 95,6\ cm^2/m \rightarrow$ (2 φ25 c 0,10)

Ponderación de hipótesis de cálculo

· EC-1: $H_{L,d} = 1,5 (787,93 + 0,6 \times 220) + 1,45 \times 630 = 2293,4\ M_p$

· IAPF-71/EH-91: $H_{L,d} = 1,5 \times 1329,8 = 1994,7\ M_p$

Resulta pésima la combinación de EC-1, por la cual se procederá al diseño de la estructura del estribo con los esfuerzos mayorados según EC-1.

Dimensionamiento pretensado de cabeza

El tablero se cose al estribo para absorber la fuerza horizontal $H_L = \pm 1549{,}9$ Mp

$$P_{ko} = \frac{1549{,}9}{4 \times 2} = 193{,}74 \text{ Mp/Tendón}$$

Se disponen 8 tendones de 14 Ø 0,6" ($R = 368$ t/tendón) tesados por un sólo extremo a $0{,}6R = 220{,}8$ t/tendón.

Dimensionado en rotura: $Fu = \frac{0{,}9 \times 368}{1{,}15} = 288$ t/tendón (EP-93)

Tsf. de cálculo: (Tc-1)

$$H_{L,d} = 1{,}50 \times (787{,}93) + 1{,}45 \times (630) + 1{,}5 \times (0{,}6 \times 770) = 2293{,}4 \text{ Mp}$$

$2293{,}4 / 8 = 286{,}67$ Mp/tendón $< Fu$ Ok

Apoyo de neopreno intermedio:

$$N = 4 \times 220{,}8 + \frac{1549{,}9}{2} = 883{,}2 + 775 = 1658{,}2 \text{ tn}$$

$$S \times 1500 = 1658 \rightarrow S = 1{,}106 \text{ m}^2 \rightarrow 0{,}8 \times 1{,}40$$

Se dispone en cada alma un apoyo de neopreno zunchado de $1400 \times 800 \times 50\ (35)$

$$\sigma_{min} = 886 - 775 = 111 \text{ tn} \rightarrow \frac{111}{1{,}106} = 10{,}04 \text{ Kp/cm}^2$$

Sobre-tensión para anclado a 227 tn (0,6 R): (L = 5,85 m)

$A_{cuña} = 6$ mm

$F_t = 0{,}708R = 260$ tn/tendón

Refuerzo de anclaje

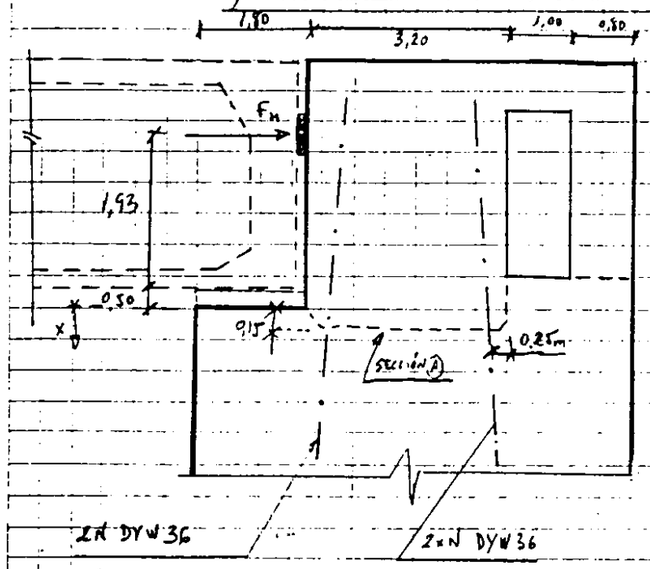
$$A_s = \frac{1}{4{,}43} \times 1{,}5 \times 260 \times 0{,}3 = 26{,}5 \text{ cm}^2 \xrightarrow{1/2} 13{,}2 \text{ cm}^2/\text{capa}$$

2 capas de 5 Ø/capa

Refuerzo del apoyo de neopreno

$$A_s = \frac{1}{4{,}43} \times \left(\frac{2293{,}4}{2} + 1{,}5 \times 883{,}2 \right) \times 0{,}3 = 167 \text{ cm}^2/\text{apoyo} \begin{cases} \times \frac{1}{(2 \times 14)} \rightarrow 59{,}80 \text{ cm}^2/\text{capa} \\ \times \frac{1}{(2 \times 8)} \rightarrow 104{,}6 \text{ cm}^2/\text{capa} \end{cases}$$

ARMADURA DEL MURO DE FRENTE



ARMADURA DEL MACIZO DE ANCLAJE (Sección A)

- Flexión - Ante la imposibilidad de dejar espera de armadura pasiva para el hormigonado de este macizo en 2ª fase, se utilizarán barras de pretensado que se conectan mediante acoplamientos roscados en la junta, de características:

DYW 36 :	A = 10,18 cm²	D = 36 mm
	R = 106,9 t_n	ϕ_v = 51 mm
	f_{yk} = 86,5 t_n	0,7R = 75 t_n (roto)

La fuerza horizontal total a absorber es: F_L = ±549,9 Mp

$$M_d = \{1,50 \times 787,93 + 1,45 \times (11,0 \times 630) + 1,5 \times (0,6 \times 220)\} \times \{1,93 + 0,5 + 0,15\}$$

$F_{L,d}$ × brazo

M_d = 2293,4 × 2,50 = ±5916,97 Mpm

(×1/2) → 2958,50 Mpm/alma

En el macizo de anclaje se dispondrá:

H-250 (El hormigón en el macizo de anclaje lo ejecuta DYW)
d = 3,00 − 0,25 = 2,75m
b ≃ 4,00m / alma

$$\begin{cases} C = 0,85x \cdot \frac{2500}{1,5} \times 4,00 = 5666,7x \\ T = \frac{86,5}{1,15} \times N \end{cases}$$

En rotura: $M_u = C_z = 5666,7x\left(3,0 - 0,25 - \frac{x}{2}\right) = 15583,4x - 2833,4x^2$

$M_u = M_d = 2958,50$ Mp·m/alma → x = 0,1969m

C = 1115,77 Mp

T = C ⇒ 1115,77 = $\frac{86,5}{1,15}$ N → N = 14,63 ; N = 15 barras (DYW36 por alma)

s = $\frac{4}{14}$ = 0,285m ≈ 0,25m

- CORTANTE -

$Q_d = H_{L,d} \times \frac{1}{2} = 2293,4/2 = 1146,7$ t/alma

$Q_d = 1146,7/4 = 286,7$ t/m

$V_{cu} = 5\sqrt{166,7} \times 1 \times 2,75 = 177,5$ t/m

$A_s = \frac{1}{4,2} \cdot \frac{286,7 - 177,5}{0,9 \cdot 2,75} = 10,33$ cm²/m/m → 2 r Φ12 a 0,20 m

$A_{s\,min} = \frac{1}{4,20} \; 0,02 \times 1667 \times 1 = 7,93$ cm²/m

Tensiones:

A nivel global de la estructura (Aumentamos una fila central de 15 barras DYW-36):

Pretensado: $P_{ki} = 3\ filas \times 15 \times 75\ (0,7R) = 3.375\ Mp$

$b \times h = 4,00 \times 3,00 = 12\ m^2$, $I = \frac{1}{12} 4 \cdot 3^3 = 9,00\ m^4$

$$\sigma_{pi} = \frac{P_{ki}}{bh} = \frac{3375}{12} = 281\ Mp/m^2$$

$M_{EXTERIOR}$: $M = 1549,9 \times 2,58m = 3998,75\ Mpm / 2 \simeq 2000\ Mpm/alma$

$$\sigma_s = + \frac{2000 \times 1,5}{9} = +333,3\ Mp/m^2$$
$$\sigma_i = -$$

$\sigma_s = 614,33\ Mp/m^2$, $\sigma_i = -52,33\ Mp/m^2$

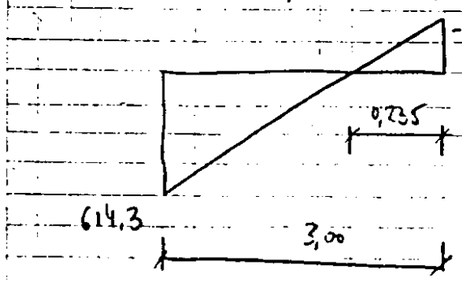
A nivel local:

$M = 2000 = C_z = 15583,4x - 2833,4x^2 \rightarrow x = 0,1315m \rightarrow C = T = 5660,7x = 745\ Mp$

Cada barra de la fila traccionada absorberá:

$T/15 \simeq 50\ t/barra < 75\ tn\ (0,7R)$

Armadura pasiva de fisuración:



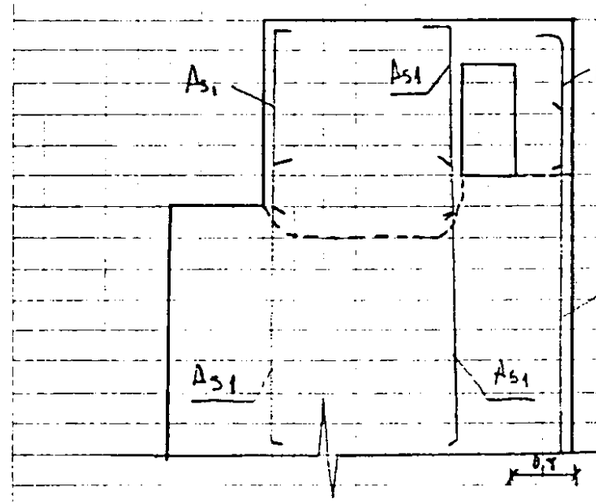
$$A_s = \frac{1}{2,0}\left(\frac{1}{2} \times 523 \times 0,235 \times 1,0\right) = 3,1\ cm^2/m$$

$\phi 10\ a\ 0,20$

Resto del macizo

Fuera de esta zona de barras DYW36 ($2 \times 4,00 = 8,00m$), se dejan esperas de armadura pasiva.

Suponiendo que toda la anchura del macizo contribuye a resistir la fuerza horizontal, tenemos:



As1

$M_d = \pm 2958,5\ Mpm/alma$

$d = 3,00 - 0,06 = 2,94m$

$b = 6,50m$

$$A_{s_1} = \frac{1}{4,43}\left[0,85\, f_{cd}\, b\, d\left(1 - \sqrt{1 - \frac{2 \times M_d}{0,85\, f_{cd}\, b d^2}}\right)\right]$$

$A_{s_1} = 35,6\ cm^2/m \rightarrow \phi 25\ a\ 12,5$

As2

$M_d = 2958,5 \frac{0,8}{3,8} = 622,8\ Mpm/alma$

$d = 0,8 - 0,05 = 0,75m$

$b = 6,5m$

$$A_{s_2} = \frac{1}{4,43}\left[0,85\, f_{cd}\, b\, d\left(1 - \sqrt{1 - \frac{2\, M_d}{0,85\, f_{cd}\, b d^2}}\right)\right] = 30,8\ cm^2/m$$

$\phi 25\ a\ 0,10$

$\phi 25\ a\ 0,15$

Refuerzo de anclajes:

- BARRAS: $\frac{1}{4,43}\ 1,35 \cdot 75 \times 0,3 = 6,86\ t/anclaje \xrightarrow{1/0,15} 27,4\ cm^2/m \xrightarrow{1/2} 13,70\ cm^2/alma$ (2 Capas)

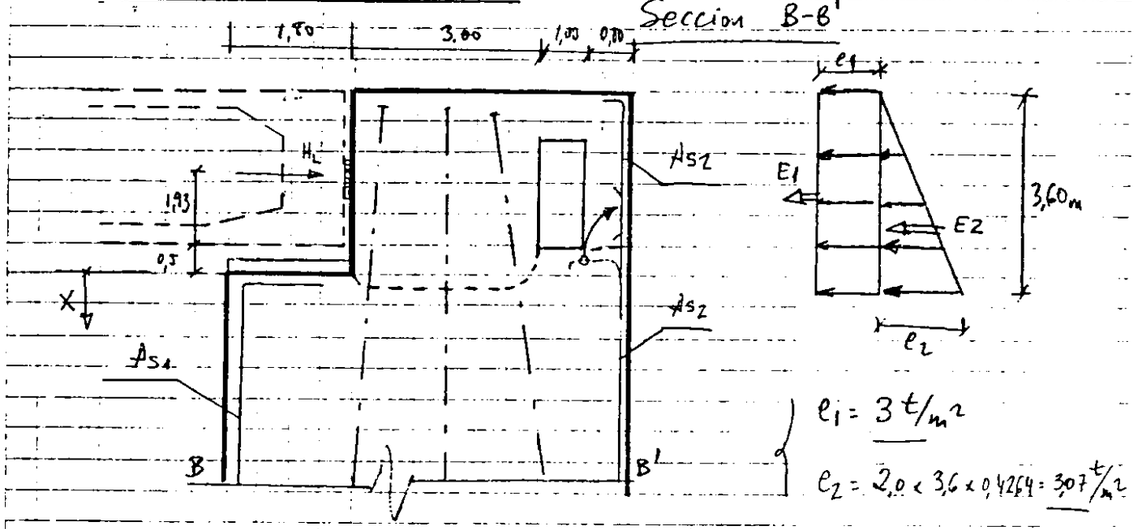
- TENDONES: $A_s = \frac{1}{4,43} \cdot 1,5 \times 265 \times 0,2 = 26,92 \text{ cm}^2/\text{anclaje}$ $\xrightarrow{\times 1/2}$ $13,5 \text{ cm}^2/\text{capa}$ (2 capas $5\phi 20$)

- APOYO: $A_s = \frac{1}{4,43} \times 1,5 \times 1683 \times 0,25 = 142,5 \text{ cm}^2/\text{apoyo}$

$\rightarrow 71,25 \text{ cm}^2/\text{capa}$ (2 capas) $\begin{cases} 1/2 = 35,6 \text{ cm}^2/\text{m} \\ 1/2,4 = 29,7 \text{ cm}^2/\text{m} \end{cases}$

ARMADURA DEL MURO:

Seccion B-B'



$e_1 = 3 \text{ t/m}^2$

$e_2 = 2,0 \times 3,6 \times 0,4264 = 3,07 \text{ t/m}^2$

A_{S1} $M_d = 2293,4 \times 2,58 = 5916,97 \text{ mt/m}$ $\xrightarrow{1/13 (*)}$ $455,15 \text{ mt/m}$

$(x=0)$

$d = 6,55 \text{ m}$

$A_{S1} = 15,73 \text{ cm}^2/\text{m}$ $\phi 20 \text{ a } 0,20$

(*) Suponemos que toda la H_L se reparte a lo largo de toda la anchura del muro. ($b = 2 \times 6,5 = 13 \text{m}$)

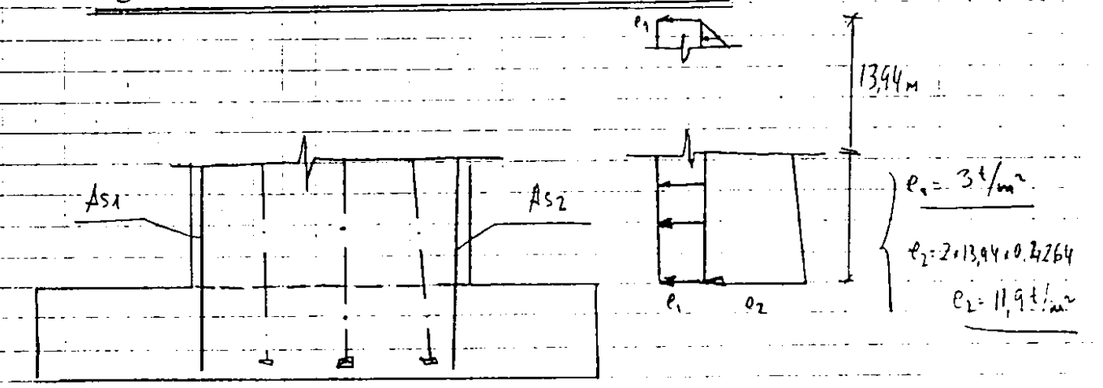
A_{S2} $E_1 = 3 \times 3,6 \cdot K_r = 4,60 \text{ t/m}^2$; $h_1 = 1,80 \text{ m}$

$E_2 = \frac{1}{2} \times 3,6 \times 3,07 \times K_r = 2,36 \text{ t/m}^2$; $h_2 = 1,20 \text{ m}$

$M_d = -455,15 - 1,35 \times (4,60 \times 1,8 + 2,36 \times 1,2) = -470,0 \text{ mt/m}$

$A_{S2} = 16,20 \text{ cm}^2/\text{m}$ $\phi 20 \text{ a } 0,15$

SECCIÓN DE EMPOTRAMIENTO CON ENCEPADO



A_{S1} $N_d = 2293,4 \times (2,43 + 10,24) = 29057,4 \text{ mt}$ $\xrightarrow{1/13}$ $2235,2 \text{ mt/m}$

N_d: $1 \times (25 \times 66 \times 0,14 + 2,5 \times 3,7 \times 3,0)$ (PP) $+ (1,0 \times 2 \times 3 \times 15 \times 75)/13$ (Pre) $= 715,94 \text{ t/m}$

$\nu_d = \frac{715,94}{1667 \times 6,6 \times 1} = 0,065$

$\mu_d = \frac{2235,2}{1667 \times 6,6^2 \times 1} = 0,031$

$\rightarrow \omega = 0,015 \Rightarrow A_{S1} = 23,8 \text{ cm}^2/\text{m}$

A_{S2} $E_1 = 3 \times 13,94 = 41,82 \text{ t/m}$ a $6,97 \text{ m}$

$T_2 = \frac{1}{2} \cdot 11,9 \times 13,94 = 82,94 \text{ t/m}$ a $4,64 \text{ m}$

- $N_d = -2235,2 - 1,35 (41,82 \times 6,97 + 82,94 \times 4,64) = 3148,2 \text{ Mr/m}$
- $N_d = 715,94 \text{ t/m}$

$\nu_d = 0,065$

$\mu_d = 0,044$

$\omega = 0,03 \Rightarrow A_{S2} = 47,6 \text{ cm}^2/\text{m}$

VIADUCTO 2

ESTRIBO E-2

Empuje Vertical: $E_V = (3 + 2,0 \times 10,613) \cdot 6 \cdot 14,5 = \underline{2109,4\ Mp}$

$M^B_{E_V} = E_V \cdot \left(6,5 \times 2,5 + \frac{6,0}{3}\right) = \underline{24680,0\ Mpm}$

Acciones transmitidas en la apoyo

$V = 791,9$ (Sin Sc terreno, restiante)

$M^B_V = V \cdot (1,15 + 2,5) = \underline{3207,2\ Mpm}$

$H_L = 1643,7\ Mp$

$M^B_{H_L} = 1643,7 \times (2,43 + 6,923 + 3,25) = \underline{-20715,60\ Mpm}$

COMPROB. AL DESLIZAMIENTO

$F = E_H + H_L = 2538,5\ Mp$

$F_{ESTAB} = \underbrace{0,538}_{\delta^*} \times (5336,3 + 2109,4 + 791,9) = 4431,80\ Mp$

ΣP_i — E_V — $V_{sin\,Sc}$

(δ^* por efecto de la cara)

$\gamma_\delta = \frac{F_{ESTAB}}{F} = 1,74$ ok

COMPROB. AL VUELCO:

$M^B_{ESTAB} = \sum M^B_{P_i} + M^B_{E_V} + M^B_V = 39580,8 + 24680,0 = \underline{64260,8\ Mpm}$

$M^B_{VUELCO} = M_{E_H} + M_{H_L} = 6425,3 + 20715,6 = \underline{27140,9\ Mpm}$

$\gamma_f = \frac{M_{EST}}{M_{VOLC}} = 2,37$ ok

Tensiones en el terreno

Esfuerzos en cara superior de zapata (H_L en sentido de E_H)

$V = 2738,4 + 2109,4 + 1132,9 = \underline{5980,7\ Mp}$

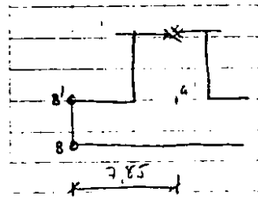
$(\sum P_i) \quad (E_V) \quad (V_{con\,Sc})$

$H_L = H_x = \underline{1643,7\ Mp}$

$H_T = \underline{28,30\ Mp}$ (=y)

$M_T = M_x = 834,7 + H_T \times 6,923 = \underline{1030,6\ Mpm}$

$M_L = M_y = M^B = M^{B'} \left(P_1 + P_2 + P_3 + E_V + V_{con\,Sc} + H_L - E_H\right) + H_L \cdot 3,25 + 3,25 \cdot E_H$



$M^{B'} = \left(\underbrace{18.181,3}_{P_1+P_2+P_3} + \underbrace{24680}_{E_V} + \underbrace{4584,6}_{V_{con\,Sc}} - 20715,6 - 6425,3\right) +$

$+ 1643,7 \times 3,25 + 3,25 \cdot 894,8 = \underline{28555,10\ Mpm}$

$M_L = M_y = M^{B'} - V \times 7,85 = \underline{-18393,1\ Mpm}$

Admitamos un terreno $\sigma_{adm} = 7,0\ kg/cm^2$ en el suelo

$\sigma_{máx} = 7,50\ kg/cm^2 < 8,75$ ok

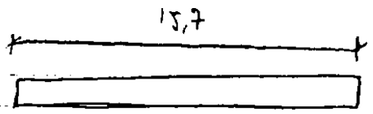
$\sigma_{cab} = 5,63\ kg/cm^2$

ok

TENSIONES EN EL TERRENO

$N_{máxima} = 8577,6$ Mp.

$M_{máx\ en\ esquina\ de\ zapata} = M^B = M_{EST} = M_{VOL} = 37120$ Mpm



$e = \frac{M}{N} = 4,32 \rightarrow 3e \simeq 13,0m < 15,7$ despega

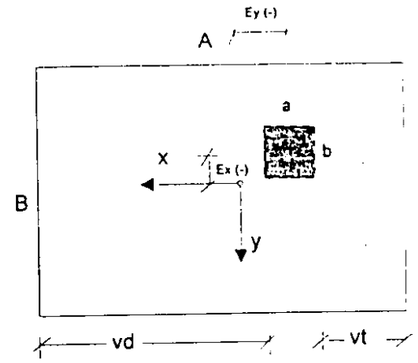
$N = \frac{1}{2} 3e \times \sigma_{máx} \times 17,5 \rightarrow$ $\sigma_{min} = 7,54$ kg/cm²

ZAPATA DE ESTRIBO E-2

ESFUERZOS EN CIMENTACIÓN

N° =	5980.700 t
H x =	1643.700 t
H y =	28.300 t
My** =	18393.4 mt
Mx **=	-1030.600 mt

* compresion (+) ** antihorarios (+)



DIMENSIONES DE LA ZAPATA				
A =	15.700 m			
B =	17.500 m			
canto =	3.250 m			
a =	6.800 m			
b =	14.500 m			
Ey =	1.550 m	Vd	Vt	
Ex =	0.000 m	2.9	6	longitud.
m³ hormigón= 892.9375		1.5	1.5	transversal

PESO DE TIERRAS	
Espesor de tierras =	0.000 m
W tierras =	0.00 t

PESO DE LA ZAPATA	
W zapata =	2232.34 t

ESFUERZOS DE CÁLCULO	En el centro de gravedad
V = 8213.04 t	
Hx = 1643.70 t	
Hy = 28.30 t	
My = 33005.51 mt	——>ex = 4.019 m
Mx = -1122.58 mt	——>ey = -0.137 m

COMPROBACIÓN DE TENSIONES		
σ,adm = 7.00 kg/cm2		
σ,media = 2.99 kg/cm2	<7	OK.
σ,cobar. = 5.63 kg/cm2	<7	OK.
σ,max. = 7.26 kg/cm2	<8.75	OK.
σ,min. = -1.29 kg/cm2	<0:redistrib.->	

tensión en esquinas				caso
6.95 kg/cm2	-0.97 kg/cm2	-1.29 kg/cm2	7.26 kg/cm2	IIIb

redistribución (caso II)
Aplicando la teoría de M.Hahn

ey/A= -0.009 **yb=** 2.73 m
ex/B= 0.230 **xa2=** 15.70 m
λ= 2.500

σ_{max}= 7.47 kg/cm2 (Máxima en punta)

COMPROBACIÓN A CORTANTE

fck [kp/cm²] = 250

Cara paralela al lado a	Cara paralela al lado b
Area = 31.343 m2	Area = 55.125 m2
Vd = 540.12 t/m	Vd = 135.03 t/m
Vcu = 4046.30 t/m	Vcu = 7116.61 t/m
Vu = 15671.25 t/m --> ok	Vu = 27562.50 t/m --> ok
Vs = innecesaria	Vs = innecesaria
As,v = 7.94 cm2/m	As,v = 7.94 cm2/m
mínima	mínima

COMPROBACIÓN A PUNZONAMIENTO

Superficie de referencia: 553.195 m2

Vp= 4741.36 t/m²

Vpu = 71417.18 t/m² --> ok

CALCULO DE ARMADURA A FLEXIÓN

Armadura paralela al lado a		Armadura paralela al lado b	
v = 3.920 m		v = 3.675 m	
s = 0.00 kg/cm2		s = diagrama 2	
t = 0.01 kg/cm2	distrib. uniforme	t = diagrama 2	
a= diagrama 1	t. cobaricént.	a= 14.19 kg/cm2	
M= 0.71 mt/m	432.28 mt/m	M = 0.57 mt/m	
Md = 1.13 mt/m	691.64 mt/m	Md = 0.91 mt/m	
Uc = 5250.00 t/m		Uc = 5250.00 t/m	
Us = 225.25 t/m		Us = 0.29 t/m	
As = 50.85 cm2/m		**As = 47.35 cm2/m**	
		MÍNIMA	

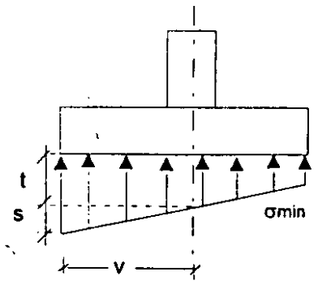


DIAGRAMA 1

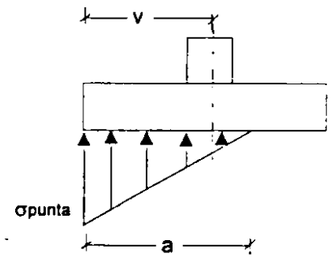


DIAGRAMA 2

Ponderación de las acc de cálculo

EC-1 $H_{L,d} = 1,5 \times (881,7 - 0,6 \times 220) + 1,15 \times 620 = 2434,1$ Mp

IAPF-71/EH-91 $H_{L,d} = 1,5 \times (597,88 + 881,7) = 2219,4$ Mp

Resulta pésima la combinación en ELU propuesta por EC-1, al igual que ya sucedía para ELS.

Por tanto, se tomarían los esfuerzos mayorados según EC-1 para proceder al cálculo de la estructura del estribo

Dimensionamiento del pretensado de cosido

El tablero se coserá al estribo para absorber la fuerza horizontal

$H_L = \pm 1643{,}7\ M_p$

$$P_{k_0} = \frac{1643{,}7}{4 \times 2} = 205{,}46\ M_p\ /\ \text{tendón}$$

Se disponen 8 tendones de $15\phi 0{,}6''$ ($R = 368\ t/\text{tendón}$) tesados por un solo extremo a $0{,}6R = 220{,}8\ t/\text{tendón}$

DIMENSIONAMIENTO EN ROTURA:

$$F_u = \frac{0{,}9 \times 368}{1{,}15} = 288\ t/\text{tendón} \quad (EP\text{-}93)$$

Esfuerzo de cálculo (Mayorado por EC-1):

$$H_{L,d} = 1{,}5\,(881{,}7 + 0{,}6 \times 220) + 1{,}45 \times 650 = 2434{,}1\ M_p \xrightarrow{1/8} 304{,}3\ M_p > F_u$$

1º tanteo

Se dispondrían entonces 8 tendones de $15\phi 0{,}6''$ ($R = 394\ t/\text{tendón}$) tesados a $0{,}6R = 236{,}4\ t/\text{tendón}$

DIMENSIONAMIENTO EN ROTURA: $F_u = \frac{0{,}9 \times 394}{1{,}15} = 308{,}3\ M_p$

$H_{L,d}/8 = 304{,}3\ M_p < F_u$ OK

Conclusión: Se disponen 8 tendones de $15\phi 0{,}6''$ ($R = 394\ t/\text{tendón}$), tesados a $0{,}6\,R$

Apoyo de neopreno intermedio

$$N = 4 \times 236{,}4 + \frac{1643{,}7}{2} = 945{,}6 + 821{,}9 = 1767{,}5\ M_p/\text{apoyo}$$

$$S_{nec} = \frac{1667{,}5}{1500} = 1{,}17\ m^2 \rightarrow \boxed{\text{Apoyo: } 0{,}8 \times 1{,}50}\ (S = 1{,}20\ m^2)$$

Se dispondrá en cada alma un apoyo de neopreno zunchado de

$1500 \times 800 \times 50\ (35)$

$\sigma_{min} = 945 - 821{,}9 = 123{,}7\ M_p \rightarrow \frac{123{,}7}{1{,}20} = 10{,}30\ Kp/cm^2$

Sobretensión para anclaje a 236,4 tn (0,6R): (L = 5,85 m)

A cuña = 6 mm

$F_t = 0{,}708R = 278{,}95\ tn\ /\ \text{tendón}$

Refuerzo de anclajes

$$A_s = \frac{1}{4{,}43} \times 150 \times 278{,}95 \times 0{,}3 = 28{,}3\ cm^2 \xrightarrow{1/2} 14{,}1\ cm^2/\text{capa}$$

2 capas

2 capas de $5\phi 20$/capa

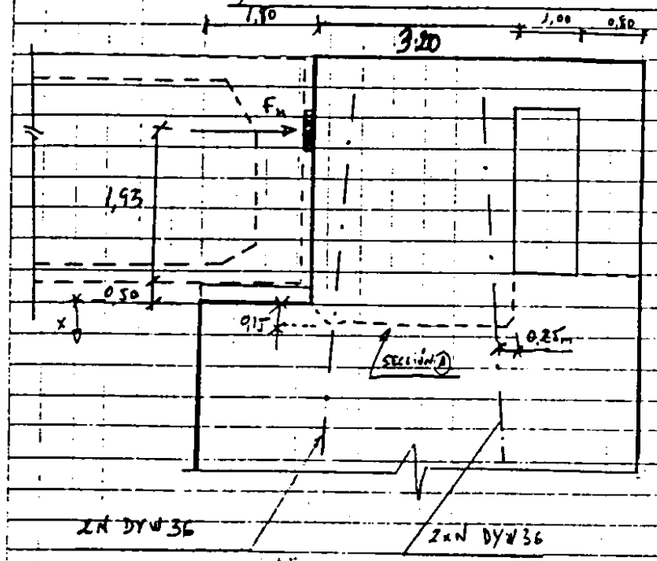
REFUERZO DEL APOYO DE NEOPRENO

$$A_s = \frac{1}{4{,}43} \times \left(1{,}5 \times 945 + \frac{2434{,}1}{2}\right) \times 0{,}3 = 174{,}8\ cm^2$$

$\frac{1}{\pi(2 \times 1{,}5)} \rightarrow 58{,}3\ cm^2/\text{capa}$ (2 capas)

$\frac{1}{12 \times 0{,}8^2} \rightarrow 109{,}3\ cm^2/\text{capa}$

ARMADURA DEL MURO DE FRENTE



ARMADURA DEL MACIZO DE ANCLAJE (Sección A)

- Flexión - Ante la imposibilidad de dejar espera de armadura pasiva para el hormigonado de este macizo en 2ª fase, se utilizarán barras de pretensado que se conectan mediante acoplamientos roscados en la junta, de características:

DYW36:	A: 10,18 cm²	D = 36 mm
	R: 106,9 t	ϕ_v = 51 mm
	f_{yk} = 86,5 t	0,7 R = 75 t (Tesado)

La fuerza horizontal total a absorber es: F_L = 1643,7 Mp

$$M_d = \{1,50 \times 881,7 + 1,45 \times (1,0 \times 630) + 1,5 \times (0,6 \times 220)\} \times \{1,93 + 0,5 + 0,15\}$$

($F_{L,d}$ · brazo)

M_d = 2434,1 × 2,58 = ± 6280,0 Mp m

(× 1/2) → 3140,0 Mp m/alma

En el macizo de anclaje se dispondrá:

H-250 (El hormigón en que se anclan las barras DYW)

d = 3,20 − 0,25 = 2,95 m

b ≈ 4,00 m / alma

$$C = 0,85 X \cdot \frac{250}{1,5} \times 4,00 = 5666,7 X$$

$$T = \frac{86,5}{1,15} \times N$$

En rotura: $M_u = C_z = 5666,7 X \left(3,2 - 0,25 - \frac{X}{2}\right) = 16716,8 X - 2833,4 X^2$

$M_u = M_d$ = 3140,0 Mp m/alma → X = 0,1942 m

C = 1100,5 Mp

T = C ⇒ 1100,5 = $\frac{86,5}{1,15} N$ → N = 14,63 ; N = 15 barras (DYW36 por alma)

$S = \frac{4}{14} = 0,285$ m ok

- CORTANTE -

$Q_d = A_{L,d} \times \frac{1}{2} = 2434,1 / 2 = 1217,1$ t/alma

$Q_d = 1217,1 / 4 = 304,26$ t/m

$V_{cu} = 5 \sqrt{166,7} \cdot 1 \cdot 2,95 = 190,44$ t/m

$A_s = \frac{1}{4,2} \cdot \frac{304,26 - 190,44}{0,9 \times 2,95} = 10,21$ cm²/a/m → 2r Φ12 a c/20 m

$A_{s\,min} = \frac{1}{4,20} 0,02 \cdot 166,7 \cdot 1 = 7,93$ cm²/a/m

Tensiones =

A nivel global de la estructura (Aumentamos una fila central de 15 barras DYW36)

Pretensado: $P_{ki} = 3 \text{ filas} \times 15 \times 75\,(0{,}7R) = 3.375 \text{ Mp}$

$b \times h = 4{,}00 \times 3{,}2 = 12{,}8 \text{ m}^2$; $I = \frac{1}{12} 4 \times 3{,}2^3 = 10{,}92 \text{ m}^4$

$$\sigma_{pi} = \frac{P_{ki}}{bh} = \frac{3375}{12{,}8} = 263{,}7 \text{ Mp/m}^2$$

Nexterior: $M = 1643{,}7 \times 2{,}58 \text{m} = 4240{,}8 \text{ Mpm}/2 = 2120{,}4 \text{ Mpm/alma}$

$$\sigma_s = \frac{+2120{,}4 \times 1{,}6}{10{,}92} = \pm 310{,}7 \text{ Mp/m}^2$$

$$\sigma_i = -$$

$\sigma_s = 574{,}40 \text{ Mp/m}^2$, $\sigma_i = -47{,}0 \text{ Mp/m}^2$

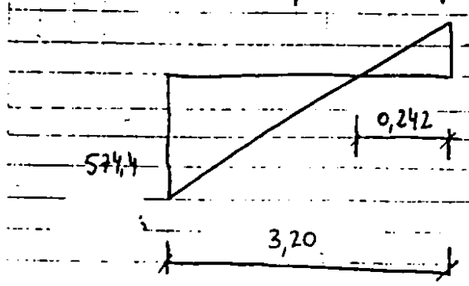
A nivel local:

$M = 2120{,}4 = C \cdot z = 16716{,}8 - 2833{,}4 x^2 \rightarrow x = 0{,}1297 \text{m} \rightarrow C = T = 5663{,}7 x \simeq 735 \text{ Mp}$

Cada barra de la fila tracionada absorberá:

$T/15 \simeq 50 \text{ t/barra} < 75 \text{ tn } (0{,}7R)$

Armadura pasiva de fisuración:



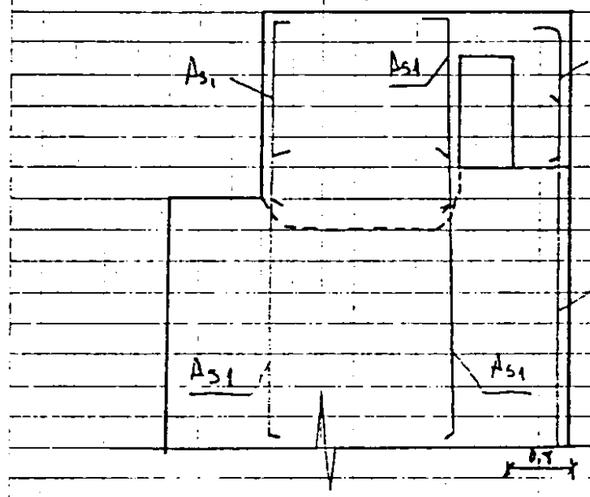
$$A_s = \frac{1}{2{,}0}\left(\frac{1}{2} \times 47{,}0 \times 0{,}242 \times 1{,}0\right) = 2{,}85 \text{ cm}^2/\text{m}$$

Ø10 a 0,20

Resto del macizo

Fuera de esta zona de barras DYW36 ($2 \times 4{,}00 = 8{,}00$m), se dejan esperas de armadura pasiva.

Suponiendo que toda la anchura del macizo contribuye a resistir la fuerza horizontal, tenemos:



As1

$M_d = \pm 3140{,}0 \text{ Mpm/alma}$

$d = 3{,}20 - 0{,}06 = 3{,}14$m

$b = 6{,}80$m

$$A_{s_1} = \frac{1}{4{,}43}\left[0{,}85 f_{cd} b d \left(1 - \sqrt{1 - \frac{2 M_d}{0{,}85 f_{cd} b d^2}}\right)\right]$$

$A_{s_1} = 33{,}7 \text{ cm}^2/\text{m} \rightarrow$ Ø25 a 12,5

As2

$M_d = 3140 \times \frac{0{,}8}{4{,}0} = 628{,}0 \text{ Mpm/alma}$

$d = 0{,}8 - 0{,}05 = 0{,}75$m

$b = 6{,}8$m

$$A_{s_2} = \frac{1}{4{,}43}\left[0{,}85 f_{cd} b d \left(1 - \sqrt{1 - \frac{2 M_d}{0{,}85 f_{cd} b d^2}}\right)\right] = 29{,}60 \text{ cm}^2/\text{m}$$

Ø20 a 0,10

Ø25 a 0,15

Refuerzo de anclaje:

- BARRAS: $\frac{1}{4{,}43} 7{,}35 \times 75 \times 0{,}3 = 6{,}86 \text{ cm}^2/\text{anclaje} \xrightarrow{1/0{,}15} 27{,}4 \text{ cm}^2/\text{m} \xrightarrow{1/2} 13{,}7 \text{ cm}^2/\text{cara}$ (2 Capas)

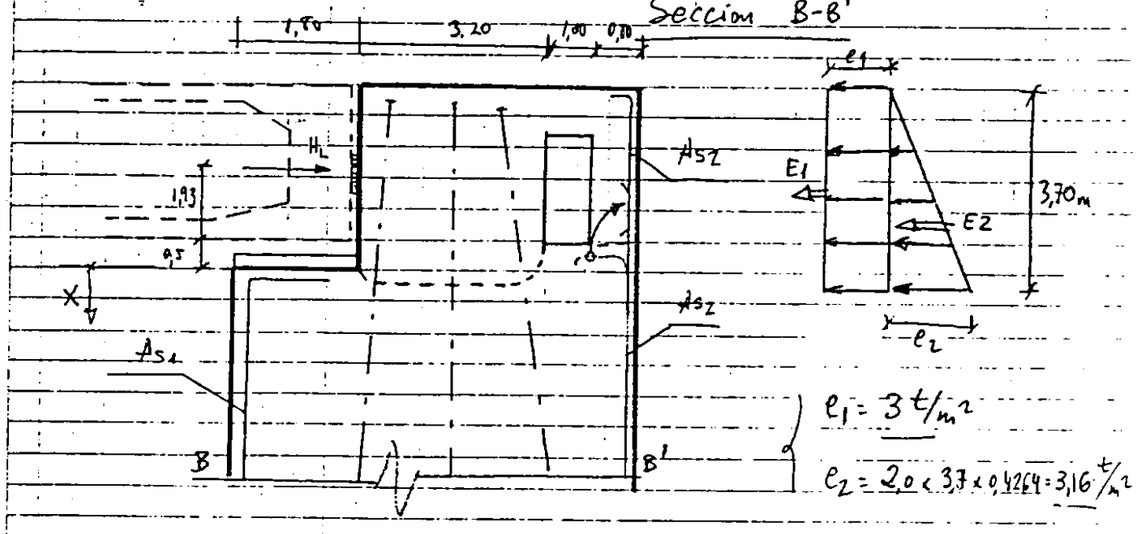
- TENDIDOS: $A_s \simeq \frac{1}{4,93} \cdot 1,5 \times 265 \times 0,3 = 26,92 \text{ cm}^2/\text{anclaje} \xrightarrow{\times 1/2} 13,5 \text{ cm}^2/\text{capa}$ (2 capas 5 Ø20)

- APOYO: $A_s \simeq \frac{1}{4,93} \times 1,5 \times 1794 \times 0,25 = 151,9 \text{ cm}^2/\text{apoyo}$

$\rightarrow 75,9 \text{ cm}^2/\text{capa}$ (2 capas) { 1/2: 38,0 cm²/m ; 1/1,4: 31,70 cm²/m }

ARMADURA DEL MURO:

Seccion B-B'



$e_1 = 3 \text{ t/m}^2$

$e_2 = 2,0 < 3,7 \times 0,4264 = 3,16 \text{ t/m}^2$

(A_{S1}) $M_d = 2434,10 \times 2,58 = 6280 \text{ Nm} \xrightarrow{1/13,6 (*)} 461,76 \text{ mt/m}$ (x=0)

d = 6,75m

$A_{S1} = 15,50 \text{ cm}^2/\text{m}$ (Ø20 < 0,20)

(*) Suponemos que toda la H_L se reparte a lo largo de toda la anchura del muro. (b = 2×6,8 = 13,6m)

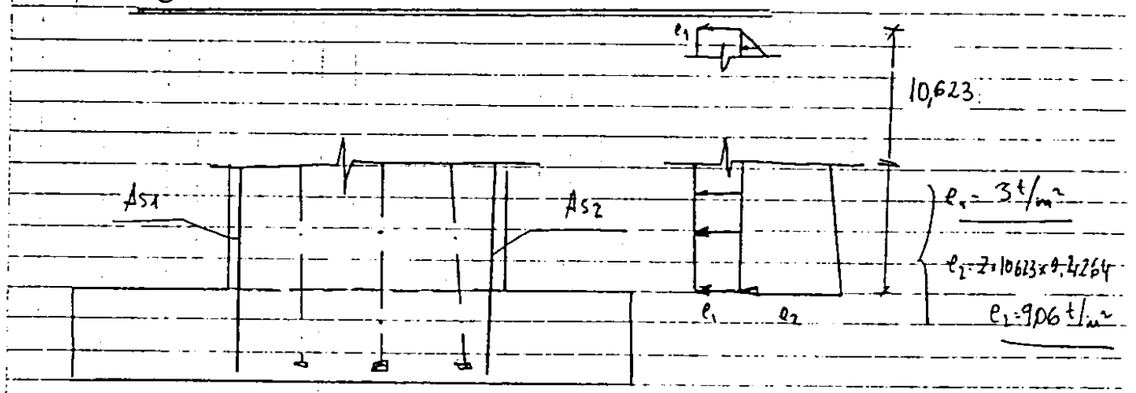
(A_{S2}) $E_1 = 3 \times 3,7 = 11,10 \text{ t/m}$; $h_1 = 1,85 \text{ m}$

$E_2 = \frac{1}{2} \times 3,7 \times 3,16 = 5,85 \text{ t/m}$; $h_2 = 1,23 \text{ m}$

$N_d = -461,76 - 1,35 \times (11,1 \times 1,85 + 5,85 \times 1,23) = 499,20 \text{ mt/m}$

$A_{S2} = 16,74 \text{ cm}^2/\text{m}$

SECCIÓN DE EMPOTRAMIENTO CON ENCEPADO



(A_{S1}) $N_d = 2434,1 \cdot (2,43 + 6,923) = 22766,13 \text{ mt} \xrightarrow{1/13,6} 1674,0 \text{ mt/m}$

$N_d = 1,35 (2,5 \times 6,8 \times 6,923 + 2,5 \times 3,7 \times 3,20) + (1,0 \times 2 \times 3 \times 15 + 75)/13,6 = 507,15 \text{ t/m}$

PP — Pre

$\nu_d = \frac{507,15}{1667 \times 6,8 \times 1} = 0,045$

$\mu_d = \frac{1674,0}{1667 \times 6,8^2 \times 1} = 0,022$

$\rightarrow \omega = 0,01 \Rightarrow A_{S1} = 17,5 \text{ cm}^2/\text{m}$ > MÍNIMA

(A_{S2}) $E_1 = 3 \times 10,623 = 31,87 \text{ t/m}$ c 5,31

$E_2 = \frac{1}{2} 9,06 \times 10,623 = 48,12 \text{ t/m}$ c 3,54 m

$N_d = -2434,1 - 1,35 (31,87 \times 5,31 + 48,12 \times 3,54) = 1975,7 \text{ Mpm}$

$\nu_d = 0,045$

$\mu_d = 0,026$

$\omega = 0,02 \Rightarrow A_{S2} = 34,8 \text{ cm}^2/\text{m}$ ($A_{S2} > A_{S\,min}$)

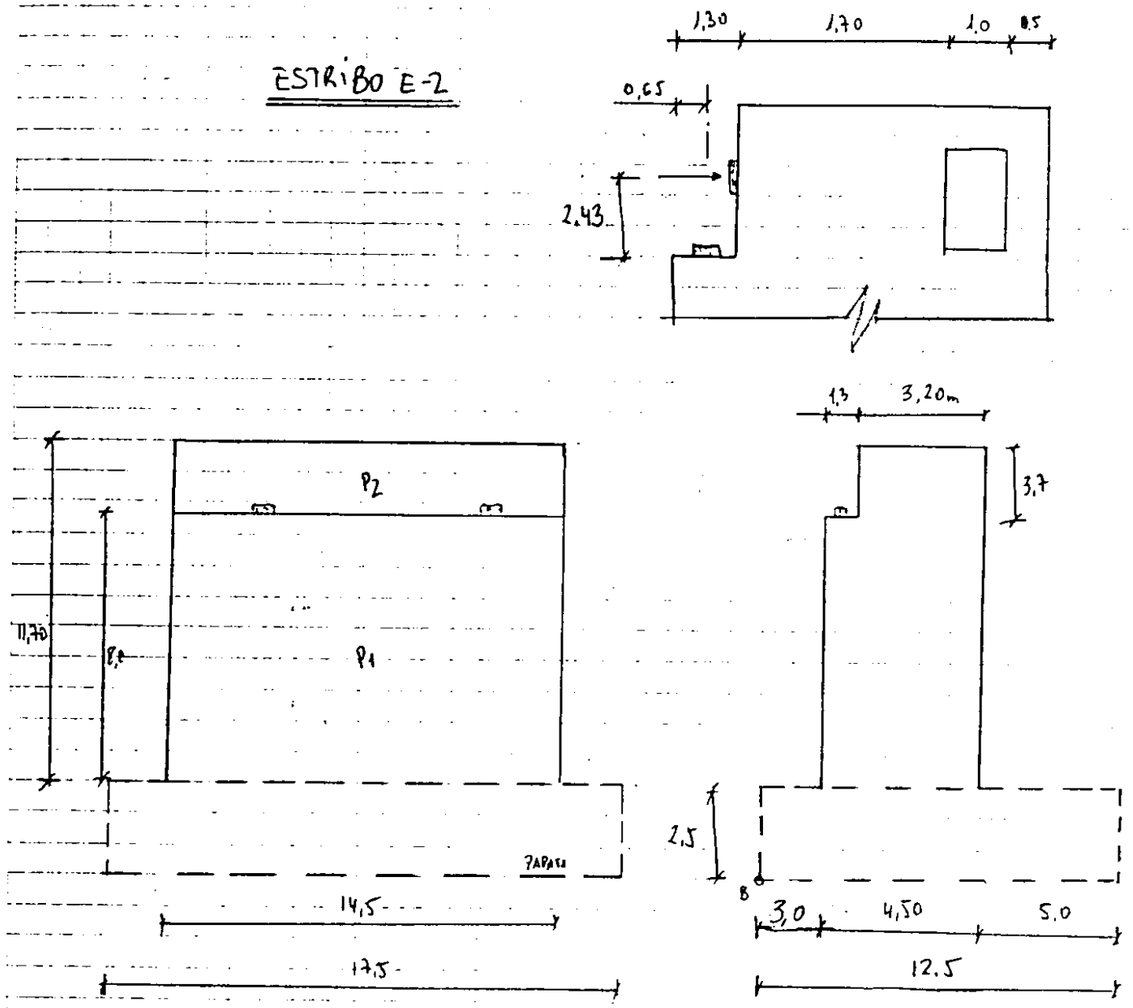
$N_d = 507,15 \text{ t/m}$

2.3.2- Estribos de recepción

VIADUCTO 1

ESTRIBO E-2

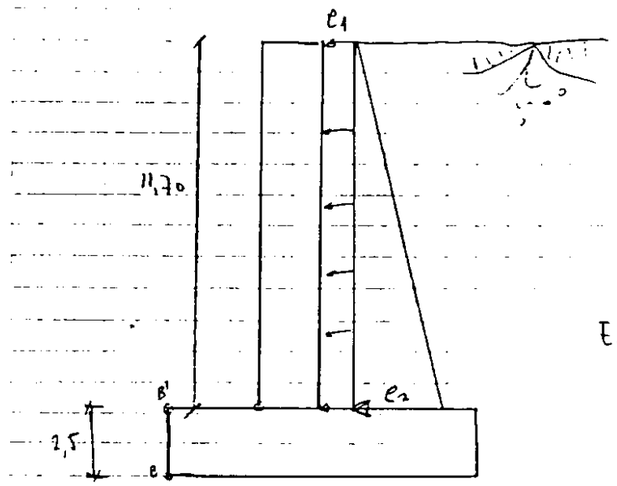
ESTRIBO E-2



P1: $2,5 \times 14,5 \times 4,50 \times 8 =$ 1305 Mp → $M^B_{P_1} = P_1 \times (3,0 + 2,25) =$ 6851,3 mMp

P2: $2,5 \times 3,7 \times 3,20 \times 14,5 =$ 429,2 Mp → $M^B_{P_2} = P_2 \times (3,0 + 1,3 + 1,6) =$ 2532,3 Mpm

ZAPATA: $2,5 \times 17,5 \times 17,5 \times 2,5 =$ 1367,2 Mp → $M^B_{ZAP} = P_{ZAP} \times (6/7) =$ 8545 Mpm



Suelo estabilizado con cemento

$\phi = 35°$; $\gamma = 2\ t/m^3$

$K_r = 1 - \sin\phi = 0,4264$

E_H: $e_1 = K_r \times 3\ t/m^2$

$E_1 = e_1 \times 11,7 \times 14,5 = 217,0$ Mp ; brazo: 5,85m

$e_2 = k_r \times 2 \times 11,7 = 9,98\ t/m^2$

$E_2 = e_2 \times \frac{1}{2} \times 11,7 \times 14,5 = 846,6$ Mp ; brazo: 3,9m

$E_H = E_1 + E_2 =$ 1063,6 Mp ; $M^{B'}_{E_H} = -4571,2$ Mpm ; $M^B_{E_H} =$ -7230,2 Mpm

E_V: $5,0 \times 12,5 \times 2 \times 11,7 =$ 2012,5 Mp

$M^B_{E_V} = E_V \times (2,5 + 4,5 - 3,0) =$ 20.415 Mpm

Acciones transmitidas por los apoyos:

V: $V =$ 1132 Mp (791,9 Mp sin sc ferroviaria vertical)

$M^B_V = V \times (0,65 + 3,0) =$ 4131,8 Mpm (2890,4 Mpm)

H_L: ± 588,3 Mp

$M^{B'}_{H_L} = H_L \times (2,43 + 8) =$ ± 6136 Mpm

$M^B_{H_L} = M^{B'}_{H_L} + H_L \times 2,5 =$ ± 7606,8 Mpm

Comprobación a deslizamiento

$F = E_H + H_L = 1651,9\ M_p$

Acción estabilizadora : $: tg\,\delta = 0,4$

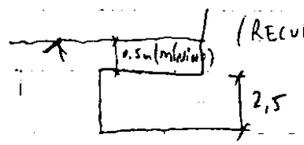
$F_{EST} = tg\,\delta \cdot \Sigma V = tg\,\delta \times (\underbrace{3068,6}_{\Sigma P_i} + \underbrace{2012,5}_{E_v} + \underbrace{791,9}_{V_{sin\,sc}})$

$F_{EST} = 0,4 \cdot 5902,0\ M_p$

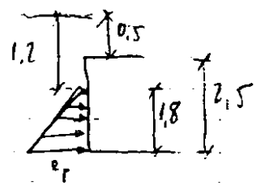
$F_{ESTAB} = 2360,8\ M_p$

$\gamma_{DESLIZAM} = \frac{F_{EST}}{F} = 1,430$ En caso de que contemos con el emp. pasivo:

Empje pasivo: (RECUBRIM MÍNIMO: 50cm)



$10\% \times 11,7 \simeq 1,20\ m \rightarrow$ Contamos con



e_p: $K_p = 0,6 \cdot tg^2\left(45 + \frac{35}{2}\right) = 2,21$

$e_p = 1,8 \times K_p \times 1,8\,t/m^3 = 7,16\ M_p/m^2$

$E_p = e_p \times \frac{1}{2} \times 1,8 \times 17,5 = 112,78\ M_p$

$N^B_{E_p} = E_p \times \frac{1,8}{3} = 67,7\ M_p m$

$F_{ESTAB} = 2360,8 + 112,78 = 2473,6 \rightarrow \gamma = 1,50 > 1,35$ OK

Sin frenado: $\gamma = \frac{2473,6}{1063,6\,(= E_H)} = 2,32$ OK

COMPROBACIÓN AL VUELCO

$M_{ESTABILIZADOR} = \Sigma M^B_{P_i} + M^B_{E_v} + M^B_V$

$M_{EST} = 17928,6 + 20415 + 2590,4 = 41234\ M_p m$

$(4131,8) = (41275)$

$M_{VOLCADOR} = M^B_{H_L} + M^B_{E_H} = 7230,2 + 7606,8 = 14837\ M_p m$

$\gamma = \frac{M_{EST}}{M_{VOL}} = 2,78$ OK

TENSIÓN EN EL TERRENO

$N_{MÁXIMO} = 5902$ t

$M_B = M_{ESTAB} - M_{VOLCADOR} = 26397$ t m

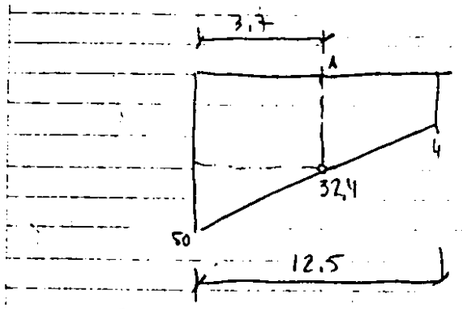
$e = \frac{M}{N} = 4{,}47$ m

$3 \times e = 13{,}4 < 12.5 \rightarrow$ No despega

$$\sigma_{MÁX} = \frac{N}{12{,}5 \times 17{,}5} \pm \left[\frac{3N}{12{,}5 \times 17{,}5} - \frac{6M^B}{12{,}5^2 \times 12{,}5}\right] = \begin{cases} 50{,}0\ t/m^2 & \text{ok} \\ 4{,}0\ t/m^2 & \end{cases}$$

Armadura:

Sección referencia: $3 + 4{,}5 \times 0{,}15 = 3{,}7$ m



$M^A = 80{,}4 + 224{,}8 = 302{,}2$ Mpm/m

$M_d^A = 453{,}3$ Mpm/m

$d = 2{,}4$ m $\rightarrow A_s = 43{,}8$ cm²/m

Ø25 c 0,10

Ponderación de las ef. de cálculo

EC-1: $H_{cd} = 1{,}5\,(219{,}74 + 0{,}6 \times 204{,}13) + 1{,}45 \times 247{,}8 = 570{,}1$ Mp

IAPF-71/EH-91: $H_{cd} = 1{,}5 \times (219{,}74 + 204{,}13) = 635{,}80$ Mp

Resulta pésima, como en el caso del E-1, la combinación resultante de la aplicación del EC-1.

Dimensionamiento del pretensado de cabio

El tablero se coge al estribo para absorber una fuerza horizontal $H_L = 588,3\ M_p$

$$P_{k_0} = \frac{588,3}{2 \times 2} = 147,1\ M_p/\text{tendón}$$

Se disponen 4 tendones (en grupos de 2) de 11 torones Ø 0,6" [R = 289,7 t/tendón] tesados por un sólo extremo a 0,6R = 173,8 /tendón.

Dimensionado en rotura:

$$F_u = \frac{0,9 \times 289,7}{1,15} = 226,7\ t/\text{tendón}$$

Esf de cálculo (ELU):

$H_{L,d} = 870,1\ Mp / 4 = 217,5\ M_p/\text{tendón} < F_u$ OK

Apoyo de neopreno intermedio

$$N = 2 \times 173,8 + \frac{588,3}{2} = 347,6 + 294,15 = 641,80\ M_p$$

$S \times 1500 = 641,8 \rightarrow S_{nec} = 0,428\ m^2 \rightarrow 0,7 \times 0,7$ ($S = 0,49 m^2$)

Se dispone en cada alma un apoyo de neopreno zunchado de 700 × 700 × 50 (35)

$$\sigma_{min} = \frac{53,45\ t}{0,49} = 10,91\ kg/cm^2$$

Sobretensión para anclada a 173,8 t (0,6R)

(L = 4,75)

A cuña = 6 mm

$$\frac{6 \times 10^{-3}}{4,75} = \frac{\Delta R}{2 \times 10^7} \Rightarrow \Delta R = 25263,1\ t/m^2 = 2526,3\ kg/cm^2$$

$R = 19000\ kg/cm^2 \Rightarrow \Delta R = 0,133 \cdot R$

Sobretensión: $0,733\ R = 212,35\ t/\text{tendón}$

$N = 2 \times 212,35 = 424,7$

Comp apoyos: $S_{nec} \frac{424,7}{1500} = 0,30 m^2 < 0,49$ OK

Refuerzo de anclajes:

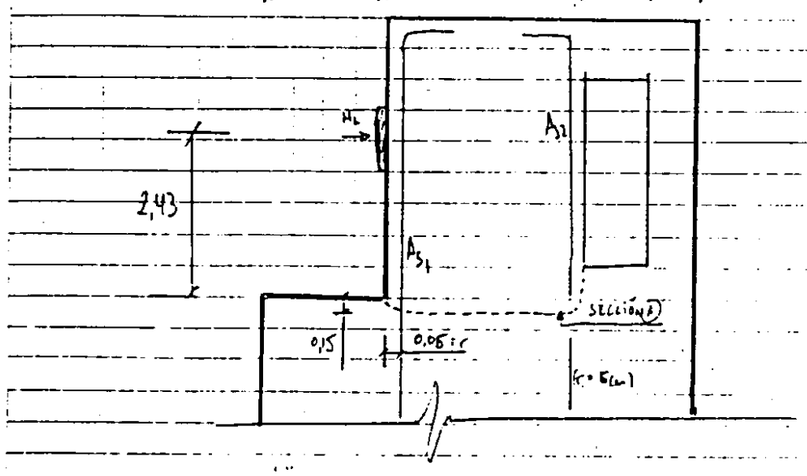
$$A_s = \frac{1}{4,43} \times 1,50 \times 212,35 \times 0,3 = 21,6\ cm^2 \xrightarrow{1/2} 10,8\ cm^2/\text{cap}/\text{zuncho}$$

(2 caps de 5 Ø20)

Refuerzo del apoyo de neopreno:

$$A_s = \frac{1}{4,43} \times \left(1,5 \times 212,35 \times 2 + \frac{870,1}{2}\right) \times 0,3 = 72,6\ cm^2/\text{apoyo} \rightarrow 36,3 cm^2/\text{cap}\ (2)$$

ARMADURA DEL MURO DE FRENTE



ARMADURA DEL NACIMIENTO DE ANCLAJE (Sección A)

FLEXIÓN: La fuerza horizontal a absorber es: $H_L = 588,3$ Mp ($H_L d = 870,1$ Mp)

$M_d = 870,1 \times 2,58 = 2244,8$ Mpm $\xrightarrow{1/2}$ 1122,4 Mpm/alma

Características: H-250
$d = 1,7 - 0,06 = 1,64$ m
$b = 4,0$ m/alma
$A_{S_1} = A_{S_2} = 160,5 cm^2/alma = 40,1 \frac{cm^2}{m}$ ($2\phi 20 \cdot 0,15$)

CORTANTE: $Q_d = H_L \cdot L/2 = 435,05$ Mp/alma $\xrightarrow{1/4}$ 108,8 Mp/m

$V_{cu} = 5 \cdot \sqrt{166,7} \times 1 \times 1,64 = 105,9$ Mp/m

$A_s = \frac{108,8 - 105,9}{0,9 \times 1,64} \times \frac{1}{4,13} = 0,45 cm^2/m$

$A_{s\,min} = \frac{1}{4,2} \times 0,2 \times 166,7 \cdot 1 = 7,93 cm^2/m$

$\rightarrow$ $2 \cdot \phi 12 \cdot 0,25$ m

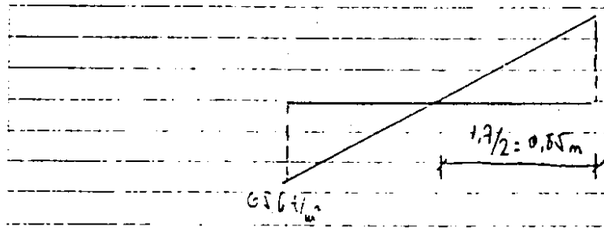
Tensiones:

$M_{EXTERIOR} = 588,3 \times 2,58 = 1517,8$ Mpm $/2 = 758,9$ Mpm/alma

$b \times h = 4 \times 1,7 = 6,8 m^2$

$I = \frac{1}{2} \times 4 \times 1,7^3 = 9,83 m^4$

$\sigma_s = \pm \frac{758,9 \times 0,85}{9,83} = \pm 65,6$ t/m²



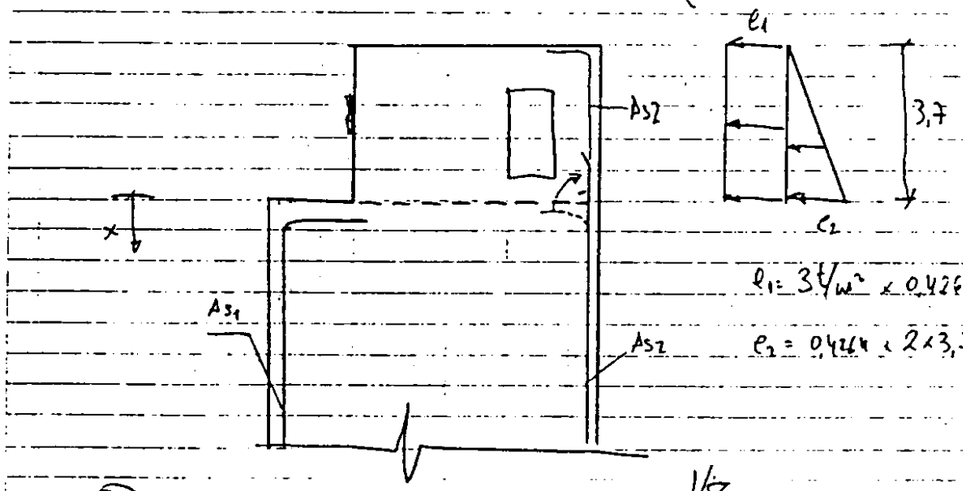
Armadura pasiva a flexión: $A_s = \frac{1}{2}\left(\frac{1}{2} \times 65,6 \times 0,85 \cdot 1,0\right) = 13,94 cm^2/m$

$\phi 16 \cdot 0,15$

ARMADURA DEL MURO

Se supone que toda la anchura del macizo contribuye a resistir la fuerza horizontal, a 45°:

Anchura = 14,5m ; (en cabeza 8,0m)



$e_1 = 3\,t/m^2 \times 0{,}4264 = 1{,}28\,t/m^2$

$e_2 = 0{,}4264 \times 2 \times 3{,}7 = 3{,}16\,t/m^2$

(As1) M_d (x=0) $= 870{,}1 \times 2{,}58 = 2244{,}9\ M_{pm}$ $\xrightarrow{1/8}$ $= 280{,}6\ M_{pm}/m$

c = 4,50m ; d = 4,44m ; $A_{s1} = 14{,}31\ cm^2/m$; $(\phi 20\ a\ 0{,}20)$

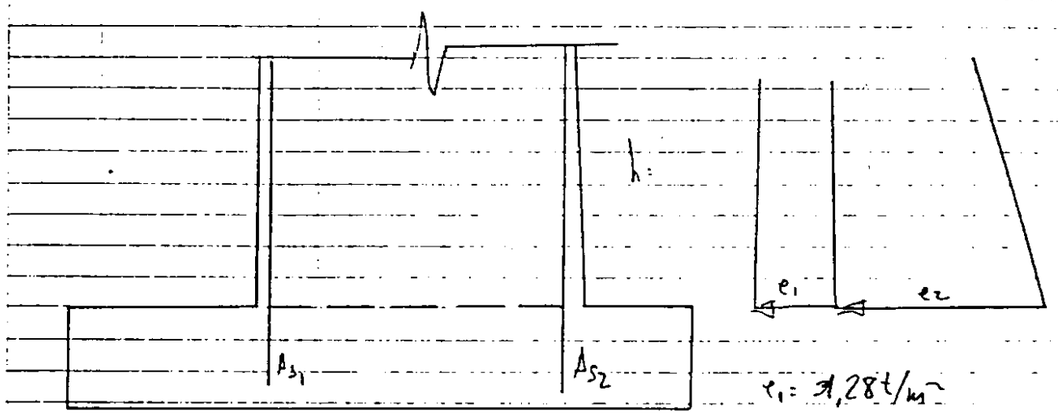
(As2) $E_1 = e_1 \times 3{,}7 = 4{,}73\ M_p$ a $3{,}7/2 = 1{,}85m$

$E_2 = \frac{1}{2} \times 3{,}7 \times e_2 = 5{,}85\ M_p$ a $1{,}23m$

$M_d = 280{,}6 - 1{,}35(4{,}73 \times 1{,}85 + 5{,}85 \times 1{,}23) = 307\ M_p/m$

$A_{s2} = 15{,}40\ cm^2/m$ $(\phi 20\ a\ 0{,}20)$

SECCIÓN DE EMPOTRAMIENTO CON ENCEPADO



$e_1 = 1{,}28\,t/m^2$

$e_2 = 0{,}4264 \times 2 \times 11{,}7 = 10\,t/m^2$

(As2) $E_1 = e_1 \times 11{,}7 = 15\ M_p$; a $5{,}85\ m$

$E_2 = e_2 \times \frac{1}{2} \times 11{,}7 = 58{,}5\ M_p$; a $3{,}9\ m$

$M_d = \frac{+}{14{,}5} 870{,}1 \times \left(2{,}43 + \frac{8}{2}\right) + 1{,}35\,(15 \times 5{,}85 + 58{,}5 \times 3{,}9)$

$M_d = 1052{,}3\ M_{pm}/m$

$A_{s2} = 54{,}50\ cm^2/m$ → $\phi 25\ a\ 0{,}20 + \phi 20\ a\ 0{,}10$

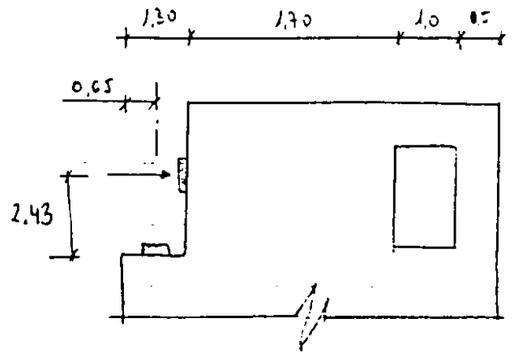
(As1) $M_d = \frac{1}{14{,}5} \times 870{,}1\left(2{,}43 + \frac{8}{2}\right) = 625{,}9\ M_{pm}/m$

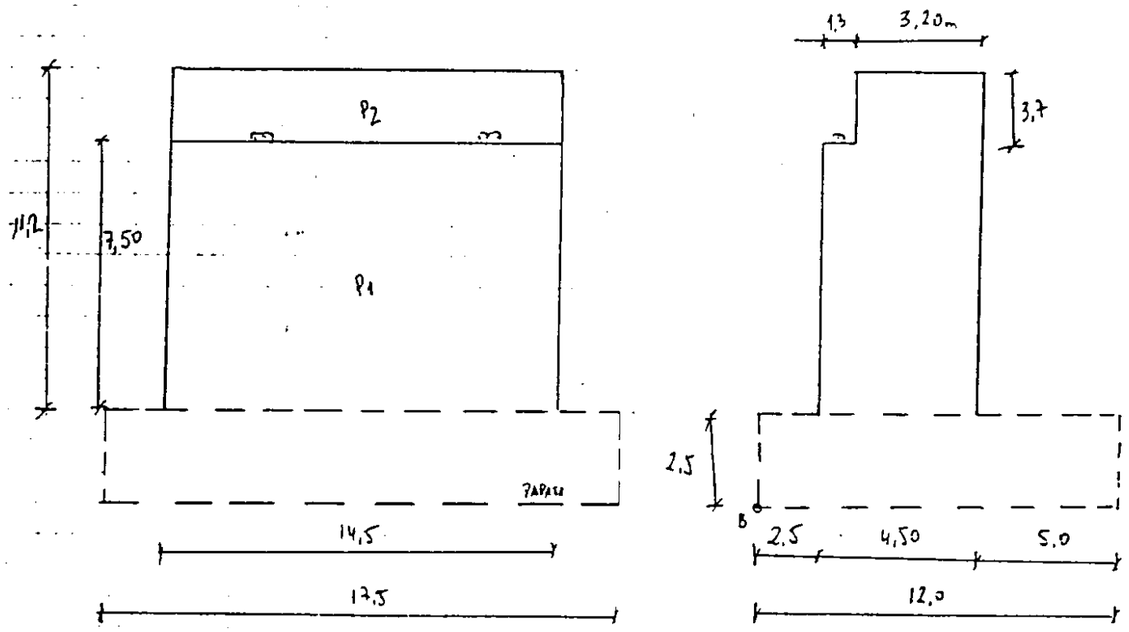
$A_{s1} = 31{,}9\ cm^2/m$ → $\phi 20\ a\ 0{,}10$

VIADUCTO 2

ESTRIBO E-1

ESTRIBO E-1

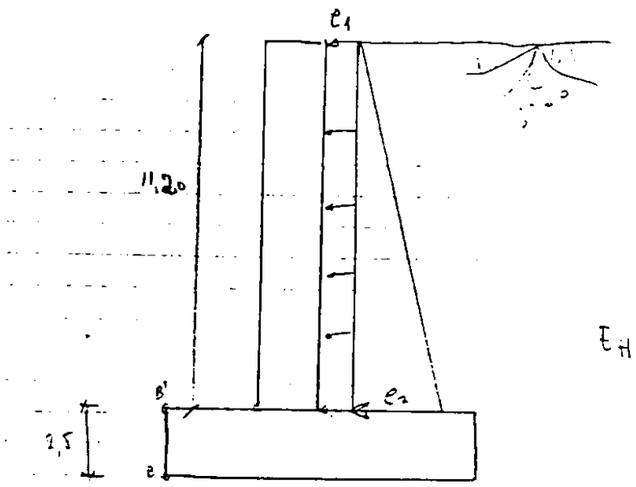




P1: $2,5 \times 14,5 \times 4,5 \times 7,5 =$ **1223,5 Mp** → $M^B_{P_1} = P_1 \times (2,5 - 2,25) =$ **5811,3 mMp**

P2: $2,5 \times 3,7 \times 3,20 \times 14,5 =$ **429,2 Mp** → $M^B_{P_2} = P_2 \times (2,5 + 1,3 + 1,6) =$ **2317,7 Mpm**

ZAPATA: $2,5 \times 17,5 \times 12,0 \times 2,5 =$ **1312,5 Mp** → $M^B_{ZAP} = P_{ZAP} \times (6) =$ **7875 Mpm**



Suelo estabilizado con cemento

$\phi = 35°$; $\gamma = 2\ t/m^3$

$K_r = 1 - \sin\phi = 0,4264$

E_H: $e_1 = K_r \times 3\ t/m^2$

$E_1 = e_1 \times 11,2 \times 14,5 = 207,7\ Mp$; brazo: 5,6

$e_2 = k_r \times 2 \times 11,2 = 9,56\ t/m^2$

$E_2 = e_2 \times \frac{1}{2} \times 11,2 \times 14,5 = 775,6\ Mp$; brazo: 3,7

$E_H = E_1 + E_2 =$ **983,3 Mp** ; $M^{B'}_{E_H} = 4032,8\ Mpm$; $M^B_{E_H} =$ **6491,1 Mpm**

E_V: $5,0 \times 14,5 \times 2 \times 11,2 =$ **1624,0 Mp**

$M^B_{E_V} = E_V \times (2,5 + 4,5 - 2,5) =$ **15428,0 Mpm**

Acciones Transmitidas por los apoyos:

V: $V = 1132\ Mp$ (741,9 Mp sin sc favorable vertical)

$M^B_V = V \times (0,65 + 2,5) = 3565,8\ Mpm$ (2494,5 Mp)

H_L: **±592,2 Mp**

$M^{B'}_{H_L} = H_L \times (2,43 + 7,5) = \pm 5880,5\ Mpm$

$M^B_{H_L} = M^{B'}_{H_L} + H_L \times 2,5 =$ **± 7361,0 Mpm**

Comprobación a deslizamiento (Sin zarpa)

$F = E_H + H_L = 1575,50\ Mp$

Acción estabilizadora: Sin zarpa: $tg\,\delta = 0,4$

$F_{EST} = tg\,\delta \cdot \Sigma V = tg\,\delta \times \left(\underbrace{2965,2}_{\Sigma P_i} + \underbrace{1696,5}_{E_v} + \underbrace{791,9}_{V_{sin\,zc}}\right)$

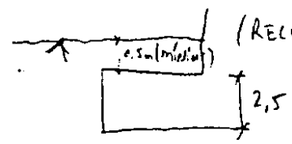
$F_{EST} = 0,4 \times 5453,6$

$F_{ESTAB} = 2181,4\ Mp$

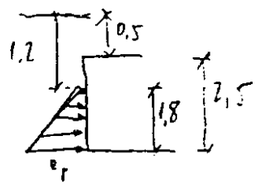
$\gamma_{DESLIZAM} = \frac{F_{EST}}{F} = 1,38$ valor ajustado

Contrarresto con el emp. pasivo:

Empje pasivo: (RECUBRIR MÍNIMO: 50cm)



$10\% \times 11,2 \simeq 1,20\ m \rightarrow$ Contrarresto con



e_p: $K_p = 0,6 \cdot tg^2\left(45 + \frac{35}{2}\right) = 2,21$

$e_p = 1,8 \times k_p \times 1,8\,t/m^3 = 7,16\ Mp/m^2$

$E_p = e_p \times \frac{1}{2} \times 1,8 \times 17,5 = 112,78\ Mp$

$M^B_{E_p} = E_p \times \frac{1,8}{3} = 67,7\ Mp\,m$

$F_{ESTAB} = 2181,4 + 112,78 = 2294,2 \rightarrow \gamma = 1,46 > 1,35$ OK

Sin forrado: $\gamma = \frac{2294,2}{983,3} = 2,33$ OK

COMPROBACIÓN AL VUELCO

$M_{ESTABILIZADOR} = \sum M^B_{P_i} + M^B_{E_v} + M^B_V$

$M_{EST} = 16.004,0 + 16116,5 + 2444,5 + 34615,3\ Mpm$

$M_{VOLCADOR} = M^E_{H_L} + M^B_{E_H} = 7361 + 6491,10 = 13852,1\ Mpm$

$\gamma = \frac{M_{EST}}{M_{VOL}} = 2,50$ OK

TENSIONES EN EL TERRENO

$N = 5793,7\ Mp\ (\Sigma N)$

$M^B = M_{EST} = M_{VOLC} = 20763,2\ Mpm$

$e = 3,58m.$

$3e = 10,75 < 15,7$ despegue

$N = 3e \times \frac{1}{2} \times 17,5 \times \sigma_{máx} \rightarrow \sigma_{máx} = 6,16\ Kg/cm^2$

$\sigma_{adm} = 7,0\ Kg/cm^2$ Junta

Armadura: $61,6 \times 17,5 \times 3,18^2/2 = 5450,6 = M$

$M_d = M \times 1,5 = 8175,8\ Mpm$

$d = 2,5 - 0,1 - 2,4m$ $A_s = 45,23\ cm^2/m$? A_{min}

Ponderación de las ef. de cálculo

EC-1: $H_{Ld} = 1,5\,(222,9 + 0,6 \times 201,5) + 1,45 \times 248,4 = 875,9\ Mp$

IAPF-71/EH-91: $H_{Ld} = 1,5 \times (229,9 + 248,4) = 706,95\ Mp$

Resulta pésima, como en el caso del E-1, la combinación resultante de la aplicación del EC-1.

Dimensionamiento del pretensado de estribo

El tablero se coge al estribo para absorber una fuerza horizontal $H_L = 592,2$ Mp

$$P_{k_0} = \frac{592,2}{2 \times 2} = 148,05 \text{ Mp/tendón}$$

Se disponen 4 tendones (en grupos de 2) de 11 torones Ø 0,6" ($R = 289,7$ t/tendón) tesados por un sólo extremo a $0,6R = 173,8$ t/tendón.

Dimensionado en rotura:

$$Fu = \frac{0,9 \times 289,7}{1,15} = 226,7 \text{ t/tendón}$$

Esf. de cálculo (tc-1):

$H_{L,d} = 875,9$ Mp / 4 ≅ 219,0 Mp/tendón < Fu OK

Apoyo de neopreno intermedio

$$N = 2 \times 173,8 + \frac{592,2}{2} = 347,60 + 296,10 = 643,7 \text{ Mp}$$

$S \times 1500 = 643,7 \rightarrow S_{nec} = 0,430 \text{ m}^2 \rightarrow 0,7 \times 0,7$ ($S = 0,49 \text{ m}^2$)

Se dispone en cada alma un apoyo de neopreno zunchado de 700 × 700 × 50 (35)

$$\sigma_{min} = \frac{65,25}{0,49} = 13,32 \text{ Kg/cm}^2$$

Sobretensión para anclado a 173,8 t (0,6R)

(L = 4,75)

A cuña = 6 mm

$$\frac{6 \times 10^{-3}}{4,75} = \frac{\Delta R}{2 \times 10^7} \Rightarrow \Delta R = 25263,1 \text{ t/m}^2 = 2526,3 \text{ kg/cm}^2$$

$R = 19000 \text{ kg/cm}^2 \Rightarrow \Delta R = 0,133 \cdot R$

Sobretensión: $0,733\,R = 212,35$ t/tendón

$N = 2 \times 212,35 = 424,7$

Comp. apoyos: $S_{nec} = \frac{424,7}{1505} = 0,30 \text{ m}^2 < 0,49$ OK

Refuerzo de anclajes

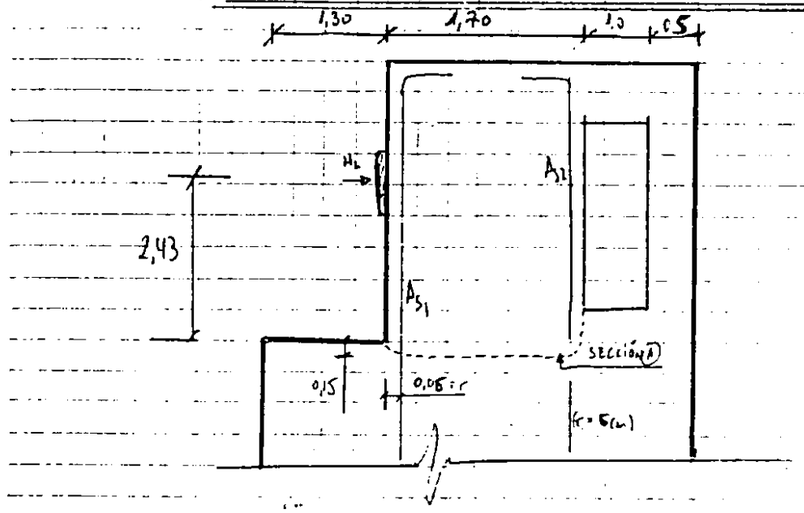
$$A_s = \frac{1}{4,43} \times 1,50 \times 212,35 \times 0,3 = 21,8 \text{ cm}^2 \xrightarrow{1/2} 10,8 \text{ cm}^2/\text{cap} \text{ (2 cap.)}$$

(2 capas de 5 Ø20)

Refuerzo del apoyo de neopreno

$$A_s = \frac{1}{4,43} \times \left(1,50 \times 173,8 \times 2 + \frac{875,9}{2}\right) \times 0,3 = 65,25 \text{ cm}^2/\text{apoyo} \rightarrow 32,5 \text{ cm}^2/\text{cap.} (2)$$

ARMADURA DEL MURO DE FRENTE



ARMADURA DEL MACIZO DE ANCLAJE (Sección A)

FLEXIÓN: La fuerza horizontal a absorber es: $H_L = \pm 592,2\ Mp$ ($H_{L,d} = \pm 759,9\ Mp$)

$Md = -875,9 \times 2,58 = \pm 2259,8\ Mp\,m$

$\xrightarrow{1/2}$ 1129,9 Mp/alma

Características: H-250; $d = 1,7 - 0,06 = 1,64\ m$; $b = 4,0\ m$/alma

$A_{S1} = A_{S2} = 1605\ cm^2$/alma $= 40,4\ cm^2/m$ ($2\phi 20 \text{ a } 0,15$)

CORTANTE: $Qd = H_L \cdot l/2 = 438,0\ Mp$/alma $\xrightarrow{1/4}$ 109,5 Mp/m

$V_{cu} = 5 \times \sqrt{166,7} \times 1 \times 1,64 = 105,9\ Mp/m$

$A_s = \frac{109,5 - 105,9}{0,9 \times 1,64} \times \frac{1}{4,43} = 0,45\ cm^2/m$

$A_{s\,min} = \frac{1}{1,2} \times 0,2 \times 166,7 \cdot 1 = 7,93\ cm^2/m$

$\rightarrow$ $2 \text{ r } \phi 12 \text{ a } 0,25 m$

Tensiones:

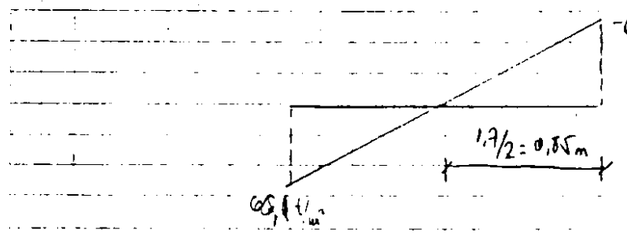
$M_{EXTERIOR} = 592,2 \times 2,58 = 1527,8\ Mp\,m / 2 = 764\ Mp\,m$/alma

$b \times h = 4 \times 1,7 = 6,8\ m^2$

$I = \frac{1}{2} \times 4 \times 1,7^3 = 9,83\ m^4$

$\sigma_s = \pm \frac{764,1 \times 0,85}{9,83} = \pm 66,1\ t/m^2$

σ_i



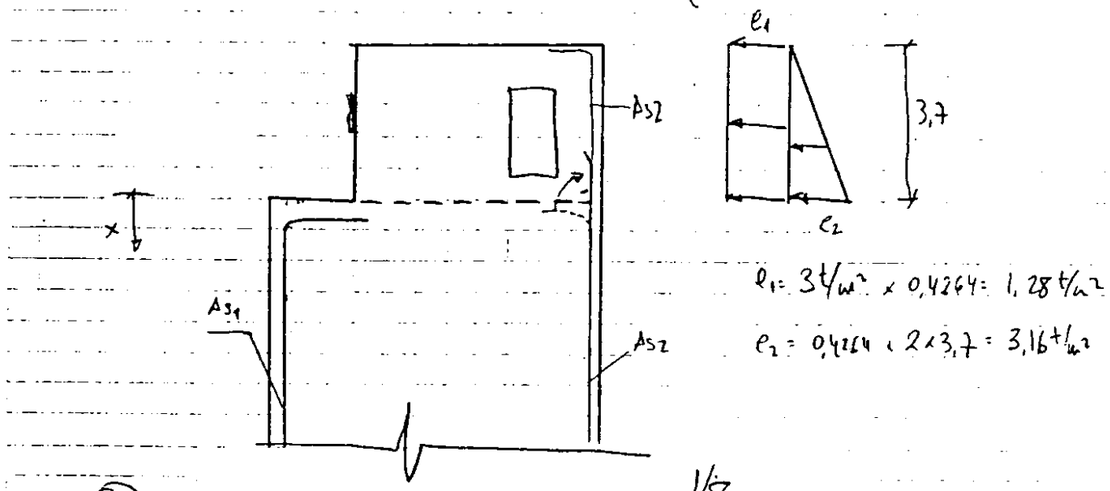
Armadura para la fisuración: $A_s = \frac{1}{2}\left(\frac{1}{2} \times 66,1 \times 0,85 \cdot 1,0\right) = 14,05\ cm^2/m$

$\phi 16 \text{ a } 0,15$

ARMADURA DEL MURO

Se supone que toda la anchura del macizo contribuye a resistir la fuerza horizontal, a 45°:

Anchura = 14,5m ; (en cabeza 8,0m)



$e_1 = 3\,t/m^2 \times 0{,}4264 = 1{,}28\,t/m^2$

$e_2 = 0{,}4264 \times 2 \times 3{,}7 = 3{,}16\,t/m^2$

(As1) M_d (x=0) $= 8759 \times 2{,}58 = 2259{,}8\ M_p m$ $\xrightarrow{1/8}$ $= 282{,}5\ Mp\,m/m$

$\left.\begin{matrix} c = 4{,}50m \\ d = 4{,}44m \end{matrix}\right\}$ $A_{s1} = 14{,}40\ cm^2/m$; ($\phi 20$ a 0,20)

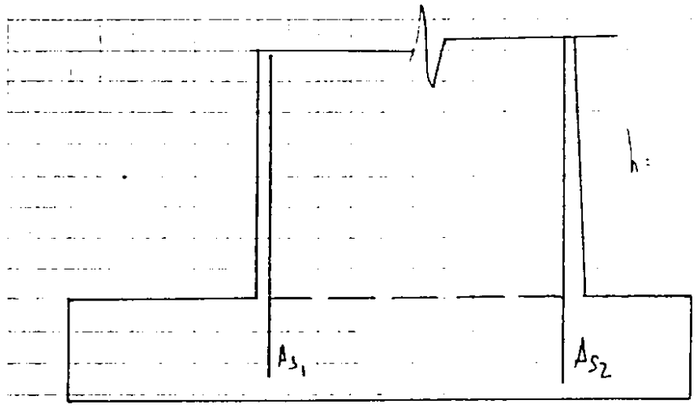
(As2) $E_1 = e_1 \times 3{,}7 = 4{,}73\ M_p$ a $3{,}7/2 = 1{,}85m$

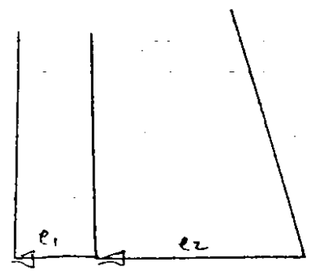
$E_2 = \frac{1}{2} \times 3{,}7 \times e_2 = 5{,}85\ M_p$ a $1{,}23\,m$

$M_d = -282{,}5 - 1{,}35\left(4{,}73 \times 1{,}85 + 5{,}85 \times 1{,}23\right) = 304{,}5\ t/m$

$A_{s2} = 15{,}50\ cm^2/m$ ($\phi 20$ a 0,20)

SECCIÓN DE EMPOTRAMIENTO CON ENCEPADO





$e_1 = 1{,}28\,t/m^2$

$e_2 = 0{,}4264 \times 2 \times 11{,}2 = 9{,}56\,t/m^2$

(As2) $E_1 = e_1 \times 11{,}2 = 14{,}34$; a $5{,}60\,m$

$E_2 = e_2 \times \frac{1}{2} \times 11{,}2 = 53{,}5\ M_p$; a $3{,}73\,m$

$M_d = \frac{1}{14{,}5} 875{,}9 \times \left(2{,}43 + 7{,}5\right) + 1{,}35\left(14{,}34 \times 5{,}6 + 53{,}5 \times 3{,}73\right)$

$M_d = 977{,}65\ tm/m$

$A_{s2} = 50{,}55\ cm^2/m$ → $\phi 25$ a 0,20 + $\phi 20$ a 0,10

→ $\phi 32$ a 0,20 + $\phi 20$ a 0,20

(As1) $M_d = \frac{1}{14{,}5} \times 875{,}9\left(2{,}43 + 7{,}5\right) = 600{,}0\ M_p \times m$

$A_{s1} = 31{,}0\ cm^2/m$ → $\phi 20$ a 0,10

2.4- PRUEBA DE CARGA

PRUEBA DE CARGA

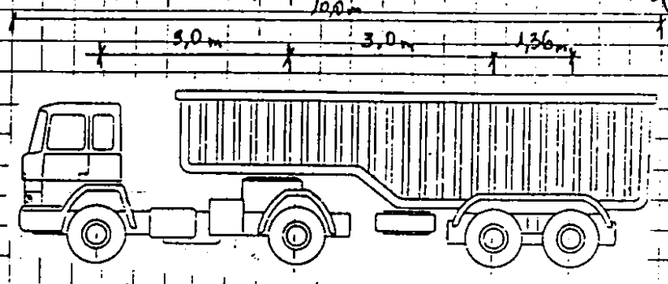
CAMIÓN UTILIZADO

Para el cálculo de la prueba de carga se utilizarán camiones como los descritos en la figura, de 35 t de carga total

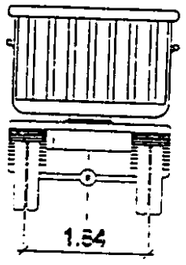
Una vez cargados los camiones, se procederá a su pesada, confirmando que los valores de sus cargas sean sensiblemente iguales a los descritos, con una tolerancia del -5%, +1% en su carga total

Los camiones se presentarán el día de la prueba con el recibo de la báscula, que indique su peso.

El camión tipo a emplear será como el de la figura:

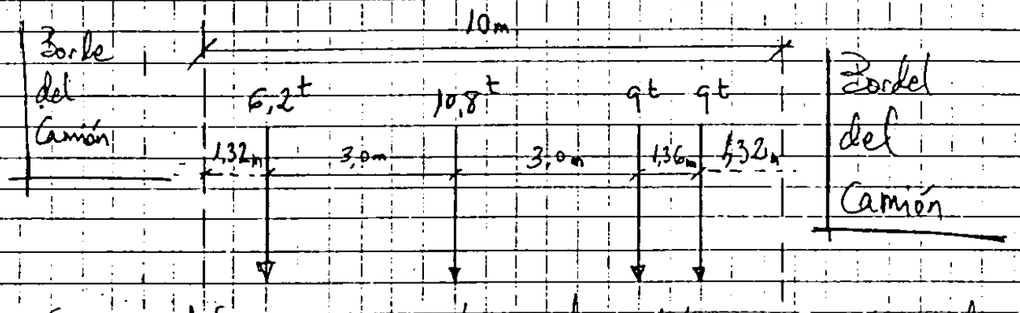


PESOS POR EJE: 6,2 t 10,8 t 9,0 t 9,0 t



PRUEBA DE CARGA

Cargas introducidas en el modelo

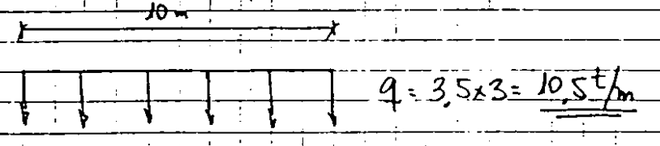


* Se supondrá una carga uniforme de 35 t/10m = 3,5 t/m a lo largo de 10m que ocupa cada camión

DISPOSICION.

TRANSVERSAL. Se dispondrán 3 camiones paralelos, simétricamente situados respecto al eje del tablero

Por ello, en el modelo de cálculo, se introducirán como cargas actuantes el triple de las anteriormente citadas:

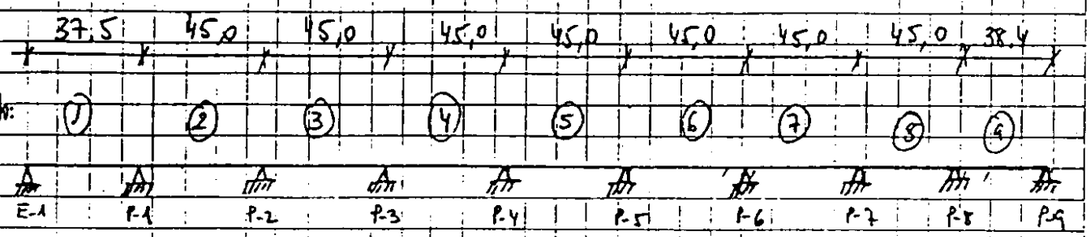


LONGITUDINAL.

Se tratarán dos distintas disposiciones, según se quiera estudiar la flecha máxima en centro de vano o el máximo momento flector sobre pila.

Serán las siguientes:

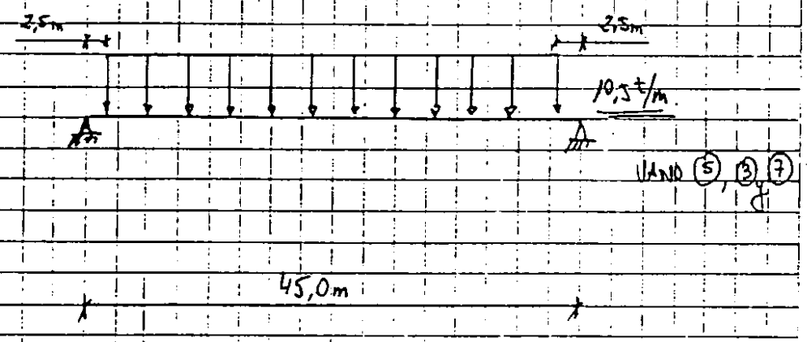
VIADUCTO 1.



(A) Momento máximo en centro de vano (5)

Se cargarán los vanos (3), (5) y (7), cada uno con 3 filas paralelas de 4 camiones, cada una. En total 12 camiones.

Esquema de vano cargado (Vano de 45m) Equivalente a 4 camiones



Nº Camiones empleados: 4 x 3 = 12 Camiones por vano

TOTAL: 12 x 3 vanos = 36 Camiones

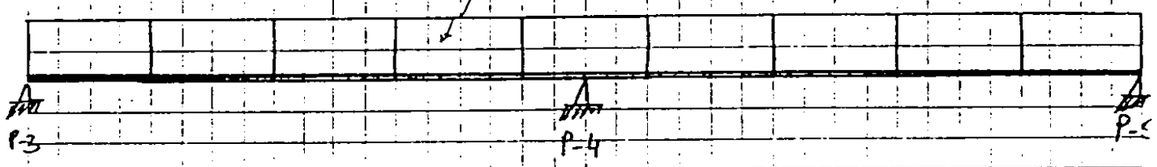
Con este esquema se calcularán:

- M max en centro de vano 5.
- Flecha en centro de todos los vanos.

(3) MOMENTO FLECTOR MÍNIMO EN PILA P-4

Se cargarán los vanos (4) y (5), adyacentes a la pila citada, cada uno con 3 filas de 4 camiones por fila.

Se colocarán otros 3 camiones sobre la pila, con lo cual quedan cubiertos los 45 + 45 = 90,0m de ambos vanos



En total se necesitarán (3 x 4) x 2 vanos + 3 = 27 camiones

RESUMEN DE RESULTADOS

Ⓐ Momento flector máximo en vano 5.

M_{pp} : 1702,7 mt

M_{sc} : 1694,2 mt

M_{TOTAL} = 3396,9 mt (en el centro del vano 5)

De los cálculos de la estructura, una vez en servicio, se tiene:

$M_{pp + BALASTO + R.C.P.}$: 2904,3 mt

$M_{sc\ IFFE}$: 3405,86 } 3405,86 mt
$M_{sc\ EC-1}$: 3284,3 }

M_{VIENTO} : 48,92 mt

6359,08 mt

Durante la prueba de carga se alcanzará un momento en centro de vano de:

CONSIDERANDO P.P. : $\frac{3396,9}{6359,08}$ = 53,42 % del $M_{máx}$ en servicio

SI ELIMINANDO EL P.P. $\frac{1694,2}{4656,38}$ = 36,38 %

Los camiones suponen un 36,38% de la acción de las sobrecargas características (incluido viento) + R.C.P.

FLECHAS PREVISTAS EN LA PRUEBA DE CARGA

CENTRO DE VANO:	1	2	3	4	5	6	7	8	9
flecha [mm]: ⊕ HACIA ABAJO	6,05	1,75	11,78	-0,41	12,35	-0,42	11,84	1,53	6,80

CENTRO DE VANO:	1	2	3	4	5	6	7	8	9
Nº NUDO:	6	17	29	41	53	65	77	89	100

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	1 P.P.	0.00000	-0.52823	0.00000	0.00000	0.00000	0.00015
	2 CAMIÓN	0.00000	-0.07703	0.00000	0.00000	0.00000	-0.00001
17	1	0.00000	-0.44387	0.00000	0.00000	0.00000	-0.00001
	2	0.00000	0.26904	0.00000	0.00000	0.00000	0.00007
29	1	0.00000	-0.48903	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.68869	0.00000	0.00000	0.00000	-0.00002
41	1	0.00000	-0.47550	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.51609	0.00000	0.00000	0.00000	0.00001
53	1	0.00000	-0.48092	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.75443	0.00000	0.00000	0.00000	0.00000
65	1	0.00000	-0.47396	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.51602	0.00000	0.00000	0.00000	-0.00001
77	1	0.00000	-0.49494	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.68870	0.00000	0.00000	0.00000	0.00002
89	1	0.00000	-0.42290	0.00000	0.00000	0.00000	0.00001
	2	0.00000	0.26981	0.00000	-0.00001	0.00000	-0.00007
100	1	0.00000	-0.59984	0.00000	-0.00002	0.00000	-0.00015
	2	0.00000	-0.07963	0.00000	0.00000	0.00000	0.00001

```
 *************************************************
 *                                               *
 *           S T A A D - III                     *
 *           Revision 17.0                       *
 *           Proprietary Program of              *
 *           RESEARCH ENGINEERS, Inc.            *
 *           Date=    MAY 20, 1998               *
 *           Time=    16:33:56                   *
 *                                               *
 *************************************************
```

```
 1. STAAD SPACE VIADUCTO 1. LINEA AVE MADRID-ZARAGOZA
 2. UNIT MET MTON
 3. JOINT COORDINATES
 4. 1 0 0 8000
 5. 2 0.799999998666667 0 7999.99996
 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
11. 8 28.2499412884074 0 7999.95012114558
12. 9 32.9999064141421 0 7999.93193759651
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14. 11 37.4998626710493 0 7999.91210953593
15. 12 38.2998536931703 0 7999.90831955011
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45. 42 154.490396133202 0 7998.50815574396
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47. 44 163.488618146887 0 7998.32929252956
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48. 45 167.987652272271 0 7998.23606482605
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65. 62 226.469740901283 0 7996.79382355554
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67. 64 235.465988742239 0 7996.53398468022
68. 65 239.964001619965 0 7996.4002699919
69. 66 244.461938571584 0 7996.26402519263
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74. 71 262.452898653843 0 7995.69374576016
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77. 74 271.44788613695 0 7995.39342653704
78. 75 275.945251758306 0 7995.23947221295
79. 76 280.442530068863 0 7995.08298814519
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107. 104 389.945422957569 0 7990.49075884044
```

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108. 105 390.744470082394 0 7990.45172434575
109. MEMBER INCIDENCES
 10. 1 1 2 104
111. MEMBER PROPERTIES
112. * TRAVIESAS
113. 1 10 11 22 23 34 35 46 47 58 59 70 71 82 83 94 95 -
114. 104 PRI AX 21.92 IX 44.9 IY 134.74 IZ 20.13 YD 3.1 ZD 14 YB 2.6 ZB 1
115. *PRE-TRAVIESAS
116. 2 9 12 21 24 33 36 45 48 57 60 69 72 81 84 93 96 -
117. 103 PRI AX 12.235 IX 25.28 IY 110.76 IZ 16.02 YD 3.1 ZD 14 YB 2.6 ZB 1
118. *SECCION TIPO (CENTROS DE VANO)
119. 3 TO 8 13 TO 20 25 TO 32 37 TO 44 49 TO 56 -
120. 61 TO 68 73 TO 80 85 TO 92 97 TO 101 -
121. 102 PRI AX 8.8 IX 18.62 IY 96.93 IZ 12.026 YD 3.1 ZD 14 YB 2.6 ZB 1
122. CONSTANTS
123. E 3500000 ALL
124. DENSITY 2.5 ALL
125. ALPHA 1E-5 ALL
126. POISSON .2 ALL
127. SUPPORTS
128. 1 FIXED BUT MZ
 29. 11 23 35 47 59 71 83 95 105 FIXED BUT FX MZ
130. LOAD 1 PP
131. SELFW Y -1
132. LOAD 2 CAMIONES EN VANOS 3 5 Y 7 (12 EN CADA VANO)
133. MEMBER LOAD
134. *VANO3
135. 24 UNI GY -10.5 1.7 3.7
136. 25 TO 32 UNI GY -10.5
137. 33 UNI GY -10.5 0 2
138. *VANO5
139. 48 UNI GY -10.5 1.7 3.7
140. 49 TO 56 UNI GY -10.5
141. 57 UNI GY -10.5 0 2
142. *VANO7
143. 72 UNI GY -10.5 1.7 3.7
144. 73 TO 80 UNI GY -10.5
145. 81 UNI GY -10.5 0 2
146. PERFORM ANALYSIS

        P R O B L E M   S T A T I S T I C S
        -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   105/  104/   10
   ORIGINAL/FINAL BAND-WIDTH =    1/    1
   TOTAL PRIMARY LOAD CASES  =    2, TOTAL DEGREES OF FREEDOM =   589
   SIZE OF STIFFNESS MATRIX =    7068 DOUBLE PREC. WORDS
   TOTAL REQUIRED DISK SPACE =   12.29 MEGA-BYTES


++ PROCESSING ELEMENT STIFFNESS MATRIX.              16:33:58
++ PROCESSING GLOBAL STIFFNESS MATRIX.               16:33:58
++ PROCESSING TRIANGULAR FACTORIZATION.              16:33:59
++ CALCULATING JOINT DISPLACEMENTS.                  16:33:59
++ CALCULATING MEMBER  FORCES.                       16:33:59

147. PRINT MEMBER FORCES LIST 52 53
```


MEMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
52	1	52	0.00	99.07	0.00	0.25	0.00	-1479.65
		53	0.00	-0.06	0.00	-0.25	0.00	1702.70
	2	52	0.00	47.25	0.00	14.31	0.00	-1587.91
		53	0.00	0.00	0.00	-14.31	0.00	1694.22
53	1	53	0.00	0.06	0.00	0.26	0.00	-1702.70
		54	0.00	98.93	0.00	-0.26	0.00	1480.27
	2	53	0.00	0.00	0.00	14.32	0.00	-1694.21
		54	0.00	47.24	0.00	-14.32	0.00	1587.93

********** END OF LATEST ANALYSIS RESULT **********

```
148. PRINT JOINT DISPL LIST 6 17 29 41 53 65 77 89 100
```

OINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	1 P.P.	0.00000	-0.52823	0.00000	0.00000	0.00000	0.00015
	2 CAMIÓN	0.00000	-0.07703	0.00000	0.00000	0.00000	-0.00001
17	1	0.00000	-0.44387	0.00000	0.00000	0.00000	-0.00001
	2	0.00000	0.26904	0.00000	0.00000	0.00000	0.00007
29	1	0.00000	-0.48903	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.68869	0.00000	0.00000	0.00000	-0.00002
41	1	0.00000	-0.47550	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.51609	0.00000	0.00000	0.00000	0.00001
53	1	0.00000	-0.48092	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.75443	0.00000	0.00000	0.00000	0.00000
65	1	0.00000	-0.47396	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.51602	0.00000	0.00000	0.00000	-0.00001
77	1	0.00000	-0.49494	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.68870	0.00000	0.00000	0.00000	0.00002
89	1	0.00000	-0.42290	0.00000	0.00000	0.00000	0.00001
	2	0.00000	0.26981	0.00000	-0.00001	0.00000	-0.00007
100	1	0.00000	-0.59984	0.00000	-0.00002	0.00000	-0.00015
	2	0.00000	-0.07963	0.00000	0.00000	0.00000	0.00001

********** END OF LATEST ANALYSIS RESULT **********

149. FINISH

********** END OF STAAD-III **********

**** DATE= MAY 20,1998 TIME= 16:34: 3 ****

```
**************************************************************
*  FOR  QUESTIONS REGARDING THIS VERSION OF PROGRAM    *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK  *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK  *
**************************************************************
```

J. a. Torroja oficina tecnica, s.a. madrid — REALIZO:

RESUMEN DE RESULTADOS

(B) Momento mínimo en pila P-4

$M_{pp} = -3962,05$

$M_{SC} = -2382,94$

$M_{TOTAL} = -6345$ mt

De los cálculos de la estructura, ya en servicio, se tiene:

$M_{pp + BALASTO + S.C.P.} = -6004,6$

$M_{ct\ i\ PP} = -4544,7$ } $-4544,7$

$M_{SC\ EC-1} = -4201,2$ }

$M_{VIENTO} = -103,72$

$-10.653,0$ mt

Durante la prueba de carga se alcanzará un momento en centro de vano de:

CONSIDERANDO P.P. : $\frac{6345}{10653} = 59,56\%$ del M_{min} en servicio

SI ELIMINAMOS EL P.P: $\frac{-2382,95}{-6690,95} = 35,61\%$

Los camiones suponen un 35,61% de la acción de la superestructura y de las sobrecargas características (incluido viento)

oficina tecnica, s.a.
madrid

REALIZO:

FLECHAS PREVISTAS EN LA PRUEBA DE CARGA

CENTRO DE VANO:	1º	2º	3º	4º	5º	6º	7º	8º	9º
VUDS :	6	17	29	41	53	65	77	89	100
flecha [mm] :	5,13	4,96	3,1	8,42	8,48	2,95	5,47	4,08	6,0

⊕ HACIA ARRIBA

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	1	0.00000	-0.52823	0.00000	0.00000	0.00000	0.00015
	2	0.00000	0.01477	0.00000	0.00000	0.00000	0.00000
17	1	0.00000	-0.44387	0.00000	0.00000	0.00000	-0.00001
	2	0.00000	-0.05158	0.00000	0.00000	0.00000	-0.00001
29	1	0.00000	-0.48903	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.17925	0.00000	0.00000	0.00000	0.00005
41	1	0.00000	-0.47550	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.36655	0.00000	0.00000	0.00000	0.00007
53	1	0.00000	-0.48092	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.36650	0.00000	0.00000	0.00000	-0.00007
65	1	0.00000	-0.47396	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.17926	0.00000	0.00000	0.00000	-0.00005
77	1	0.00000	-0.49494	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.05176	0.00000	0.00000	0.00000	0.00001
89	1	0.00000	-0.42290	0.00000	0.00000	0.00000	0.00001
	2	0.00000	0.01493	0.00000	0.00000	0.00000	0.00000
100	1	0.00000	-0.59984	0.00000	-0.00002	0.00000	-0.00015
	2	0.00000	-0.00441	0.00000	0.00000	0.00000	0.00000


```
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*                                               *
*           S T A A D - III                     *
*           Revision 17.0                       *
*           Proprietary Program of              *
*           RESEARCH ENGINEERS, Inc.            *
*           Date=    MAY 20, 1998               *
*           Time=    16:35:45                   *
*                                               *
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 6. 3 4.49999976269532 0 7999.99873437503
 7. 4 9.24999793892429 0 7999.99465234435
 8. 5 13.9999928541678 0 7999.98775000313
 9. 6 18.749982833867 0 7999.97802735381
10. 7 23.4999662034651 0 7999.96548439982
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45. 42 154.490396133202 0 7998.50815574396
46. 43 158.989532292685 0 7998.41998951176
47. 44 163.488618146887 0 7998.32929252956
```

EMBER END FORCES STRUCTURE TYPE = SPACE

ALL UNITS ARE -- MTON MET

MEMB	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
46	1	46	0.00	-508.82	0.00	-12.71	0.00	3537.32
		47	0.00	552.67	0.00	12.71	0.00	-3962.05
	2	46	0.00	-261.97	0.00	-5.32	0.00	2169.94
		47	0.00	270.37	0.00	5.32	0.00	-2382.94
47	1	47	0.00	553.06	0.00	-15.39	0.00	3962.07
		48	0.00	-509.26	0.00	15.39	0.00	-3537.53
	2	47	0.00	270.37	0.00	-5.20	0.00	2383.00
		48	0.00	-261.98	0.00	5.20	0.00	-2170.25

********** END OF LATEST ANALYSIS RESULT **********

137. PRINT JOINT DISPL LIST 6 17 29 41 53 65 77 89 100

JOINT DISPLACEMENT (CM RADIANS) STRUCTURE TYPE = SPACE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
6	1	0.00000	-0.52823	0.00000	0.00000	0.00000	0.00015
	2	0.00000	0.01477	0.00000	0.00000	0.00000	0.00000
17	1	0.00000	-0.44387	0.00000	0.00000	0.00000	-0.00001
	2	0.00000	-0.05158	0.00000	0.00000	0.00000	-0.00001
29	1	0.00000	-0.48903	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.17925	0.00000	0.00000	0.00000	0.00005
41	1	0.00000	-0.47550	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.36655	0.00000	0.00000	0.00000	0.00007
53	1	0.00000	-0.48092	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.36650	0.00000	0.00000	0.00000	-0.00007
65	1	0.00000	-0.47396	0.00000	0.00000	0.00000	0.00000
	2	0.00000	0.17926	0.00000	0.00000	0.00000	-0.00005
77	1	0.00000	-0.49494	0.00000	0.00000	0.00000	0.00000
	2	0.00000	-0.05176	0.00000	0.00000	0.00000	0.00001
89	1	0.00000	-0.42290	0.00000	0.00000	0.00000	0.00001
	2	0.00000	0.01493	0.00000	0.00000	0.00000	0.00000
100	1	0.00000	-0.59984	0.00000	-0.00002	0.00000	-0.00015
	2	0.00000	-0.00441	0.00000	0.00000	0.00000	0.00000

********** END OF LATEST ANALYSIS RESULT **********

138. FINISH

********** END OF STAAD-III **********

**** DATE= MAY 20,1998 TIME= 16:35:52 ****

****
* FOR QUESTIONS REGARDING THIS VERSION OF PROGRAM *
* TEL:(0454) 281-080, FAX:(0454)-415-866 THORNBURY UK *
* 10, St.MARY ST, St.MARY CENTRE,THORNBURY,BRISTOL,UK *
****

3.2 PASOS SUPERIORES

PASOS SUPERIORES

ÍNDICE

PROYECTO CONSTRUCTIVO (Continuación)

3. CÁLCULOS (Continuación)

3.2. PASOS SUPERIORES

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1. NORMATIVA
2. ACCIONES A CONSIDERAR
3. CUANTIFICACIÓN DE LAS ACCIONES
4. HIPÓTESIS DE CARGA
5. CARACTERÍSTICAS DE LOS MATERIALES
6. CARACTERÍSTICAS DEL TERRENO
7. MÉTODOS DE CÁLCULO

CRITERIOS DE DISEÑO PARA PUENTES DE VIGAS

1. NORMATIVA
2. ACCIONES A CONSIDERAR
3. CUANTIFICACIÓN DE LAS ACCIONES
4. HIPÓTESIS DE CARGA
5. CARACTERÍSTICAS DE LOS MATERIALES
6. (El contenido de este epígrafe no se ha podido incorporar)
7. (El contenido de este epígrafe no se ha podido incorporar)
8. CRITERIOS DE ACEPTACIÓN

PASO SUPERIOR 700+240

TABLERO

PROYECTO DE PRUEBA DE CARGA DE LOS PUENTES DE VIGAS EN ARTESA

ESTRIBOS

PASO SUPERIOR 705+000

TABLERO

ESTRIBOS

PASO SUPERIOR 706+000

TABLERO

ESTRIBOS

PASO SUPERIOR 708+100

TABLERO, PILAS Y ZAPATAS DE PILAS

PRUEBA DE CARGA

PASO SUPERIOR 710+900

TABLERO

ESTRIBOS

PASO SUPERIOR 712+620

TABLERO, PILAS Y ZAPATAS DE PILAS

ESTRIBOS

CRITERIOS DE DISEÑO PARA PUENTES POSTENSADOS

1. NORMATIVA.

- Instrucción relativa a las acciones a considerar en el proyecto de puentes de carretera (IPC).

- Instrucción para el proyecto y la ejecución de obras de hormigón en masa y armado (EH-91).

- Instrucción para el proyecto y la ejecución de obras de hormigón pretensado (EP-93).

- Norma de construcción Sismorresistente NCSE-94.

2. ACCIONES A CONSIDERAR.

a. cargas permanentes:
   - a1: peso propio.
   - a2: cargas muertas.

b. sobrecargas.

c. acciones indirectas:
   - c1: reológicas.
   - c2: hiperestáticas de pretensado
   - c3: asientos diferenciales de la cimentación

3. CUANTIFICACIÓN DE LAS ACCIONES.

a. cargas permanentes

- a1: volumen de hormigón con un peso específico de 2,5 t/m3
- a2: cargas muertas: Sobre tablero se consideran tanto el peso del pavimento (suponiendo un peso específico de 2,4 t/m3) como el de las barreras, impostas y barandillas.

b. sobrecargas

- b1: Las sobrecargas en tablero son las siguientes:
  - Tren de cargas de la IPC, compuesto por:
    . Carga uniforme de 0,40 t/m2
    . Vehículo de 60 t, distribuidas en tres ejes separados 1,5 metros, formados cada uno por dos ruedas distanciadas 2 metros.
    . Se consideran también las de frenado, fuerza centrífuga, empuje sobre barandillas y empujes de viento.

- b2: La sobrecarga de superficie sobre rellenos de trasdós de alzados se considera de 1 t/m2 en caso de estribos y aletas vueltas, y 0 en caso de aletas en prolongación.

- b3: Para los empujes del terreno sobre alzados de estribo se analizan dos estados de carga correspondientes a empuje en reposo y empuje activo, considerando el ángulo de rozamiento interno φ del terreno indicado en el anejo de geotecnia para cada estructura. El ángulo de rozamiento entre hormigón y terreno se considera de 2/3 excepto en el caso de que el estribo se sitúe en un tramo en desmonte donde se considerará un ángulo de rozamiento de 0, por existir una capa drenante en la interfase. No se considera empuje pasivo en puntera de zapatas.

- b4: Para las aletas desvinculadas del alzado de estribo mediante junta de dilatación se utiliza el coeficiente de empuje activo. En los casos en los que la aleta esté unida al alzado de estribo dependerá de la relación de rigideces de ambos elementos (con rigideces similares en aletas y alzados de estribo el coeficiente de empuje será el reposo).

c. acciones indirectas

Se consideran las reológicas, las del pretensado (considerando los efectos hiperestáticos producidos por la introducción de la fuerza de pretensado) y los asientos diferenciales, teniendo en cuenta la fluencia del hormigón del tablero, según los valores definidos en el anejo de geotecnia. Para la estimación de las sobrecargas reológicas se parte del valor de la humedad relativa del aire para la zona, estimado en el 70% (anejo de climatología e hidrología).

4. HIPÓTESIS DE CARGA.

Para el tablero se realizan las combinaciones de carga definidas en la IPC, con las disposiciones de sobrecarga del tren de la Instrucción que proporcionen valores máximos y

mínimos de esfuerzos en las distintas secciones del tablero (momentos flectores, cortantes y torsores), así como de reacciones en los apoyos.

Las pilas se calculan a partir de los esfuerzos verticales obtenidos en el cálculo del tablero combinados con las correspondientes reacciones horizontales obtenidas en cabeza de elementos (pilas y estribos) del reparto de las cargas horizontales (reológicas, frenado, viento, centrífuga y sísmicas) entre los elementos de soporte, considerando para ello las rigideces de pilas y estribos así como las dimensiones de los aparatos de apoyo.

En los estribos se consideran las hipótesis de carga que proporcionan las reacciones verticales máximas y mínimas, combinándose con las horizontales obtenidas en el cálculo antes mencionado, diferenciándose respecto al empuje de tierras dos estados de carga, en reposo sin actuación del sismo, y con sismo y empuje activo.

5. CARACTERÍSTICAS DE LOS MATERIALES.

5.1 HORMIGONES

- hormigón de limpieza H-125 (fck =125 kg/cm^2)
- hormigón en alzados de estribos y cimientos H-250 (fck=250 kg/cm^2)
- hormigón en alzados de pila H-300 (fck =300 kg/cm^2).
- hormigón en tableros H-400 (fck = 400 kg/cm^2).
- nivel de control en tablero INTENSO.
- nivel de control en resto de obra NORMAL.
- caso de fisuración adoptado II.
- clase de pretensado : II

5.2 ACERO EN ARMADURA PASIVA

- tipo AEH-500 N (fyk = 5.100 kg/cm^2).
- módulo de elasticidad E = 2.100.000 kg/cm^2
- diámetros de armadura: 8 mm $\leq \phi \leq$ 32 mm.
- nivel de control NORMAL (coeficiente de seguridad c.s.=1,15).
- recubrimientos de armadura
  cimientos - 5 cm.
  alzados, pilas y tableros -3 cm.

5.3 ACERO EN ARMADURA ACTIVA

- tensión de rotura 190.000 t/m^2.
- límite elástico 171.000 t/m^2.
- módulo de elasticidad E = 2.100.000 kg/cm^2
- nivel de control INTENSO
- coeficiente de rozamiento en curva: 0,21
- relajación : R2
- recubrimiento mínimo =1ϕ (ϕ = diámetro de la vaina).
- Para el pretensado se considera que la armadura activa está constituida por tendones formados por varios elementos agrupados en una misma vaina de acero, sin tratamiento superficial y compuestos por alambres torzales o cordones trefilados.

5.4 MATERIAL ELASTOMÉRICO (APARATOS DE APOYO)

- módulo de elasticidad instantáneo Ei = 200 t/m^2
- módulo de elasticidad diferido Ed = 100 t/m^2
- compresión máxima admisible 150 kg/cm^2.
- compresión media mínima con seguridad al deslizamiento 30 kg/cm^2.

6. CARACTERÍSTICAS DEL TERRENO.

6.1 TERRAPLÉN

- ángulo de rozamiento interno φ
- peso especifico γ

6.2 CIMENTACIÓN

- ángulo de rozamiento cimiento - terreno δ
- cohesión c
- tensión admisible σ
- coeficiente de punta
- profundidad de cimentación

Estos parámetros son los que se indican en el anejo geotécnico.

7. MÉTODOS DE CÁLCULO.

7.1 TABLEROS

Se calculan como viga continua considerando las características mecánicas de las diversas secciones transversales, obteniéndose, en primer lugar, la envolvente de momentos flectores y esfuerzos cortantes considerando las cargas permanentes y sobrecargas según las hipótesis contempladas en la Instrucción. El pretensado se encaja a partir de geometrías parabólicas, introduciendo los efectos adicionales que éste provoca y evaluando las pérdidas según la EP-93. En último término se comprueba el estado tensional de la pieza (cada una de las secciones) en la hipótesis de peso propio estricto y primer pretensado (con pérdidas instantáneas), así como el resto de hipótesis de carga de servicio, considerando pérdidas instantáneas y diferidas. Se comprueba también el estado límite último de cortante, torsor y rotura (flexo-compresión) en cada una de las secciones. También se calcula la prueba de carga para cada vano del tablero.

Para determinar los esfuerzos en riostras sobre pilas o estribos se considera la carga máxima sobre el apoyo repartiendo uniformemente la misma en el ancho del tablero, despreciando la zona no colaborante de los voladizos de la sección. Se calcula como viga n-apoyada (n=nº de apoyos), o empotrada en el eje para casos de apoyo único, suponiendo el ancho de influencia correspondiente al que se obtiene por geometría, bien repartiendo a 45º desde la base de los apoyos hacia la parte superior del tablero, o bien considerando el ancho real de la riostra configurada en estribos, donde la sección tiene distinta geometría que el resto de las secciones de tablero en un ancho determinado.

7.2 PLACAS DE APOYO

Se calculan según las "Recomendaciones para el Proyecto y Puesta en Obra de los Apoyos Elastoméricos para Puentes de Carretera" (MOPTMA) a partir de los esfuerzos obtenidos en el cálculo del tablero y los esfuerzos horizontales, calculados con un modelo de muelles donde se considera la rigidez de los distintos elementos de soporte (neoprenos y pilas o estribos) sometidos a los esfuerzos horizontales debidos a los efectos reológicos, de viento, de frenado, centrífuga y sismo, asumiendo un comportamiento rígido del tablero en su plano.

7.3 PILAS

Se supone la estructura empotrada en cimentación y libre en el extremo superior, y se calculan a partir de los esfuerzos obtenidos en el análisis del tablero y cálculo de los neoprenos. Se analiza también el pandeo siguiendo las prescripciones de la EH-91.

7.4 ESTRIBOS

Los alzados son calculados como ménsulas empotradas en la cimentación, que soportan los empujes de tierras y sobrecarga en trasdós, así como las fuerzas verticales y horizontales provenientes del tablero (reológicas, frenado, viento, sismo). En caso de existir aletas vueltas vinculadas al alzado de estribo, los bordes de éste se comprueban asumiendo un comportamiento de placas biempotradas en base y lado, dimensionándose la armadura horizontal para absorber los esfuerzos locales que esta forma de trabajo pueda ocasionar. La cimentación se comprueba considerando todas las cargas actuantes sobre el estribo (cargas verticales y horizontales del tablero, empujes de tierra, sobrecargas de trasdós, peso propio del conjunto y peso de tierras). Se considera que las cargas se reparten uniformemente en todo el ancho del estribo. Se comprueban las tensiones en el terreno y la seguridad al deslizamiento y vuelco del conjunto.

7.5 ALETAS

En las aletas desvinculadas del estribo se asume un comportamiento en ménsula considerándose un empotramiento perfecto en zapata, estudiándose diversas secciones según la altura. El dimensionamiento de la zapata se realiza asumiendo un funcionamiento como zapata corrida. En estos casos, además, es preciso comprobar la seguridad del conjunto estructural al deslizamiento y vuelco. En aletas unidas al estribo hay que considerar también el ya mencionado comportamiento como placa en las proximidades de la unión.

7.6 PROGRAMAS UTILIZADOS

En todos los casos el tipo de análisis efectuado es estático y lineal y para su resolución se hace uso de programas de ordenador u hojas de cálculo. Los programas utilizados son:

- PUENLOSA (TYPSA), para cálculo del tablero, apoyos y pilas.
- PLACA (TYPSA)

CRITERIOS DE DISEÑO PARA PUENTES DE VIGAS

1. NORMATIVA.

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- Instrucción para el proyecto y la ejecución de obras de hormigón en masa y armado (EH-91).
- Instrucción para el proyecto y la ejecución de obras de hormigón pretensado (EP-93).

2. ACCIONES A CONSIDERAR.

a. cargas permanentes:
   - a1: peso propio.
   - a2: cargas muertas.

b. sobrecargas.

c. acciones indirectas:
   - c1: reológicas.

3. CUANTIFICACIÓN DE LAS ACCIONES.

a. cargas permanentes

- a1: volumen de hormigón con un peso específico de 2,5 t/m^3
- a2: cargas muertas: Sobre tablero se consideran tanto el peso del pavimento (suponiendo un peso específico de 2,4 t/m3) como el de las barreras, impostas y barandillas.

b. sobrecargas

- b1 Las sobrecargas en tablero son las siguientes:
  - Tren de cargas de la IPC, compuesto por:
    . Carga uniforme de 0,40 t/m^2
    . Vehículo de 60 t, distribuidas en tres ejes separados 1,5 metros, formados cada uno por dos ruedas distanciadas 2 metros.
  - Se consideran también las de frenado, fuerza centrífuga, empuje sobre barandillas y empujes de viento.
  - En su caso tren de cargas de la Instrucción Española de Ferrocarriles o el SW-2 de la UIC según el que sea más desfavorable

- b2 La sobrecarga de superficie sobre rellenos de trasdós de alzados se considera de 1 t/m^2 en caso de los estribos-cargaderos y aletas vueltas.
- b3 Para los empujes del terreno sobre alzados de estribo se analizan dos estados de carga correspondientes a empuje en reposo y empuje activo, considerando el ángulo de rozamiento interno φ del terreno indicado en el anejo de geotecnia para cada estructura. El ángulo de rozamiento entre hormigón y terreno se considera de 2/3 . No se considera empuje pasivo en puntera de zapatas.
- b4 Para las aletas se utiliza el coeficiente de empuje activo.

c.- acciones indirectas

Se consideran las reológicas. Para la estimación de éstas se parte del valor de la humedad relativa del aire para la zona, estimado en el 70% (anejo de climatología e hidrología).

4. HIPÓTESIS DE CARGA.

Para el tablero se realizan las combinaciones de carga definidas en la IPC, con las disposiciones de sobrecarga del tren de la Instrucción que proporcionen valores máximos y mínimos de esfuerzos en las distintas secciones del tablero (momentos flectores, cortantes y torsores), así como de reacciones en los apoyos.

En los estribos se consideran las hipótesis de carga que proporcionan las reacciones verticales máximas y mínimas, combinándose con las horizontales (reológicas, frenado, viento y sísmicas), diferenciándose respecto al empuje de tierras dos estados de carga, en reposo sin actuación del sismo, y con sismo y empuje activo.

5. CARACTERÍSTICAS DE LOS MATERIALES.

5.1 HORMIGONES

- hormigón de limpieza H-125 (fck =125 kg/cm^2)
- hormigón en alzados de estribos y cimientos H-250 (fck=250 kg/cm^2)
- hormigón en vigas prefabricadas H-450 (fck = 450 kg/cm^2).
- hormigón en losas y riostras H-250 (fck = 250 kg/cm^2).
- nivel de control en vigas INTENSO.
- nivel de control en resto de obra NORMAL.
- caso de fisuración adoptado II.

5.2 ACERO EN ARMADURA PASIVA

- tipo AEH-500 N (fyk = 5.100 kg/cm^2).
- módulo de elasticidad E = 2.100.000 kg/cm^2
- diámetros de armadura: 8 mm $\leq \phi \leq$ 32 mm.

La página con el contenido de los epígrafes correspondientes al final del punto 5, el 6 y parte del 7 no se encontraban en la documentación aportada como “Proyecto Constructivo”, de ahí que no se pueda incorporar en este documento.

7.4 ALETAS

En las aletas, del tipo orejas, se asume un comportamiento en ménsula considerándose un empotramiento perfecto con el alzado del estribo.

7.5 PROGRAMAS UTILIZADOS

En todos los casos el tipo de análisis efectuado es estático y lineal y para su resolución se hace uso de programas de ordenador u hojas de cálculo. Los programas utilizados son:

- PUENTE NERVADO, para el cálculo del tablero (vigas y losa) y prueba de carga.
- VIGA FLOTANTE (TYPSA), para la comprobación de la cimentación de los estribos cargaderos.
- diversas hojas de cálculo

8. CRITERIOS DE ACEPTACIÓN

Se seguirán las prescripciones de la EH-91 asumiendo un nivel de control intenso en la ejecución de las vigas y normal en el resto de elementos estructurales.

Los estados límites últimos se comprobarán con los siguientes coeficientes de seguridad:

- hormigón en vigas = 1,4
- hormigón en resto de obra = 1,5
- acero activo = 1,1
- acero pasivo en vigas = 1,1
- acero pasivo = 1,15
- cargas en tablero = 1,5
- empuje sobre estribos y aletas en hipótesis sísmica (Mononobe-Okabe)= 2
- resto de cargas = 1,6

Se comprobarán los estados límites de servicio con coeficientes 0,9 ó 1,1 (según sean acciones favorables o desfavorables) tanto para materiales como para cargas.

No se admitirán tracciones superiores a la máxima de tracción permitida por el hormigón en ninguna sección de las vigas en ningún estado de cargas. Se tiende, no obstante, a reducir al máximo los valores de tracción, acercándonos al estado de pretensado clase I (todo comprimido) lo más posible.

En la prueba de carga del tablero los momentos obtenidos no deberán superar el 80% de los que proporcione el tren de la Instrucción, y deberán ser superiores al 70%.

No se admitirán tensiones en el terreno superiores a las definidas en el anejo de cimentación de estructuras.

Tampoco deberán superarse los anchos de fisura indicados en la EH-91 para el caso de fisuración que se indica en el punto 5.1.

En estribos se rechazarán geometrías que presenten coeficientes de seguridad al deslizamiento inferiores a 1,5, y coeficientes de seguridad al vuelco por debajo de 1,8 en hipótesis sin sismo, e inferiores a 1,2 frente al deslizamiento y por debajo de 1,3 frente al vuelco en hipótesis con sismo.

PASO SUPERIOR 700+240

PASO SUPERIOR 700+240
TABLERO

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 teoría 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_f = 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
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 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.

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DATOS GEOMETRICOS

Solucion ..... = 2 CJ- 110
Luz de Calculo .....[m] = 23
Intereje .....[m] = 4
Dis. eje V.Borde a Ex.Tablero [m] = 2.2

Ancho del Tablero .....[m] = 8.4
Ancho de las Aceras .....[m] = 1.4
Ancho Eficaz [B0] .....[m] = 8.142

Angulo de Esviaje .....[g] = 0
Espesor de la Losa .....[m] = .24
Canto Total .....[m] = 1.34
Espesor del Pavimento .....[cm] = 8

Peso del Carro .....[Tn] = 60
Distan. del carro a la Acera [m] = .5
Peso Aceras y Barandillas [Tn/ml] = 1.5

CARGAS [Tn/ml]

P1 = 2.0911
P2 = 2.5200
P3 = 0.7680
P3'= 1.2312
P4 = 1.6800

CARACTERISTICAS MECANICAS

[INICIALES]

VaI ... [m] = .6647659
VbI .... [m] = .4352341
AREA .. [m2] = .8766884
INERCIA [m4] = .1279128

[FINALES]

VIGA No. 1

VaF ..... [m] = 0.296444
VbF ..... [m] = 0.803556
VcF ..... [m] = 0.536444
INER.FIN. [m4] = 0.385039
K (rasante)... = 0.872172

VIGA CENTRAL

VaF ..... [m] = 0.305964
VbF ..... [m] = 0.794036
VcF ..... [m] = 0.545964
INER.FIN. [m4] = 0.378312
K (rasante)... = 0.864737

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COEFICIENTES EXCENTRICIDAD SIN AJUSTAR

	CARGA ACERA	CARRO EXCENTRI.	CARRO CENTRADO	CARRO OPCIONAL
Y 1	.8438851	.5649541	.2456322	
Y 2	-.8438851	7.368964E-02	-.2456322	

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	.97391	1.23849	1.01415	
2	.97391	.78149	1.01415	

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REPARTO TRANSVERSAL
K (Flexion) = 0.532808
K (Torsion) = 0.850000

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COEFICIENTES MAS DESFAVORABLES

Numero de VIGA	Y 1	Y 2	COEFICIENTE MAS DESFAVORABLE
1	.56495	.07368	1.23849
2	-.07369	-.56496	1.23849

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ESFUERZOS LONGITUDINALES [MTn.]

[VIGA DE BORDE]	[VIGA NO. 2]
M1 = 138.2720	138.2720
M2 = 166.6350	166.6350
M3 = 50.7840	50.7840
M3'= 79.2890	79.2890
M4 = 111.0900	111.0900
M5 = 193.1312	195.0622

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	
11.50	718.6	470.5-	1689.8	1310.5-	187.7	1937.4	1953.1-	629.5	L/2
10.50	713.1	467.0-	1677.0	1300.6-	186.2	1922.7	1938.3-	624.7	
9.50	696.8	456.3-	1638.6	1270.9-	182.0	1878.8	1894.0-	610.5	
8.50	669.6	438.5-	1574.8	1221.3-	174.9	1805.5	1820.2-	586.7	
7.50	631.6	413.6-	1485.3	1152.0-	165.0	1703.0	1716.8-	553.3	
6.50	582.7	381.6-	1370.3	1062.8-	152.2	1571.1	1583.9-	510.5	
5.50	522.9	342.5-	1229.8	953.8-	136.6	1410.0	1421.5-	458.1	
4.50	452.3	296.2-	1063.7	825.0-	118.1	1219.5	1229.5-	396.2	
3.50	370.8	242.9-	872.0	676.3-	96.8	999.8	1008.0-	324.8	
2.50	278.4	182.4-	654.8	507.9-	72.7	750.7	756.9-	243.9	
1.50	175.2	114.8-	412.0	319.6-	45.7	472.4	476.3-	153.5	
0.50	61.1	40.1-	143.7	111.5-	15.9	164.8	166.2-	53.5	
.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						
TRAZADO	RECTO	RECTO	RECTO	RECTO					N	EX
COTA->	4	9	106	106					(TN)	(Cm)
X	Num.	Num.	Num.	Num.						
11.5	33	16	6	2					1106	25

No se consideran los entubados cuya longitud es menor de 0.5 metros

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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	
11.50	571.2	1609.8	1565.7	441.3	187.7	1813.3	201.3-	629.5	L/2
.50	565.7	1613.3	1552.9	451.2	186.2	1798.6	186.5-	624.7	
50	549.4	1624.0	1514.5	480.9	182.0	1754.7	142.2-	610.5	
.50	522.2	1641.8	1450.7	530.5	174.9	1681.4	68.4-	586.7	
7.50	484.2	1666.7	1361.2	599.8	165.0	1578.9	35.0	553.3	
6.50	435.3	1698.7	1246.2	689.0	152.2	1447.0	167.9	510.5	
5.50	375.5	1737.8	1105.7	798.0	136.6	1285.9	330.3	458.1	
4.50	304.9	1784.1	939.6	926.8	118.1	1095.4	522.3	396.2	
3.50	223.4	1837.4	747.9	1075.5	96.8	875.7	743.8	324.8	
2.50	131.0	1897.9	530.7	1243.9	72.7	626.6	994.9	243.9	
1.50	27.8	1965.5	287.9	1432.2	45.7	348.3	1275.5	153.5	
0.50	86.3-	2040.2	19.6	1640.3	15.9	40.7	1585.6	53.5	
0.00	147.4-	2080.3	124.1-	1751.8	0.0	124.1-	1751.8	0.0	APOYO

Calculo de las tensiones con el entubado real

RESISTENCIA DE HORMIGONES [Tn/m2]

DESTESAR .. = 3328.49
A LOS 28 DIAS = 2901.42 se dispone Hormigon de 4500
EN LOSA ..... = 1007.26 '' '' '' '' 2500

P U E N T E N E R V A D O

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ARMADURAS DE CORTANTES [EP-93]

Acero Fy ..... [Kg/cm2] >= 5100
Espesor del Alma ... [cm] = 30.0
Fct'K .....[Kg/cm2] = 264.2536
Vcuo ..... [Tn] = 34.6915
Armadura Minima..[cm2/ml] = 5.8235

*** Armaduras por Alma del Cajón ***

ARMADURAS DE CORTANTES

PTO	X	U	URD	SIGMA	COTAG	Z	VCU	A90	Diam	S
1	0	147.15	235.44	-175.19	1.58	AB	34.69	26.01	12	15
2	1.5	132.21	211.53	-98.99	1.94	AB	34.69	18.68	10	15
3	3.49	106.65	170.64	-13.93	2.27	AB	34.69	12.25	8	15
4	5.5	76.73	122.76	52.23	2.5	C	0	12.58	8	15
5	7.5	57.85	92.57	99.49	2.65	C	3.83	9.09	8	20

S I M B O L O G I A

PTO = Punto numero
X = Distancia al apoyo en m.
U = Cortante en seccion considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobacion (Art. 48.1.3.3)
VCU = Contribucion hormigon 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 = Separacion entre estribos en cm.

P U E N T E N E R V A D O

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ARMADURAS DE RASANTE

ARMADURAS DE RASANTE

Punto	X	E.R.	C.M.N.	C.M.E.E.	C.M.S.	Diam.	S
1	0	94.12	122.09	69.85	52.24	12	20
2	1.5	86.1	111.68	48.83	62.85	12	10
3	3.49	69.76	90.49	30.9	59.58	12	10
4	5.5	49.06	63.64	30.9	32.73	10	20
5	7.5	39.41	51.12	23.18	27.93	10	20

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	2.13995	-1.89
FLEXION LOCALIZADA	2.48	-2.56
T O T A L E S	4.61995	-4.45

DEFORMACION TRANSVERSAL : Obtenida con el desarrollo en serie de la carga con siete terminos.
FLEXION LOCALIZADA .... : Obtenida por el metodo de Westergaard.

P U E N T E N E R V A D O

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ARMADO LOSA

Res. Caract. del Hormigon [Tn/m2] = 2500
Res. Acero de la Losa [Tn/m2] = 51000
Recubrimiento ..... [cm] = 4.0
Armadura Minima ..... [Tn] = 13.3333

[CARA SUPERIOR]
Armadura Principal= 38.22002 Tn/ml se dispone 11 Φ 10 por ml
Armadura Reparto = 9.555004 Tn/ml se dispone 5 Φ 8 por ml

[CARA INFERIOR]
Armadura Principal= 39.82592 Tn/ml se dispone 5 Φ 16 por ml
Armadura Reparto = 9.956479 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] = 75.6487
Carga Maxima en Apoyo..... [Tn] = 147.1541
Carga de Frenado en Apoyo..... [Tn] = 1.7370
Giro de Apoyo..... [Min.] = 2.9357
Des. Hori.[Retra. Fluen. Temp.] [cm]= 0.8050

APOYO de 250 mm X 600 mm. en Planta y 43 mm. de Altura

[COMPROBACION]

Tension Minima de Compresion [Kg/cm2] = 50.4325
Tension Maxima de Compresion [Kg/cm2] = 98.1027
Giro por Cargas Lentas TG ..... = 0.2683
Giro de Frenado TG..... = 0.0579
Giro Total TG..... = 0.3262
Fuerza Horizontal Carga Lenta [Kg] = 3220.0000
Coeficiente 1 = 0.0426
Coeficiente 2 = 0.0337
Giro Admisible de Apoyo .....[Min] = 49.4928

[PLACA VALIDA]

P U E N T E N E R V A D O

(c) Oficina Técnica ALVISA

CALCULO A ROTURA

Pasiva en Traccion	[Tn] =	0.00
Armadura Activa	[Tn] =	1020.05
Capacidad total en traccion N..	[Tn] =	1020.05
Pasiva en Compresion	[Tn] =	0.00
Recubrimiento Pasiva Compresion	[cm] =	5.00
Zona	=	I
Ancho Eficaz	[m] =	4.40
Capa Compresion	[cm] =	24.00
Dis. CDG Compre. a Fibra Super.	[cm] =	8.18
Profundidad de Compresiones ...	[cm] =	16.36
Dis. CDG Trac. a Fibra Inferior	[cm] =	5.63
Canto Resistente	[m] =	1.20
Momento de Rotura (MR+) ..	[MTn.] =	1225.95

COEFICIENTE DE SEGURIDAD A ROTURA = [1.65]

[MOMENTOS [MTn.]]

M1 ... =	138.272
M2 ... =	166.634
M3 ... =	50.784
M3'... =	79.289
M4 ... =	111.090
M5 ... =	195.062
M TOTAL=	741.132

[VOLUMEN DE TRACCIONES]

SA [Tn/m2] =	1813.38944
SB [Tn/m2] =	-201.19260
X [m] =	0.10985

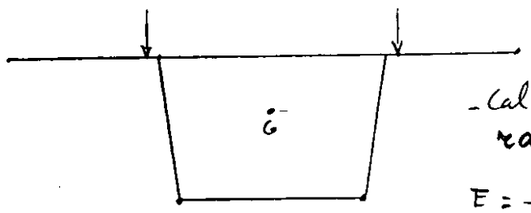
Ancho Cabeza Inferior [cm] = 170.0
Volumen de Tracciones [Tn] = 18.8

PRUEBA DE CARGA DE LOS PUENTES DE VIGAS EN ARTESA

Prueba de carga considerando medio puente.-

$E_{Tab.(H-250)} = 3004163'8\ T/m^2$

$E_{viga(H-450)} = 4030508'7\ T/m^2$



- Calculamos una E. media ponderada con las areas

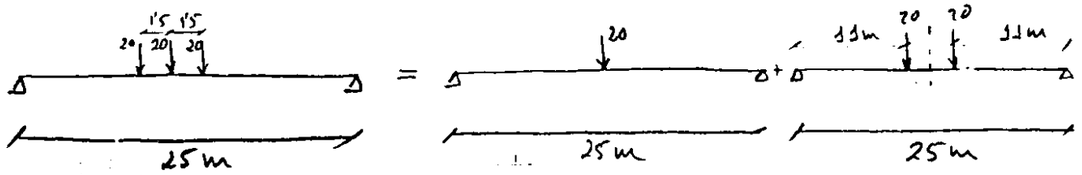
$$E = \frac{E_{Tab}\cdot 1'05 + E_{viga}\cdot 0'8125}{1'05 + 0'8425} = \frac{3004163'8\cdot 1'05 + 4030508'7\cdot 0'8425}{1'8925} = 3461070'314$$

$Y_G = 0'888\ m$

$I_G = 0'409\ m^4$

Area de la sección de tablero $= 42\cdot 0'25 = 1'05\ m^2$

Area de la antesa $= 0'8425\ m^2$



① momento y flecha en el punto medio

$$M = \frac{P\cdot \ell}{4} = \frac{20\cdot 25}{4} = 125\ mT$$

$$f = \frac{P\ell^3}{48EJ} = \frac{20.25^3}{48.3461070'314.0'409} = 0'0045\,99123\ m$$

② momento y flecha en el punto medio.

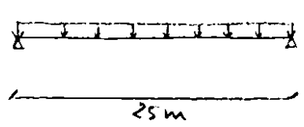
$$M = P.a = 20.11 = 220\ mT$$

$$f = \frac{P.a}{24EJ}(3\ell^2 - 4a^2) = \frac{20.11}{24.3461070'314.0'409}\underbrace{(3.25^2 - 4.11^2)}_{1391} = 0'009007511$$

Por lo tanto

$M_{carro} = 345\ mT$ $\quad f_{carro} = 0'0136066\ m.$

carga repartida.-



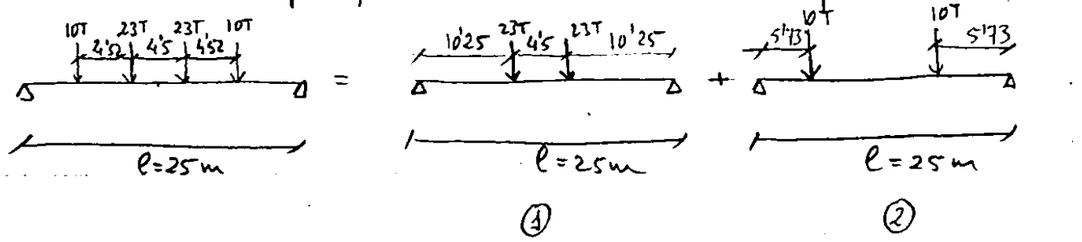
$$M = \frac{P\ell^2}{8} = \frac{4'168.25^2}{8} = 133'25\ mT$$

$$f = \frac{5p\ell^4}{384EJ} = \frac{5.168.25^4}{384.3461070'314.0'409} = 0'006036349$$

Momento y flecha de solo carga mas carro

$M_{sc} = 345 + 131'25 = 476'25$ $\quad f_{sc} = 0'0136066 + 0'006036349 = 0'019642949\ m$

Prueba de carga primer escalón, una sola fila de camiones



① momento y flecha en el punto medio

$$M = P.a = 23.10'25 = 235'75$$

$$f = \frac{P.a}{24.E.J}(3\ell^2 - 4a^2) = \frac{23.10'25}{24.3461070'314.0'409}\underbrace{(3.25^2 - 4.10'25^2)}_{1454'75} = 0'010094739\ m$$

② momento y flecha en el punto medio

$$M = P.a = 10.5'73 = 57'3\ m.T$$

$$f = \frac{P.a}{24EJ}(3\ell^2 - 4a^2) = \frac{10.5'73}{24.3461070'314.0'409}\underbrace{(3.25^2 - 4.5'73^2)}_{1743'68} = 0'002940854$$

Momento total y flecha total en primer escalón

$M_{T1} = 235'75 + 57'3 = 293'05$ $\quad f_{T1} = 0'013035593\ m$

Porcentaje de momento alcanzado

$$\frac{M_{T1}}{M_{SC}} = \frac{293'05}{476'25} = 0'6153$$

Segundo escalón · considerando fila y media de camiones
El cálculo será idéntico al anterior pero considerando cargas de $10+5 = 15\,T$ y $23 + \frac{23}{2} = 34'5\,T$

① momento y flecha en el punto medio

$M = P.a = 34'5 \cdot 10'25 = 353'625\ mT$

$f = 0'010094739 \cdot \frac{34'5}{23} = 0'015142108\ m$

② momento y flecha en el punto medio

$M = P.a = 15 \cdot 5'73 = 85'95\ mT$

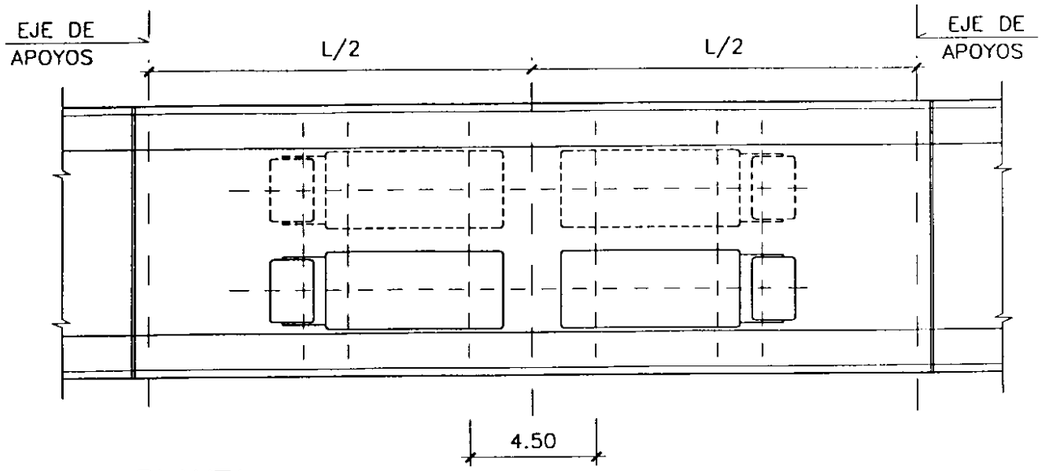
$f = 0'002940854 \cdot \frac{15}{10} = 0'004411281\ m$

Momento total y flecha total en el segundo escalón

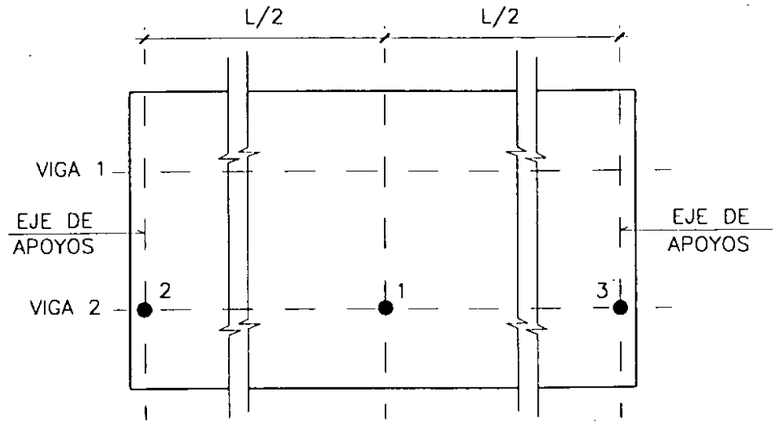
$M_{T2} = 353'625 + 85'95 = \underline{439'575}\ mT$; $f_T = \underline{0'019553389}\ m$

Porcentaje del momento alcanzado

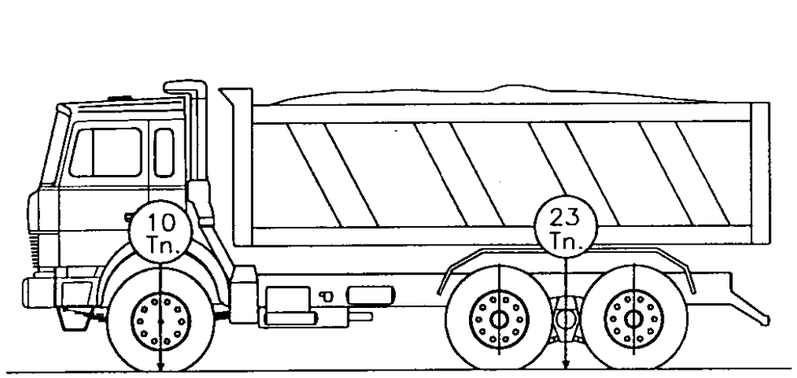
$\frac{M_{T2}}{M_{SC}} = \frac{439'575}{476'25} = \underline{0'9229}$



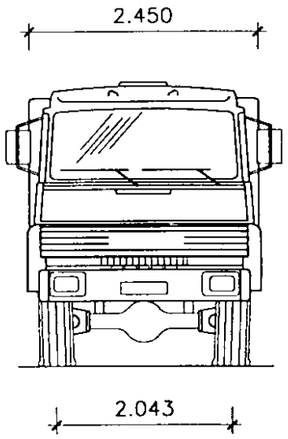
PLANTA

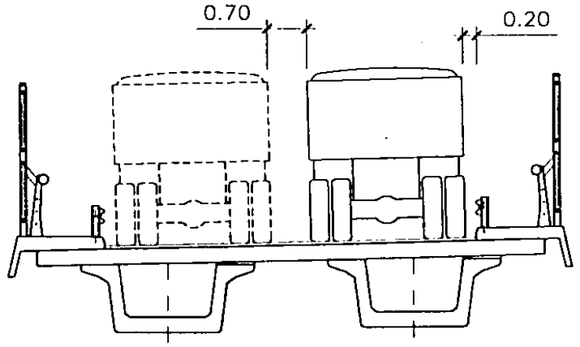


POSICION DE APARATOS
DE MEDIDA



CAMION TIPO





SECCION

MOMENTO MAXIMO (m. Tn.) PRODUCIDO EN EL TREN DE CARGAS DE :		
INSTRUCCION	PRUEBA DE CARGA	
	1° ESCALON	2? ESCALON
476.25	293.05	439.57

FLECHAS TEORICAS (mm.) PRODUCIDO EN EL TREN DE CARGAS DE :		
INSTRUCCION	PRUEBA DE CARGA	
	1° ESCALON	2? ESCALON
19.64	13.03	19.55

-LOS VALORES DE MOMENTOS Y FLECHAS SE DAN PARA CENTRO DE VANO DE LA VIGA 1

ESCALON 1 ———
ESCALON 2 - - - - - - - -

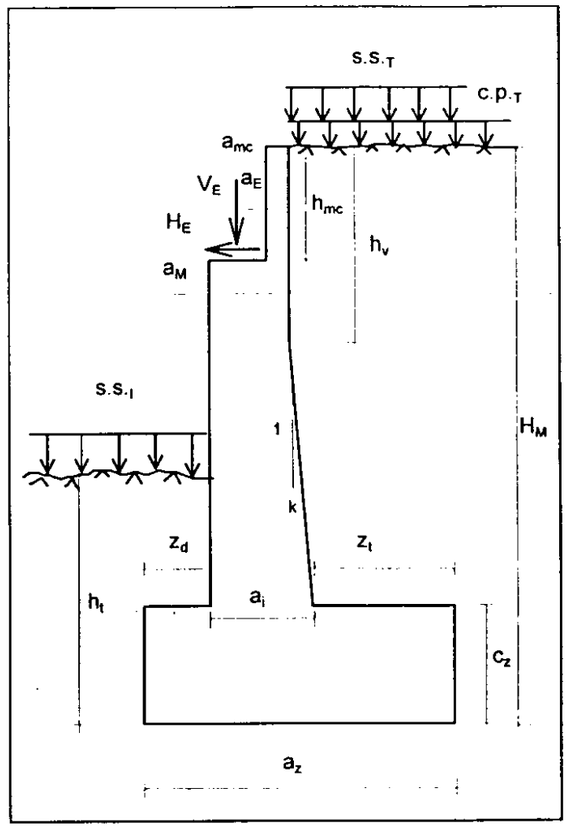
PRUEBA DE CARGA

PASO SUPERIOR 700+240
ESTRIBOS

CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	14.03	m
h_t=	2.05	m
h_v=	12.73	m
h_{mc}=	1.45	m
a_{mc}=	0.30	m
a_M=	1.10	m
a_z=	6.70	m
c_z=	1.30	m
k=	0.00	
a_i=	1.10	m
z_d=	1.40	m
z_t=	4.20	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	º
angulo de rozamiento contacto relleno-muro δ_M =	0.0	º
angulo de rozamiento contacto terreno-muro δ_T =	40	º
cohesión =	0	t/m²
σ_{adm} =	70	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	1.00	t/m²
$s.s._I$ =	0.00	t/m²
$(V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$(V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.40	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	30.6 t/m²	$(\sigma_{med})_{adm}$ =	70.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	84.3 t/m²	$(\sigma_{máx})_{adm}$ =	87.5 t/m²	l_c= 4.86 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.14	$(\gamma_d)_{adm}$=	1.50
γ_v=	1.83	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

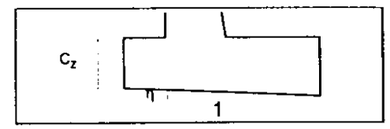
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

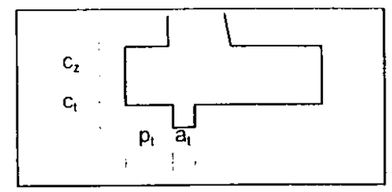
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 γ_c = 1.50

ACERO AEH-500 γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

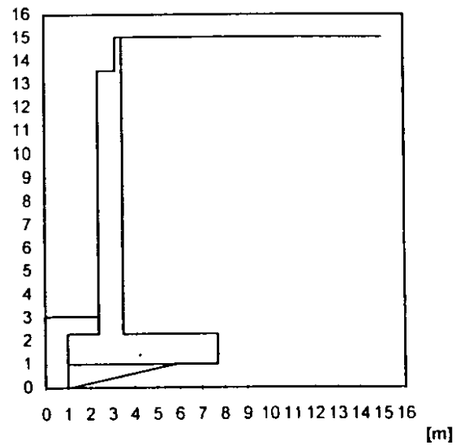
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 75.04 t

Vd= 95.30 t

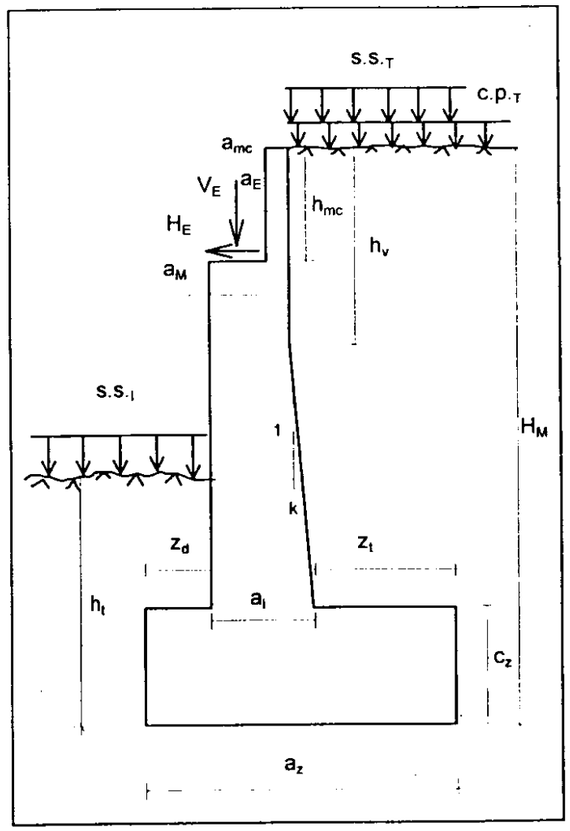
COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	14.03	m
h_t=	2.05	m
h_v=	12.73	m
h_{mc}=	1.45	m
a_{mc}=	0.30	m
a_M=	1.10	m
a_Z=	6.70	m
c_Z=	1.30	m
k=	0.00	
a_t=	1.10	m
z_d=	1.40	m
z_t=	4.20	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	°
angulo de rozamiento contacto relleno-muro δ_M =	0.0	°
angulo de rozamiento contacto terreno-muro δ_T =	40	°
cohesión =	0	t/m²
σ_{adm} =	70	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	1.00	t/m²
$s.s._I$ =	0.00	t/m²
$(V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$(V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.40	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	28.6 t/m²	$(\sigma_{med})_{adm}$ =	70.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	77.1 t/m²	$(\sigma_{máx})_{adm}$ =	87.5 t/m²	l_c= 4.97 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.02	$(\gamma_d)_{adm}$=	1.50
γ_v=	1.81	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

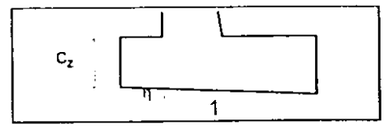
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

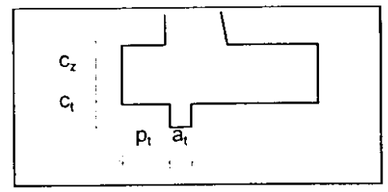
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 ▼ γ_c = 1.50

ACERO AEH-500 ▼ γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

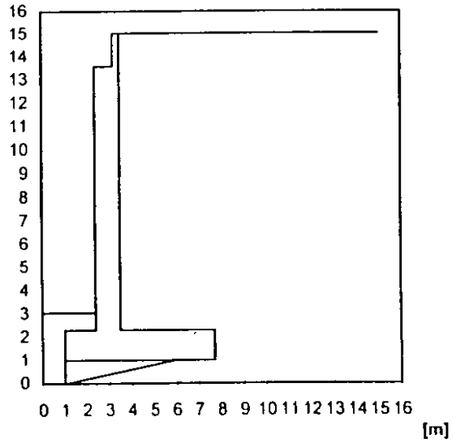
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 75.04 t

Vd= 86.87 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



ACCIONES EN ESTRIBOS Y CÁLCULO DE PLACAS

ACCIONES MÁXIMAS Y MÍNIMAS POR APOYO

p.p. de viga=	2.09	t/m
p.p. de losa de compresión=	0.60	t/m²
p.p. de aceras=	0.88	t/m por cada acera
entrega de viga=	0.35	m
luz entre apoyos de la viga=	25.00	m
ancho de losa=	8.00	m
ancho de plataforma=	8.80	m (incluso aceras)
ancho total de aceras=	2.80	m
espesor de pavimento=	0.08	m
sobrecarga uniforme=	0.40	t/m²
carga puntual carro de I.P.C.=	60.00	ton

carga vertical máxima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que en la situación de carro de la I.P.C. más próximo al apoyo, éste se lleva el 80% del peso del carro

$V_{máx}$=

26.86	de p.p. de viga
30.84	de p.p. de losa de compresión
11.24	de p.p. de aceras
7.40	de p.p. de pavimento
22.62	de sobrecarga uniforme
48.18	de carro de la I.P.C.
147.14	ton

carga vertical mínima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que la reacción mínima se produce cuando no hay sobrecarga uniforme ni carro de la I.P.C. en el tablero

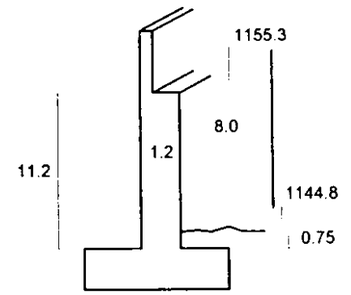
$V_{mín}$=

26.86	de p.p. de viga
30.84	de p.p. de losa de compresión
11.24	de p.p. de aceras
7.40	de p.p. de pavimento
76.34	ton

HIPÓTESIS DE CARGA SOBRE ESTRIBO

En adelante se utilizan cargas horizontales obtenidas del "CÁLCULO DE CARGAS EN CABEZA DE ELEMENTOS" con las siguientes premisas:

- los apoyos de neopreno, para las cargas verticales arriba obtenidas y para las horizontales de contracción y frenado, tienen por dimensiones 250 x 600 x 52 mm (neto 37 mm)
- las dimensiones de los estribos que afectan al reparto de cargas horizontales en cabeza de elementos son



Se consideran dos hipótesis de carga para el cálculo del estribo con las siguientes cargas:

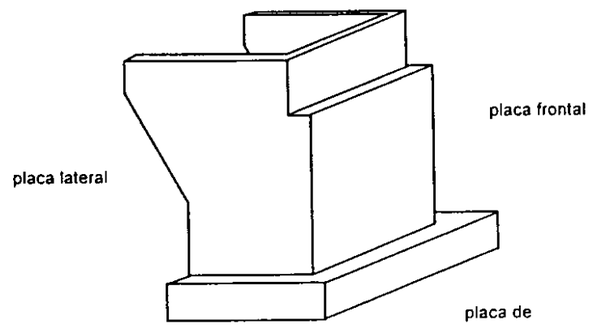
1) Carga vertical máxima sobre la línea de apoyos del estribo (con sobrecarga en todo el tablero y carro de la I.P.C. junto a la línea de apoyos), frenado de la sobrecarga y el carro de la I.P.C. y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$s.s._T$ =	1.00	t/m²

2) Carga vertical mínima sobre la línea de apoyos del estribo y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$s.s._T$ =	1.00	t/m²

DISCRETIZACIÓN EN PLACAS



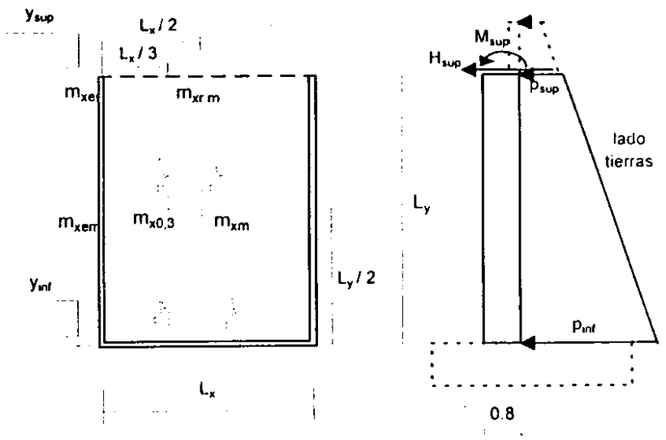
MATERIALES

f_{ck}=	250	kp/cm²
γ_c=	1.50	
f_{yk}=	5100	kp/cm²
γ_s=	1.15	

CÁLCULO DE ARMADURAS DE PLACA FRONTAL

Se considera una hipótesis de carga en trasdós de placa y dos tipos de coacción en borde de placa rectangular. La hipótesis de carga incluye el empuje de tierras al reposo producido por (peso de las tierras + sobrecarga uniforme en trasdós de la placa) y la reacción horizontal procedente de tablero

L_x=	8.00	m
y_{sup}=	1155.30	m
y_{inf}=	1144.05	m
L_y=	11.25	m
espesor placa =	1.10	m
coeficiente de empuje K_r =	0.36	
p_{sup}=	1.44	t/m²
p_{inf}=	9.88	t/m²
H_{sup} (*) =	2.77	t/m.a.
M_{sup}=	0.76	mt/m.a.
γ_f =	1.60	
L_y/L_x=	1.41	



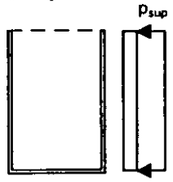
(*) Incluye la reacción horizontal procedente del tablero y debida a efectos reológicos y frenado

En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.

$M_i > 0$ si produce tracciones en intradós

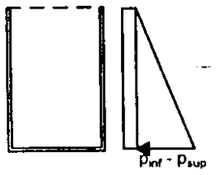
esfuerzos para coacción

K = $p_{sup} * L_x * L_y$ = 130.04



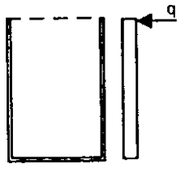
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-16.6	-17.9	33.4	38.2	67.8	-24.5	-34.5	235.0	345.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-7.83	-7.26	3.89	3.40	1.92	-5.31	-3.77	0.55	0.38

K = $(p_{inf}-p_{sup}) * L_x * L_y /2$ = 379.76



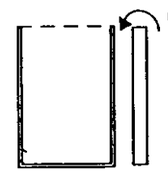
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-74.6	-18.4	100.0	41.6	71.1	-17.0	-22.3	145.0	205.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-5.09	-20.64	3.80	9.13	5.34	-22.34	-17.03	2.62	1.85

K = $q * L_x$ = 22.13

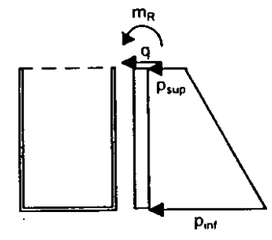


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-2.3	-155.0	7.2	111.0	385.0	------	------	-62.1	-87.8
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-9.58	-0.14	3.06	0.20	0.06	0.00	0.00	-0.36	-0.25

K = m_R = 0.76 mt/m.a.



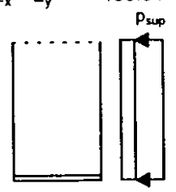
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-0.7	10.2	3.5	-20.4	-39.2	66.7	110.0	------	250.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-1.02	0.07	0.21	-0.04	-0.02	0.01	0.01	0.00	0.00



M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-23.5	-28.0	11.0	12.7	7.3	-27.6	-20.8	2.8	2.0

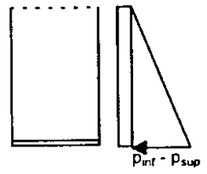
esfuerzos para coacción

K = $p_{sup} * L_x * L_y$ = 130.04



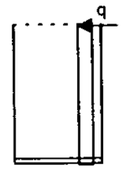
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	12.5	18.1	20.7	-11.3	-13.8	79.0	100.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	10.40	7.18	6.28	-11.51	-9.42	1.65	1.30

K = $(p_{inf}-p_{sup}) * L_x * L_y /2$ = 379.76



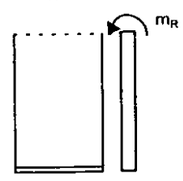
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	25.4	22.7	25.2	-9.8	-11.8	56.3	72.5
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	14.95	16.73	15.07	-38.63	-32.18	6.75	5.24

K = $q * L_x$ = 22.13

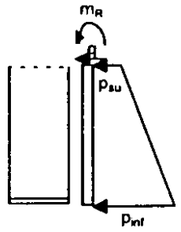


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	4.1	17.6	21.6	-28.3	-34.0	-32.6	-40.2
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	5.37	1.26	1.02	-0.78	-0.65	-0.68	-0.55

K = m_R = 0.76 mt/m.a.



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	3.0	-21.0	-25.0	18.2	23.8	-22.2	-28.6
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	0.25	-0.04	-0.03	0.04	0.03	-0.03	-0.03



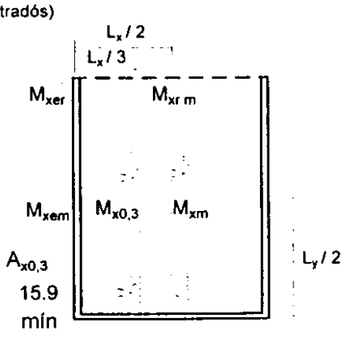
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.0	0.0	31.0	25.1	22.3	-50.9	-42.2	7.7	6.0

envolvente de momentos según X (los momentos son positivos si producen tracciones en intradós)

	M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	31.0	25.1	22.3
momentos negativos (mt/m.a.)	-23.5	-28.0	0.0	0.0	0.0

envolvente de momentos según Y (los momentos son positivos si producen tracciones en intradós)

	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	7.7	6.0
momentos negativos (mt/m.a.)	-50.9	-42.2	0.0	0.0



armado según X

or cuantía geométrica $A_{mín}$= 17.6 cm²/m.a. a repartir entre las dos caras

	A_{xer}	A_{xem}	$A_{xr\,m}$	A_{xm}	$A_{x0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	15.9	15.9	mín	mín	mín

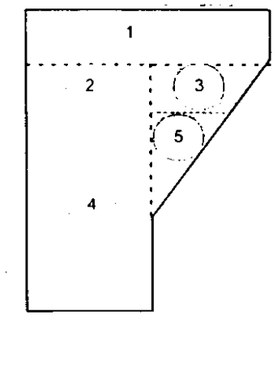
armado según Y

or cuantía geométrica $A_{mín}$= 9.9 cm²/m.a. a repartir entre las dos caras

	A_{yem}	A_{ye}	A_{ym}	$A_{y0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	17.7	15.9	mín	mín

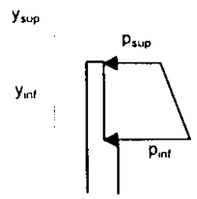
CÁLCULO DE ARMADURAS DE PLACA LATERAL

Se considera una hipótesis de carga en trasdós de placa que incluye sólo el empuje de tierras al reposo producido por (peso de las tierras + sobrec uniforme en trasdós de la placa)



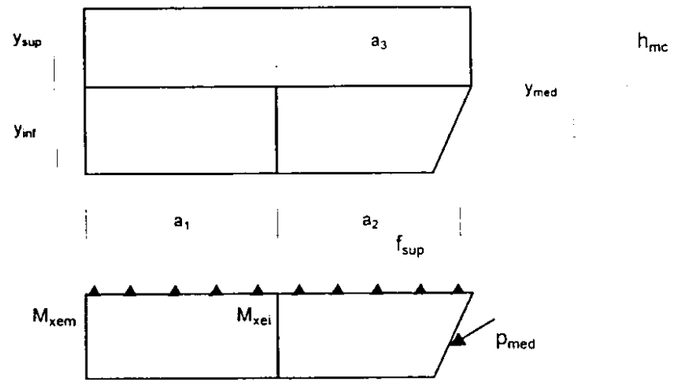
γ_f =	1.60
coeficiente de empuje reposo K_r =	0.36
coeficiente de empuje activo K_a =	0.22
peso especifico del relleno γ_r =	2.10 t/m³

armado de sector 1



espesor placa =	0.30 m
y_{sup}=	1156.75 m
y_{inf}=	1155.30 m
h_{mc}=	1.45 m
p_{sup}=	0.36 t/m²
p_{inf}=	1.44 t/m²
M_{yem}=	0.76 mt/m.a.
armadura nec. en trasdós A_{yem}=	3.91 cm²/m.a.

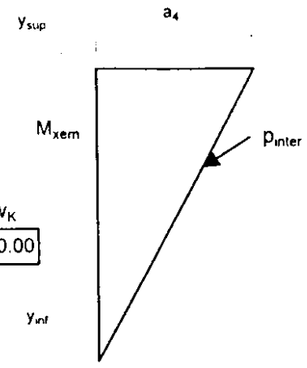
armado de sectores 2 y 3



espesor sector 2 =	1.10 m
espesor sector 3 =	0.60 m
y_{sup}=	1155.30 m
y_{inf}=	1151.85 m
y_{med}=	1153.58 m
a_1=	3.90 m
a_2=	3.24 m
a_3=	4.10 m
arga lineal en borde superior f_{sup}=	1.31 t/m
presión media en trasdós p_{med}=	1.69 t/m²
M_{xei}=	11.35 mt/m.a.
armadura nec. trasdós A_{xei}=	8.42 cm²/m.a.
M_{xem}=	53.78 mt/m.a.
armadura nec. trasdós A_{xem}=	18.75 cm²/m.a.

	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{xei}	16	0.15	13.4	0.26	0.00
M_{xem}	20	0.15	20.9	0.24	0.22

armado de sector 5

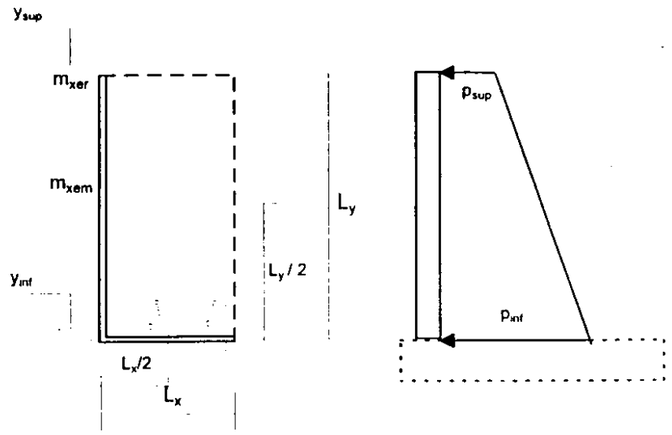


espesor sector 5 =	0.60 m
y_{sup}=	1151.85 m
y_{inf}=	1146.80 m
a_4=	2.37 m
presión intermedia trasdós p_{inter}=	3.26 t/m²
M_{xem}=	4.09 mt/m.a.
armadura nec. trasdós A_{xem}=	8.42 cm²/m.a.

	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{xem}	16	0.15	13.4	0.26	0.00

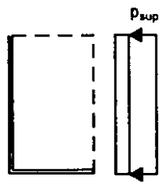
armado de sector 4

L_x=	3.90	m
y_{sup}=	1151.85	m
y_{inf}=	1144.05	m
L_y=	7.80	m
espesor placa =	1.10	m
p_{sup}=	4.03	t/m²
p_{inf}=	9.88	t/m²
γ_f =	1.60	
L_y/L_x=	2.00	



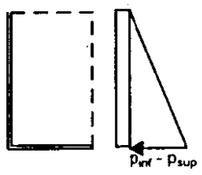
En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.
$M_i > 0$ si produce tracciones en intradós

$K = p_{sup} * L_x * L_y$ = 122.68



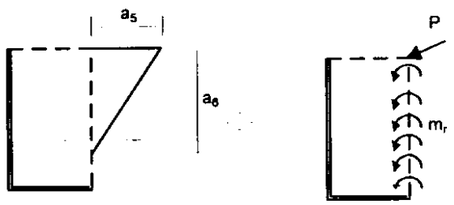
m_{xer}	m_{xem}	m_{yer}	m_{yem}
-4.18	-5.90	-4.88	-12.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-29.3	-20.8	-25.1	-9.9

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 89.00



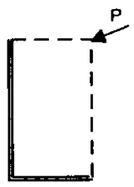
m_{xer}	m_{xem}	m_{yer}	m_{yem}
-10.30	-6.76	-4.75	-10.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-8.6	-13.2	-18.7	-8.6

El triángulo de extremo de aleta se convierte en una carga puntual aplicada al vértice de la placa y en un momento uniforme aplicado al borde libre vertical



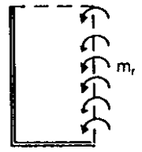
a_5=	2.37	m	
a_6=	4.75	m	
presión intermedia en trasdós p_{inter}=	3.26	t/m²	
		P=	18.40 ton
		m_r=	4.09 mt/m

$K = P$ = 18.40 ton



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-0.68	-3.96	-2.63	-13.50
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-27.1	-4.6	-7.0	-1.4

$K = m_r$ = 4.09 mt/m



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-1.30	15.50	-0.53	53.90
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-3.1	0.3	-7.7	0.1

armado según X

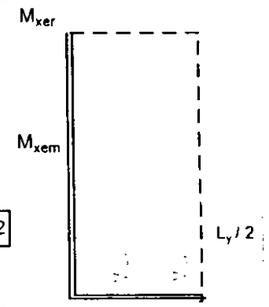
por cuantía geométrica A_{min}= 17.6 cm²/m.a. a repartir entre las dos caras

		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{xer}=	-68.2 mt/m.a.					
armadura nec. trasdós A_{xer}=	23.9 cm²/m.a.	25	0.15	32.7	0.22	0.15
M_{xem}=	-38.3 mt/m.a.					
armadura nec. trasdós A_{xem}=	15.9 cm²/m.a.	20	0.15	20.9	0.24	0.00

armado según Y

por cuantía geométrica A_{min}= 9.9 cm²/m.a. a repartir entre las dos caras

		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{yer}=	-58.6 mt/m.a.					
armadura nec. trasdós A_{yer}=	20.5 cm²/m.a.	20	0.150	20.9	0.24	0.22
M_{yem}=	-19.7 mt/m.a.					
armadura nec. trasdós A_{yem}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00

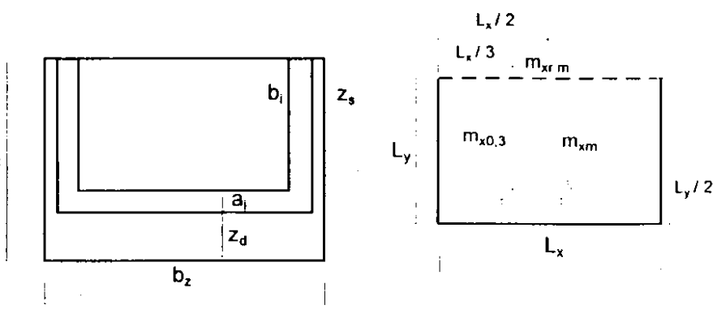


CÁLCULO DE ARMADURAS DE PLACA DE CIMENTACIÓN

Se considera una hipótesis de carga que incluye el peso de tierras sobre placa de cimentación (incluso sobrecarga sobre trasdós)
y la respuesta del terreno en forma de ley triangular de presiones (obtenida para la hipótesis de carga máxima procedente de tablero)

z_d= 1.40 m
a_i= 1.10 m
a_z= 6.70 m
b_i= 1.10 m
b_z= 8.50 m
z_s= 0.25 m

L_x= 6.90 m
L_y= 4.75 m
L_y/L_x= 0.69

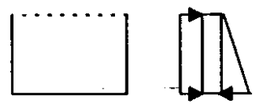


p_{sup}= 27.7 t/m²
$K = p_{sup} * L_x * L_y$ = 908.95

$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
9.2	15.2	17.2	27.5	33.4
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
98.58	59.80	52.85	33.05	27.21

p_{inf}= -48.28 t/m²
$K = p_{inf} * L_x * L_y /2$ = -791.19

$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
14.0	20.8	23.1	24.5	29.7
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
-56.51	-38.04	-34.25	-32.29	-26.64



$M_{xr\,m}$=	42.1 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. $A_{xr\,m}$=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
M_{xm}=	21.8 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. A_{xm}=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
$M_{x0,3}$=	18.6 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. $A_{x0,3}$=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00

COMPROBACIÓN DE APOYOS ELASTOMÉRICOS ARMADOS

MATERIALES

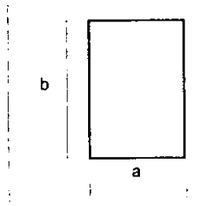
$G_{diferido}$ = 100 t/m²
$G_{instantáneo}$ = 200 t/m²
σ_{adm} = 150 kp/cm²
$(\tau_{H\ larga\ duración})_{adm}$ = 0.50 $G_{diferido}$
$(\tau_{H\ total})_{adm}$ = 0.70 $G_{diferido}$
$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = 5 $G_{diferido}$, siendo:

$(\tau_{H\ larga\ duración})_{adm}$: tensión tangencial admisible para desplazamientos impuestos
$(\tau_{H\ total})_{adm}$: tensión tangencial admisible para (desplazamientos impuestos + cargas horizontales instantáneas)
$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$: tensión tangencial admisible para (cargas verticales + desplazamientos impuestos + cargas horizontales instantáneas + giros impuestos)

GEOMETRÍA

TIPO DE APOYO: (●) Rectangular ( ) Circular

espesor neto = 37 mm
a = 250 mm (a < b)
b = 600 mm



Eje longitudinal del puente

DESPLAZAMIENTOS IMPUESTOS Y CARGAS

sismo ☐

$\delta_{longitudinal}$ = 7.0 mm
$\delta_{transversal}$ = 0.0 mm
$V_{máx}$ = 147.14 ton
$V_{mín}$ = 76.34 ton $H_{concomitante}$ = 0.00 ton
$(H_{longitudinal})_{máx}$ = 1.93 ton $(H_{transversal})_{concomitante}$ = 0.00 ton

con sismo

$V_{máx}$ = ton
$V_{mín}$ = ton $H_{concomitante}$ = ton
$(H_{longitudinal})_{máx}$ = ton $(H_{transversal})_{concomitante}$ = ton

COMPROBACIÓN DE TENSIONES NORMALES

$\sigma_{máx}$ = 98 kp/cm² σ_{adm} = 150 kp/cm²
$\sigma_{mín}$ = 51 kp/cm²

con sismo

$\sigma_{máx}$ = kp/cm² σ_{adm} = kp/cm²
$\sigma_{mín}$ = kp/cm²

COMPROBACIÓN DE SEGURIDAD AL DESLIZAMIENTO

$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2}$ = 0.19 ($\sigma_{mínima}$ en Nw/mm^2)

Para $V_{mín}$ se tiene $H_{concomitante}$ = 0.00 ton siendo $H_{adm} = f * V_{mín}$ = 14.25 ton

con sismo

$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2}$ = ($\sigma_{mínima}$ en Nw/mm^2)

Para $V_{mín}$ se tiene $H_{concomitante}$ = ton siendo $H_{adm} = f * V_{mín}$ = ton

NO ES PRECISO ANCLAR EL APOYO

COMPROBACIÓN DE TENSIÓN TANGENCIAL EN EL CONTACTO NEOPRENO-CHAPA DE ACERO

TIPO DE COMPROBACIÓN

(●) simplificada : se obtiene la tensión tangencial producida sólo por la carga horizontal máxima ($H_{máx}$) y por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$)

( ) completa : se obtiene la tensión tangencial producida por la carga horizontal máxima ($H_{máx}$), por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$) y por la carga vertical ($V_{concomitante}$) y los giros impuestos ($\alpha_{longitudinal}$ y $\alpha_{transversal}$) coincidentes con la carga horizontal máxima

$V_{concomitante}$ = ton
$\alpha_{longitudinal}$ = rad/1000
$\alpha_{transversal}$ = rad/1000

con sismo

$V_{concomitante}$ = ton
$\alpha_{longitudinal}$ = rad/1000
$\alpha_{transversal}$ = rad/1000

NOTA.- $\alpha_{longitudinal}$ es giro del apoyo alrededor de un eje paralelo al eje del puente y $\alpha_{transversal}$ es giro alrededor de un eje perpendicular al eje del puente

$\tau_{H\ larga\ duración}$ =	1.9 kp/cm²	$(\tau_{H\ larga\ duración})_{adm}$ =	5.0 kp/cm²
$\tau_{H\ total}$ =	2.5 kp/cm²	$(\tau_{H\ total})_{adm}$ =	7.0 kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

con sismo

$\tau_{H\ total}$ =	kp/cm²	$(\tau_{H\ total})_{adm}$ =	kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

COMPROBACIÓN DE ESTABILIDAD

a/10 = 25 mm
espesor neto = 37 mm
a/5 = 50 mm

SE CUMPLE LA CONDICIÓN a/10 ≤ espesor neto ≤ a/5

CÁLCULO DE REFUERZO BAJO APOYOS

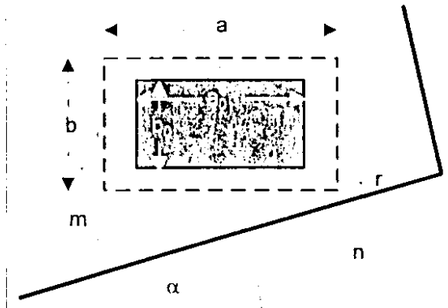
APOYO DE NEOPRENO

a_0 = 0.60 m ($a_0 > b_0$)
b_0 = 0.25 m

ELEMENTO ESTRUCTURAL BAJO APOYO

m= 0.40 m
n= 2.00 m
α= 100.0 g
r= 0.05 m

dimensiones del rectángulo homotético
a= 1.68 m
b= 0.70 m



AXIL

N= 147.14 ton
γ_f= 1.6

MATERIALES

f_{ck}= 250 kp/cm²
f_{yk}= 5100 kp/cm²
γ_s= 1.15

TENSIÓN MÁXIMA DE TRACCIÓN

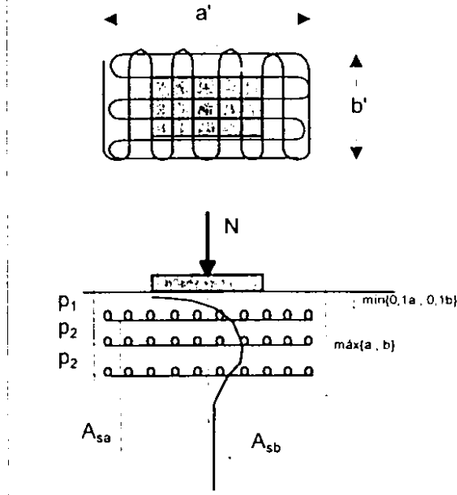
$\sigma_{máx}$= 35.9 t/m²
$f_{ct,k}$ / 2= 89.3 t/m²

ARMADURA NECESARIA

$(A_{sa})_{nec} = (A_{sb})_{nec}$ = 10.2 cm²

GEOMETRIA REFUERZO

mín{ 0.1a , 0.1b }= 0.07 m
máx{ a, b }= 1.68 m



ARMADURA DISPUESTA

número de parrillas= 3
p_1 = 0.15 m
p_2 = 0.20 m

PARALELA A "a" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	b' (m)	b (m)
8	8	0.10	0.70	0.70

Total $(A_{sa})_{disp}$= 12.1cm²

PARALELA A "b" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	a' (m)	a (m)
14	8	0.10	1.30	1.68

Total $(A_{sb})_{disp}$= 21.1cm²

PASO SUPERIOR 705+000

PASO SUPERIOR 705+000
TABLERO

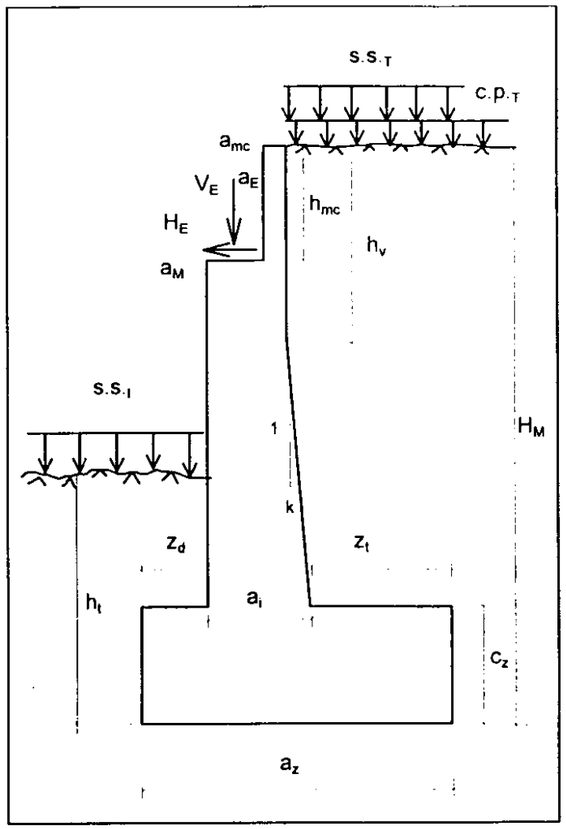
Para el tablero de este paso es válido el cálculo efectuado para el tablero del P.S. 700+240

PASO SUPERIOR 705+000
ESTRIBOS

CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	13.14	m
h_t=	2.05	m
h_v=	11.84	m
h_{mc}=	1.45	m
a_{mc}=	0.30	m
a_M=	1.10	m
a_Z=	6.30	m
c_Z=	1.30	m
k=	0.00	
a_i=	1.10	m
z_d=	1.40	m
z_t=	3.80	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	°
angulo de rozamiento contacto relleno-muro δ_M =	0.0	°
angulo de rozamiento contacto terreno-muro δ_T =	40	°
cohesión =	0	t/m²
σ_{adm} =	70	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	1.00	t/m²
$s.s._I$ =	0.00	t/m²
$(V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$(V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.40	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	29.0 t/m²	$(\sigma_{med})_{adm}$ =	70.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	78.9 t/m²	$(\sigma_{máx})_{adm}$ =	87.5 t/m²	l_c= 4.64 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.16	$(\gamma_d)_{adm}$=	1.50
γ_v=	1.85	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

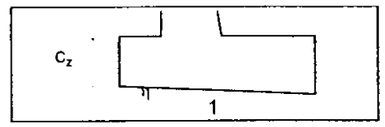
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

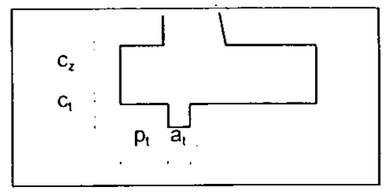
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 γ_c = 1.50

ACERO AEH-500 γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

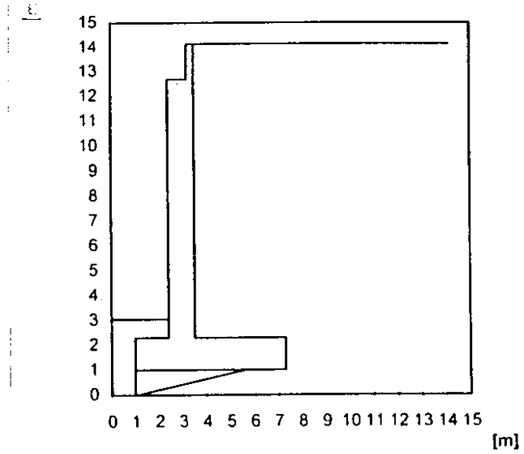
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 75.04 t

Vd= 88.41 t

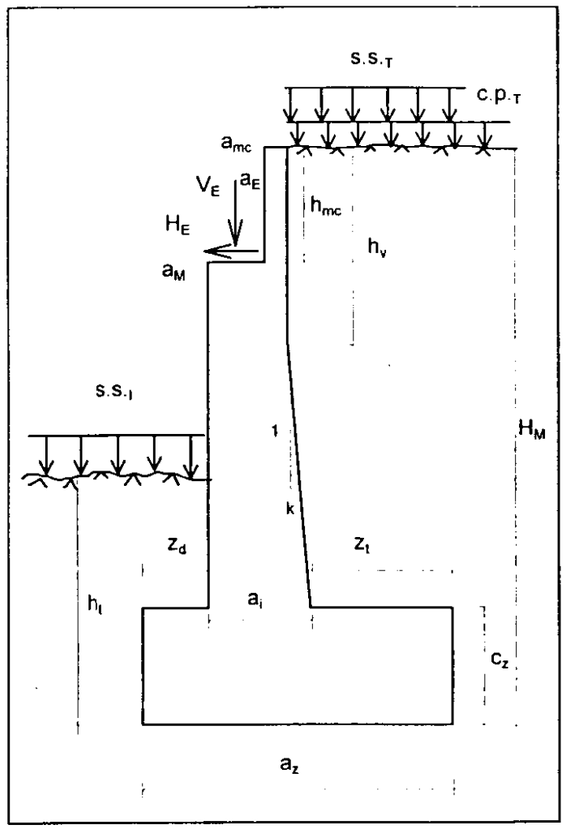
COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	13.14 m
h_t=	2.05 m
h_v=	11.84 m
h_{mc}=	1.45 m
a_{mc}=	0.30 m
a_M=	1.10 m
a_Z=	6.30 m
c_Z=	1.30 m
k=	0.00
a_i=	1.10 m
z_d=	1.40 m
z_t=	3.80 m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10 t/m³
angulo de rozamiento del relleno ϕ =	40 °
angulo de rozamiento contacto relleno-muro δ_M =	0.0 °
angulo de rozamiento contacto terreno-muro δ_T =	40 °
cohesión =	0 t/m²
σ_{adm} =	70 t/m²
f_p=	1.25

CARGAS

$c.p._T$ =	0.00 t/m²
$s.s._T$ =	1.00 t/m²
$s.s._I$ =	0.00 t/m²
$(V_E)_{cp}$=	19.09 t/m.a.
$(H_E)_{contracción}$=	0.71 t/m.a.
$(V_E)_{sc}$=	0.00 t/m.a.
$(H_E)_{frenado}$=	0.00 t/m.a.
$(H_E)_{sismo}$=	0.00 t/m.a.
a_E =	0.40 m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	26.9 t/m²	$(\sigma_{med})_{adm}$ =	70.0 t/m²
$\sigma_{máx}$ =	71.7 t/m²	$(\sigma_{máx})_{adm}$ =	87.5 t/m²

longitud comprimida l_c= 4.73 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.03	$(\gamma_d)_{adm}$=	1.50
γ_v=	1.83	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

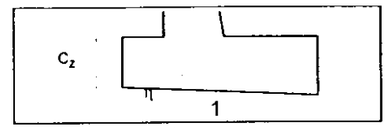
K_p=	3.00
peso específico del terreno γ_T =	2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

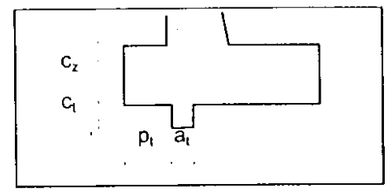
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00 m
c_t=	0.00 m
a_t=	0.00 m
K_p=	3.00
Vcu=	0.00 t
Vd=	0.00 t



MATERIALES

HORMIGÓN H-250 ▾ γ_c = 1.50

ACERO AEH-500 ▾ γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

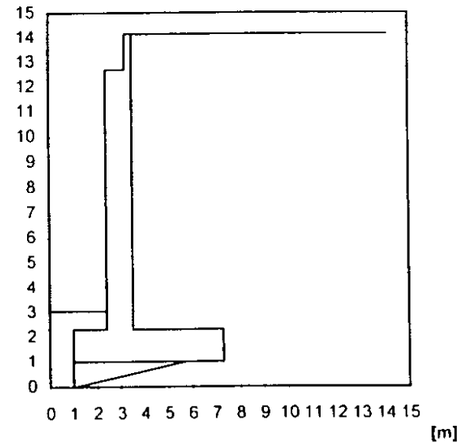
COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu=	75.04 t
Vd=	80.08 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



ACCIONES EN ESTRIBOS Y CÁLCULO DE PLACAS

ACCIONES MÁXIMAS Y MÍNIMAS POR APOYO

p.p. de viga=	2.09	t/m
p.p. de losa de compresión=	0.60	t/m²
p.p. de aceras=	0.88	t/m por cada acera
entrega de viga=	0.35	m
luz entre apoyos de la viga=	25.00	m
ancho de losa=	8.00	m
ancho de plataforma=	8.80	m (incluso aceras)
ancho total de aceras=	2.80	m
espesor de pavimento=	0.08	m
sobrecarga uniforme=	0.40	t/m²
carga puntual carro de I.P.C.=	60.00	ton

carga vertical máxima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que en la situación de carro de la I.P.C. más próximo al apoyo, éste se lleva el 80% del peso del carro

$V_{máx}$=

26.86	de p.p. de viga
30.84	de p.p. de losa de compresión
11.24	de p.p. de aceras
7.40	de p.p. de pavimento
22.62	de sobrecarga uniforme
48.18	de carro de la I.P.C.
147.14	ton

carga vertical minima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que la reacción mínima se produce cuando no hay sobrecarga uniforme ni carro de la I.P.C. en el tablero

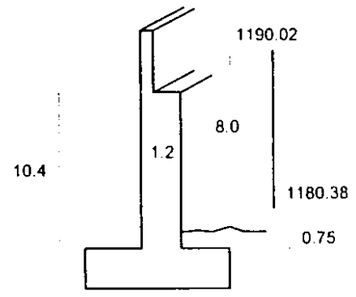
$V_{mín}$=

26.86	de p.p. de viga
30.84	de p.p. de losa de compresión
11.24	de p.p. de aceras
7.40	de p.p. de pavimento
76.34	ton

HIPÓTESIS DE CARGA SOBRE ESTRIBO

En adelante se utilizan cargas horizontales obtenidas del "CÁLCULO DE CARGAS EN CABEZA DE ELEMENTOS" con las siguientes premisas

- los apoyos de neopreno, para las cargas verticales arriba obtenidas y para las horizontales de contracción y frenado, tienen por dimensiones 250 x 600 x 52 mm (neto 37 mm)
- las dimensiones de los estribos que afectan al reparto de cargas horizontales en cabeza de elementos son



Se consideran dos hipótesis de carga para el cálculo del estribo con las siguientes cargas:

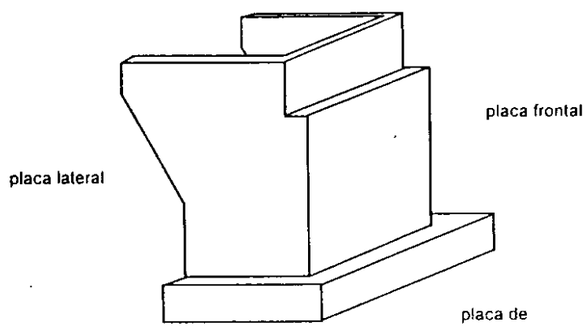
1) Carga vertical máxima sobre la linea de apoyos del estribo (con sobrecarga en todo el tablero y carro de la I.P.C. junto a la linea de apoyos), frenado de la sobrecarga y el carro de la I.P.C. y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$s.s._T$ =	1.00	t/m²

2) Carga vertical mínima sobre la linea de apoyos del estribo y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$s.s._T$ =	1.00	t/m²

DISCRETIZACIÓN EN PLACAS



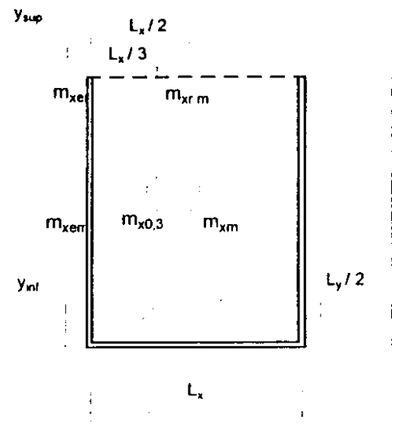
MATERIALES

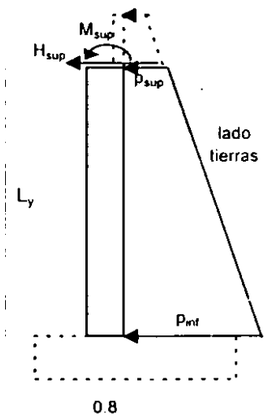
f_{ck}=	250	kp/cm²
γ_c=	1.50	
f_{yk}=	5100	kp/cm²
γ_s=	1.15	

CÁLCULO DE ARMADURAS DE PLACA FRONTAL

Se considera una hipótesis de carga en trasdós de placa y dos tipos de coacción en borde de placa rectangular. La hipótesis de carga incluye el empuje de tierras al reposo producido por (peso de las tierras + sobrecarga uniforme en trasdós de la placa) y la reacción horizontal procedente de tablero

L_x=	8.00	m
y_{sup}=	1190.02	m
y_{inf}=	1179.63	m
L_y=	10.39	m
espesor placa =	1.10	m
coeficiente de empuje K_r =	0.36	
p_{sup}=	1.44	t/m²
p_{inf}=	9.24	t/m²
H_{sup} (*) =	2.77	t/m.a.
M_{sup}=	0.76	mt/m.a.
γ_f =	1.60	
L_y/L_x=	1.30	





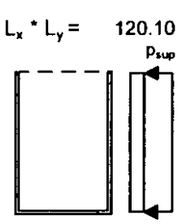
(*) Incluye la reacción horizontal procedente del tablero y debida a efectos reológicos y frenado

En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.

$M_i > 0$ si produce tracciones en intradós

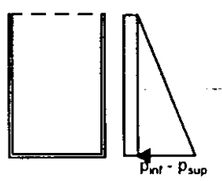
esfuerzos para coacción

$K = p_{sup} * L_x * L_y$ = 120.10



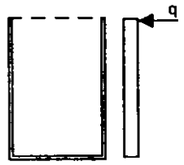
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-15.3	-17.0	31.0	37.0	64.9	-22.9	-31.3	190.0	270.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-7.85	-7.06	3.87	3.25	1.85	-5.24	-3.84	0.63	0.44

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 323.92



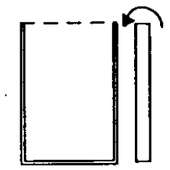
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-64.0	-17.8	86.1	41.1	69.0	-16.3	-21.4	119.0	170.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-5.06	-18.20	3.76	7.88	4.69	-19.87	-15.14	2.72	1.91

$K = q * L_x$ = 22.13

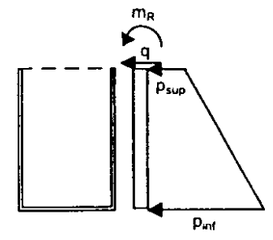


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-2.3	-98.0	7.2	83.4	265.0	------	------	-51.0	-72.5
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-9.75	-0.23	3.07	0.27	0.08	0.00	0.00	-0.43	-0.31

$K = m_R$ = 0.76 mt/m.a.



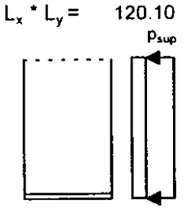
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-0.7	8.7	3.5	-18.7	-33.9	41.7	66.7	------	-285.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-1.05	0.09	0.21	-0.04	-0.02	0.02	0.01	0.00	0.00



M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-23.7	-25.4	10.9	11.4	6.6	-25.1	-19.0	2.9	2.0

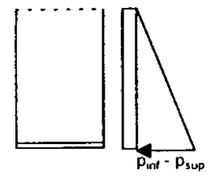
esfuerzos para coacción

$K = p_{sup} * L_x * L_y$ = 120.10



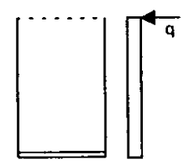
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	12.1	18.1	20.7	-10.6	-12.7	71.5	92.2
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	9.93	6.64	5.80	-11.33	-9.46	1.68	1.30

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 323.92



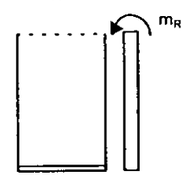
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	23.8	23.3	25.7	-9.5	-11.4	51.6	65.8
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	13.61	13.90	12.60	-33.99	-28.41	6.28	4.92

$K = q * L_x$ = 22.13

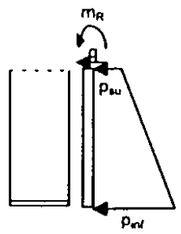


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	4.1	16.2	19.9	-21.7	-26.4	-30.3	-37.2
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	5.36	1.37	1.11	-1.02	-0.84	-0.73	-0.59

$K = m_R$ = 0.76 mt/m.a.



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	3.0	-22.9	-26.4	15.4	20.2	-16.4	-21.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	0.25	-0.03	-0.03	0.05	0.04	-0.05	-0.04



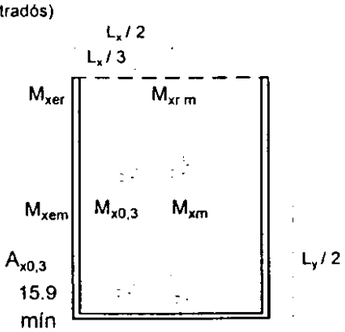
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.0	0.0	29.1	21.9	19.5	-46.3	-38.7	7.2	5.6

envolvente de momentos según X (los momentos son positivos si producen tracciones en intradós)

	M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	29.1	21.9	19.5
momentos negativos (mt/m.a.)	-23.7	-25.4	0.0	0.0	0.0

envolvente de momentos según Y (los momentos son positivos si producen tracciones en intradós)

	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	7.2	5.6
momentos negativos (mt/m.a.)	-46.3	-38.7	0.0	0.0



armado según X

or cuantía geométrica A_{min}= 17.6 cm²/m.a. a repartir entre las dos caras

	A_{xer}	A_{xem}	$A_{xr\,m}$	A_{xm}	$A_{x0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	15.9	15.9	mín	mín	mín

armado según Y

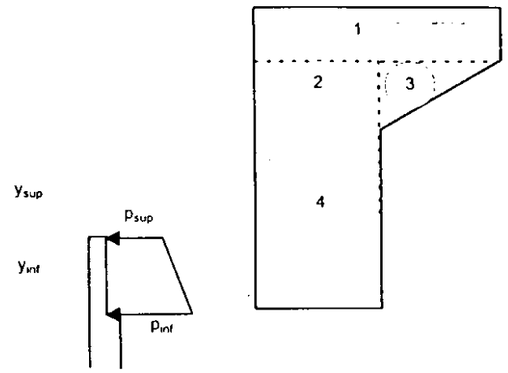
or cuantía geométrica A_{min}= 9.9 cm²/m.a. a repartir entre las dos caras

	A_{yem}	A_{ye}	A_{ym}	$A_{y0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	16.1	15.9	mín	mín

CÁLCULO DE ARMADURAS DE PLACA LATERAL

Se considera una hipótesis de carga en trasdós de placa que incluye sólo el empuje de tierras al reposo producido por (peso de las tierras + sobrec uniforme en trasdos de la placa)

γ_f =	1.60
coeficiente de empuje reposo K_r =	0.36
coeficiente de empuje activo K_a =	0.22
peso especifico del relleno γ_t =	2.10 t/m³

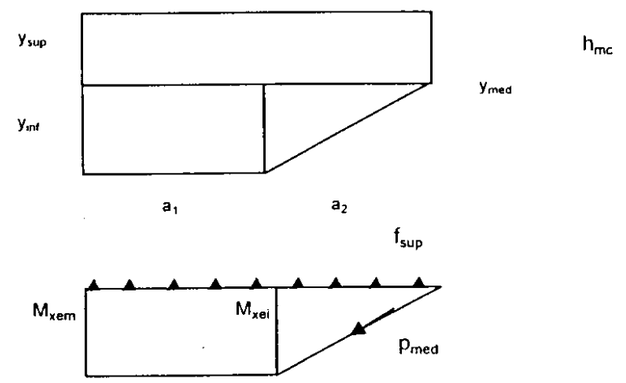


armado de sector 1

espesor placa =	0.30 m
y_{sup}=	1191.45 m
y_{inf}=	1190.00 m
h_{mc}=	1.45 m
p_{sup}=	0.36 t/m²
p_{inf}=	1.44 t/m²
M_{yem}=	0.76 mt/m.a.
armadura nec. en trasdós A_{yem}=	3.91 cm²/m.a.

armado de sectores 2 y 3

espesor sector 2 =	1.10 m
espesor sector 3 =	1.10 m
y_{sup}=	1190.00 m
y_{inf}=	1187.23 m
y_{med}=	1188.62 m
a_1=	3.80 m
a_2=	2.00 m
carga lineal en borde superior f_{sup}=	1.31 t/m
presión media en trasdós p_{med}=	1.53 t/m²



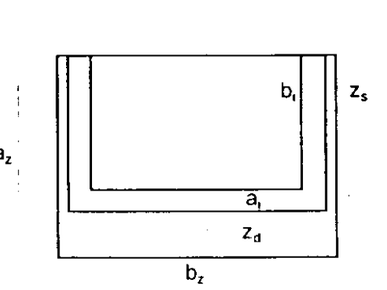
		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{xei}=	2.47 mt/m.a.					
armadura nec. trasdós A_{xei}=	8.42 cm²/m.a.	16	0.15	13.4	0.26	0.00
M_{xem}=	25.81 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. trasdós A_{xem}=	15.93 cm²/m.a.	20	0.15	20.9	0.24	0.00

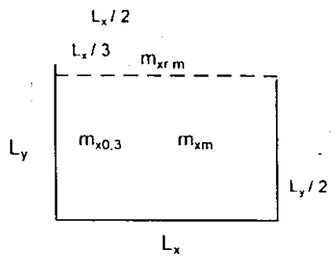
armado de sector 4

CÁLCULO DE ARMADURAS DE PLACA DE CIMENTACIÓN

Se considera una hipótesis de carga que incluye el peso de tierras sobre placa de cimentación (incluso sobrecarga sobre trasdós)
y la respuesta del terreno en forma de ley triangular de presiones (obtenida para la hipótesis de carga máxima procedente de tablero)

z_d=	1.40 m
a_i=	1.10 m
a_z=	6.30 m
b_i=	1.10 m
b_z=	8.50 m
z_s=	0.25 m
L_x=	6.90 m
L_y=	4.35 m
L_y/L_x=	0.63





p_{sup}= 25.9 t/m²

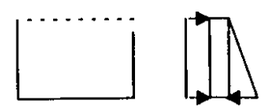
$K = p_{sup} * L_x * L_y$ = 776.31

$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
9.2	15.2	17.2	27.5	33.4
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
84.20	51.07	45.13	28.23	23.24

p_{inf}= -54.48 t/m²

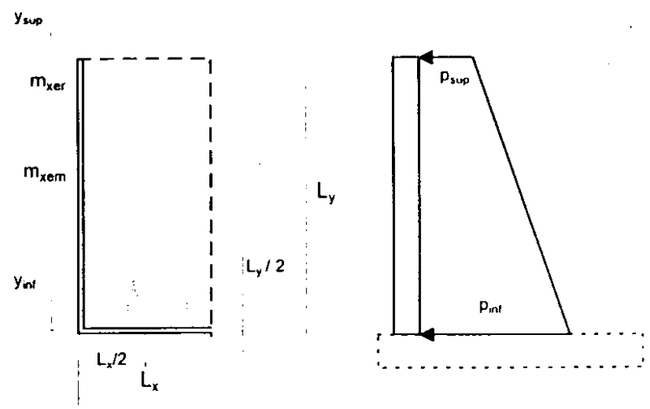
$K = p_{inf} * L_x * L_y /2$ = -817.59

$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
14.0	20.8	23.1	24.5	29.7
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
-58.40	-39.31	-35.39	-33.37	-27.53



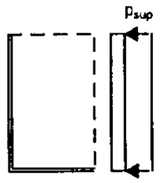
$M_{xr\,m}$=	25.8 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. $A_{xr\,m}$=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
M_{xm}=	11.8 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. A_{xm}=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
$M_{x0,3}$=	9.7 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. cara inf. $A_{x0,3}$=	18.9 cm²/m.a.	20	0.150	20.9	0.24	0.00

L_x=	3.80 m
y_{sup}=	1187.23 m
y_{inf}=	1179.63 m
L_y=	7.60 m
espesor placa =	1.10 m
p_{sup}=	3.52 t/m²
p_{inf}=	9.22 t/m²
γ_f =	1.60
L_y/L_x=	2.00



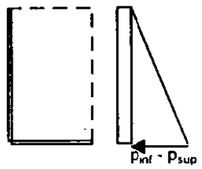
En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.
$M_i > 0$ si produce tracciones en intradós

$K = p_{sup} * L_x * L_y$ = 101.74



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-4.18	-5.90	-4.88	-12.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-24.3	-17.2	-20.8	-8.2

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 82.32



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-10.30	-6.76	-4.75	-10.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-8.0	-12.2	-17.3	-7.9

armado según X

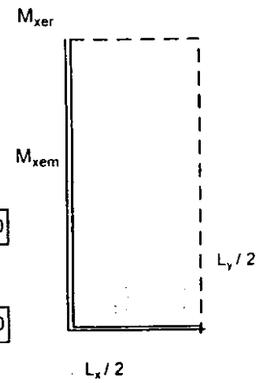
por cuantía geométrica A_{min}= 17.6 cm²/m.a. a repartir entre las dos caras

M_{xer}=	-32.3 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. trasdós A_{xer}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
M_{xem}=	-29.4 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. trasdós A_{xem}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00

armado según Y

por cuantía geométrica A_{min}= 9.9 cm²/m.a. a repartir entre las dos caras

M_{yer}=	-38.2 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. trasdós A_{yer}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00
M_{yem}=	-16.1 mt/m.a.	ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
armadura nec. trasdós A_{yem}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00



COMPROBACIÓN DE APOYOS ELASTOMÉRICOS ARMADOS

MATERIALES

$G_{diferido}$ = 100 t/m²

$G_{instantáneo}$ = 200 t/m²

σ_{adm} = 150 kp/cm²

$(\tau_{H\ larga\ duración})_{adm}$ = 0.50 $G_{diferido}$

$(\tau_{H\ total})_{adm}$ = 0.70 $G_{diferido}$

$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = 5 $G_{diferido}$, siendo:

$(\tau_{H\ larga\ duración})_{adm}$: tensión tangencial admisible para desplazamientos impuestos

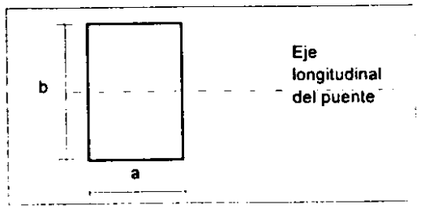
$(\tau_{H\ total})_{adm}$: tensión tangencial admisible para (desplazamientos impuestos + cargas horizontales instantáneas)

$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$: tensión tangencial admisible para (cargas verticales + desplazamientos impuestos + cargas horizontales instantáneas + giros impuestos)

GEOMETRÍA

TIPO DE APOYO

(◉) Rectangular ( ) Circular



espesor neto = 37 mm

a = 250 mm (a < b)

b = 600 mm

DESPLAZAMIENTOS IMPUESTOS Y CARGAS

sismo ☐

$\delta_{longitudinal}$ = 7.0 mm

$\delta_{transversal}$ = 0.0 mm

$V_{máx}$ = 147.14 ton

$V_{mín}$ = 76.34 ton $H_{concomitante}$ = 0.00 ton

$(H_{longitudinal})_{máx}$ = 1.93 ton $(H_{transversal})_{concomitante}$ = 0.00 ton

con sismo

$V_{máx}$ = ton

$V_{mín}$ = ton $H_{concomitante}$ = ton

$(H_{longitudinal})_{máx}$ = ton $(H_{transversal})_{concomitante}$ = ton

COMPROBACIÓN DE TENSIONES NORMALES

$\sigma_{máx}$ = 98 kp/cm² σ_{adm} = 150 kp/cm²

$\sigma_{mín}$ = 51 kp/cm²

con sismo

$\sigma_{máx}$ = kp/cm² σ_{adm} = kp/cm²

$\sigma_{mín}$ = kp/cm²

COMPROBACIÓN DE SEGURIDAD AL DESLIZAMIENTO

$$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2} = 0.19 \qquad (\sigma_{mínima}\ en\ Nw/mm^2)$$

Para $V_{mín}$ se tiene $H_{concomitante}$ = 0.00 ton siendo $H_{adm} = f * V_{mín}$ = 14.25 ton

con sismo

$$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2} = \qquad (\sigma_{mínima}\ en\ Nw/mm^2)$$

Para $V_{mín}$ se tiene $H_{concomitante}$ = ton siendo $H_{adm} = f * V_{mín}$ = ton

NO ES PRECISO ANCLAR EL APOYO

COMPROBACIÓN DE TENSIÓN TANGENCIAL EN EL CONTACTO NEOPRENO-CHAPA DE ACERO

TIPO DE COMPROBACIÓN

(◉) simplificada : se obtiene la tensión tangencial producida sólo por la carga horizontal máxima ($H_{máx}$) y por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$)

( ) completa : se obtiene la tensión tangencial producida por la carga horizontal máxima ($H_{máx}$), por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$) y por la carga vertical ($V_{concomitante}$) y los giros impuestos ($\alpha_{longitudinal}$ y $\alpha_{transversal}$) coincidentes con la carga horizontal máxima

$V_{concomitante}$ = ton

$\alpha_{longitudinal}$ = rad/1000

$\alpha_{transversal}$ = rad/1000

con sismo

$V_{concomitante}$ = ton

$\alpha_{longitudinal}$ = rad/1000

$\alpha_{transversal}$ = rad/1000

NOTA.- $\alpha_{longitudinal}$ es giro del apoyo alrededor de un eje paralelo al eje del puente y $\alpha_{transversal}$ es giro alrededor de un eje perpendicular al eje del puente

$\tau_{H\ larga\ duración}$ = 1.9 kp/cm² $(\tau_{H\ larga\ duración})_{adm}$ = 5.0 kp/cm²

$\tau_{H\ total}$ = 2.5 kp/cm² $(\tau_{H\ total})_{adm}$ = 7.0 kp/cm²

$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ = kp/cm² $(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = kp/cm²

con sismo

$\tau_{H\ total}$ = kp/cm² $(\tau_{H\ total})_{adm}$ = kp/cm²

$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ = kp/cm² $(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = kp/cm²

COMPROBACIÓN DE ESTABILIDAD

a/10 = 25 mm

espesor neto = 37 mm

a/5 = 50 mm

SE CUMPLE LA CONDICIÓN a/10 ≤ espesor neto ≤ a/5

CÁLCULO DE REFUERZO BAJO APOYOS

APOYO DE NEOPRENO

a_0 = 0.60 m ($a_0 > b_0$)

b_0 = 0.25 m

ELEMENTO ESTRUCTURAL BAJO APOYO

m= 0.40 m

n= 2.00 m

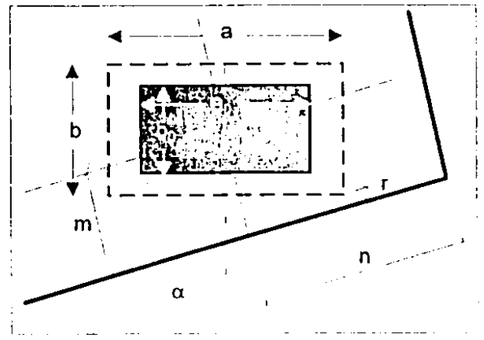
α= 100.0 g

r= 0.05 m

dimensiones del rectángulo homotético

a= 1.68 m

b= 0.70 m



AXIL

N= 147.14 ton

γ_f= 1.6

MATERIALES

f_{ck}= 250 kp/cm²

f_{yk}= 5100 kp/cm²

γ_s= 1.15

TENSIÓN MÁXIMA DE TRACCIÓN

$\sigma_{máx}$= 35.9 t/m²

$f_{ct,k}$ / 2= 89.3 t/m²

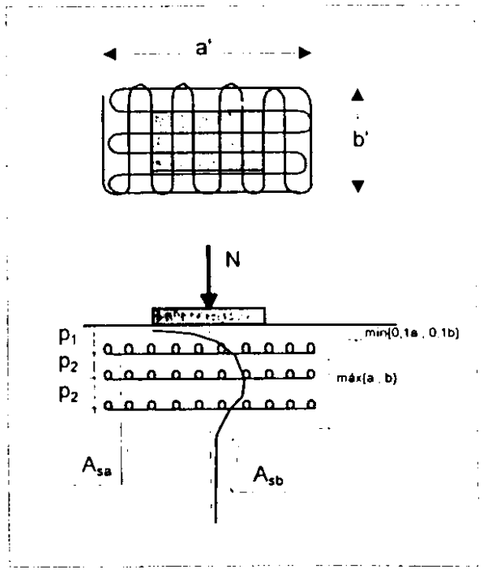
ARMADURA NECESARIA

$(A_{sa})_{nec} = (A_{sb})_{nec}$ = 10.2 cm²

GEOMETRIA REFUERZO

mín{ 0.1a , 0.1b }= 0.07 m

máx{ a, b }= 1.68 m



ARMADURA DISPUESTA

número de parrillas= 3

p_1 = 0.15 m

p_2 = 0.20 m

PARALELA A "a" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	b' (m)	b (m)
8	8	0.10	0.70	0.70

Total $(A_{sa})_{disp}$= 12.1cm²

PARALELA A "b" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	a' (m)	a (m)
14	8	0.10	1.30	1.68

Total $(A_{sb})_{disp}$= 21.1cm²

PASO SUPERIOR 706+000

PASO SUPERIOR 706+000
TABLERO

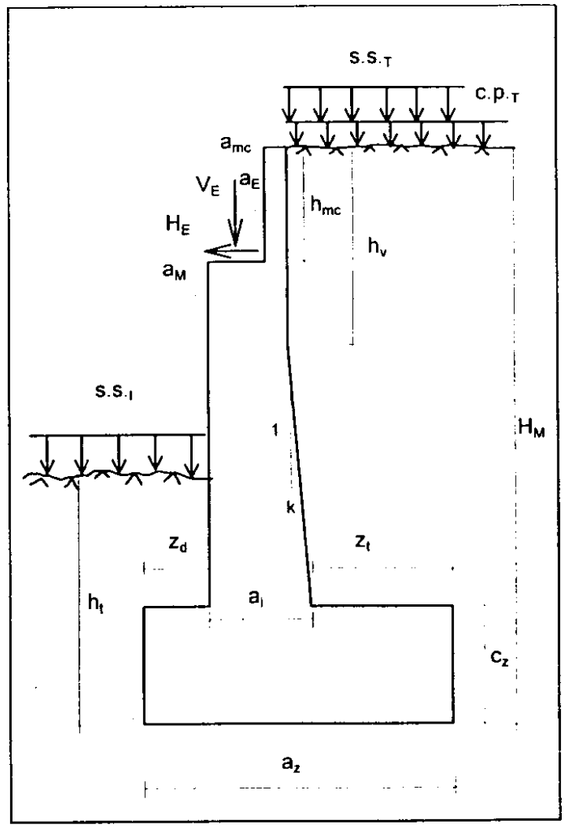
Para el tablero de este paso es válido el cálculo efectuado para el tablero del P.S. 700+240

PASO SUPERIOR 706+000
ESTRIBOS

CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	14.55	m
h_t=	2.25	m
h_v=	13.05	m
h_{mc}=	1.45	m
a_{mc}=	0.30	m
a_M=	1.10	m
a_z=	9.80	m
c_z=	1.50	m
k=	0.00	
a_t=	1.10	m
z_d=	2.20	m
z_t=	6.50	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	°
angulo de rozamiento contacto relleno-muro δ_M =	0.0	°
angulo de rozamiento contacto terreno-muro δ_T =	35	°
cohesión =	0	t/m²
σ_{adm} =	40	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	1.00	t/m²
$s.s._t$ =	0.00	t/m²
$(V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$(V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.40	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	29.6 t/m²	$(\sigma_{med})_{adm}$ =	40.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	48.1 t/m²	$(\sigma_{máx})_{adm}$ =	50.0 t/m²	l_c= 9.80 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.36	$(\gamma_d)_{adm}$=	1.50
γ_v=	3.54	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

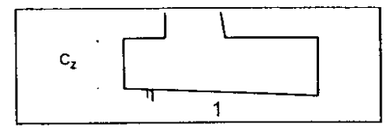
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

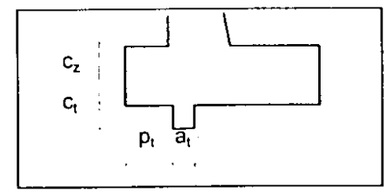
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 ▼

γ_c = 1.50

ACERO AEH-500 ▼

γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

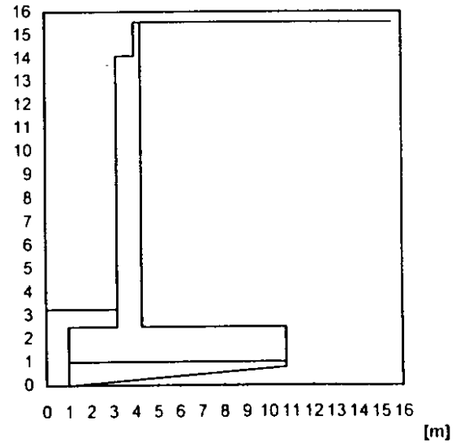
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 93.60 t

Vd= 94.38 t

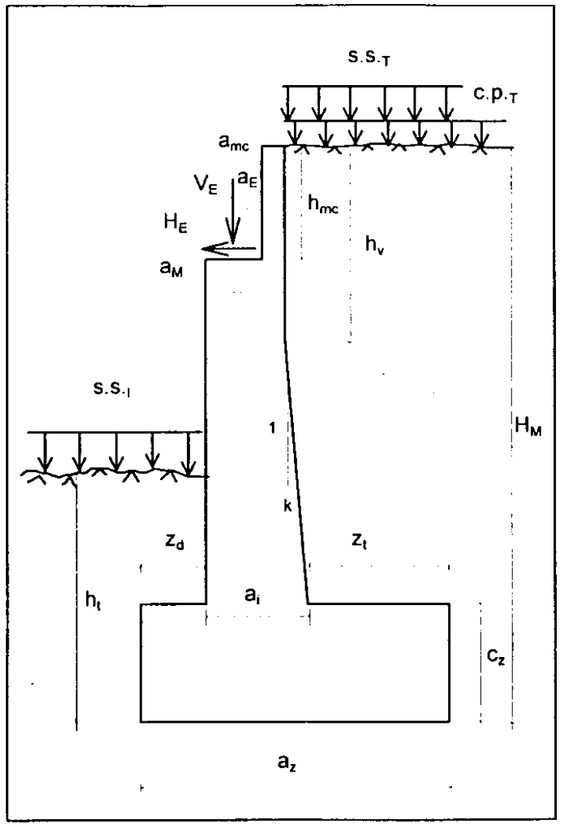
COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	14.55	m
h_t=	2.25	m
h_v=	13.05	m
h_{mc}=	1.45	m
a_{mc}=	0.30	m
a_M=	1.10	m
a_Z=	9.80	m
c_Z=	1.50	m
k=	0.00	
a_i=	1.10	m
z_d=	2.20	m
z_t=	6.50	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	°
angulo de rozamiento contacto relleno-muro δ_M =	0.0	°
angulo de rozamiento contacto terreno-muro δ_T =	35	°
cohesión =	0	t/m²
σ_{adm} =	40	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	1.00	t/m²
$s.s._t$ =	0.00	t/m²
$(V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$(V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.40	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ◯	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	28.3 t/m²	$(\sigma_{med})_{adm}$ =	40.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	44.3 t/m²	$(\sigma_{máx})_{adm}$ =	50.0 t/m²	l_c= 9.80 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.27	$(\gamma_d)_{adm}$=	1.50
γ_v=	3.54	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

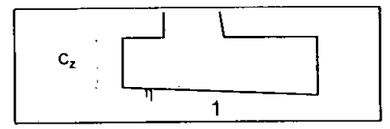
peso especifico del terreno γ_T = 2.10 t/m³

– SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

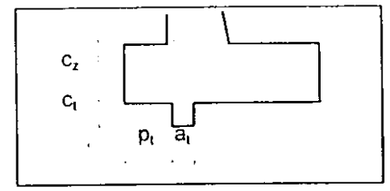
◯ base de zapata inclinada

η = 0.10



◯ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 ▼ γ_c = 1.50

ACERO AEH-500 ▼ γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

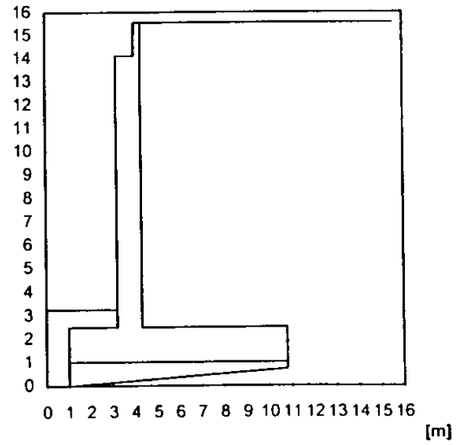
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 93.60 t

Vd= 86.20 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



ACCIONES EN ESTRIBOS Y CÁLCULO DE PLACAS

ACCIONES MÁXIMAS Y MÍNIMAS POR APOYO

p.p. de viga=	2.09	t/m	
p.p. de losa de compresión=	0.60	t/m²	
p.p. de aceras=	0.88	t/m	por cada acera
entrega de viga=	0.35	m	
luz entre apoyos de la viga=	25.00	m	
ancho de losa=	8.00	m	
ancho de plataforma=	8.80	m	(incluso aceras)
ancho total de aceras=	2.80	m	
espesor de pavimento=	0.08	m	
sobrecarga uniforme=	0.40	t/m²	
carga puntual carro de I.P.C.=	60.00	ton	

carga vertical máxima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que en la situación de carro de la I.P.C. más próximo al apoyo, éste se lleva el 80% del peso del carro

$V_{máx}$=	26.86	de p.p. de viga
	30.84	de p.p. de losa de compresión
	11.24	de p.p. de aceras
	7.40	de p.p. de pavimento
	22.62	de sobrecarga uniforme
	48.18	de carro de la I.P.C.
	147.14	ton

carga vertical mínima por apoyo

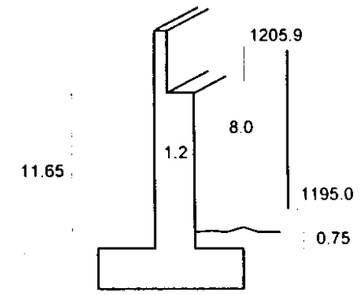
Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que la reacción mínima se produce cuando no hay sobrecarga uniforme ni carro de la I.P.C. en el tablero

$V_{mín}$=	26.86	de p.p. de viga
	30.84	de p.p. de losa de compresión
	11.24	de p.p. de aceras
	7.40	de p.p. de pavimento
	76.34	ton

HIPÓTESIS DE CARGA SOBRE ESTRIBO

En adelante se utilizan cargas horizontales obtenidas del "CÁLCULO DE CARGAS EN CABEZA DE ELEMENTOS" con las siguientes premisas

- los apoyos de neopreno, para las cargas verticales arriba obtenidas y para las horizontales de contracción y frenado, tienen por dimensiones 250 x 600 x 52 mm (neto 37 mm)
- las dimensiones de los estribos que afectan al reparto de cargas horizontales en cabeza de elementos son



Se consideran dos hipótesis de carga para el cálculo del estribo con las siguientes cargas:

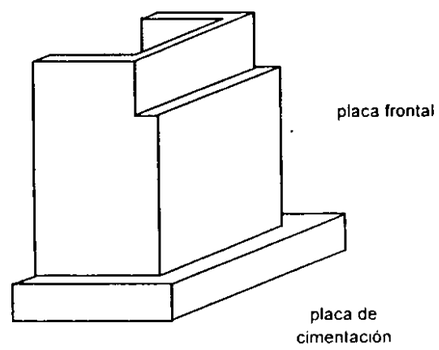
1) Carga vertical máxima sobre la línea de apoyos del estribo (con sobrecarga en todo el tablero y carro de la I.P.C. junto a la línea de apoyos), frenado de la sobrecarga y el carro de la I.P.C, y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	13.15	t/m.a.
$(H_E)_{frenado}$=	0.75	t/m.a.
$s.s._T$ =	1.00	t/m²

2) Carga vertical mínima sobre la línea de apoyos del estribo y sobrecarga en trasdós

$V_E)_{cp}$=	19.09	t/m.a.
$(H_E)_{contracción}$=	0.71	t/m.a.
$V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$s.s._T$ =	1.00	t/m²

DISCRETIZACIÓN EN PLACAS



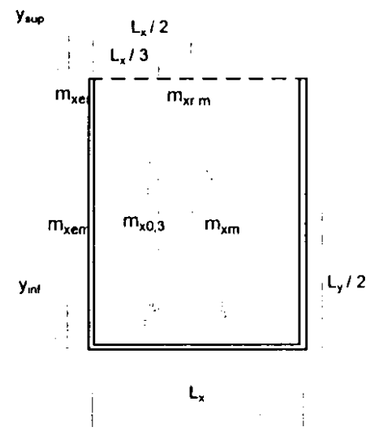
MATERIALES

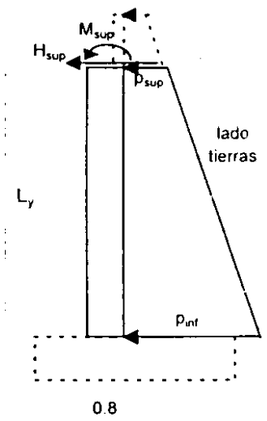
f_{ck}=	250	kp/cm²
γ_c=	1.50	
f_{yk}=	5100	kp/cm²
γ_s=	1.15	

CÁLCULO DE ARMADURAS DE PLACA FRONTAL

Se considera una hipótesis de carga en trasdós de placa y dos tipos de coacción en borde de placa rectangular. La hipótesis de carga incluye el empuje de tierras al reposo producido por (peso de las tierras + sobrecarga uniforme en trasdós de la placa) y la reacción horizontal procedente de tablero

L_x=	8.00 m
y_{sup}=	1205.90 m
y_{inf}=	1194.30 m
L_y=	11.60 m
espesor placa =	1.10 m
coeficiente de empuje K_r =	0.36
p_{sup}=	1.44 t/m²
p_{inf}=	10.15 t/m²
H_{sup} (*) =	2.77 t/m.a.
M_{sup}=	0.76 mt/m.a.
γ_f =	1.60
L_y/L_x=	1.45





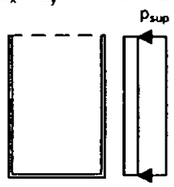
(*) Incluye la reacción horizontal procedente del tablero y debida a efectos reológicos y frenado

En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.

$M_i > 0$ si produce tracciones en intradós

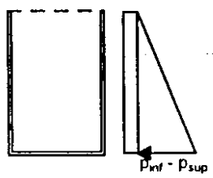
esfuerzos para coacción

K = $p_{sup} * L_x * L_y$ = 134.09



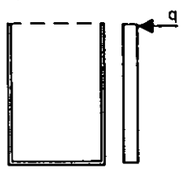
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-16.6	-17.9	33.4	38.2	67.8	-24.5	-34.5	235.0	345.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-8.08	-7.49	4.01	3.51	1.98	-5.47	-3.89	0.57	0.39

K = $(p_{inf}-p_{sup}) * L_x * L_y /2$ = 403.76



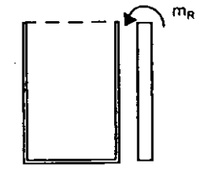
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-74.6	-18.4	100.0	41.6	71.1	-17.0	-22.3	145.0	205.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-5.41	-21.94	4.04	9.71	5.68	-23.75	-18.11	2.78	1.97

K = $q * L_x$ = 22.13

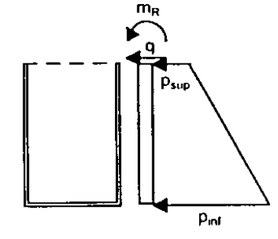


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-2.3	-155.0	7.2	111.0	385.0	------	------	-62.1	-87.8
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-9.58	-0.14	3.06	0.20	0.06	0.00	0.00	-0.36	-0.25

K = m_R = 0.76 mt/m.a.



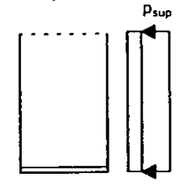
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-0.7	10.2	3.5	-20.4	-39.2	66.7	110.0	------	250.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-1.02	0.07	0.21	-0.04	-0.02	0.01	0.01	0.00	0.00



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-24.1	-29.5	11.3	13.4	7.7	-29.2	-22.0	3.0	2.1

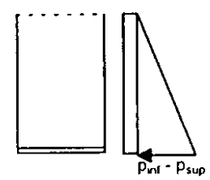
esfuerzos para coacción

K = $p_{sup} * L_x * L_y$ = 134.09



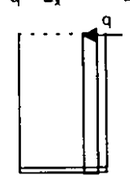
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	12.5	18.1	20.7	-11.3	-13.8	79.0	100.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	10.73	7.41	6.48	-11.87	-9.72	1.70	1.34

K = $(p_{inf}-p_{sup}) * L_x * L_y /2$ = 403.76



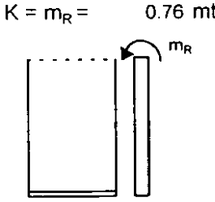
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	25.4	22.7	25.2	-9.8	-11.8	56.3	72.5
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	15.90	17.79	16.02	-41.07	-34.22	7.17	5.57

K = $q * L_x$ = 22.13

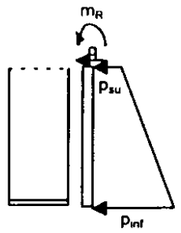


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	4.1	17.6	21.6	-28.3	-34.0	-32.6	-40.2
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	5.37	1.26	1.02	-0.78	-0.65	-0.68	-0.55

K = m_R = 0.76 mt/m.a.



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	3.0	-21.0	-25.0	18.2	23.8	-22.2	-28.6
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	0.25	-0.04	-0.03	0.04	0 03	-0.03	-0.03



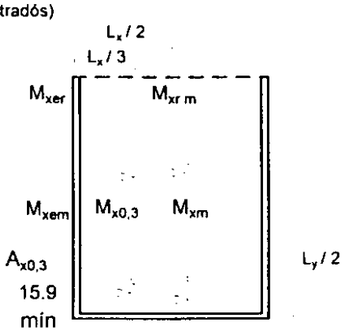
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.0	0.0	32.2	26.4	23.5	-53.7	-44.6	8.2	6.3

envolvente de momentos según X (los momentos son positivos si producen tracciones en intradós)

	M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	32.2	26.4	23.5
momentos negativos (mt/m.a.)	-24.1	-29.5	0.0	0.0	0.0

envolvente de momentos según Y (los momentos son positivos si producen tracciones en intradós)

	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	8.2	6.3
momentos negativos (mt/m.a.)	-53.7	-44.6	0.0	0.0



armado según X

or cuantía geométrica A_{min}= 17.6 cm²/m.a. a repartir entre las dos caras

	A_{xer}	A_{xem}	$A_{xr\,m}$	A_{xm}	$A_{x0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	15.9	15.9	mín	mín	mín

armado según Y

or cuantía geométrica A_{min}= 9.9 cm²/m.a. a repartir entre las dos caras

	A_{yem}	A_{ye}	A_{ym}	$A_{y0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	15.9	15.9
armadura necesaria en trasdós (cm²/m.a.)	18.7	15.9	mín	mín

CÁLCULO DE ARMADURAS DE PLACA LATERAL

Se considera una hipótesis de carga en trasdós de placa que incluye sólo el empuje de tierras al reposo producido por (peso de las tierras + sobrec uniforme en trasdós de la placa)

γ_f = 1.60

coeficiente de empuje activo K_a = 0.22 1

peso específico del relleno γ_r = 2.10 t/m³

armado de sector 1

espesor placa = 0.30 m

y_{sup} = 1207.35 m

y_{inf} = 1205.90 m

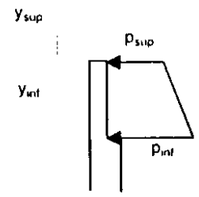
h_{mc} = 1.45 m

p_{sup} = 0.22 t/m²

p_{inf} = 0.89 t/m²

M_{yem} = 0.47 mt/m.a.

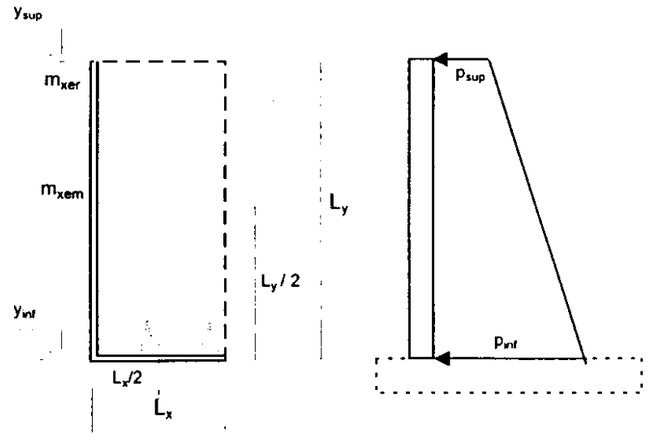
armadura nec. en trasdós A_{yem} = 3.91 cm²/m.a.



2

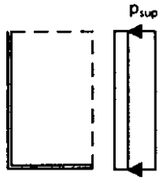
armado de sector 2

L_x=	6.50	m
y_{sup}=	1205.90	m
y_{inf}=	1194.30	m
L_y=	11.60	m
espesor placa =	1.10	m
p_{sup}=	0.89	t/m²
p_{inf}=	6.25	t/m²
γ_f =	1.60	
L_y/L_x=	1.78	



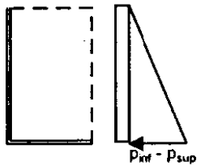
En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.
$M_i > 0$ si produce tracciones en intradós

$K = p_{sup} * L_x * L_y$ = 67.10



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-3.81	-5.91	-4.27	-10.90
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-17.6	-11.4	-15.7	-6.2

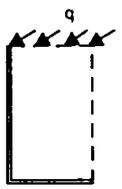
$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 202.04



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-8.98	-6.92	-4.41	-9.51
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-22.5	-29.2	-45.8	-21.2

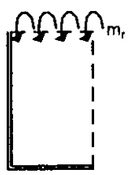
El rectángulo del sector 1 se convierte en una carga lineal y un momento lineal aplicados en el borde superior de la placa

q=	0.80	ton
$K = q * L_x$ =	5.23	ton



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-0.68	-3.96	-2.63	-13.50
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-7.7	-1.3	-2.0	-0.4

m_r =	-0.47	mt/m
$K = m_r$ =	-0.47	mt/m



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-0.61	4.75	11.20	19.30
M_{xer}	M_{xem}	M_{yer}	M_{yem}
0.8	-0.1	0.0	0.0

armado según X

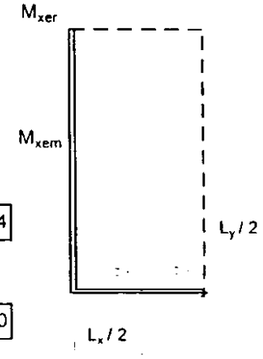
por cuantia geométrica A_{min}= 17.6 cm²/m.a. a repartir entre las dos caras

		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{xer}=	-47.0 mt/m.a.					
armadura nec. trasdós A_{xer}=	16.3 cm²/m.a.	20	0.15	20.9	0.24	0.00
M_{xem}=	-42.0 mt/m.a.					
armadura nec. trasdós A_{xem}=	15.9 cm²/m.a.	20	0.15	20.9	0.24	0.00

armado según Y

por cuantia geométrica A_{min}= 9.9 cm²/m.a. a repartir entre las dos caras

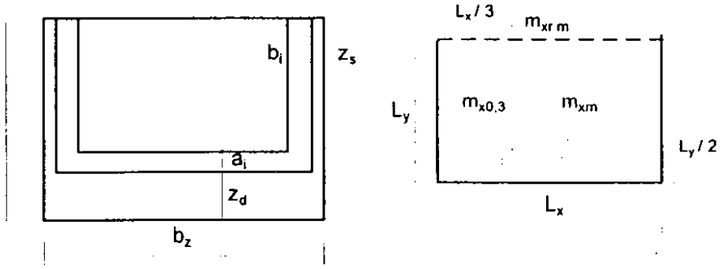
		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
M_{yer}=	-63.6 mt/m.a.					
armadura nec. trasdós A_{yer}=	22.3 cm²/m.a.	25	0.150	32.7	0.22	0.14
M_{yem}=	-27.8 mt/m.a.					
armadura nec. trasdós A_{yem}=	15.9 cm²/m.a.	20	0.150	20.9	0.24	0.00

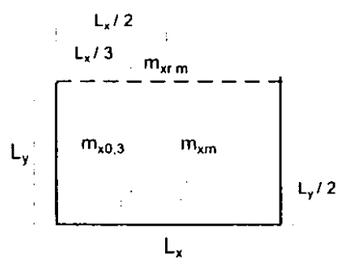


CÁLCULO DE ARMADURAS DE PLACA DE CIMENTACIÓN

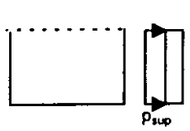
Se considera una hipótesis de carga que incluye el peso de tierras sobre placa de cimentación (incluso sobrecarga sobre trasdós) y la respuesta del terreno en forma de ley triangular de presiones (obtenida para la hipótesis de carga máxima procedente de tablero)

z_d= 2.20 m
a_i= 1.10 m
a_z= 9.80 m
b_i= 1.10 m
b_z= 8.50 m
z_s= 0.25 m
L_x= 6.90 m
L_y= 7.05 m
L_y/L_x= 1.02



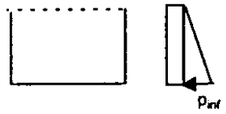


p_{sup}= 28.4 t/m²
$K = p_{sup} * L_x * L_y$ = 1381.76

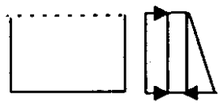


$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
9.8	13.7	16.0	46.1	57.2
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
141.4	100.9	86.4	30.0	24.2

p_{inf}= -34.60 t/m²
$K = p_{inf} * L_x * L_y /2$ = -841.62



$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{ym}	$m_{y0,3}$
16.2	17.1	19.8	35.9	44.5
$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{ym}	$M_{y0,3}$
-51.95	-49.22	-42.51	-23.44	-18.91



		ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
$M_{xr\,m}$=	89.5 mt/m.a.					
armadura nec. cara inf. $A_{xr\,m}$=	22.6 cm²/m.a.	25	0.150	32.7	0.22	0.00
M_{xm}=	51.6 mt/m.a.					
armadura nec. cara inf. A_{xm}=	21.9 cm²/m.a.	25	0.150	32.7	0.22	0.00
$M_{x0,3}$=	43.9 mt/m.a.					
armadura nec. cara inf. $A_{x0,3}$=	21.9 cm²/m.a.	25	0.150	32.7	0.22	0.00
M_{ym}=	6.5 mt/m.a.					
armadura nec. cara inf. A_{ym}=	min cm²/m.a.					
$M_{y0,3}$=	5.2 mt/m.a.					
armadura nec. cara inf. A_{ym}=	min cm²/m.a.					

COMPROBACIÓN DE APOYOS ELASTOMÉRICOS ARMADOS

MATERIALES

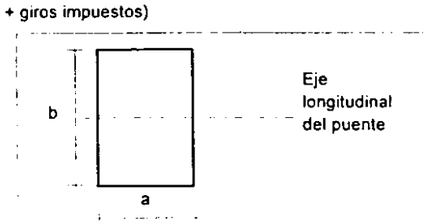
$G_{diferido}$ = 100 t/m²
$G_{instantáneo}$ = 200 t/m²
σ_{adm} = 150 kp/cm²
$(\tau_{H\ larga\ duración})_{adm}$ = 0.50 $G_{diferido}$
$(\tau_{H\ total})_{adm}$ = 0.70 $G_{diferido}$
$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = 5 $G_{diferido}$, siendo:

$(\tau_{H\ larga\ duración})_{adm}$: tensión tangencial admisible para desplazamientos impuestos
$(\tau_{H\ total})_{adm}$: tensión tangencial admisible para (desplazamientos impuestos + cargas horizontales instantáneas)
$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$: tensión tangencial admisible para (cargas verticales + desplazamientos impuestos + cargas horizontales instantáneas + giros impuestos)

GEOMETRÍA

TIPO DE APOYO: (◉) Rectangular ( ) Circular

espesor neto = 37 mm
a = 250 mm (a < b)
b = 600 mm



DESPLAZAMIENTOS IMPUESTOS Y CARGAS

sismo ☐

$\delta_{longitudinal}$ = 7.0 mm
$\delta_{transversal}$ = 0.0 mm
$V_{máx}$ = 147.14 ton
V_{min} = 76.34 ton — $H_{concomitante}$ = 0.00 ton
$(H_{longitudinal})_{máx}$ = 1.93 ton — $(H_{transversal})_{concomitante}$ = 0.00 ton

con sismo

$V_{máx}$ = ton
V_{min} = ton — $H_{concomitante}$ = ton
$(H_{longitudinal})_{máx}$ = ton — $(H_{transversal})_{concomitante}$ = ton

COMPROBACIÓN DE TENSIONES NORMALES

$\sigma_{máx}$ = 98 kp/cm² — σ_{adm} = 150 kp/cm²
σ_{min} = 51 kp/cm²

con sismo

$\sigma_{máx}$ = kp/cm² — σ_{adm} = kp/cm²
σ_{min} = kp/cm²

COMPROBACIÓN DE SEGURIDAD AL DESLIZAMIENTO

$f = 1 - \frac{\sqrt[4]{10\sigma_{mínimo} - 5}}{3.2}$ = 0.19 ($\sigma_{mínimo}$ en N/mm^2)

Para V_{min} se tiene $H_{concomitante}$ = 0.00 ton siendo $H_{adm} = f * V_{min}$ = 14.25 ton

con sismo

$f = 1 - \frac{\sqrt[4]{10\sigma_{mínimo} - 5}}{3.2}$ = ($\sigma_{mínimo}$ en N/mm^2)

Para V_{min} se tiene $H_{concomitante}$ = ton siendo $H_{adm} = f * V_{min}$ = ton

NO ES PRECISO ANCLAR EL APOYO

COMPROBACIÓN DE TENSIÓN TANGENCIAL EN EL CONTACTO NEOPRENO-CHAPA DE ACERO

TIPO DE COMPROBACIÓN

◉ simplificada : se obtiene la tensión tangencial producida sólo por la carga horizontal máxima ($H_{máx}$) y por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$)

○ completa : se obtiene la tensión tangencial producida por la carga horizontal máxima ($H_{máx}$), por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$) y por la carga vertical ($V_{concomitante}$) y los giros impuestos ($\alpha_{longitudinal}$ y $\alpha_{transversal}$) coincidentes con la carga horizontal máxima

$V_{concomitante}$ =	ton
$\alpha_{longitudinal}$ =	rad/1000
$\alpha_{transversal}$ =	rad/1000

con sismo

$V_{concomitante}$ =	ton
$\alpha_{longitudinal}$ =	rad/1000
$\alpha_{transversal}$ =	rad/1000

NOTA.- $\alpha_{longitudinal}$ es giro del apoyo alrededor de un eje paralelo al eje del puente y $\alpha_{transversal}$ es giro alrededor de un eje perpendicular al eje del puente

$\tau_{H\ larga\ duración}$ =	1.9 kp/cm²	$(\tau_{H\ larga\ duración})_{adm}$ =	5.0 kp/cm²
$\tau_{H\ total}$ =	2.5 kp/cm²	$(\tau_{H\ total})_{adm}$ =	7.0 kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

con sismo

$\tau_{H\ total}$ =	kp/cm²	$(\tau_{H\ total})_{adm}$ =	kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

COMPROBACIÓN DE ESTABILIDAD

a/10 = 25 mm
espesor neto = 37 mm
a/5 = 50 mm

SE CUMPLE LA CONDICIÓN a/10 ≤espesor neto ≤ a/5

CÁLCULO DE REFUERZO BAJO APOYOS

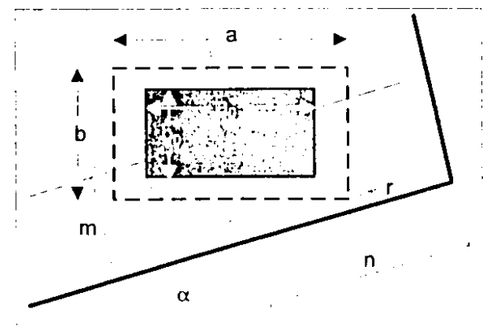
APOYO DE NEOPRENO

a_0 = 0.60 m ($a_0 > b_0$)
b_0 = 0.25 m

ELEMENTO ESTRUCTURAL BAJO APOYO

m= 0.40 m
n= 2.00 m
α= 100.0 g
r= 0.05 m

dimensiones del rectángulo homotético
a= 1.68 m
b= 0.70 m



AXIL

N= 147.14 ton
γ_f= 1.6

MATERIALES

f_{ck}= 250 kp/cm²
f_{yk}= 5100 kp/cm²
γ_s= 1.15

TENSIÓN MÁXIMA DE TRACCIÓN

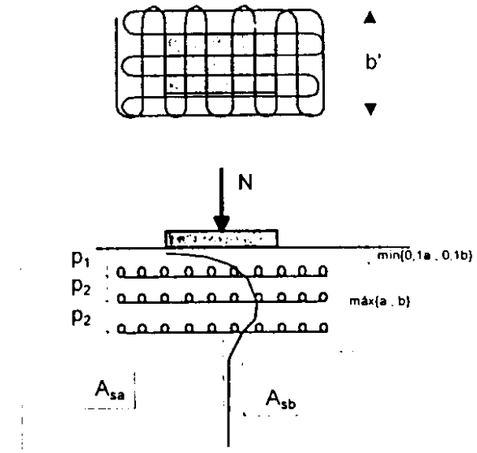
$\sigma_{máx}$= 35.9 t/m²
$f_{ct,k}$ / 2= 89.3 t/m²

ARMADURA NECESARIA

$(A_{sa})_{nec} = (A_{sb})_{nec}$ = 10.2 cm²

GEOMETRIA REFUERZO

mín{ 0.1a , 0.1b }= 0.07 m
máx{ a, b }= 1.68 m



ARMADURA DISPUESTA

número de parrillas= 3
p_1 = 0.15 m
p_2 = 0.20 m

PARALELA A "a" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	b' (m)	b (m)
8	8	0.10	0.70	0.70

Total $(A_{sa})_{disp}$= 12.1cm²

PARALELA A "b" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	a' (m)	a (m)
14	8	0.10	1.30	1.68

Total $(A_{sb})_{disp}$= 21.1cm²

PASO SUPERIOR 708+100

PASO SUPERIOR 708+100
TABLERO, PILAS Y ZAPATAS DE PILAS

PASO SUPERIOR 2.9.7

Ancho de tablero	Ancho en base	Canto	Xc	Yc	Az			Espesor pavim.
8,20	3,60	1,20	553443,630	4551372,540	157,1966			0,05

SECCION	a	b	c	d	Za	Zb	Zc	Zd
1	553430,364	553423,948	553428,564	553425,748	1223,964	1223,800	1223,918	1223,846
	4551395,787	4551390,680	4551394,354	4551392,112				
2	553430,644	553424,229	553428,845	553426,028	1223,962	1223,798	1223,916	1223,844
	4551395,435	4551390,328	4551394,002	4551391,760				
3	553432,746	553426,331	553430,947	553428,130	1223,945	1223,781	1223,899	1223,827
	4551392,794	4551387,687	4551391,362	4551389,120				
4	553434,848	553428,433	553433,049	553430,232	1223,928	1223,764	1223,882	1223,810
	4551390,154	4551385,047	4551388,721	4551386,479				
5	553436,950	553430,535	553435,151	553432,334	1223,911	1223,747	1223,865	1223,793
	4551387,514	4551382,406	4551386,081	4551383,839				
6	553439,052	553432,637	553437,253	553434,436	1223,895	1223,731	1223,849	1223,777
	4551384,873	4551379,766	4551383,441	4551381,198				
7	553440,999	553434,583	553439,199	553436,383	1223,879	1223,715	1223,833	1223,761
	4551382,428	4551377,321	4551380,996	4551378,754				
8	553442,945	553436,530	553441,146	553438,329	1223,863	1223,699	1223,817	1223,745
	4551379,983	4551374,876	4551378,551	4551376,309				
9	553444,891	553438,476	553443,092	553440,275	1223,848	1223,684	1223,802	1223,730
	4551377,538	4551372,431	4551376,106	4551373,864				
10	553446,838	553440,422	553445,038	553442,222	1223,832	1223,668	1223,786	1223,714
	4551375,094	4551369,986	4551373,661	4551371,419				
11	553448,784	553442,369	553446,985	553444,168	1223,816	1223,652	1223,770	1223,698
	4551372,649	4551367,542	4551371,216	4551368,974				
12	553450,730	553444,315	553448,931	553446,114	1223,801	1223,637	1223,755	1223,683
	4551370,204	4551365,097	4551368,771	4551366,529				
13	553452,677	553446,261	553450,877	553448,061	1223,785	1223,621	1223,739	1223,667
	4551367,759	4551362,652	4551366,326	4551364,084				
14	553454,623	553448,208	553452,824	553450,007	1223,770	1223,606	1223,724	1223,652
	4551365,314	4551360,207	4551363,882	4551361,639				
15	553456,725	553450,310	553454,926	553452,109	1223,753	1223,589	1223,707	1223,635
	4551362,674	4551357,566	4551361,241	4551358,999				
16	553458,827	553452,412	553457,028	553454,211	1223,736	1223,572	1223,690	1223,618
	4551360,033	4551354,926	4551358,601	4551356,359				
17	553460,929	553454,514	553459,130	553456,313	1223,719	1223,555	1223,673	1223,601
	4551357,393	4551352,286	4551355,960	4551353,718				
18	553463,031	553456,616	553461,232	553458,415	1223,702	1223,538	1223,656	1223,584
	4551354,752	4551349,645	4551353,320	4551351,078				
19	553463,312	553456,896	553461,512	553458,696	1223,536	1223,700	1223,582	1223,654
	4551354,400	4551349,293	4551352,968	4551350,726				

PASO SUPERIOR 708+100

GEOMETRIA DEL TABLERO

DATOS GENERALES

NUMERO DE VANOS : 3
ESPESOR DEL FIRME : 0.080
COTA DE ALMOHADILLA : 0.000

HAY ALIGERAMIENTOS

VANO	LUZ
1	13.50
2	25.00
3	13.50

CONTORNO EXTERIOR

PERFIL LONGITUDINAL

Ai EN TANTO POR UNO DE LA LUZ
Bi EN METROS

VANO	A1	B1	A2	B2	A3	A4	B4
1	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20
2	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20
3	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20

LEY DE VUELOS

PUNTO	X	Y
1	0.00	0.25
2	2.10	0.40
3	2.30	1.20

LEY DE ANCHO SUPERIOR

P.K.	ANCHO
0.00	8.20
52.00	8.20

LEY DE CAMBIO DE PERALTES

ANCHO : DISTANCIA AL EXTREMO IZQUIERDO DE LA CARA FRONTAL
EN EL SENTIDO DE AVANCE DE LOS P.K.

P.K.	ANCHO	CANTO
0.00	8.20	0.000
52.00	8.20	0.000

ALIGERAMIENTOS

DATOS GENERALES

TIPO1 INDICA EL TIPO DE ALIGERAMIENTO Y DE TRANSICION ENTRE LOS
PUNTOS SUPERIORES

1 : ALIGERAMIENTO CIRCULAR
2 : ALIGERAMIENTO RECTANGULAR CON TRANSICION LINEAL
3 : ALIGERAMIENTO RECTANGULAR CON TRANSICION PARABOLICA CUBICA
TIPO2 DEFINE LA TRANSICION ENTRE LOS PUNTOS INFERIORES DEL ALIGERAMIENTO RECTANGULAR Y TOMA LOS VALORES 2 o 3 CON EL MISMO SIGNIFICADO QUE EN EL CASO ANTERIOR

VANO	N.ALIG	TIPO1	TIPO2
1	0	0	0
2	3	1	0
3	0	0	0

ALZADO

Li : LONGITUDES QUE DEFINEN LOS EXTREMOS DE LOS ALIGERAMIENTOS
DPSi : DISTANCIA AL PARAMENTO SUPERIOR DE LOS EXTREMOS DE LOS ALIG.
Ci : CANTO DE LOS ALIGERAMIENTOS EN LOS EXTREMOS

VN	L1	L2	L3	L4	DPS1	DPS2	DPS3	DPS4	C1	C2	C3	C4
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2.00	10.50	10.50	2.00	0.30	0.30	0.30	0.30	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLANTA Y SECCIONES TRANSVERSALES

Si : DISTANCIAS ENTRE EJES DE ALIGERAMIENTOS
Ai : ANCHOS DE LOS ALIGERAMIENTOS
B : ANCHO SUPERIOR DEL ALIGERAMIENTO EXTREMO

VANO	S1	A1	S2	A2	S3	A3	S4	A4	S5	A5	B
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.60	1.10	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PASO SUPERIOR 708+100

CARACTERISTICAS MECANICAS DE LAS SECCIONES DEL TABLERO

SECCION NUMERO : 1

CONTORNO EXTERIOR

PUNTO	COORD.X	COORD.Y
1	-4.100	0.000
2	-4.100	-0.250
3	-2.000	-0.400
4	-1.800	-1.200
5	1.800	-1.200
6	2.000	-0.400
7	4.100	-0.250
8	4.100	0.000

AREA	CENTRO DE GRAVEDAD COORD.X	CENTRO DE GRAVEDAD COORD.Y	MOMENTOS DE INERCIA EJE X	MOMENTOS DE INERCIA EJE Y
6.005	0.000	-0.492	0.754032	18.328620

S E C C I O N B R U T A

Distancia de la fibra neutra al borde inferior : 0.7077 m
Distancia de la fibra neutra al borde superior : 0.4923 m
Ancho : 8.20 m
Canto : 1.20 m
Area : 6.005 m2
Momento de inercia : 0.75403 m4

SECCION NUMERO : 2

CONTORNO EXTERIOR

PUNTO	COORD.X	COORD.Y
1	-4.100	0.000
2	-4.100	-0.250
3	-2.000	-0.400
4	-1.800	-1.200
5	1.800	-1.200
6	2.000	-0.400
7	4.100	-0.250
8	4.100	0.000

AREA	CENTRO DE GRAVEDAD COORD.X	CENTRO DE GRAVEDAD COORD.Y	MOMENTOS DE INERCIA EJE X	MOMENTOS DE INERCIA EJE Y
6.005	0.000	-0.492	0.754032	18.328620

ALIGERAMIENTOS CIRCULARES

CIRCULO	X CENTRO	Y CENTRO	DIAMETRO	AREA	INERCIA
1	-1.100	-0.600	0.600	0.282	0.006346
2	0.000	-0.600	0.600	0.282	0.006346
3	1.100	-0.600	0.600	0.282	0.006346

S E C C I O N B R U T A

Distancia de la fibra neutra al borde inferior : 0.7254 m
Distancia de la fibra neutra al borde superior : 0.4746 m
Ancho : 8.20 m
Canto : 1.20 m
Area : 5.158 m2
Momento de inercia : 0.72356 m4

PASO SUPERIOR 708+100

DEFINICION DEL PUENTE

VANO	BANDA	LONGITUD	SECCION
1	1	13.500	1
2	1	2.000	1
2	2	21.000	2
2	3	2.000	1
3	1	13.500	1

PASO SUPERIOR 708+100

GEOMETRIA DEL TABLERO
****

VANO NUMERO 1
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
13.500	6.005	0.75403	8.20	1.20	0.492

Longitud total del vano : 13.500 m

VANO NUMERO 2
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
2.000	6.005	0.75403	8.20	1.20	0.492
21.000	5.158	0.72356	8.20	1.20	0.475
2.000	6.005	0.75403	8.20	1.20	0.492

Longitud total del vano : 25.000 m

VANO NUMERO 3
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
13.500	6.005	0.75403	8.20	1.20	0.492

Longitud total del vano : 13.500 m

PUENTE COMPLETO
==========

Numero de vanos : 3

Longitud total : 52.00 m
Superficie del tablero : 426.40 m2
Volumen de hormigon : 294.47 m3

PASO SUPERIOR 708+100

DEFORMACIONES DIFERIDAS

MODULOS DE DEFORMACION

Módulo deformac. longit. secante hormigón a 28 días : 3800000.00 t/m2
Módulo elasticidad de armaduras activas y pasivas : 20000000.00 t/m2

DEFORMACIONES DIFERIDAS

Humedad relativa del ambiente : 50 %
Edad teorica del hormigon : 10000 dias
Edad de comienzo de ser efectivo el efecto de la retraccion : 3 dias
Edad de puesta en carga : 28 dias

Retiaccion : 0.00033
Coeficiente de fluencia : 3.273

PASO SUPERIOR 708+100

DEFORMACIONES DIFERIDAS
****

DATOS
=====

Humedad relativa del ambiente : 50 %
Edad teorica del hormigon : 10000 dias
Edad de comienzo de ser efectivo el efecto de la retraccion : 3 dias
Edad de puesta en carga : 28 dias

RESULTADOS
==========

Coeficientes que dependen de la humedad relativa
ALFA : 1.10
EPSILON 01 : -0.00046
FI 01 : 2.80

Coeficiente de la variacion de la resistencia del hormigon con el tiempo
BETA a : 0.25

Coeficiente de la variacion de la deformacion elastica diferida
BETA t-j : 1.00

SECCION NUMERO 1

Area : 6.01 m2
Perimetro : 18.16 m
Espesor ficticio : 0.73 m

Coeficientes que dependen del espesor ficticio
EPSILON 02 : 0.75
FI 02 : 1.26

Coeficientes de la evolucion de la retraccion en el tiempo
BETA t : 0.95
BETA j : 0.01

Coeficientes de la evolucion en el tiempo de la deformacion plastica diferida
BETA t : 0.99
BETA j : 0.25

Retraccion : 0.000323
Coeficiente de fluencia : 3.257

SECCION NUMERO 2

Area : 5.16 m2
Perimetro : 18.16 m
Espesor ficticio : 0.63 m

Coeficientes que dependen del espesor ficticio
EPSILON 02 : 0.76
FI 02 : 1.29

Coeficientes de la evolucion de la retraccion en el tiempo
BETA t : 0.95
BETA j : 0.01

Coeficientes de la evolucion en el tiempo de la deformacion plastica diferida
BETA t : 1.00
BETA j : 0.26

Retraccion : 0.000330
Coeficiente de fluencia : 3.298

DEFORMACIONES DIFERIDAS

PASO SUPERIOR 708+100

CARGAS EXISTENTES SOBRE EL TABLERO

Cargas muertas en el extremo izquierdo del tablero : 1.80 Tn/m
Cargas muertas en el extremo derecho del tablero : 1.80 Tn/m

Espesor del pavimento : 0.080 m
Peso especifico : 2.400 Tn/m3
Ancho de barrera y acera izquierda : 1.40 m
Ancho de barrera y acera derecha : 1.40 m

Sobrecarga uniforme en plataforma : 0.40 Tn/m2
Sobrecarga uniforme en barreras : 0.10 Tn/m2
Ancho de barrera izquierda : 0.35 m
Ancho de barrera derecha : 0.35 m

Tren constituido por 3 ejes.
Carga por eje : 20.00 Tn
Distancia entre ejes : 1.50 m

TEMPERATURAS

Coeficiente de dilatacion termica : 0.000010 grados-1

Gradiente positivo : 5.00 grados
Gradiente negativo : -5.00 grados

Gradiente positivo (situacion transitoria) : 5.00 grados
Gradiente negativo (situacion transitoria) : -5.00 grados

DESCENSO DE APOYOS

No se considera esta hipotesis

COEF. EXCENTRICIDAD DEL CARRO. SECCIONES Y MOMENTOS ADICIONALES

SECCION	C.EX.	MOMENTO MAX.	MOMENTO MIN.
0.30	1.60	0.00	0.00
0.40	1.60	0.00	0.00
0.50	1.60	0.00	0.00
0.70	1.60	0.00	0.00
1.00	1.60	0.00	0.00
1.30	1.60	0.00	0.00
1.50	1.60	0.00	0.00
1.70	1.60	0.00	0.00
2.00	1.60	0.00	0.00
2.30	1.60	0.00	0.00
2.50	1.60	0.00	0.00
2.60	1.60	0.00	0.00
2.70	1.60	0.00	0.00
0.60	1.60	0.00	0.00
0.80	1.60	0.00	0.00
0.90	1.60	0.00	0.00
1.10	1.60	0.00	0.00
1.15	1.60	0.00	0.00
1.25	1.60	0.00	0.00
1.75	1.60	0.00	0.00
1.85	1.60	0.00	0.00
1.90	1.60	0.00	0.00
2.10	1.60	0.00	0.00
2.20	1.60	0.00	0.00
2.40	1.60	0.00	0.00

PASO SUPERIOR 708+100

CARGAS EXISTENTES SOBRE EL TABLERO
****

CARGAS PERMANENTES
==========

Cargas muertas en el extremo izquierdo del tablero : 1.80 Tn/m
Cargas muertas en el extremo derecho del tablero : 1.80 Tn/m

Espesor del pavimento : 0.080 m
Peso especifico : 2.400 Tn/m3
Ancho de barrera y acera izquierda : 1.40 m
Ancho de barrera y acera derecha : 1.40 m

SOBRECARGAS DE USO
==========

Sobrecarga uniforme en plataforma : 0.40 Tn/m2
Sobrecarga uniforme en barreras : 0.10 Tn/m2
Ancho de barrera izquierda : 0.35 m
Ancho de barrera derecha : 0.35 m

Tren constituido por 3 ejes.
Carga por eje : 20.00 Tn
Distancia entre ejes : 1.50 m

SECCION C. EXCENTRICIDAD

0.30	1.60
0.40	1.60
0.50	1.60
0.60	1.60
0.70	1.60
0.80	1.60
0.90	1.60
1.00	1.60
1.10	1.60
1.15	1.60
1.25	1.60
1.30	1.60
1.50	1.60
1.70	1.60
1.75	1.60
1.85	1.60
1.90	1.60
2.00	1.60
2.10	1.60
2.20	1.60
2.30	1.60
2.40	1.60
2.50	1.60
2.60	1.60
2.70	1.60

TEMPERATURAS
==========

Coeficiente de dilatacion termica : 0.000010 grados-1

Gradiente positivo : 5.00 grados
Gradiente negativo : -5.00 grados

Gradiente positivo (situacion transitoria) : 5.00 grados
Gradiente negativo (situacion transitoria) : -5.00 grados

PASO SUPERIOR 708+100

ENVOLVENTE DE MOMENTOS FLECTORES
****

Unidades : mtn
Positivo : tensiones de traccion en la fibra inferior

PESO PROPIO, CARGA MUERTA, CARGA PERMANENTE, SOBRECARGA Y TREN
==========

SECC.	P.P.	C.M.	C.P.	SC. UNIF.		TREN	
0.30	112.32	27.15	139.47	53.39	-35.42	204.25	-72.09
0.40	95.04	19.29	114.33	60.00	-47.22	230.45	-96.11
0.50	50.40	2.99	53.39	61.01	-59.03	230.70	-120.14
0.60	-21.60	-21.76	-43.36	56.42	-70.83	207.70	-144.17
0.70	-120.96	-54.97	-175.93	46.24	-82.64	164.75	-168.20
0.80	-247.68	-96.62	-344.31	30.47	-94.44	105.75	-192.23
0.90	-401.76	-146.73	-548.49	13.45	-110.60	35.19	-216.26
1.00	-583.21	-205.28	-788.49	8.83	-144.75	30.51	-240.28
1.10	-220.55	-74.87	-295.42	13.68	-63.25	58.46	-101.67
1.15	-79.51	-24.16	-103.67	21.74	-37.74	101.04	-73.82
1.25	162.26	62.78	225.04	59.43	-17.86	202.17	-61.55
1.30	263.00	99.01	362.01	83.41	-17.86	250.97	-55.41
1.50	424.19	156.97	581.15	121.79	-17.86	330.33	-30.86
1.70	263.00	99.01	362.01	83.41	-17.86	250.97	-55.41
1.75	162.26	62.78	225.04	59.43	-17.86	202.17	-61.55
1.85	-79.51	-24.16	-103.67	21.74	-37.74	101.04	-73.82
1.90	-220.55	-74.87	-295.42	13.68	-63.25	58.46	-101.67
2.00	-583.21	-205.28	-788.49	8.83	-144.75	30.51	-240.28
2.10	-401.76	-146.73	-548.49	13.45	-110.60	35.19	-216.26
2.20	-247.68	-96.62	-344.31	30.47	-94.44	105.75	-192.23
2.30	-120.96	-54.97	-175.93	46.24	-82.64	164.75	-168.20
2.40	-21.60	-21.76	-43.36	56.42	-70.83	207.70	-144.17
2.50	50.40	2.99	53.39	61.01	-59.03	230.70	-120.14
2.60	95.04	19.29	114.33	60.00	-47.22	230.45	-96.11
2.70	112.32	27.15	139.47	53.39	-35.42	204.25	-72.09

TEMPERATURAS
==========

FASE DEFINITIVA

SECC.	MAXIMO	MINIMO
0.30	39.53	-39.53
0.40	52.70	-52.70
0.50	65.88	-65.88
0.60	79.06	-79.06
0.70	92.23	-92.23
0.80	105.41	-105.41
0.90	118.59	-118.59
1.00	131.76	-131.76
1.10	131.76	-131.76
1.15	131.76	-131.76
1.25	131.76	-131.76
1.30	131.76	-131.76
1.50	131.76	-131.76
1.70	131.76	-131.76
1.75	131.76	-131.76
1.85	131.76	-131.76
1.90	131.76	-131.76
2.00	131.76	-131.76
2.10	118.59	-118.59
2.20	105.41	-105.41
2.30	92.23	-92.23
2.40	79.06	-79.06
2.50	65.88	-65.88
2.60	52.70	-52.70
2.70	39.53	-39.53

FASE TRANSITORIA

SECC.	MAXIMO	MINIMO
0.30	39.53	-39.53
0.40	52.70	-52.70
0.50	65.88	-65.88
0.60	79.06	-79.06
0.70	92.23	-92.23
0.80	105.41	-105.41
0.90	118.59	-118.59
1.00	131.76	-131.76
1.10	131.76	-131.76
1.15	131.76	-131.76
1.25	131.76	-131.76
1.30	131.76	-131.76
1.50	131.76	-131.76
1.70	131.76	-131.76
1.75	131.76	-131.76
1.85	131.76	-131.76
1.90	131.76	-131.76
2.00	131.76	-131.76
2.10	118.59	-118.59
2.20	105.41	-105.41
2.30	92.23	-92.23
2.40	79.06	-79.06
2.50	65.88	-65.88
2.60	52.70	-52.70
2.70	39.53	-39.53

ENVOLVENTE DE MOMENTOS
==========

SECC.	MAXIMO	MINIMO
0.30	436.64	-7.56
0.40	457.48	-81.71
0.50	410.98	-191.66
0.60	299.82	-337.43
0.70	127.30	-519.00
0.80	-102.68	-736.39
0.90	-381.26	-993.94
1.00	-617.39	-1305.29
1.10	-91.52	-592.10
1.15	150.87	-346.99
1.25	618.40	13.87
1.30	828.15	156.97
1.50	1165.03	400.66
1.70	828.15	156.97
1.75	618.40	13.87
1.85	150.87	-346.99
1.90	-91.52	-592.10
2.00	-617.39	-1305.29
2.10	-381.26	-993.94
2.20	-102.68	-736.39
2.30	127.30	-519.00
2.40	299.82	-337.43
2.50	410.98	-191.66
2.60	457.48	-81.71
2.70	436.64	-7.56

PASO SUPERIOR 708+100

CARACTERISTICAS DE LOS MATERIALES

Numero de grupos de tendones que se tesan sucesiv.	:	2
Modulo de elasticidad de la armadura activa	:	20000000.00 t/m2
Modulo de elasticidad instantanea del hormigon en el momento del tesado	:	3831305.00 t/m2
Modulo de deformacion longitudinal secante del hormigon a los 28 dias de edad	:	3800000.00 t/m2
Penetracion de cuñas	:	0.0040 m
Coeficiente de rozamiento en curva	:	0.210
Coeficiente de rozamiento parasito	:	0.0013
Valor final de la retraccion del hormigon a partir de la introduccion del pretensado	:	0.00033
Valor final del coeficiente de fluencia del hormigon	:	3.273
Valor final de la relajacion del acero	:	0.030
Tension de trabajo del acero de la armadura activa	:	142310.81 t/m2

PASO SUPERIOR 708+100

TRAZADO DEFINITIVO

Numero de trazado elegido	:	5
Numero de familias de cables	:	1
Fuerza de pretensado final	:	2694.00 tn
Fuerza de primer pretensado	:	1500.00 tn
Seccion total de armadura activa	:	0.01895 m2

PASO SUPERIOR 708+100

TRAZADO DE CABLES
****

DATOS DE PARTIDA
==========

Numero de grupos de tendones que se tesan sucesiv.	: 2
Modulo de elasticidad de la armadura activa	: 20000000.00 t/m2
Modulo de elasticidad instantanea del hormigon en el momento del tesado	: 3831305.00 t/m2
Modulo de deformacion longitudinal secante del hormigon a los 28 dias de edad	: 3800000.00 t/m2
Penetracion de cuñas	: 0.0040 m
Coeficiente de rozamiento en curva	: 0.210
Coeficiente de rozamiento parasito	: 0.0013
Valor final de la retraccion del hormigon a partir de la introduccion del pretensado	: 0.00033
Valor final del coeficiente de fluencia del hormigon	: 3.273
Valor final de la relajacion del acero	: 0.030
Fuerza de pretensado	: 2694.00 tn
Fuerza de primer pretensado	: 1500.00 tn
Seccion total de armadura activa	: 0.01895 m2
Tension de trabajo del acero de la armadura activa	: 142163.59 t/m2
Cuantia geometrica	: 18.14 Kg/m2 tablero

GEOMETRIA DEL TRAZADO
==========

V.I. y V.S. representan la distancia del centro de gravedad de la armadura activa a los extremos inferior y superior de la seccion, respect.

VANO	X/L	X	CANTO	V.I.	V.S.
1	0.00	0.000	1.200	0.647	0.553
1	0.05	0.675	1.200	0.623	0.577
1	0.10	1.350	1.200	0.604	0.596
1	0.15	2.025	1.200	0.589	0.611
1	0.20	2.700	1.200	0.579	0.621
1	0.25	3.375	1.200	0.572	0.628
1	0.30	4.050	1.200	0.570	0.630
1	0.35	4.725	1.200	0.573	0.627
1	0.40	5.400	1.200	0.581	0.619
1	0.45	6.075	1.200	0.596	0.604
1	0.50	6.750	1.200	0.616	0.584
1	0.55	7.425	1.200	0.641	0.559
1	0.60	8.100	1.200	0.673	0.527
1	0.65	8.775	1.200	0.710	0.490
1	0.70	9.450	1.200	0.753	0.447
1	0.75	10.125	1.200	0.801	0.399
1	0.80	10.800	1.200	0.856	0.344
1	0.85	11.475	1.200	0.916	0.284
1	0.90	12.150	1.200	0.981	0.219
1	0.95	12.825	1.200	1.033	0.167
1	1.00	13.500	1.200	1.050	0.150
2	0.00	0.000	1.200	1.050	0.150
2	0.05	1.250	1.200	1.007	0.193
2	0.10	2.500	1.200	0.878	0.322
2	0.15	3.750	1.200	0.717	0.483
2	0.20	5.000	1.200	0.577	0.623
2	0.25	6.250	1.200	0.459	0.741
2	0.30	7.500	1.200	0.362	0.838
2	0.35	8.750	1.200	0.287	0.913
2	0.40	10.000	1.200	0.233	0.967
2	0.45	11.250	1.200	0.201	0.999
2	0.50	12.500	1.200	0.190	1.010
2	0.55	13.750	1.200	0.201	0.999
2	0.60	15.000	1.200	0.233	0.967
2	0.65	16.250	1.200	0.287	0.913
2	0.70	17.500	1.200	0.362	0.838
2	0.75	18.750	1.200	0.459	0.741
2	0.80	20.000	1.200	0.577	0.623
2	0.85	21.250	1.200	0.717	0.483
2	0.90	22.500	1.200	0.878	0.322
2	0.95	23.750	1.200	1.007	0.193
2	1.00	25.000	1.200	1.050	0.150
3	0.00	0.000	1.200	1.050	0.150
3	0.05	0.675	1.200	1.033	0.167
3	0.10	1.350	1.200	0.981	0.219
3	0.15	2.025	1.200	0.916	0.284
3	0.20	2.700	1.200	0.856	0.344
3	0.25	3.375	1.200	0.801	0.399
3	0.30	4.050	1.200	0.753	0.447
3	0.35	4.725	1.200	0.710	0.490
3	0.40	5.400	1.200	0.673	0.527
3	0.45	6.075	1.200	0.641	0.559
3	0.50	6.750	1.200	0.616	0.584
3	0.55	7.425	1.200	0.596	0.604
3	0.60	8.100	1.200	0.581	0.619
3	0.65	8.775	1.200	0.573	0.627
3	0.70	9.450	1.200	0.570	0.630
3	0.75	10.125	1.200	0.572	0.628
3	0.80	10.800	1.200	0.579	0.621
3	0.85	11.475	1.200	0.589	0.611
3	0.90	12.150	1.200	0.604	0.596
3	0.95	12.825	1.200	0.623	0.577
3	1.00	13.500	1.200	0.647	0.553

VANO	LONGITUD DEL CABLE
1	13.517
2	25.077
3	13.517

Longitud total del cable : 52.112 m

PERDIDAS DE PRETENSADO
==========

Expresadas en % de la fuerza inicial de pretensado

ROZ : rozamiento
PCU : penetracion de cuñas
AEH : acortamiento elastico del hormigon
RET : retraccion
FLH : fluencia del hormigon
RAC : relajacion del acero
INS : instantaneas
DIF : diferidas
TOT : totales

SECC	ROZ	PCU	AEH	RET	FLH	RAC	INS	DIF	TOT
0.30	1.32	5.94	0.43	4.58	5.30	2.18	7.68	12.05	19.73
0.40	1.84	4.97	0.42	4.58	5.24	2.19	7.23	12.01	19.24
0.50	2.36	4.01	0.40	4.58	5.14	2.21	6.77	11.93	18.70
0.60	2.87	3.05	0.38	4.58	5.08	2.23	6.31	11.89	18.20
0.70	3.39	2.10	0.41	4.58	5.20	2.24	5.89	12.02	17.91
0.80	3.90	1.15	0.50	4.58	5.71	2.22	5.54	12.50	18.05
0.90	4.40	0.20	0.71	4.58	6.84	2.16	5.31	13.57	18.88
1.00	6.58	0.00	0.85	4.58	6.82	2.09	7.43	13.50	20.93
1.10	9.52	0.00	0.56	4.58	6.55	2.03	10.07	13.16	23.23
1.15	9.99	0.00	0.43	4.58	5.65	2.07	10.41	12.30	22.72
1.25	10.92	0.00	0.56	4.58	6.28	2.00	11.47	12.86	24.33
1.30	11.38	0.00	0.70	4.58	7.01	1.94	12.08	13.54	25.62
1.50	13.21	0.00	1.09	4.58	8.96	1.76	14.30	15.30	29.60
1.70	11.38	0.00	0.70	4.58	7.01	1.94	12.08	13.54	25.62
1.75	10.92	0.00	0.56	4.58	6.28	2.00	11.47	12.86	24.33
1.85	9.99	0.00	0.43	4.58	5.65	2.07	10.41	12.30	22.72
1.90	9.52	0.00	0.56	4.58	6.55	2.03	10.07	13.16	23.23
2.00	6.58	0.00	0.85	4.58	6.82	2.09	7.43	13.50	20.93
2.10	4.40	0.20	0.71	4.58	6.84	2.16	5.31	13.57	18.88
2.20	3.90	1.15	0.50	4.58	5.71	2.22	5.54	12.50	18.05
2.30	3.39	2.10	0.41	4.58	5.20	2.24	5.89	12.02	17.91
2.40	2.87	3.05	0.38	4.58	5.08	2.23	6.31	11.89	18.20
2.50	2.36	4.01	0.40	4.58	5.14	2.21	6.77	11.93	18.70
2.60	1.84	4.97	0.42	4.58	5.24	2.19	7.23	12.01	19.24
2.70	1.32	5.94	0.43	4.58	5.30	2.18	7.68	12.05	19.73

ESFUERZOS DE PRETENSADO
==========

SECC	PRIMER PRETENSADO AXIL	M isos	M hiper	PRETENSADO FINAL (INIC) AXIL	M isos	M hiper	PRETENSADO FINAL (FINAL) AXIL	M isos	M hiper
0.30	1473.44	-202.85	43.49	2487.17	-342.42	78.11	2162.48	-297.72	68.70
0.40	1465.83	-185.05	57.99	2499.31	-315.53	104.15	2175.65	-274.67	91.64
0.50	1458.41	-134.11	72.49	2511.72	-230.98	130.19	2190.26	-201.42	114.65
0.60	1450.92	-50.52	86.99	2523.93	-87.88	156.23	2203.61	-76.72	137.65
0.70	1442.96	65.20	101.48	2535.24	114.55	182.26	2211.42	99.92	160.36
0.80	1434.00	212.29	115.98	2544.66	376.71	208.30	2207.80	326.84	182.26
0.90	1423.34	389.65	130.48	2550.91	698.32	234.34	2185.24	598.22	202.53
1.00	1388.53	475.33	144.98	2493.81	853.69	260.38	2130.21	729.23	225.24
1.10	1348.89	205.90	144.98	2422.60	369.79	260.38	2068.14	315.68	226.12
1.15	1343.79	-11.57	144.98	2413.44	-20.78	260.38	2081.97	-17.92	228.34
1.25	1327.92	-354.04	144.98	2384.95	-635.85	260.38	2038.52	-543.49	226.89
1.30	1318.73	-479.17	144.98	2368.45	-860.60	260.38	2003.79	-728.09	225.13
1.50	1285.44	-688.17	144.98	2308.65	-1235.95	260.38	1896.49	-1015.30	220.54
1.70	1318.73	-479.17	144.98	2368.45	-860.60	260.38	2003.79	-728.09	225.13
1.75	1327.92	-354.04	144.98	2384.95	-635.85	260.38	2038.52	-543.49	226.89
1.85	1343.79	-11.57	144.98	2413.44	-20.78	260.38	2081.97	-17.92	228.34
1.90	1348.89	205.90	144.98	2422.60	369.79	260.38	2068.14	315.68	226.12
2.00	1388.53	475.33	144.98	2493.81	853.69	260.38	2130.21	729.23	225.24
2.10	1423.34	389.65	130.48	2550.91	698.32	234.34	2185.24	598.22	202.53
2.20	1434.00	212.29	115.98	2544.66	376.71	208.30	2207.80	326.84	182.26
2.30	1442.96	65.20	101.48	2535.24	114.55	182.26	2211.42	99.92	160.36
2.40	1450.92	-50.52	86.99	2523.93	-87.88	156.23	2203.61	-76.72	137.65
2.50	1458.41	-134.11	72.49	2511.72	-230.98	130.19	2190.26	-201.42	114.65
2.60	1465.83	-185.05	57.99	2499.31	-315.53	104.15	2175.65	-274.67	91.64
2.70	1473.44	-202.85	43.49	2487.17	-342.42	78.11	2162.48	-297.72	68.70

ALARGAMIENTO DE LOS CABLES
==========

PRIMER PRETENSADO.
Extremo izquierdo : 96 mm
Extremo derecho : 96 mm

HASTA EL PRETENSADO FINAL.
Extremo izquierdo : 76 mm
Extremo derecho : 76 mm

TENSIONES EN EL HORMIGON
==========

Unidades : tn/m2
Positivo : compresiones

F.S. : fibra superior
F.I. : fibra inferior

TENSIONES CON MOMENTO FLECTOR DADO POR PESO PROPIO ESTRICTO
CONSIDERANDO PERDIDAS INSTANTANEAS

SECC	MOM. EXT.	*PRIMER PRETENSADO* F.S.	F.I.	*PRETENSADO FINAL* F.S.	F.I.
0.30	151.85	240.46	252.42	340.76	519.72
	72.79	188.85	326.62	289.14	593.92
0.40	147.75	257.61	224.69	374.66	475.92
	42.34	188.78	323.62	305.83	574.85
0.50	116.28	278.55	191.57	428.39	403.73
	-15.48	192.52	315.23	342.36	527.39
0.60	57.46	302.95	153.47	502.45	302.23
	-100.66	199.71	301.86	399.21	450.63
0.70	-28.73	330.37	110.82	597.23	170.58
	-213.20	209.92	283.95	476.78	343.71
0.80	-142.27	360.24	64.24	712.83	8.24
	-353.09	222.59	262.10	575.18	206.09
0.90	-283.18	391.73	14.65	848.86	-184.76
	-520.35	236.88	237.24	694.01	37.83
1.00	-451.44	341.48	72.75	847.93	-206.60
	-714.97	169.42	320.07	675.87	40.72
1.10	-88.78	433.45	-1.22	824.83	-73.04
	-352.31	260.58	262.96	651.96	191.14
1.15	52.25	382.32	74.41	659.37	175.34
	-211.27	209.45	338.59	486.50	439.52
1.25	294.03	313.19	172.28	408.97	544.04
	30.50	140.33	436.46	236.10	808.22
1.30	394.77	295.41	194.96	324.42	665.16
	131.24	122.54	459.14	151.55	929.34
1.50	555.95	257.59	236.43	172.33	868.27
	292.42	84.72	500.62	-0.54	1132.45
1.70	394.77	295.41	194.96	324.42	665.16
	131.24	122.54	459.14	151.55	929.34
1.75	294.03	313.19	172.28	408.97	544.04
	30.50	140.33	436.46	236.10	808.22
1.85	52.25	382.32	74.41	659.37	175.34
	-211.27	209.45	338.59	486.50	439.52
1.90	-88.78	433.45	-1.22	824.83	-73.04
	-352.31	260.58	262.96	651.96	191.14
2.00	-451.44	341.48	72.75	847.93	-206.60
	-714.97	169.42	320.07	675.87	40.72
2.10	-283.18	391.73	14.65	848.86	-184.76
	-520.35	236.88	237.24	694.01	37.83
2.20	-142.27	360.24	64.24	712.83	8.24
	-353.09	222.59	262.10	575.18	206.09
2.30	-28.73	330.37	110.82	597.23	170.58
	-213.20	209.92	283.95	476.78	343.71
2.40	57.46	302.95	153.47	502.45	302.23
	-100.66	199.71	301.86	399.21	450.63
2.50	116.28	278.55	191.57	428.39	403.73
	-15.48	192.52	315.23	342.36	527.39
2.60	147.75	257.61	224.69	374.66	475.92
	42.34	188.78	323.62	305.83	574.85
2.70	151.85	240.46	252.42	340.76	519.72
	72.79	188.85	326.62	289.14	593.92

Resistencia caracteristica minima del hormigon de primer pretensado : 80.10 Kp/cm2

TENSIONES CON MOMENTO FLECTOR DADO POR LAS CARGAS PERMANENTES
CONSIDERANDO PERDIDAS INSTANTANEAS

SECC	MOM. EXT.	*PRIMER PRETENSADO* F.S.	F.I.	*PRETENSADO FINAL* F.S.	F.I.
0.30	179.00	258.19	226.94	358.48	494.25
	99.94	206.57	301.14	306.86	568.44
0.40	167.04	270.20	206.58	387.26	457.82
	61.63	201.38	305.51	318.43	556.75
0.50	119.27	280.50	188.77	430.34	400.92
	-12.49	194.47	312.43	344.31	524.59
0.60	35.69	288.74	173.89	488.24	322.66
	-122.42	185.50	322.29	385.00	471.05

0.70	-83.70	294.48	162.41	561.34	222.17
	-268.16	174.03	335.54	440.89	395.30
0.80	-238.90	297.16	154.92	649.74	98.92
	-449.72	159.51	352.78	512.09	296.78
0.90	-429.91	295.93	152.35	753.06	-47.05
	-667.08	141.08	374.95	598.20	175.54
1.00	-656.73	207.45	265.41	713.90	-13.94
	-920.25	35.39	512.74	541.84	233.39
1.10	-163.66	384.33	73.84	775.71	2.03
	-427.18	211.46	338.02	602.84	266.21
1.15	28.09	366.47	98.63	643.52	199.56
	-235.43	193.61	362.81	470.65	463.74
1.25	356.81	354.38	109.34	450.15	481.11
	93.28	181.51	373.52	277.28	745.29
1.30	493.77	360.35	95.71	389.36	565.91
	230.25	187.48	359.89	216.50	830.09
1.50	712.91	360.55	79.08	275.30	710.92
	449.39	187.68	343.26	102.43	975.10
1.70	493.77	360.35	95.71	389.36	565.91
	230.25	187.48	359.89	216.50	830.09
1.75	356.81	354.38	109.34	450.15	481.11
	93.28	181.51	373.52	277.28	745.29
1.85	28.09	366.47	98.63	643.52	199.56
	-235.43	193.61	362.81	470.65	463.74
1.90	-163.66	384.33	73.84	775.71	2.03
	-427.18	211.46	338.02	602.84	266.21
2.00	-656.73	207.45	265.41	713.90	-13.94
	-920.25	35.39	512.74	541.84	233.39
2.10	-429.91	295.93	152.36	753.06	-47.05
	-667.08	141.08	374.95	598.20	175.54
2.20	-238.90	297.16	154.92	649.74	98.92
	-449.72	159.51	352.78	512.09	296.78
2.30	-83.70	294.48	162.41	561.34	222.17
	-268.16	174.03	335.54	440.89	395.30
2.40	35.69	288.73	173.89	488.24	322.66
	-122.42	185.50	322.29	385.00	471.05
2.50	119.27	280.50	188.77	430.34	400.92
	-12.49	194.47	312.43	344.31	524.59
2.60	167.04	270.20	206.58	387.26	457.82
	61.63	201.38	305.51	318.43	556.75
2.70	179.00	258.19	226.94	358.48	494.25
	99.94	206.57	301.14	306.86	568.44

Resistencia caracteristica minima del hormigon de primer pretensado : 82.04 Kp/cm2

TENSIONES CON MOMENTOS FLECTORES MAXIMOS Y MINIMOS

		TENSIONES INICIALES (PERDIDAS INSTANT.)		*TENSIONES DIFERIDAS* (PERDIDAS TOTALES)	
SECC	MOM. EXT.	F.S.	F.I.	F.S.	F.I.
0.30	436.64	526.70	252.44	495.67	165.26
	-7.56	236.67	669.34	205.64	582.15
0.40	457.48	576.90	185.23	541.51	104.72
	-81.71	224.84	691.27	189.45	610.77
0.50	410.98	620.80	127.15	576.43	60.46
	-191.66	227.32	692.74	182.95	626.04
0.60	299.82	660.69	74.77	602.50	28.40
	-337.43	244.62	672.84	186.43	626.46
0.70	127.30	699.10	24.15	621.32	4.52
	-519.00	277.12	630.71	199.33	611.08
0.80	-102.68	738.68	-28.92	633.02	-13.77
	-736.39	324.92	565.82	219.26	580.97
0.90	-381.26	784.82	-92.70	637.80	-29.79
	-993.94	384.79	482.31	237.77	545.21
1.00	-617.39	739.59	-50.86	574.82	38.39
	1305.29	290.44	594.75	125.68	684.00
1.10	-91.52	823.03	-70.29	696.34	-50.43
	-592.10	494.66	431.53	367.97	451.39
1.15	150.87	724.06	76.47	640.65	41.46
	-346.99	397.47	575.58	314.06	540.57
1.25	618.40	621.75	218.86	593.21	92.67
	13.87	225.19	824.89	196.65	698.70
1.30	828.15	608.71	230.69	601.81	62.49
	156.97	168.43	903.54	161.53	735.34
1.50	1165.03	571.88	257.67	610.58	-3.50
	400.66	70.47	1023.94	109.17	762.77
1.70	828.15	608.71	230.69	601.81	62.49
	156.97	168.43	903.54	161.53	735.34
1.75	618.40	621.75	218.86	593.21	92.67
	13.87	225.19	824.89	196.65	698.70
1.85	150.87	724.06	76.47	640.65	41.46
	-346.99	397.47	575.58	314.06	540.57
1.90	-91.52	823.03	-70.29	696.34	-50.43
	-592.10	494.66	431.53	367.97	451.39
2.00	-617.39	739.59	-50.86	574.82	38.39
	-1305.29	290.44	594.75	125.68	684.00
2.10	-381.26	784.82	-92.70	637.80	-29.79
	-993.94	384.79	482.31	237.77	545.21
2.20	-102.68	738.68	-28.92	633.02	-13.77
	-736.39	324.92	565.82	219.26	580.98
2.30	127.30	699.10	24.15	621.32	4.52
	-519.00	277.12	630.72	199.33	611.08
2.40	299.82	660.69	74.77	602.50	28.40
	-337.43	244.62	672.84	186.43	626.46
2.50	410.98	620.80	127.15	576.43	60.46
	-191.66	227.32	692.74	182.95	626.04
2.60	457.48	576.90	185.23	541.51	104.72
	-81.71	224.84	691.27	189.45	610.77
2.70	436.64	526.70	252.44	495.67	165.26
	-7.56	236.67	669.34	205.64	582.15

Resistencia caracteristica minima del hormigon de pretensado final : 311.09 Kp/cm2

PASO SUPERIOR 708+100

ESFUERZOS CORTANTES ADICIONALES Y COEF. DE EXCENTRICIDAD DEL CARRO

SECCION	Q MAX	Q MIN	C. EXC
ESTRIBO 1	0.00	0.00	1.60
PILA 1 IZQ	0.00	0.00	1.60
PILA 1 DER	0.00	0.00	1.60
PILA 2 IZQ	0.00	0.00	1.60
PILA 2 DER	0.00	0.00	1.60
ESTRIBO 2	0.00	0.00	1.60

NUMERO DE APOYOS POR PILA

N = 1 : una placa
N = 2 : más de una placa

PILA	N
1	2
2	2

RIGIDEZ TORSIONAL

RT : rigidez torsional unitaria (m.t.)

VANO	BANDA	RT
1	1	1.77
2	1	1.77
2	2	1.00
2	3	1.77
3	1	1.77

POSICION TRANSVERSAL DE LAS CARGAS PERMANENTES Y EL TREN DE CARGAS

CARGAS PERMANENTES (EXCL. PESO PROPIO Y PAVIMENTO)
  Distancia al borde izquierdo del tablero : 1.10 m
  Distancia al borde derecho del tablero : 1.10 m
EJE DEL TREN DE CARGAS
  Distancia al borde izquierdo del tablero : 2.10 m
  Distancia al borde derecho del tablero : 2.10 m

PASO SUPERIOR 708+100

ESFUERZOS CORTANTES

Unidades : tn
Positivo : sobre una rebanada sentido de giro horario

TREN DE CARGAS

APOYO	C. EXCENTRICIDAD
ESTRIBO 1	1.60
PILA 1 IZQ	1.60
PILA 1 DER	1.60
PILA 2 IZQ	1.60
PILA 2 DER	1.60
ESTRIBO 2	1.60

SOBRECARGA

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	9.37	9.37	-4.37	-4.37	0.33	0.33
PILA 1 IZQ	-11.35	-11.35	-4.37	-4.37	0.33	0.33
PILA 1 DER	0.71	0.71	19.19	19.19	-0.71	-0.71
PILA 2 IZQ	0.71	0.71	-19.19	-19.19	-0.71	-0.71
PILA 2 DER	-0.33	-0.33	4.37	4.37	11.35	11.35
ESTRIBO 2	-0.33	-0.33	4.37	4.37	-9.37	-9.37

CARGA PERMANENTE, SOBRECARGA, TREN Y PRETENSADO

APOYO	C.P.	SC.UNIF.		TREN		PRET.	TOTALES	
ESTRIBO 1	74.23	19.40	-8.74	83.35	-17.80	19.29	196.27	66.97
PILA 1 IZQ	-191.04	0.65	-31.44	2.26	-88.38	19.29	-168.84	-291.58
PILA 1 DER	221.79	39.80	-1.42	92.28	-4.91	0.00	353.87	215.46
PILA 2 IZQ	-221.79	1.42	-39.80	4.91	-92.28	0.00	-215.46	-353.87
PILA 2 DER	191.04	31.44	-0.65	88.38	-2.26	-19.29	291.58	168.84
ESTRIBO 2	-74.23	8.74	-19.40	17.80	-83.35	-19.29	-66.97	-196.27

TEMPERATURAS

APOYO	MAXIMO	MINIMO
ESTRIBO 1	9.76	-9.76
PILA 1 IZQ	9.76	-9.76
PILA 1 DER	0.00	0.00
PILA 2 IZQ	0.00	0.00
PILA 2 DER	9.76	-9.76
ESTRIBO 2	9.76	-9.76

ESFUERZOS CORTANTES MAXIMOS
==========

APOYO	MAXIMO	MINIMO
ESTRIBO 1	206.03	57.21
PILA 1 IZQ	-159.08	-301.34
PILA 1 DER	353.87	215.46
PILA 2 IZQ	-215.46	-353.87
PILA 2 DER	301.34	159.08
ESTRIBO 2	-57.21	-206.03

PASO SUPERIOR 708+100

MOMENTOS TORSORES
****

Unidades : mtn
Positivo : giro devogiro en la cara frontal de una rebanada

CARGAS PERMANENTES (EXCL. PESO PROPIO Y PAVIMENTO)
  Distancia al borde izquierdo del tablero : 1.10 m
  Distancia al borde derecho del tablero : 1.10 m
EJE DEL TREN DE CARGAS
  Distancia al borde izquierdo del tablero : 2.10 m
  Distancia al borde derecho del tablero : 2.10 m

TREN EN CENTRO DE VANO
==========

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	-60.00	60.00	0.00	0.00	0.00	0.00
PILA 1 IZQ	60.00	-60.00	0.00	0.00	0.00	0.00
PILA 1 DER	0.00	0.00	-60.00	60.00	0.00	0.00
PILA 2 IZQ	0.00	0.00	60.00	-60.00	0.00	0.00
PILA 2 DER	0.00	0.00	0.00	0.00	-60.00	60.00
ESTRIBO 2	0.00	0.00	0.00	0.00	60.00	-60.00

SOBRECARGA
==========

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	-19.91	19.91	0.00	0.00	0.00	0.00
PILA 1 IZQ	19.91	-19.91	0.00	0.00	0.00	0.00
PILA 1 DER	0.00	0.00	-36.87	36.87	0.00	0.00
PILA 2 IZQ	0.00	0.00	36.87	-36.87	0.00	0.00
PILA 2 DER	0.00	0.00	0.00	0.00	-19.91	19.91
ESTRIBO 2	0.00	0.00	0.00	0.00	19.91	-19.91

CARGA PERMANENTE, SOBRECARGA Y TREN
==========

APOYO	C.PERM.	SC.UNIF.IZQ.	SC.UNIF.DER.	TREN IZQ.	TREN DER.
ESTRIBO 1	0.00	-19.91	19.91	-106.66	106.66
PILA 1 IZQ	0.00	19.91	-19.91	106.66	-106.66
PILA 1 DER	0.00	-36.87	36.87	-114.88	114.88
PILA 2 IZQ	0.00	36.87	-36.87	114.88	-114.88
PILA 2 DER	0.00	-19.91	19.91	-106.66	106.66
ESTRIBO 2	0.00	19.91	-19.91	106.66	-106.66

PASO SUPERIOR 708+100

ARMADURA PASIVA DEL TABLERO
****

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
Resistencia caracteristica : 400.00 Kp/cm2
Coeficiente de minoracion : 1.50
ACERO
Resistencia caracteristica : 5100.00 Kp/cm2
Coeficiente de minoracion : 1.15
Recubrimiento : 0.04 m
ACCIONES
Coeficiente de mayoracion : 1.60

ARMADURA A FLEXION POR FISURACION Y DESCOMPRESION
==========

AREA : area de la seccion (m2)
Amin : armadura minima por fisuracion (cm2)
Asup y Ainf : armadura por aparicion de fisuras de traccion en las caras superior e inferior (cm2)

VANO	BANDA	AREA	Amin	Asup	Ainf
1	0.00 - 13.50	6.005	90.08	0.00	23.02
2	0.00 - 2.00	6.005	90.08	0.00	16.48
2	2.00 - 23.00	5.158	77.37	0.00	17.11
2	23.00 - 25.00	6.005	90.08	0.00	16.48
3	0.00 - 13.50	6.005	90.08	0.00	23.02

ARMADURA A CORTANTE
==========

Bw : ancho eficaz (m)
Du : canto util (m)
Vu1 : esfuerzo cortante de agotamiento por compresion oblicua en el alma (tn)
Vd : esfuerzo cortante de calculo (tn)
Vcu : contribucion del hormigon a la resistencia a esfuerzo cortante (tn)
An : armadura necesaria (cm2/m)
Am : armadura minima (cm2/m)

VANO	BANDA	Bw	Du	Vu1	Vd	Vcu	An	Am
1	0.00 - 13.50	3.80	1.16	3526.40	-478.09	359.91	26.95	48.25
2	0.00 - 2.00	3.80	1.16	3526.40	566.19	359.91	47.04	48.25
2	2.00 - 23.00	3.80	1.16	3526.40	-493.31	359.91	30.42	48.25
2	23.00 - 25.00	3.80	1.16	3526.40	-566.19	359.91	47.04	48.25
3	0.00 - 13.50	3.80	1.16	3526.40	478.09	359.91	26.95	48.25

ARMADURA A TORSION
==========

B : ancho del alma (m)
H : canto del alma (m)
Td : momento torsor de calculo (m.t.)
Tu1 : momento torsor de agotamiento por compresion del hormigon (m.t.)
AT : armadura transversal (cm2/m)
AL : armadura longitudinal (cm2)
RT : rigidez torsional unitaria (m.t.)

VANO	BANDA	B	H	Td	Tu1	AT	AL	RT
1	0.00 - 13.50	3.80	1.20	-202.51	648.00	6.70	58.35	1.77
2	0.00 - 2.00	3.80	1.20	242.80	648.00	8.03	69.96	1.77
2	2.00 - 23.00	3.80	1.20	218.65	648.00	7.23	63.00	1.00
2	23.00 - 25.00	3.80	1.20	-242.80	648.00	8.03	69.96	1.77
3	0.00 - 13.50	3.80	1.20	-202.51	648.00	6.70	58.35	1.77

COMPROBACION DE CORTANTE Y TORSION
==========

VANO	BANDA	Vd/Vu1	Td/Tu1	SUMA
1	0.00 - 13.50	0.136	0.313	0.448
2	0.00 - 2.00	0.161	0.375	0.535
2	2.00 - 23.00	0.140	0.337	0.477
2	23.00 - 25.00	0.161	0.375	0.535
3	0.00 - 13.50	0.136	0.313	0.448

ARMADURA DEL VOLADIZO
==========

Longitud : 2.10 m
Canto mayor : 0.40 m
Canto menor : 0.25 m

CARGAS PERMANENTES .-

Voladizo : 1.706 t/m a 1.131 m del borde
Pavimento : 0.134 t/m a 1.750 m del borde
Resto c.p. : 1.800 t/m a 1.100 m del borde

SOBRECARGAS .-

Uniforme vertical : 0.700 t/m a 1.225 m del borde
0.035 t/m a 0.175 m del borde
Uniforme horizontal : 0.150 t/m a 1.000 m del pavimento
Concentrada : carro de 60.00 tn con la primera carga a 1.10 m del borde

ARMADURA LONGITUDINAL .-

Momento de calculo : 22.996 m.t.
Armadura necesaria : 15.04 cm2

ARMADURA TRANSVERSAL .-

Esfuerzo cortante de calculo : 23.001 t.
Contribucion del hormigon : 29.394 t.
No es necesaria armadura

ARMADURA LONGITUDINAL ELEGIDA .-

8 redondos de 16 mm
Comprobada la fisuracion para el tipo de ambiente 2

ARMADURA EN ANCLAJES ACTIVOS
==========

Coeficiente de seguridad del acero : 2.50

Numero de placas : 8
Dimension de la placa paralela al paramento inferior de la losa : 0.32 m
Dimension de la placa perpendicular al paramento inf de la losa : 0.32 m
Distancia paralela al paramento inferior entre ejes de cables : 0.32 m

Armadura total necesaria : 26.84 cm2
Las tracciones criticas se extienden de 0.19 a 1.11 m
a partir del paramento

Momento de inercia respecto al eje X1 : 1.47125 m4
Momento de inercia respecto al eje Y1 : 0.19909 m4

PASO SUPERIOR 708+100

DEFINICION DE LOS APOYOS
****

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
Resistencia caracteristica en estribos : 250.00 Kp/cm2
Resistencia caracteristica en pilas : 300.00 Kp/cm2
Coeficiente de minoracion : 1.50
ACERO
Resistencia caracteristica : 5100.00 Kp/cm2
Coeficiente de minoracion : 1.15
Recubrimiento : 0.04 m
ACCIONES
Coeficiente de mayoracion : 1.60

SISTEMAS DE EJES
==========

Las ordenadas son ortogonales a las abscisas
en el sentido contrario a las agujas del reloj

Ejes generales del puente.
X : estribo 1 - estribo 2
Y
Ejes locales de los apoyos.
X1
Y1 : eje de apoyos (lado mayor del apoyo)

GEOMETRIA DE LOS APOYOS
==========

ESTRIBO NUMERO 1

Altura : 3.00 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 190.22900 m4
Momento de inercia respecto al eje Y1 : 5.56570 m4

ESTRIBO NUMERO 2

Altura : 3.00 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 190.22900 m4
Momento de inercia respecto al eje Y1 : 5.56570 m4

PILA NUMERO 1

SECCION OVOIDAL

Lado mayor del rectangulo en la base inferior : 1.80 m
Lado mayor del rectangulo en la base superior : 1.80 m
Radio del semicirculo : 0.50 m

Altura : 11.50 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 1.47125 m4
Momento de inercia respecto al eje Y1 : 0.19909 m4

PILA NUMERO 2

SECCION OVOIDAL

Lado mayor del rectangulo en la base inferior : 1.80 m
Lado mayor del rectangulo en la base superior : 1.80 m
Radio del semicirculo : 0.50 m

Altura : 11.50 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.

PASO SUPERIOR 708+100

FUERZAS HORIZONTALES

CONTRACCION

Coeficiente de contraccion : 0.00000

VIENTO

SI se considera el efecto del viento
Altura de las aceras : 0.20 m
SI existen barandillas

SISMO

Coeficiente sismico vertical : 0.00
Coeficiente sismico horizontal : 0.00

Sobrecarga de uso : 0.00 %
Viento : 0.00 %

Combinaciones de las componentes sismicas

No existen hipotesis

F.CENTRIFUGA

Velocidad especifica : 100.00 Km/h

CARACTERISTICAS DE LOS ELASTOMEROS

Modulo de elasticidad instantaneo : 200.00 t/m2
Modulo de elasticidad diferido : 100.00 t/m2
Compresion media minima : 30.00 Kp/cm2

DEFINICION DE LAS PLACAS

APOYO	TIPO DE PLACA	NUMERO PLACAS	COMPRESION ADMISIBLE	SEPARACION
ESTRIBO 1	CIRCULAR	2	150.00	2.60
PILA 1	CIRCULAR	2	150.00	1.80
PILA 2	CIRCULAR	2	150.00	1.80
ESTRIBO 2	CIRCULAR	2	150.00	2.60

Unidades : compresion admisible, Kp/cm2
separacion, metros

PASO SUPERIOR 708+100

FUERZAS EN CABEZA DE ELEMENTOS

CARACTERISTICAS DE LOS APOYOS

X,Y : Coordenadas de las placas de apoyo en los ejes generales del puente (m)
B : Angulo que forma el eje Y1 con el eje X (grados cent.)
Ix1,Iy1 : Momentos de inercia de los apoyos respecto de los ejes locales (m4)
H : Altura del apoyo (m)
Sn : Area del neopreno (m2)
Hn : Altura neta del neopreno (m)

APOYO	X	Y	B	Ix1	Iy1	H	Sn	Hn
1	0.000	1.300	100.0000	190.2290	5.5657	3.00	0.0962	0.055
2	0.000	-1.300	100.0000	190.2290	5.5657	3.00	0.0962	0.055
3	13.500	0.900	100.0000	1.4713	0.1991	11.50	0.2376	0.016
4	13.500	-0.900	100.0000	1.4713	0.1991	11.50	0.2376	0.016
5	38.500	0.900	100.0000	1.4713	0.1991	11.50	0.2376	0.016
6	38.500	-0.900	100.0000	1.4713	0.1991	11.50	0.2376	0.016
7	52.000	1.300	100.0000	190.2290	5.5657	3.00	0.0962	0.055
8	52.000	-1.300	100.0000	190.2290	5.5657	3.00	0.0962	0.055

CONTRACCION

Coeficiente de contraccion : 0.00100

APOYO	FX	FY	FX1	FY1
1	4.567	-0.228	4.567	-0.228
2	4.567	0.228	4.567	0.228
3	7.284	-1.108	7.284	-1.108
4	7.284	1.108	7.284	1.108
5	-7.284	-1.108	-7.284	-1.108
6	-7.284	1.108	-7.284	1.108
7	-4.567	-0.228	-4.567	-0.228
8	-4.567	0.228	-4.567	0.228

VIENTO

Fuerza : 29.18 tn

APOYO	FX	FY	FX1	FY1
1	0.000	0.957	0.000	0.957
2	0.000	0.957	0.000	0.957
3	0.000	6.338	0.000	6.338
4	0.000	6.338	0.000	6.338
5	0.000	6.338	0.000	6.338
6	0.000	6.338	0.000	6.338
7	0.000	0.957	0.000	0.957
8	0.000	0.957	0.000	0.957

FRENADO

Fuerza : 10.98 tn

APOYO	FX	FY	FX1	FY1
1	0.731	0.000	0.731	0.000
2	0.731	0.000	0.731	0.000
3	2.015	0.000	2.015	0.000
4	2.015	0.000	2.015	0.000
5	2.015	0.000	2.015	0.000
6	2.015	0.000	2.015	0.000

7	0.731	0.000	0.731	0.000
8	0.731	0.000	0.731	0.000

PASO SUPERIOR 708+100

FUERZAS ACTUANTES SOBRE LOS APOYOS
****

Hipotesis de reaccion minima.
1.- Carga vertical minima y momento torsor asociado
2.- Momento torsor maximo y carga vertical minima asociada si es mas desfavorable
Hipotesis de reaccion maxima.
3.- Carga vertical maxima y momento torsor asociado
4.- Momento torsor maximo y carga vertical maxima asociada si es mas desfavorable

Las placas se numeran de izquierda a derecha
Unidades : tn

ESTRIBO NUMERO 1°
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	31.94	31.94	116.92	19.56	128.41	46.36	131.38	34.02
2	31.94	31.94	19.56	116.92	46.36	128.41	34.02	131.38

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	4.567	3.000	0.000
	FY1	-0.228	0.000	0.957
2	FX1	4.567	3.000	0.000
	FY1	0.228	0.000	0.957

PILA NUMERO 1
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	189.32	189.32	332.87	142.13	329.93	202.29	343.67	152.93
2	189.32	189.32	142.13	332.87	202.29	329.93	152.93	343.67

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	7.284	3.000	0.000
	FY1	-1.108	0.000	6.338
2	FX1	7.284	3.000	0.000
	FY1	1.108	0.000	6.338

PILA NUMERO 2
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	189.32	189.32	332.87	142.13	329.93	202.29	343.67	152.93
2	189.32	189.32	142.13	332.87	202.29	329.93	152.93	343.67

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	-7.284	3.000	0.000
	FY1	-1.108	0.000	6.338
2	FX1	-7.284	3.000	0.000
	FY1	1.108	0.000	6.338

ESTRIBO NUMERO 2

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	31.94	31.94	116.92	19.56	128.41	46.36	131.38	34.02
2	31.94	31.94	19.56	116.92	46.36	128.41	34.02	131.38

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	-4.567	3.000	0.000
	FY1	-0.228	0.000	0.957
2	FX1	-4.567	3.000	0.000
	FY1	0.228	0.000	0.957

PASO SUPERIOR 708+100

DIMENSIONAMIENTO DE LAS PLACAS DE APOYO

MODULOS DE ELASTICIDAD

ELASTOMEROS

Instantaneo : 200.00 t/m2
Diferido : 100.00 t/m2

HORMIGON EN ESTRIBOS

Instantaneo : 3320391.54 t/m2
Diferido : 2213594.36 t/m2

HORMIGON EN PILAS

Instantaneo : 3637306.70 t/m2
Diferido : 2424871.13 t/m2

ESTRIBO NUMERO 1

PLACA CIRCULAR : 350 x 101 (55 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 131.38 tn
Carga vertical minima : 19.56 tn
Fuerza horizontal maxima : 3.15 tn
Corrimientos impuestos : 2.61 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 136.55 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 20.33 Kp/cm2
Compresion media minima : 30.00 Kp/cm2
Coeficiente de rozamiento elastomero-hormigon : 0.40
Apoyo ANCLADO

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.48 < 0.50 (valido)
Acciones totales
Distorsion : 0.64 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 6.36

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 2.50 mm
Espesor considerado : 4.83 mm

6. Verificacion final

Distorsion : 3.53 < 5.00 (valido)

PILA NUMERO 1

PLACA CIRCULAR : 550 x 24 (16 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 343.67 tn
Carga vertical minima : 142.13 tn
Fuerza horizontal maxima : 7.01 tn
Corrimientos impuestos : 0.50 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 144.65 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 59.83 Kp/cm2
Compresion media minima : 30.00 Kp/cm2

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.31 < 0.50 (valido)
Acciones totales
Distorsion : 0.46 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 34.38

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 3.86 mm
Espesor considerado : 4.00 mm

6. Verificacion final

Distorsion : 3.50 < 5.00 (valido)

PILA NUMERO 2
==========

PLACA CIRCULAR : 550 x 24 (16 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 343.67 tn
Carga vertical minima : 142.13 tn
Fuerza horizontal maxima : 7.01 tn
Corrimientos impuestos : 0.50 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 144.65 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 59.83 Kp/cm2
Compresion media minima : 30.00 Kp/cm2

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.31 < 0.50 (valido)
Acciones totales
Distorsion : 0.46 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 34.38

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 3.86 mm
Espesor considerado : 4.00 mm

6. Verificacion final

Distorsion : 3.50 < 5.00 (valido)

ESTRIBO NUMERO 2
==========

PLACA CIRCULAR : 350 x 101 (55 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 131.38 tn
Carga vertical minima : 19.56 tn
Fuerza horizontal maxima : 3.15 tn
Corrimientos impuestos : 2.61 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 136.55 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 20.33 Kp/cm2
Compresion media minima : 30.00 Kp/cm2
Coeficiente de rozamiento elastomero-hormigon : 0.40
Apoyo ANCLADO

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.48 < 0.50 (valido)
Acciones totales
Distorsion : 0.64 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 6.36

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 2.50 mm
Espesor considerado : 4.83 mm

6. Verificacion final

Distorsion : 3.53 < 5.00 (valido)

PASO SUPERIOR 708+100

APOYO	ANCHO TRAVIESA	ANCHO ALMA
ESTRIBO 1	1.00	7.60
PILA 1	1.00	3.80
PILA 2	1.00	3.80
ESTRIBO 2	1.00	7.60

PASO SUPERIOR 708+100

ARMADURA DE LAS TRAVIESAS
****

ESTRIBO 1
=========

Placas de apoyo : 2 a 2.60 m

Ancho del alma : 7.60 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 230.05 mtn
Armadura necesaria : 46.60 cm2

Armadura longitudinal inferior.
Momento de calculo : 0.00 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura transversal.
Cortante de calculo : 183.97 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 20.36 cm2/m

PILA 1
=======

Placas de apoyo : 2 a 1.80 m

Ancho del alma : 3.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 229.77 mtn
Armadura necesaria : 46.54 cm2

Armadura longitudinal inferior.
Momento de calculo : 0.00 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura transversal.
Cortante de calculo : 450.14 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 81.06 cm2/m

PILA 2
=======

Placas de apoyo : 2 a 1.80 m

Ancho del alma : 3.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 229.77 mtn
Armadura necesaria : 46.54 cm2

Armadura longitudinal inferior.
Momento de calculo : 0.00 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura transversal.
Cortante de calculo : 450.14 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 81.06 cm2/m

ESTRIBO 2

==========

Placas de apoyo : 2 a 2.60 m

Ancho del alma : 7.60 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 230.05 mtn
Armadura necesaria : 46.60 cm2

Armadura longitudinal inferior.
Momento de calculo : 0.00 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura transversal.
Cortante de calculo : 183.97 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 20.36 cm2/m

PASO SUPERIOR 708+100

DATOS DEL ARMADO DE FUSTES

Cuantia geometrica minima de armadura pasiva : 0.40 %

ALFA : Coeficiente de pandeo
NS : numero de secciones
R : relacion entre las areas de acero siguientes :
Tipo R.- lados mayor y menor de la base
Tipo O.- lado mayor y semicirculo de la base
Tipo C.- no existe relacion

PILA	ALFA	NS	R
1	1.20	3	1.15
2	1.20	3	1.15

No existen secciones adicionales

PASO SUPERIOR 708+100

ARMADURA DE LOS FUSTES
****

En la hipotesis de carga minima, las cargas permanentes estan afectadas
por el coeficiente de carga favorable, y en la hipotesis de carga maxima,
las cargas permanentes estan afectadas por el coeficiente de carga desfavorable

En las excentricidades esta incluido el pandeo y las excentricidades
minima y accidental

Unidades. Axil : tn
Excentricidades : m

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
Resistencia caracteristica : 300.00 Kp/cm2
Coeficiente de minoracion : 1.50
Coef. hormigonado vertical : 0.90
ACERO
Resistencia caracteristica : 5100.00 Kp/cm2
Coeficiente de minoracion : 1.15
Recubrimiento : 4.00 cm
ACCIONES
Coeficiente de mayoracion : 1.60

PILA NUMERO 1
==========

FUSTE RECTANGULAR REMATADO CON SEMICIRCULOS
Lado mayor de la base : 1.80 m
Lado menor de la base : 1.00 m
Altura del fuste : 11.50 m
Coeficiente de pandeo : 1.20

SECCION A 3.83 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	350.71	0.510	0.140
2	DER	MINIMA	VIENTO	313.71	0.513	0.224
3	DER	MINIMA	CP + SC	504.89	0.394	0.544
4	DER	MINIMA	VIENTO	452.48	0.396	0.702
5	DER	MAXIMA	CP + SC	902.76	0.273	0.204
6	DER	MAXIMA	VIENTO	810.56	0.273	0.291
7	DER	MAXIMA	CP + SC	845.77	0.284	0.325
8	DER	MAXIMA	VIENTO	759.27	0.284	0.418

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 103.42 cm2
Cuantia geometrica : 0.40 %

Armadura en el lado mayor : 27.66 cm2
Armadura en el lado menor : 24.05 cm2

SECCION A 7.67 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	373.01	0.834	0.140
2	DER	MINIMA	VIENTO	333.78	0.838	0.420
3	DER	MINIMA	CP + SC	527.19	0.633	0.521
4	DER	MINIMA	VIENTO	472.55	0.635	0.820
5	DER	MAXIMA	CP + SC	942.41	0.413	0.195
6	DER	MAXIMA	VIENTO	846.24	0.414	0.361
7	DER	MAXIMA	CP + SC	885.41	0.431	0.310
8	DER	MAXIMA	VIENTO	794.94	0.432	0.487

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 103.42 cm2
Cuantia geometrica : 0.40 %

Armadura en el lado mayor : 27.66 cm2
Armadura en el lado menor : 24.05 cm2

SECCION A 11.50 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	395.31	1.118	0.140
2	DER	MINIMA	VIENTO	353.85	1.123	0.594
3	DER	MINIMA	CP + SC	549.49	0.846	0.500
4	DER	MINIMA	VIENTO	492.61	0.849	0.928
5	DER	MAXIMA	CP + SC	982.05	0.536	0.187
6	DER	MAXIMA	VIENTO	881.92	0.537	0.426
7	DER	MAXIMA	CP + SC	925.06	0.561	0.297
8	DER	MAXIMA	VIENTO	830.62	0.562	0.551

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 161.56 cm2
Cuantia geometrica : 0.62 %

Armadura en el lado mayor : 43.21 cm2
Armadura en el lado menor : 37.57 cm2

PILA NUMERO 2
==========

FUSTE RECTANGULAR REMATADO CON SEMICIRCULOS
Lado mayor de la base : 1.80 m
Lado menor de la base : 1.00 m
Altura del fuste : 11.50 m
Coeficiente de pandeo : 1.20

SECCION A 3.83 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	350.71	0.510	0.140
2	DER	MINIMA	VIENTO	313.71	0.513	0.224
3	DER	MINIMA	CP + SC	504.89	0.394	0.544
4	DER	MINIMA	VIENTO	452.48	0.396	0.702
5	DER	MAXIMA	CP + SC	902.76	0.273	0.204
6	DER	MAXIMA	VIENTO	810.56	0.273	0.291
7	DER	MAXIMA	CP + SC	845.77	0.284	0.325
8	DER	MAXIMA	VIENTO	759.27	0.284	0.418

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 103.42 cm2
Cuantia geometrica : 0.40 %

Armadura en el lado mayor : 27.66 cm2
Armadura en el lado menor : 24.05 cm2

SECCION A 7.67 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	373.01	0.834	0.140
2	DER	MINIMA	VIENTO	333.78	0.838	0.420
3	DER	MINIMA	CP + SC	527.19	0.633	0.521
4	DER	MINIMA	VIENTO	472.55	0.635	0.820

5	DER	MAXIMA	CP + SC	942.41	0.413	0.195
6	DER	MAXIMA	VIENTO	846.24	0.414	0.361
7	DER	MAXIMA	CP + SC	885.41	0.431	0.310
8	DER	MAXIMA	VIENTO	794.94	0.432	0.487

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 103.42 cm2
Cuantia geometrica : 0.40 %

Armadura en el lado mayor : 27.66 cm2
Armadura en el lado menor : 24.05 cm2

SECCION A 11.50 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	395.31	1.118	0.140
2	DER	MINIMA	VIENTO	353.85	1.123	0.594
3	DER	MINIMA	CP + SC	549.49	0.846	0.500
4	DER	MINIMA	VIENTO	492.61	0.849	0.928
5	DER	MAXIMA	CP + SC	982.05	0.536	0.187
6	DER	MAXIMA	VIENTO	881.92	0.537	0.426
7	DER	MAXIMA	CP + SC	925.06	0.561	0.297
8	DER	MAXIMA	VIENTO	830.62	0.562	0.551

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 161.56 cm2
Cuantia geometrica : 0.62 %

Armadura en el lado mayor : 43.21 cm2
Armadura en el lado menor : 37.57 cm2

PASO SUPERIOR 708+100

DATOS DE LAS ZAPATAS

HORMIGON
Resistencia característica : 250.00 Kp/cm2
Coeficiente de minoración : 1.50
ACERO
Resistencia característica : 5100.00 Kp/cm2
Coeficiente de minoración : 1.15
Recubrimiento inferior : 0.05 m
Recubrimiento superior : 0.05 m
TERRENO
Tensión (coef. de punta) : 1.25
Tensión (coef. de sismo) : 0.00
Peso específico : 2.20 tn/m3
ACCIONES
Coeficiente de mayoración : 1.60
HIPOTESIS DE CARGA PARA TENSIONES
Se consideran los coeficientes de simultaneidad de acciones
FISURACION
Caso numero 3

ZAPATA	TENSION ADMISIBLE (Kp/cm2)	ALTURA TIERRAS (m)	VUELO MINIMO (m)	CANTO MINIMO (m)
1	4.00	1.00	0.50	1.30
2	4.00	1.00	0.50	1.30

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
Resistencia característica : 250.00 Kp/cm2
Coeficiente de minoración : 1.50

ACERO
Resistencia característica : 5100.00 Kp/cm2
Coeficiente de minoración : 1.15
Recubrimiento : 0.05 m

TERRENO
Tensión (coef. de punta) : 1.25
Peso específico : 2.20 tn/m3

ACCIONES
Coeficiente de mayoración : 1.60

HIPOTESIS DE CARGA PARA TENSIONES
Se consideran los coeficientes de simultaneidad de acciones

FISURACION
Caso numero 3

ZAPATA NUMERO 1
==========

Altura de tierras sobre cara superior de zapata : 1.00 m
Tensión admisible del terreno : 4.00 Kp/cm2

Canto : 1.30 m
Longitud : 5.99 m
Anchura : 4.40 m

DIMENSIONAMIENTO

Tensión media

Hipótesis de cálculo más desfavorable : cargas permanentes y sobrecargas

Fuerza vertical : 744.39 tn
Excentricidad según el eje paralelo al lado menor : 35.41 cm
Excentricidad según el eje paralelo al lado mayor : 15.43 cm

Base comprimida : 100.00 %
Tensión media : 2.83 Kp/cm2

Tensión máxima

Hipótesis de cálculo más desfavorable : viento

Fuerza vertical : 635.96 tn
Excentricidad según el eje paralelo al lado menor : 37.30 cm
Excentricidad según el eje paralelo al lado mayor : 47.28 cm

Tensión máxima : 4.79 Kp/cm2

ARMADURA

Hipótesis de cálculo más desfavorable : viento

Fuerza vertical de cálculo : 1029.12 tn
Excentricidad según el eje paralelo al lado menor : 36.88 cm
Excentricidad según el eje paralelo al lado mayor : 46.75 cm

Tensión máxima : 7.70 Kp/cm2

Armadura longitudinal y transversal.

2	20.00	1.485
2	23.00	5.325
2	23.00	6.685

ESFUERZOS EN LOS APOYOS

Canto : 1.30 m
Longitud : 5.99 m
Anchura : 4.40 m

DIMENSIONAMIENTO

Tensión media

Hipótesis de cálculo más desfavorable : cargas permanentes y sobrecargas

Fuerza vertical : 744.39 tn
Excentricidad según el eje paralelo al lado menor : 14.75 cm
Excentricidad según el eje paralelo al lado mayor : 15.43 cm

Base comprimida : 100.00 %
Tensión media : 2.83 Kp/cm2

Tensión máxima

Hipótesis de cálculo más desfavorable : viento

Fuerza vertical : 635.96 tn
Excentricidad según el eje paralelo al lado menor : 37.30 cm
Excentricidad según el eje paralelo al lado mayor : 47.28 cm

Tensión máxima : 4.79 Kp/cm2

ARMADURA

Hipótesis de cálculo más desfavorable : viento

Fuerza vertical de cálculo : 1029.12 tn
Excentricidad según el eje paralelo al lado menor : 36.88 cm
Excentricidad según el eje paralelo al lado mayor : 46.75 cm

Tensión máxima : 7.70 Kp/cm2

Armadura longitudinal y transversal.
Momento de cálculo : 118.94 mtn/m
Armadura necesaria : 22.08 cm2/m
Armadura elegida : 8 barras de 25 mm

3	20.00	1.485
3	23.00	5.325
3	23.00	6.685

ESFUERZOS EN LOS APOYOS

APOYO	MOMENTO	CORTANTE EXT. IZQ.	CORTANTE EXT. DER.
ESTRIBO 1	0.00	0.00	-2.78
PILA 1	-37.52	-2.78	6.70
PILA 2	-176.02	-59.30	56.38
ESTRIBO 2	0.00	-9.62	0.00

DEFORMADAS EN CENTRO DE VANOS

VANO	FLECHA	GIRO EXT. IZQ.	GIRO EXT. DER.
1	-0.15	-0.00003	0.00006
2	1.00	0.00006	-0.00005
3	0.21	-0.00005	-0.00006

CENTRO DE VANO 3

CARGAS EN LOS VANOS

VANO	CARGA	DIST. ORIGEN VANO
3	23.00	0.065
3	23.00	1.425
3	20.00	5.265
3	20.00	8.235
3	23.00	12.075
3	23.00	13.435

ESFUERZOS EN LOS APOYOS

APOYO	MOMENTO	CORTANTE EXT. IZQ.	CORTANTE EXT. DER.
ESTRIBO 1	0.00	0.00	1.35
PILA 1	18.18	1.35	-2.93
PILA 2	-54.96	-2.93	70.07
ESTRIBO 2	0.00	-61.93	0.00

MOMENTOS FLECTORES Y DEFORMADAS EN CENTRO DE VANOS

VANO	MOMENTO	FLECHA	GIRO EXT. IZQ.	GIRO EXT. DER.
1	9.09	0.07	0.00001	-0.00003
2	-18.39	-0.52	-0.00003	0.00014
3	112.09	0.72	0.00014	-0.00018

RESUMEN DE RESULTADOS

PRUEBA	MOMENTOS C.FIJA	MOMENTOS TREN INST	MOMENTOS TREN PRUEBA	% MOMENTO PRUEBA SOBRE M.TREN INST	% MOMENTO PRUEBA SOBRE M.CALCULO	FLECHA
C.V. 1	53.39	205.19	112.09	54.63	63.99	0.72
PILA 1	-788.49	-294.93	-176.02	59.68	89.02	0.21 1.00
C.V. 2	581.15	328.25	262.83	80.07	92.81	5.06
PILA 2	-788.49	-294.93	-176.02	59.68	89.02	1.00 0.21
C.V. 3	53.39	205.19	112.09	54.63	63.99	0.72

Los esfuerzos estan expresados en tn. y mtn., las flechas en mm.
y los giros en radianes

Modulo de elasticidad del hormigon : 3800000.00 t/m2

PRUEBA DE CARGA PASO SUPERIOR 708+100

PASO SUPERIOR 708+100

PRUEBA DE CARGA
****

CARACTERISTICAS DEL CAMION
==========

Carga en el eje delantero : 10.00 tn
Carga en el eje medio : 11.50 tn
Carga en el eje trasero : 11.50 tn

Distancia del eje delantero al borde anterior : 1.325 m
Distancia del eje delantero al eje medio : 3.840 m
Distancia del eje medio al eje trasero : 1.360 m
Distancia del eje trasero al borde posterior : 2.040 m

CENTRO DE VANO 1
==========

CARGAS EN LOS VANOS

VANO	CARGA	DIST. ORIGEN VANO
1	23.00	1.075
1	23.00	2.435
1	23.00	7.015
1	23.00	8.375
1	20.00	12.215

ESFUERZOS EN LOS APOYOS

APOYO	MOMENTO	CORTANTE EXT. IZQ.	CORTANTE EXT. DER.
ESTRIBO 1	0.00	0.00	56.57
PILA 1	-69.26	-55.43	3.69
PILA 2	22.91	3.69	-1.70
ESTRIBO 2	0.00	-1.70	0.00

MOMENTOS FLECTORES Y DEFORMADAS EN CENTRO DE VANOS

VANO	MOMENTO	FLECHA	GIRO EXT. IZQ.	GIRO EXT. DER.
1	152.10	0.93	0.00023	-0.00017
2	-23.18	-0.66	-0.00017	0.00004
3	11.46	0.09	0.00004	-0.00002

PILA NUMERO 1
==========

CARGAS EN LOS VANOS

VANO	CARGA	DIST. ORIGEN VANO
1	20.00	10.260
2	23.00	0.600
2	23.00	1.960
2	23.00	8.040
2	23.00	9.400
2	20.00	13.240

ESFUERZOS EN LOS APOYOS

APOYO	MOMENTO	CORTANTE EXT. IZQ.	CORTANTE EXT. DER.
ESTRIBO 1	0.00	0.00	-10.75
PILA 1	-209.94	-30.75	86.23
PILA 2	-129.31	-25.77	9.58
ESTRIBO 2	0.00	9.58	0.00

DEFORMADAS EN CENTRO DE VANOS

VANO	FLECHA	GIRO EXT. IZQ.	GIRO EXT. DER.
1	-0.60	-0.00012	0.00026
2	3.13	0.00026	-0.00020
3	-0.51	-0.00020	0.00010

CENTRO DE VANO 2
==========

CARGAS EN LOS VANOS

VANO	CARGA	DIST. ORIGEN VANO
2	20.00	4.260
2	23.00	8.100
2	23.00	9.460
2	23.00	15.540
2	23.00	16.900
2	20.00	20.740

ESFUERZOS EN LOS APOYOS

APOYO	MOMENTO	CORTANTE EXT. IZQ.	CORTANTE EXT. DER.
ESTRIBO 1	0.00	0.00	-18.34
PILA 1	-247.53	-18.34	66.00
PILA 2	-247.53	-66.00	18.34
ESTRIBO 2	0.00	18.34	0.00

MOMENTOS FLECTORES Y DEFORMADAS EN CENTRO DE VANOS

VANO	MOMENTO	FLECHA	GIRO EXT. IZQ.	GIRO EXT. DER.
1	-123.77	-0.98	-0.00019	0.00039
2	241.55	4.85	0.00039	-0.00039
3	-123.77	-0.98	-0.00039	0:00019

PILA NUMERO 2
==========

CARGAS EN LOS VANOS

VANO	CARGA	DIST. ORIGEN VANO
2	20.00	11.760
2	23.00	15.600
2	23.00	16.960
2	23.00	23.040
2	23.00	24.400
3	20.00	3.240

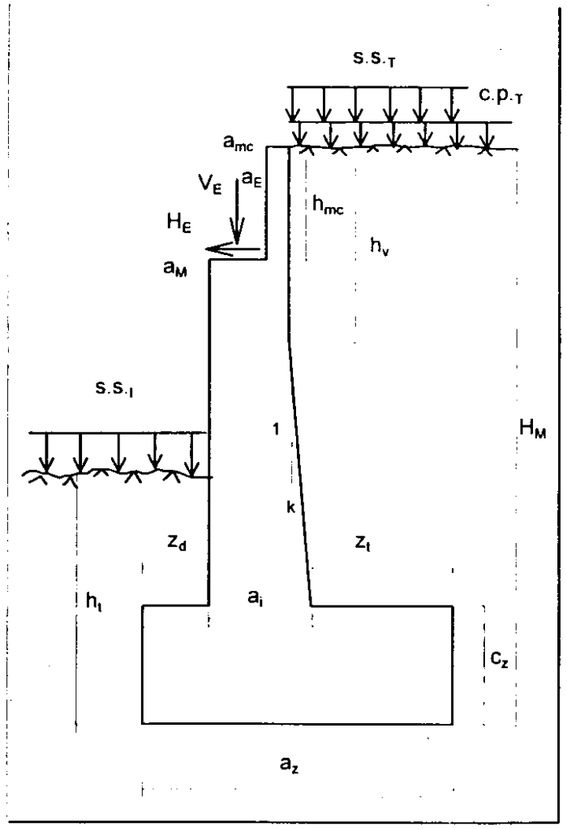
ESFUERZOS EN LOS APOYOS

PASO SUPERIOR 708+100
ESTRIBOS

CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	5.10 m
h_t=	1.50 m
h_v=	4.40 m
h_{mc}=	1.30 m
a_{mc}=	0.30 m
a_M=	1.30 m
a_Z=	3.30 m
c_Z=	0.70 m
k=	0.00
a_i=	1.30 m
z_d=	0.70 m
z_t=	1.30 m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10 t/m³
angulo de rozamiento del relleno ϕ =	40 °
angulo de rozamiento contacto relleno-muro δ_M =	0.0 °
angulo de rozamiento contacto terreno-muro δ_T =	40 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1.25

CARGAS

$c.p._T$ =	0.00 t/m²
$s.s._T$ =	1.00 t/m²
$s.s._I$ =	0.00 t/m²
$(V_E)_{cp}$=	22.70 t/m.a.
$(H_E)_{contracción}$=	1.19 t/m.a.
$(V_E)_{sc}$=	0.00 t/m.a.
$(H_E)_{frenado}$=	0.78 t/m.a.
$(H_E)_{sismo}$=	0.00 t/m.a.
a_E =	0.50 m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 13/9

TENSIONES EN EL TERRENO

σ_{med} =	16.4 t/m²	$(\sigma_{med})_{adm}$ =	35.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	39.3 t/m²	$(\sigma_{máx})_{adm}$ =	43.8 t/m²	l_c= 2.75 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.41	$(\gamma_d)_{adm}$=	1.50
γ_v=	2.29	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

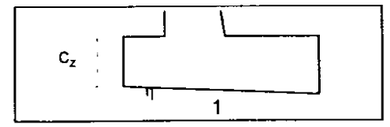
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

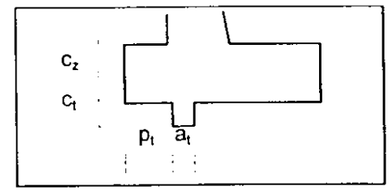
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00 m
c_t=	0.00 m
a_t=	0.00 m
K_p=	3.00
Vcu=	0.00 ton
Vd=	0.00 ton



MATERIALES

HORMIGÓN H-250 γ_c = 1.50

ACERO AEH-500 γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu=	36.31 ton
Vd=	20.53 ton

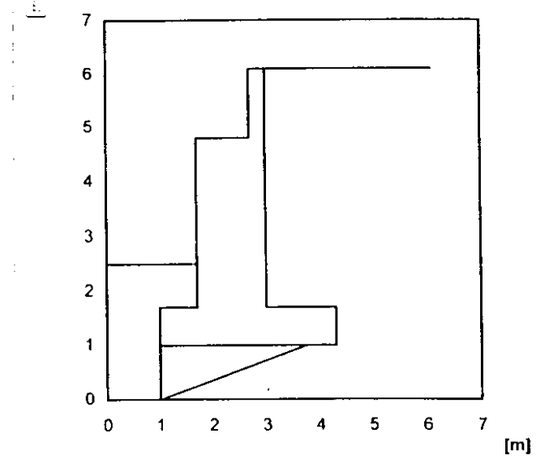
en zarpa trasera

Vcu=	41.96 ton
Vd=	15.65 ton

en base de muro

Vcu=	81.33 ton
Vd=	23.70 ton

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



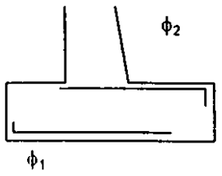
CÁLCULO A FLEXIÓN DE ZAPATA

d=	0.65 m
Uc=	1083.3 ton
Amín=	9.8 cm²/m.a. de armadura en tracción (cuantía mecánica)
	15.7 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md=	15.5 mt
Anec=	5.4 cm²/m.a. por flexión

ϕ_1(mm)	16
sep(m)	0.200
Adisp	10.1 cm²/m.a.



zarpa trasera

Md=	17.0 mt
Anec=	6.0 cm²/m.a. por flexión

ϕ_2(mm)	16
sep(m)	0.200
Adisp	10.1 cm²/m.a.

COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II

zarpa delantera

M= 9.7 mt

w_{adm}= 0.30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 10.6 mt

w_{adm}= 0.30 mm

$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)

Md= 48.0 mt

Nd= 54.0 ton Anec= 18.9 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	0	25
sep(m)	0.200	0.200	0.200
Adisp(*)	5.7	24.5	cm²/m.a.

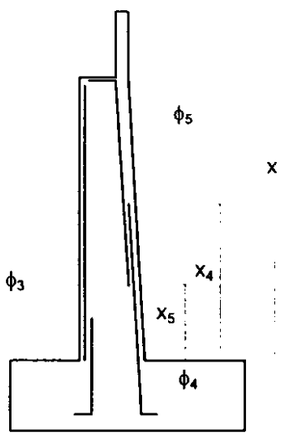
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base

Intervalos de armadura	
x_4 (m)	0.00
x_5 (m)	0.00

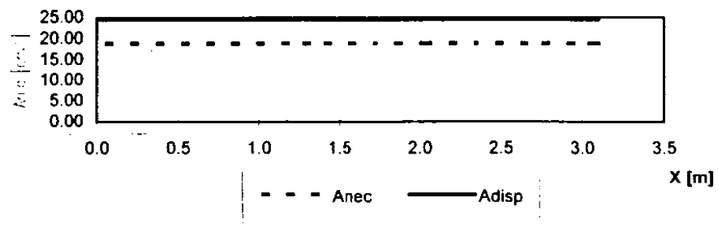
longitud de anclaje para ϕ_3= 0.00 m

longitud de anclaje para ϕ_4= 0.00 m

longitud de anclaje para ϕ_5= 0.00 m Anclaje en patilla



Anec por flexocompresión y Adisp en trasdós de fuste de estribo



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0.0 m

h= 1.30 m

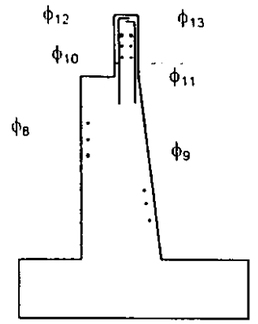
M= 29.99 mt w_{adm}= 0.22 mm

N= 33.75 ton $w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ALZADO

Familia	ϕ_8 + ϕ_9		ϕ_{10} + ϕ_{11}		ϕ_{12} + ϕ_{13}	
Anec(*)(cm²)	20.8		2.7		4.8	
ϕ(mm)	12	16	12	12	12	12
sep(m)	0.150	0.150	0.200	0.200	0.150	0.150
Adisp (cm²)	20.9		11.3		15.1	

(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE REFUERZO BAJO APOYOS

APOYO DE NEOPRENO

a_0 = 0.31 m ($a_0 > b_0$)

b_0 = 0.31 m

ELEMENTO ESTRUCTURAL BAJO APOYO

m= 0.50 m

n= 1.50 m

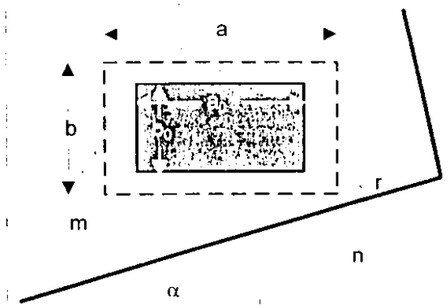
α= 100.0 g

r= 0.05 m

dimensiones del rectángulo homotético

a= 0.90 m

b= 0.90 m



AXIL

N= 128.41 ton

γ_f = 1.6

MATERIALES

f_{ck} = 250 kp/cm²

f_{yk} = 5100 kp/cm²

γ_s = 1.15

TENSIÓN MÁXIMA DE TRACCIÓN

$\sigma_{máx}$ = 46.3 t/m²

$f_{ct,k} / 2$ = 89.3 t/m²

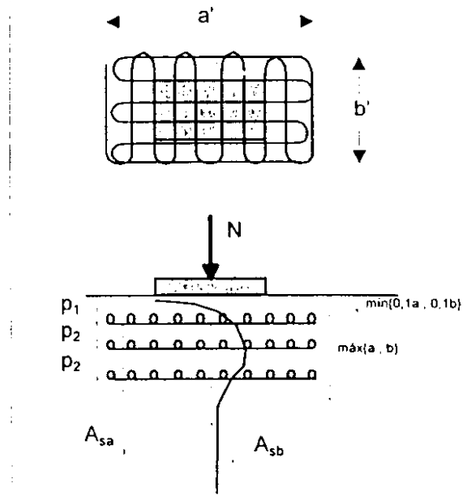
ARMADURA NECESARIA

$(A_{sa})_{nec} = (A_{sb})_{nec}$ = 9.1 cm²

GEOMETRIA REFUERZO

min{ 0.1a , 0.1b }= 0.09 m

máx{ a, b }= 0.90 m



ARMADURA DISPUESTA

número de parrillas= 3

p_1 = 0.15 m

p_2 = 0.20 m

PARALELA A "a" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	b' (m)	b (m)
7	8	0.10	0.60	0.90

Total $(A_{sa})_{disp}$= 10.6cm²

PARALELA A "b" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	a' (m)	a (m)
7	8	0.10	0.60	0.90

Total $(A_{sb})_{disp}$= 10.6cm²

PASO SUPERIOR 710+900

PASO SUPERIOR 710+900
TABLERO

Para el tablero de este paso es válido el cálculo efectuado para el tablero del P.S. 700+240

PASO SUPERIOR 710+900
ESTRIBOS

Para los estribos de este paso es válido el cálculo efectuado para el estribo 1 del P.S. 705+020

PASO SUPERIOR 712+620

PASO SUPERIOR 712+620
TABLERO , PILAS Y ZAPATAS DE PILAS

F.C. ALTA VELOCIDAD MADRID-ZARAGOZA (3274)

PASO SUPERIOR 2.9.9

Ancho de tablero	Ancho en base	Canto	Xc	Yc	Az			Espesor pavim.
11,20	6,60	1,20	556754,804	4554447,435	153,1136			0,05

SECCION	a	b	c	d	Za	Zb	Zc	Zd
1	556741,186	556732,889	556739,482	556734,593	1166,873	1166,649	1166,827	1166,695
	4554470,791	4554463,269	4554469,247	4554464,813				
2	556741,489	556733,191	556739,785	556734,895	1166,871	1166,647	1166,825	1166,693
	4554470,458	4554462,935	4554468,913	4554464,480				
3	556743,756	556735,458	556742,052	556737,162	1166,857	1166,633	1166,811	1166,679
	4554467,958	4554460,435	4554466,413	4554461,980				
4	556746,023	556737,725	556744,319	556739,429	1166,855	1166,631	1166,809	1166,677
	4554465,457	4554457,935	4554463,913	4554459,479				
5	556748,290	556739,992	556746,586	556741,696	1166,864	1166,640	1166,818	1166,686
	4554462,957	4554455,434	4554461,412	4554456,979				
6	556750,557	556742,259	556748,853	556743,963	1166,885	1166,661	1166,839	1166,707
	4554460,457	4554452,934	4554458,912	4554454,479				
7	556752,656	556744,358	556750,952	556746,062	1166,914	1166,690	1166,868	1166,736
	4554458,142	4554450,619	4554456,597	4554452,164				
8	556754,755	556746,457	556753,051	556748,161	1166,953	1166,729	1166,907	1166,775
	4554455,827	4554448,304	4554454,282	4554449,849				
9	556756,854	556748,556	556755,150	556750,260	1167,002	1166,778	1166,956	1166,824
	4554453,512	4554445,989	4554451,967	4554447,534				
10	556758,953	556750,655	556757,249	556752,359	1167,060	1166,836	1167,014	1166,882
	4554451,196	4554443,674	4554449,652	4554445,218				
11	556761,052	556752,754	556759,348	556754,458	1167,128	1166,904	1167,082	1166,950
	4554448,881	4554441,358	4554447,336	4554442,903				
12	556763,151	556754,853	556761,447	556756,557	1167,206	1166,982	1167,160	1167,028
	4554446,566	4554439,043	4554445,021	4554440,588				
13	556765,250	556756,952	556763,546	556758,656	1167,294	1167,070	1167,248	1167,116
	4554444,251	4554436,728	4554442,706	4554438,273				
14	556767,349	556759,051	556765,645	556760,755	1167,392	1167,168	1167,346	1167,214
	4554441,936	4554434,413	4554440,391	4554435,958				
15	556769,616	556761,318	556767,912	556763,022	1167,508	1167,284	1167,462	1167,330
	4554439,436	4554431,913	4554437,891	4554433,458				
16	556771,883	556763,585	556770,179	556765,289	1167,636	1167,412	1167,590	1167,458
	4554436,935	4554429,413	4554435,391	4554430,957				
17	556774,150	556765,852	556772,446	556767,556	1167,775	1167,551	1167,729	1167,597
	4554434,435	4554426,912	4554432,890	4554428,457				
18	556776,417	556768,119	556774,713	556769,823	1167,926	1167,702	1167,880	1167,748
	4554431,935	4554424,412	4554430,390	4554425,957				
19	556776,719	556768,422	556775,015	556770,126	1167,723	1167,947	1167,769	1167,901
	4554431,601	4554424,079	4554430,057	4554425,623				

PASO SUPERIOR 712+620

GEOMETRIA DEL TABLERO

DATOS GENERALES

NUMERO DE VANOS : 3
ESPESOR DEL FIRME : 0.080
COTA DE ALMOHADILLA : 0.000

HAY ALIGERAMIENTOS

VANO	LUZ
1	13.50
2	25.00
3	13.50

CONTORNO EXTERIOR

PERFIL LONGITUDINAL

Ai EN TANTO POR UNO DE LA LUZ
Bi EN METROS

VANO	A1	B1	A2	B2	A3	A4	B4
1	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20
2	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20
3	0.0000	1.20	0.5000	1.20	0.5000	1.0000	1.20

LEY DE VUELOS

PUNTO	X	Y
1	0.00	0.25
2	2.10	0.40
3	2.30	1.20

LEY DE ANCHO SUPERIOR

P.K.	ANCHO
0.00	11.20
52.00	11.20

LEY DE CAMBIO DE PERALTES

ANCHO : DISTANCIA AL EXTREMO IZQUIERDO DE LA CARA FRONTAL
EN EL SENTIDO DE AVANCE DE LOS P.K.

P.K.	ANCHO	CANTO
0.00	11.20	0.000
52.00	11.20	0.000

ALIGERAMIENTOS

DATOS GENERALES

TIPO1 INDICA EL TIPO DE ALIGERAMIENTO Y DE TRANSICION ENTRE LOS
PUNTOS SUPERIORES

1 : ALIGERAMIENTO CIRCULAR
2 : ALIGERAMIENTO RECTANGULAR CON TRANSICION LINEAL
3 : ALIGERAMIENTO RECTANGULAR CON TRANSICION PARABOLICA CUBICA
TIPO2 DEFINE LA TRANSICION ENTRE LOS PUNTOS INFERIORES DEL ALIGERAMIENTO RECTANGULAR Y TOMA LOS VALORES 2 o 3 CON EL MISMO SIGNIFICADO QUE EN EL CASO ANTERIOR

VANO	N.ALIG	TIPO1	TIPO2
1	0	0	0
2	5	1	0
3	0	0	0

ALZADO

Li : LONGITUDES QUE DEFINEN LOS EXTREMOS DE LOS ALIGERAMIENTOS
DPSi : DISTANCIA AL PARAMENTO SUPERIOR DE LOS EXTREMOS DE LOS ALIG.
Ci : CANTO DE LOS ALIGERAMIENTOS EN LOS EXTREMOS

VN	L1	L2	L3	L4	DPS1	DPS2	DPS3	DPS4	C1	C2	C3	C4
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2.00	10.50	10.50	2.00	0.30	0.30	0.30	0.30	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

PLANTA Y SECCIONES TRANSVERSALES

Si : DISTANCIAS ENTRE EJES DE ALIGERAMIENTOS
Ai : ANCHOS DE LOS ALIGERAMIENTOS
B : ANCHO SUPERIOR DEL ALIGERAMIENTO EXTREMO

VANO	S1	A1	S2	A2	S3	A3	S4	A4	S5	A5	B
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.60	1.25	0.60	2.50	0.60	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

CARACTERISTICAS MECANICAS DE LAS SECCIONES DEL TABLERO
****

SECCION NUMERO : 1
==========

CONTORNO EXTERIOR

PUNTO	COORD.X	COORD.Y
1	-5.600	0.000
2	-5.600	-0.250
3	-3.500	-0.400
4	-3.300	-1.200
5	3.300	-1.200
6	3.500	-0.400
7	5.600	-0.250
8	5.600	0.000

AREA	CENTRO DE GRAVEDAD COORD.X	CENTRO DE GRAVEDAD COORD.Y	MOMENTOS DE INERCIA EJE X	MOMENTOS DE INERCIA EJE Y
9.605	0.000	-0.533	1.212126	60.170870

S E C C I O N B R U T A

Distancia de la fibra neutra al borde inferior : 0.6673 m
Distancia de la fibra neutra al borde superior : 0.5327 m
Ancho : 11.20 m
Canto : 1.20 m
Area : 9.605 m2
Momento de inercia : 1.21213 m4

SECCION NUMERO : 2
==========

CONTORNO EXTERIOR

PUNTO	COORD.X	COORD.Y
1	-5.600	0.000
2	-5.600	-0.250
3	-3.500	-0.400
4	-3.300	-1.200
5	3.300	-1.200
6	3.500	-0.400
7	5.600	-0.250
8	5.600	0.000

AREA	CENTRO DE GRAVEDAD COORD.X	CENTRO DE GRAVEDAD COORD.Y	MOMENTOS DE INERCIA EJE X	MOMENTOS DE INERCIA EJE Y
9.605	0.000	-0.533	1.212126	60.170870

ALIGERAMIENTOS CIRCULARES

CIRCULO	X CENTRO	Y CENTRO	DIAMETRO	AREA	INERCIA
1	-2.500	-0.600	0.600	0.282	0.006346
2	-1.250	-0.600	0.600	0.282	0.006346
3	0.000	-0.600	0.600	0.282	0.006346
4	1.250	-0.600	0.600	0.282	0.006346
5	2.500	-0.600	0.600	0.282	0.006346

S E C C I O N B R U T A

Distancia de la fibra neutra al borde inferior : 0.6789 m
Distancia de la fibra neutra al borde superior : 0.5211 m
Ancho : 11.20 m
Canto : 1.20 m
Area : 8.193 m2
Momento de inercia : 1.17290 m4

PASO SUPERIOR 712+620

DEFINICION DEL PUENTE

VANO	BANDA	LONGITUD	SECCION
1	1	13.500	1
2	1	2.000	1
2	2	21.000	2
2	3	2.000	1
3	1	13.500	1

PASO SUPERIOR 712+620

GEOMETRIA DEL TABLERO
****

VANO NUMERO 1
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
13.500	9.605	1.21213	11.20	1.20	0.533

Longitud total del vano : 13.500 m

VANO NUMERO 2
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
2.000	9.605	1.21213	11.20	1.20	0.533
21.000	8.193	1.17290	11.20	1.20	0.521
2.000	9.605	1.21213	11.20	1.20	0.533

Longitud total del vano : 25.000 m

VANO NUMERO 3
==========

LONGITUD	AREA	INERCIA	ANCHO	CANTO	DIST. FN. BS.
13.500	9.605	1.21213	11.20	1.20	0.533

Longitud total del vano : 13.500 m

PUENTE COMPLETO
==========

Numero de vanos : 3

Longitud total : 52.00 m
Superficie del tablero : 582.40 m2
Volumen de hormigon : 469.81 m3

PASO SUPERIOR 712+620

DEFORMACIONES DIFERIDAS

MODULOS DE DEFORMACION

Módulo deformac. longit. secante hormigón a 28 días : 3800000.00 t/m2
Módulo elasticidad de armaduras activas y pasivas : 20000000.00 t/m2

DEFORMACIONES DIFERIDAS

Humedad relativa del ambiente : 50 %
Edad teorica del hormigon : 10000 dias
Edad de comienzo de ser efectivo el efecto de la retraccion : 3 dias
Edad de puesta en carga : 28 dias

PASO SUPERIOR 712+620

DEFORMACIONES DIFERIDAS
****

DATOS
=====

Humedad relativa del ambiente : 50 %
Edad teorica del hormigon : 10000 dias
Edad de comienzo de ser efectivo el efecto de la retraccion : 3 dias
Edad de puesta en carga : 28 dias

RESULTADOS
==========

Coeficientes que dependen de la humedad relativa
ALFA : 1.10
EPSILON 01 : -0.00046
FI 01 : 2.80

Coeficiente de la variacion de la resistencia del hormigon con el tiempo
BETA a : 0.25

Coeficiente de la variacion de la deformacion elastica diferida
BETA t-j : 1.00

SECCION NUMERO 1

Area : 9.61 m2
Perimetro : 24.16 m
Espesor ficticio : 0.88 m

Coeficientes que dependen del espesor ficticio
EPSILON 02 : 0.74
FI 02 : 1.22

Coeficientes de la evolucion de la retraccion en el tiempo
BETA t : 0.93
BETA j : 0.01

Coeficientes de la evolucion en el tiempo de la deformacion plastica diferida
BETA t : 0.99
BETA j : 0.24

Retraccion : 0.000314
Coeficiente de fluencia : 3.212

SECCION NUMERO 2

Area : 8.19 m2
Perimetro : 24.16 m
Espesor ficticio : 0.75 m

Coeficientes que dependen del espesor ficticio
EPSILON 02 : 0.75
FI 02 : 1.25

Coeficientes de la evolucion de la retraccion en el tiempo
BETA t : 0.94
BETA j : 0.01

Coeficientes de la evolucion en el tiempo de la deformacion plastica diferida
BETA t : 0.99
BETA j : 0.25

Retraccion : 0.000322
Coeficiente de fluencia : 3.250

DEFORMACIONES DIFERIDAS

Retraccion : 0.00032
Coeficiente de fluencia : 3.227

PASO SUPERIOR 712+620

CARGAS EXISTENTES SOBRE EL TABLERO
****

CARGAS PERMANENTES
==========

Cargas muertas en el extremo izquierdo del tablero : 1.80 Tn/m
Cargas muertas en el extremo derecho del tablero : 1.80 Tn/m

Espesor del pavimento : 0.080 m
Peso especifico : 2.400 Tn/m3
Ancho de barrera y acera izquierda : 1.40 m
Ancho de barrera y acera derecha : 1.40 m

SOBRECARGAS DE USO
==========

Sobrecarga uniforme en plataforma : 0.40 Tn/m2
Sobrecarga uniforme en barreras : 0.10 Tn/m2
Ancho de barrera izquierda : 0.35 m
Ancho de barrera derecha : 0.35 m

Tren constituido por 3 ejes.
Carga por eje : 20.00 Tn
Distancia entre ejes : 1.50 m

SECCION	C. EXCENTRICIDAD
0.30	1.80
0.40	1.80
0.50	1.80
0.60	1.80
0.70	1.80
0.80	1.80
0.90	1.80
1.00	1.80
1.10	1.80
1.15	1.80
1.25	1.80
1.30	1.80
1.50	1.80
1.70	1.80
1.75	1.80
1.85	1.80
1.90	1.80
2.00	1.80
2.10	1.80
2.20	1.80
2.30	1.80
2.40	1.80
2.50	1.80
2.60	1.80
2.70	1.80

TEMPERATURAS
==========

Coeficiente de dilatacion termica : 0.000010 grados-1

Gradiente positivo : 5.00 grados
Gradiente negativo : -5.00 grados

Gradiente positivo (situacion transitoria) : 5.00 grados
Gradiente negativo (situacion transitoria) : -5.00 grados

PASO SUPERIOR 712+620

ENVOLVENTE DE MOMENTOS FLECTORES
****

Unidades : mtn
Positivo : tensiones de traccion en la fibra inferior

PESO PROPIO, CARGA MUERTA, CARGA PERMANENTE, SOBRECARGA Y TREN
==========

SECC.	P.P.	C.M.	C.P.	SC. UNIF.		TREN	
0.30	181.75	30.64	212.39	74.22	-49.12	229.71	-80.84
0.40	154.81	21.85	176.66	83.39	-65.49	259.13	-107.78
0.50	84.10	3.57	87.67	84.79	-81.87	259.36	-134.73
0.60	-30.37	-24.22	-54.59	78.40	-98.24	233.45	-161.68
0.70	-188.60	-61.51	-250.11	64.23	-114.61	185.12	-188.62
0.80	-390.59	-108.30	-498.89	42.28	-130.99	118.76	-215.57
0.90	-636.35	-164.59	-800.94	18.67	-153.49	39.46	-242.52
1.00	-925.87	-230.38	-1156.25	12.28	-200.99	34.31	-269.46
1.10	-349.79	-83.77	-433.56	19.11	-87.73	66.15	-113.65
1.15	-125.76	-26.75	-152.52	30.40	-52.32	114.32	-83.35
1.25	258.29	70.99	329.28	83.13	-24.98	228.18	-69.51
1.30	418.31	111.71	530.02	116.48	-24.98	283.05	-62.58
1.50	674.34	176.87	851.22	169.86	-24.98	372.35	-34.90
1.70	418.31	111.71	530.02	116.48	-24.98	283.05	-62.58
1.75	258.29	70.99	329.28	83.13	-24.98	228.18	-69.51
1.85	-125.76	-26.75	-152.51	30.40	-52.32	114.32	-83.35
1.90	-349.79	-83.77	-433.56	19.11	-87.73	66.15	-113.65
2.00	-925.87	-230.38	-1156.24	12.28	-200.99	34.31	-269.46
2.10	-636.35	-164.59	-800.94	18.67	-153.49	39.46	-242.52
2.20	-390.59	-108.30	-498.89	42.28	-130.99	118.76	-215.57
2.30	-188.60	-61.51	-250.11	64.23	-114.61	185.12	-188.62
2.40	-30.37	-24.22	-54.59	78.40	-98.24	233.45	-161.68
2.50	84.10	3.57	87.67	84.79	-81.87	259.36	-134.73
2.60	154.81	21.85	176.66	83.39	-65.49	259.13	-107.78
2.70	181.75	30.64	212.39	74.22	-49.12	229.71	-80.84

TEMPERATURAS
==========

FASE DEFINITIVA

SECC.	MAXIMO	MINIMO
0.30	63.88	-63.88
0.40	85.17	-85.17
0.50	106.46	-106.46
0.60	127.75	-127.75
0.70	149.05	-149.05
0.80	170.34	-170.34
0.90	191.63	-191.63
1.00	212.92	-212.92
1.10	212.92	-212.92
1.15	212.92	-212.92
1.25	212.92	-212.92
1.30	212.92	-212.92
1.50	212.92	-212.92
1.70	212.92	-212.92
1.75	212.92	-212.92
1.85	212.92	-212.92
1.90	212.92	-212.92
2.00	212.92	-212.92
2.10	191.63	-191.63
2.20	170.34	-170.34
2.30	149.05	-149.05
2.40	127.75	-127.75
2.50	106.46	-106.46

2.60	85.17	-85.17
2.70	63.88	-63.88

FASE TRANSITORIA

SECC.	MAXIMO	MINIMO
0.30	63.88	-63.88
0.40	85.17	-85.17
0.50	106.46	-106.46
0.60	127.75	-127.75
0.70	149.05	-149.05
0.80	170.34	-170.34
0.90	191.63	-191.63
1.00	212.92	-212.92
1.10	212.92	-212.92
1.15	212.92	-212.92
1.25	212.92	-212.92
1.30	212.92	-212.92
1.50	212.92	-212.92
1.70	212.92	-212.92
1.75	212.92	-212.92
1.85	212.92	-212.92
1.90	212.92	-212.92
2.00	212.92	-212.92
2.10	191.63	-191.63
2.20	170.34	-170.34
2.30	149.05	-149.05
2.40	127.75	-127.75
2.50	106.46	-106.46
2.60	85.17	-85.17
2.70	63.88	-63.88

ENVOLVENTE DE MOMENTOS

SECC.	MAXIMO	MINIMO
0.30	580.20	18.55
0.40	604.36	-81.79
0.50	538.28	-235.39
0.60	385.02	-442.26
0.70	148.28	-702.39
0.80	-167.52	-1015.79
0.90	-551.17	-1388.57
1.00	-896.73	-1839.62
1.10	-135.37	-847.86
1.15	205.13	-501.10
1.25	853.50	21.87
1.30	1142.48	229.54
1.50	1606.35	578.42
1.70	1142.48	229.54
1.75	853.50	21.87
1.85	205.13	-501.10
1.90	-135.37	-847.86
2.00	-896.73	-1839.62
2.10	-551.17	-1388.57
2.20	-167.51	-1015.79
2.30	148.28	-702.39
2.40	385.02	-442.26
2.50	538.28	-235.39
2.60	604.36	-81.79
2.70	580.20	18.55

PASO SUPERIOR 712+620

CARACTERISTICAS DE LOS MATERIALES

Numero de grupos de tendones que se tesan sucesiv.	: 2
Modulo de elasticidad de la armadura activa	: 20000000.00 t/m2
Modulo de elasticidad instantanea del hormigon en el momento del tesado	: 3831305.00 t/m2
Modulo de deformacion longitudinal secante del hormigon a los 28 dias de edad	: 3800000.00 t/m2
Penetracion de cuñas	: 0.0040 m
Coeficiente de rozamiento en curva	: 0.210
Coeficiente de rozamiento parasito	: 0.0013
Valor final de la retraccion del hormigon a partir de la introduccion del pretensado	: 0.00032
Valor final del coeficiente de fluencia del hormigon	: 3.227
Valor final de la relajacion del acero	: 0.030
Tension de trabajo del acero de la armadura activa	: 142310.81 t/m2

PASO SUPERIOR 712+620

TRAZADO DEFINITIVO

Numero de trazado elegido : 5
Numero de familias de cables : 1

Fuerza de pretensado final : 3370.00 tn
Fuerza de primer pretensado : 2000.00 tn
Seccion total de armadura activa : 0.02369 m2

PASO SUPERIOR 712+620

TRAZADO DE CABLES
****

DATOS DE PARTIDA
==========

Numero de grupos de tendones que se tesan sucesiv. : 2
Modulo de elasticidad de la armadura activa : 20000000.00 t/m2
Modulo de elasticidad instantanea del hormigon en el momento del tesado : 3831305.00 t/m2
Modulo de deformacion longitudinal secante del hormigon a los 28 dias de edad : 3800000.00 t/m2
Penetracion de cuñas : 0.0040 m
Coeficiente de rozamiento en curva : 0.210
Coeficiente de rozamiento parasito : 0.0013
Valor final de la retraccion del hormigon a partir de la introduccion del pretensado : 0.00032
Valor final del coeficiente de fluencia del hormigon : 3.227
Valor final de la relajacion del acero : 0.030

Fuerza de pretensado : 3370.00 tn
Fuerza de primer pretensado : 2000.00 tn

Seccion total de armadura activa : 0.02369 m2
Tension de trabajo del acero de la armadura activa : 142254.11 t/m2
Cuantia geometrica : 16.60 Kg/m2 tablero

GEOMETRIA DEL TRAZADO
==========

V.I. y V.S. representan la distancia del centro de gravedad de la armadura activa a los extremos inferior y superior de la seccion, respect.

VANO	X/L	X	CANTO	V.I.	V.S.
1	0.00	0.000	1.200	0.647	0.553
1	0.05	0.675	1.200	0.623	0.577
1	0.10	1.350	1.200	0.604	0.596
1	0.15	2.025	1.200	0.589	0.611
1	0.20	2.700	1.200	0.579	0.621
1	0.25	3.375	1.200	0.572	0.628
1	0.30	4.050	1.200	0.570	0.630
1	0.35	4.725	1.200	0.573	0.627
1	0.40	5.400	1.200	0.581	0.619
1	0.45	6.075	1.200	0.596	0.604
1	0.50	6.750	1.200	0.616	0.584
1	0.55	7.425	1.200	0.641	0.559
1	0.60	8.100	1.200	0.673	0.527
1	0.65	8.775	1.200	0.710	0.490
1	0.70	9.450	1.200	0.753	0.447
1	0.75	10.125	1.200	0.801	0.399
1	0.80	10.800	1.200	0.856	0.344
1	0.85	11.475	1.200	0.916	0.284
1	0.90	12.150	1.200	0.981	0.219
1	0.95	12.825	1.200	1.033	0.167
1	1.00	13.500	1.200	1.050	0.150
2	0.00	0.000	1.200	1.050	0.150
2	0.05	1.250	1.200	1.007	0.193
2	0.10	2.500	1.200	0.878	0.322
2	0.15	3.750	1.200	0.717	0.483
2	0.20	5.000	1.200	0.577	0.623
2	0.25	6.250	1.200	0.459	0.741
2	0.30	7.500	1.200	0.362	0.838
2	0.35	8.750	1.200	0.287	0.913
2	0.40	10.000	1.200	0.233	0.967
2	0.45	11.250	1.200	0.201	0.999
2	0.50	12.500	1.200	0.190	1.010
2	0.55	13.750	1.200	0.201	0.999
2	0.60	15.000	1.200	0.233	0.967
2	0.65	16.250	1.200	0.287	0.913
2	0.70	17.500	1.200	0.362	0.838
2	0.75	18.750	1.200	0.459	0.741
2	0.80	20.000	1.200	0.577	0.623

2	0.85	21.250	1.200	0.717	0.483
2	0.90	22.500	1.200	0.878	0.322
2	0.95	23.750	1.200	1.007	0.193
2	1.00	25.000	1.200	1.050	0.150
3	0.00	0.000	1.200	1.050	0.150
3	0.05	0.675	1.200	1.033	0.167
3	0.10	1.350	1.200	0.981	0.219
3	0.15	2.025	1.200	0.916	0.284
3	0.20	2.700	1.200	0.856	0.344
3	0.25	3.375	1.200	0.801	0.399
3	0.30	4.050	1.200	0.753	0.447
3	0.35	4.725	1.200	0.710	0.490
3	0.40	5.400	1.200	0.673	0.527
3	0.45	6.075	1.200	0.641	0.559
3	0.50	6.750	1.200	0.616	0.584
3	0.55	7.425	1.200	0.596	0.604
3	0.60	8.100	1.200	0.581	0.619
3	0.65	8.775	1.200	0.573	0.627
3	0.70	9.450	1.200	0.570	0.630
3	0.75	10.125	1.200	0.572	0.628
3	0.80	10.800	1.200	0.579	0.621
3	0.85	11.475	1.200	0.589	0.611
3	0.90	12.150	1.200	0.604	0.596
3	0.95	12.825	1.200	0.623	0.577
3	1.00	13.500	1.200	0.647	0.553

VANO	LONGITUD DEL CABLE
1	13.517
2	25.077
3	13.517

Longitud total del cable : 52.112 m

PERDIDAS DE PRETENSADO
======================

Expresadas en % de la fuerza inicial de pretensado

ROZ : rozamiento
PCU : penetracion de cuñas
AEH : acortamiento elastico del hormigon
RET : retraccion
FLH : fluencia del hormigon
RAC : relajacion del acero
INS : instantaneas
DIF : diferidas
TOT : totales

SECC	ROZ	PCU	AEH	RET	FLH	RAC	INS	DIF	TOT
0.30	1.32	5.93	0.32	4.46	3.91	2.27	7.57	10.64	18.21
0.40	1.84	4.97	0.31	4.46	3.91	2.28	7.12	10.66	17.78
0.50	2.36	4.01	0.30	4.46	3.90	2.30	6.67	10.66	17.33
0.60	2.87	3.05	0.30	4.46	3.93	2.31	6.23	10.70	16.93
0.70	3.39	2.10	0.33	4.46	4.06	2.31	5.81	10.84	16.65
0.80	3.90	1.15	0.41	4.46	4.40	2.30	5.46	11.17	16.62
0.90	4.40	0.20	0.58	4.46	5.07	2.27	5.19	11.81	16.99
1.00	6.58	0.00	0.70	4.46	4.68	2.23	7.28	11.37	18.65
1.10	9.52	0.00	0.46	4.46	5.11	2.13	9.98	11.70	21.68
1.15	9.99	0.00	0.35	4.46	4.46	2.16	10.33	11.07	21.40
1.25	10.92	0.00	0.42	4.46	4.71	2.11	11.34	11.28	22.62
1.30	11.38	0.00	0.53	4.46	5.10	2.07	11.91	11.63	23.54
1.50	13.21	0.00	0.81	4.46	6.19	1.94	14.02	12.59	26.61
1.70	11.38	0.00	0.53	4.46	5.10	2.07	11.91	11.63	23.54
1.75	10.92	0.00	0.42	4.46	4.71	2.11	11.34	11.28	22.62
1.85	9.99	0.00	0.35	4.46	4.46	2.16	10.33	11.07	21.40
1.90	9.52	0.00	0.46	4.46	5.11	2.13	9.98	11.70	21.68
2.00	6.58	0.00	0.70	4.46	4.68	2.23	7.28	11.37	18.65
2.10	4.40	0.20	0.58	4.46	5.07	2.27	5.19	11.81	16.99
2.20	3.90	1.15	0.41	4.46	4.40	2.30	5.46	11.17	16.62
2.30	3.39	2.10	0.33	4.46	4.06	2.31	5.81	10.84	16.65
2.40	2.87	3.05	0.30	4.46	3.93	2.31	6.23	10.70	16.93
2.50	2.36	4.01	0.30	4.46	3.90	2.30	6.67	10.66	17.33
2.60	1.84	4.97	0.31	4.46	3.91	2.28	7.12	10.66	17.78
2.70	1.32	5.93	0.32	4.46	3.91	2.27	7.57	10.64	18.21

ESFUERZOS DE PRETENSADO
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SECC	PRIMER PRETENSADO AXIL	M isos	M hiper	PRETENSADO FINAL (INIC) AXIL	M isos	M hiper	PRETENSADO FINAL (FINAL) AXIL	M isos	M hiper
0.30	1966.93	-191.42	30.35	3115.04	-303.15	51.14	2756.43	-268.25	45.70
0.40	1956.63	-168.05	40.47	3130.04	-268.84	68.19	2770.94	-237.99	60.93
0.50	1946.48	-100.44	50.59	3145.19	-162.30	85.24	2785.85	-143.76	76.15
0.60	1936.24	10.73	60.70	3160.08	17.51	102.29	2799.43	15.51	91.34
0.70	1925.51	164.71	70.82	3174.05	271.51	119.33	2808.79	240.26	106.40
0.80	1913.73	360.54	80.94	3186.16	600.26	136.38	2809.84	529.37	121.15
0.90	1900.23	596.88	91.06	3195.21	1003.65	153.43	2797.32	878.67	135.32
1.00	1854.44	709.66	101.17	3124.74	1195.78	170.48	2741.57	1049.15	151.10
1.10	1800.39	358.43	101.17	3033.66	603.95	170.48	2639.42	525.46	150.54
1.15	1793.33	67.84	101.17	3021.77	114.32	170.48	2648.71	100.21	151.61
1.25	1773.26	-390.42	101.17	2987.95	-657.85	170.48	2607.85	-574.17	151.25
1.30	1761.87	-558.37	101.17	2968.76	-940.85	170.48	2576.78	-816.63	150.65
1.50	1719.52	-840.71	101.17	2897.40	-1416.59	170.48	2473.15	-1209.17	149.02
1.70	1761.87	-558.37	101.17	2968.76	-940.85	170.48	2576.78	-816.63	150.65
1.75	1773.26	-390.42	101.17	2987.95	-657.85	170.48	2607.85	-574.17	151.25
1.85	1793.33	67.85	101.17	3021.77	114.32	170.48	2648.71	100.21	151.61
1.90	1800.39	358.43	101.17	3033.66	603.95	170.48	2639.42	525.46	150.54
2.00	1854.44	709.66	101.17	3124.74	1195.78	170.48	2741.57	1049.15	151.10
2.10	1900.23	596.88	91.06	3195.21	1003.65	153.43	2797.32	878.67	135.32
2.20	1913.73	360.54	80.94	3186.16	600.26	136.38	2809.84	529.36	121.15
2.30	1925.51	164.71	70.82	3174.05	271.51	119.34	2808.79	240.26	106.40
2.40	1936.24	10.73	60.70	3160.08	17.51	102.29	2799.43	15.51	91.34
2.50	1946.48	-100.44	50.59	3145.19	-162.30	85.24	2785.85	-143.76	76.15
2.60	1956.63	-168.05	40.47	3130.04	-268.84	68.19	2770.94	-237.99	60.93
2.70	1966.93	-191.42	30.35	3115.04	-303.15	51.14	2756.43	-268.25	45.70

ALARGAMIENTO DE LOS CABLES
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PRIMER PRETENSADO.
Extremo izquierdo : 102 mm
Extremo derecho : 102 mm

HASTA EL PRETENSADO FINAL.
Extremo izquierdo : 70 mm
Extremo derecho : 70 mm

TENSIONES EN EL HORMIGON
========================

Unidades : tn/m2
Positivo : compresiones

F.S. : fibra superior
F.I. : fibra inferior

TENSIONES CON MOMENTO FLECTOR DADO POR PESO PROPIO ESTRICTO
CONSIDERANDO PERDIDAS INSTANTANEAS

SECC	MOM. EXT.	*PRIMER PRETENSADO* F.S.	F.I.	*PRETENSADO FINAL* F.S.	F.I.
0.30	245.63	241.94	158.23	321.51	327.83
	117.87	185.80	228.56	265.37	398.16
0.40	239.98	253.10	141.83	343.16	304.22
	69.64	178.24	235.61	268.30	398.00
0.50	190.56	264.49	125.19	377.33	264.97
	-22.36	170.92	242.41	283.76	382.19
0.60	97.39	275.78	108.65	424.45	209.44
	-158.12	163.49	249.31	312.16	350.10
0.70	-39.55	286.59	92.58	484.84	137.06
	-337.64	155.59	256.69	353.84	301.17

0.80	-220.25	296.46	77.45	558.65	47.43
	-560.93	146.75	265.00	408.94	234.98
0.90	-444.72	304.72	63.94	645.72	-59.52
	-827.98	136.30	274.93	477.29	151.48
1.00	-712.95	236.09	139.18	612.43	-34.35
	-1138.79	48.95	373.62	425.29	200.09
1.10	-136.87	363.12	32.94	653.52	1.23
	-562.71	173.93	279.43	464.33	247.73
1.15	87.16	332.70	70.60	534.07	153.52
	-338.69	143.51	317.09	344.88	400.01
1.25	471.21	297.28	111.10	357.51	374.05
	45.36	108.09	357.60	168.32	620.54
1.30	631.23	292.36	114.31	300.53	442.89
	205.39	103.17	360.80	111.34	689.39
1.50	887.26	275.51	124.36	194.22	561.35
	461.42	86.32	370.86	5.03	807.85
1.70	631.23	292.36	114.31	300.53	442.89
	205.39	103.17	360.80	111.34	689.39
1.75	471.21	297.28	111.10	357.51	374.05
	45.37	108.09	357.60	168.32	620.54
1.85	87.16	332.70	70.60	534.07	153.52
	-338.69	143.51	317.09	344.88	400.01
1.90	-136.87	363.12	32.94	653.52	1.23
	-562.71	173.93	279.43	464.33	247.73
2.00	-712.95	236.09	139.18	612.43	-34.35
	-1138.79	48.95	373.62	425.29	200.09
2.10	-444.72	304.72	63.94	645.72	-59.52
	-827.98	136.30	274.93	477.29	151.48
2.20	-220.25	296.46	77.45	558.65	47.43
	-560.93	146.75	265.00	408.94	234.98
2.30	-39.55	286.59	92.58	484.84	137.06
	-337.64	155.59	256.69	353.84	301.17
2.40	97.39	275.78	108.65	424.45	209.44
	-158.12	163.49	249.31	312.16	350.10
2.50	190.56	264.49	125.19	377.33	264.97
	-22.36	170.92	242.41	283.76	382.19
2.60	239.98	253.10	141.83	343.16	304.22
	69.64	178.24	235.61	268.30	398.00
2.70	245.63	241.94	158.23	321.51	327.83
	117.87	185.80	228.56	265.37	398.16

Resistencia caracteristica mínima del hormigon de primer pretensado : 59.78 Kp/cm2

TENSIONES CON MOMENTO FLECTOR DADO POR LAS CARGAS PERMANENTES
CONSIDERANDO PERDIDAS INSTANTANEAS

		PRIMER PRETENSADO		*PRETENSADO FINAL*	
SECC	MOM. EXT.	F.S.	F.I.	F.S.	F.I.
0.30	276.27	255.41	141.36	334.98	310.96
	148.51	199.27	211.69	278.83	381.29
0.40	261.83	262.71	129.80	352.76	292.19
	91.49	187.85	223.58	277.91	385.97
0.50	194.13	266.05	123.23	378.90	263.00
	-18.79	172.48	240.45	285.33	380.23
0.60	73.16	265.13	121.98	413.80	222.77
	-182.34	152.85	262.65	301.52	363.44
0.70	-101.06	259.56	126.44	457.81	170.92
	-399.15	128.56	290.55	326.81	335.03
0.80	-328.55	248.87	137.07	511.06	107.05
	-669.23	99.16	324.63	361.35	294.60
0.90	-609.31	232.39	154.55	573.39	31.09
	-992.57	63.97	365.55	404.96	242.09
1.00	-943.32	134.85	266.01	511.19	92.48
	-1369.17	-52.29	500.45	324.05	326.92
1.10	-220.64	325.91	81.42	616.30	49.72
	-646.48	136.72	327.92	427.11	296.21
1.15	60.41	320.81	86.08	522.18	169.00
	-365.44	131.62	332.58	332.99	415.50
1.25	542.20	328.81	70.01	389.05	332.96
	116.35	139.63	316.51	199.86	579.45
1.30	742.94	341.99	49.64	350.16	378.23
	317.10	152.80	296.14	160.97	624.72
1.50	1064.14	354.09	21.98	272.79	458.97
	638.29	164.90	268.48	83.60	705.47
1.70	742.94	341.99	49.64	350.16	378.23
	317.10	152.80	296.14	160.97	624.72
1.75	542.20	328.82	70.01	389.05	332.96
	116.35	139.63	316.51	199.86	579.45
1.85	60.41	320.81	86.08	522.18	169.00
	-365.44	131.62	332.58	332.99	415.50
1.90	-220.64	325.91	81.42	616.30	49.72
	-646.48	136.72	327.92	427.11	296.21
2.00	-943.32	134.85	266.01	511.19	92.48
	-1369.17	-52.29	500.45	324.05	326.92
2.10	-609.31	232.39	154.55	573.39	31.09
	-992.57	63.97	365.55	404.96	242.09
2.20	-328.55	248.87	137.07	511.06	107.05
	-669.23	99.16	324.63	361.35	294.60
2.30	-101.06	259.56	126.44	457.81	170.92
	-399.15	128.56	290.55	326.81	335.03
2.40	73.16	265.13	121.98	413.80	222.77
	-182.34	152.85	262.65	301.52	363.44
2.50	194.13	266.05	123.23	378.90	263.00
	-18.79	172.48	240.45	285.33	380.23
2.60	261.83	262.71	129.80	352.76	292.19
	91.49	187.85	223.58	277.91	385.97
2.70	276.27	255.41	141.36	334.98	310.96
	148.51	199.27	211.69	278.83	381.29

Resistencia caracteristica minima del hormigon de primer pretensado : 80.07 Kp/cm2

TENSIONES CON MOMENTOS FLECTORES MAXIMOS Y MINIMOS

		TENSIONES INICIALES (PERDIDAS INSTANT.)		*TENSIONES DIFERIDAS* (PERDIDAS TOTALES)	
SECC	MOM. EXT.	F.S.	F.I.	F.S.	F.I.
0.30	580.20	468.54	143.63	444.15	90.08
	18.55	221.72	452.84	197.33	399.28
0.40	604.36	503.29	103.62	476.27	53.25
	-81.79	201.76	481.36	174.73	431.00
0.50	538.28	530.14	73.54	496.88	30.92
	-235.39	190.14	499.47	156.88	456.85

0.60	385.02	550.85	51.09	507.61	20.67
	-442.26	187.29	506.53	144.06	476.11
0.70	148.28	567.38	33.65	509.94	19.94
	-702.39	193.54	501.98	136.10	488.27
0.80	-167.52	581.83	18.39	504.80	26.63
	-1015.79	209.05	485.40	132.02	493.63
0.90	-551.17	598.93	-0.91	494.62	36.44
	-1388.57	230.93	460.11	126.62	497.46
1.00	-896.73	531.66	66.83	418.81	118.34
	-1839.62	117.30	585.92	4.45	637.43
1.10	-135.37	654.18	0.36	562.33	9.22
	-847.86	337.65	412.78	245.80	421.64
1.15	205.13	586.48	85.23	526.29	58.79
	-501.10	272.72	494.03	212.53	467.59
1.25	853.50	527.35	152.76	509.60	69.06
	21.87	157.88	634.14	140.13	550.44
1.30	1142.48	527.66	146.96	526.20	38.69
	229.54	122.07	675.41	120.61	567.14
1.50	1606.35	513.68	145.12	544.52	-14.30
	578.42	57.00	740.13	87.84	580.71
1.70	1142.48	527.66	146.96	526.20	38.69
	229.54	122.07	675.41	120.61	567.14
1.75	853.50	527.35	152.76	509.60	69.06
	21.87	157.88	634.14	140.13	550.44
1.85	205.13	586.48	85.23	526.29	58.79
	-501.10	272.72	494.03	212.53	467.59
1.90	-135.37	654.18	0.36	562.33	9.22
	-847.86	337.65	412.78	245.80	421.64
2.00	-896.73	531.66	66.83	418.81	118.34
	-1839.62	117.30	585.92	4.45	637.43
2.10	-551.17	598.93	-0.91	494.62	36.44
	-1388.57	230.93	460.11	126.62	497.46
2.20	-167.51	581.83	18.39	504.80	26.63
	-1015.79	209.05	485.39	132.02	493.63
2.30	148.28	567.38	33.65	509.94	19.94
	-702.39	193.54	501.98	136.10	488.27
2.40	385.02	550.85	51.09	507.61	20.67
	-442.26	187.29	506.53	144.06	476.11
2.50	538.28	530.14	73.54	496.88	30.92
	-235.39	190.14	499.47	156.88	456.85
2.60	604.36	503.29	103.62	476.27	53.25
	-81.79	201.76	481.36	174.73	431.00
2.70	580.20	468.54	143.63	444.15	90.08
	18.55	221.72	452.84	197.33	399.28

Resistencia caracteristica minima del hormigon de pretensado final : 129.26 Kp/cm2

PASO SUPERIOR 712+620

ESFUERZOS CORTANTES ADICIONALES Y COEF. DE EXCENTRICIDAD DEL CARRO

SECCION	Q MAX	Q MIN	C. EXC
ESTRIBO 1	0.00	0.00	1.80
PILA 1 IZQ	0.00	0.00	1.80
PILA 1 DER	0.00	0.00	1.80
PILA 2 IZQ	0.00	0.00	1.80
PILA 2 DER	0.00	0.00	1.80
ESTRIBO 2	0.00	0.00	1.80

NUMERO DE APOYOS POR PILA

N = 1 : una placa
N = 2 : más de una placa

PILA	N
1	2
2	2

RIGIDEZ TORSIONAL

RT : rigidez torsional unitaria (m.t.)

VANO	BANDA	RT
1	1	1.75
2	1	1.75
2	2	1.00
2	3	1.75
3	1	1.75

POSICION TRANSVERSAL DE LAS CARGAS PERMANENTES Y EL TREN DE CARGAS

CARGAS PERMANENTES (EXCL. PESO PROPIO Y PAVIMENTO)
  Distancia al borde izquierdo del tablero : 1.10 m
  Distancia al borde derecho del tablero : 1.10 m
EJE DEL TREN DE CARGAS
  Distancia al borde izquierdo del tablero : 2.10 m
  Distancia al borde derecho del tablero : 2.10 m

PASO SUPERIOR 712+620

ESFUERZOS CORTANTES
****

Unidades : tn
Positivo : sobre una rebanada sentido de giro horario

TREN DE CARGAS
==========

APOYO	C. EXCENTRICIDAD
ESTRIBO 1	1.80
PILA 1 IZQ	1.80
PILA 1 DER	1.80
PILA 2 IZQ	1.80
PILA 2 DER	1.80
ESTRIBO 2	1.80

SOBRECARGA
==========

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	13.03	13.03	-6.06	-6.06	0.45	0.45
PILA 1 IZQ	-15.79	-15.79	-6.06	-6.06	0.45	0.45
PILA 1 DER	0.99	0.99	26.69	26.69	-0.99	-0.99
PILA 2 IZQ	0.99	0.99	-26.69	-26.69	-0.99	-0.99
PILA 2 DER	-0.45	-0.45	6.06	6.06	15.79	15.79
ESTRIBO 2	-0.45	-0.45	6.06	6.06	-13.03	-13.03

CARGA PERMANENTE, SOBRECARGA, TREN Y PRETENSADO
==========

APOYO	C.P.	SC.UNIF.		TREN		PRET.	TOTALES	
ESTRIBO 1	111.62	26.97	-12.13	93.76	-19.96	12.63	244.99	92.16
PILA 1 IZQ	-282.92	0.91	-43.71	2.54	-99.44	12.63	-266.84	-413.44
PILA 1 DER	325.61	55.36	-1.98	103.81	-5.54	0.00	484.77	318.09
PILA 2 IZQ	-325.61	1.98	-55.36	5.54	-103.81	0.00	-318.09	-484.77
PILA 2 DER	282.92	43.71	-0.91	99.44	-2.54	-12.63	413.44	266.84
ESTRIBO 2	-111.62	12.13	-26.97	19.96	-93.76	-12.63	-92.16	-244.99

TEMPERATURAS
==========

APOYO	MAXIMO	MINIMO
ESTRIBO 1	15.77	-15.77
PILA 1 IZQ	15.77	-15.77
PILA 1 DER	0.00	0.00
PILA 2 IZQ	0.00	0.00
PILA 2 DER	15.77	-15.77
ESTRIBO 2	15.77	-15.77

ESFUERZOS CORTANTES MAXIMOS
==========

APOYO	MAXIMO	MINIMO
ESTRIBO 1	260.76	76.39
PILA 1 IZQ	-251.07	-429.21
PILA 1 DER	484.77	318.09
PILA 2 IZQ	-318.09	-484.77
PILA 2 DER	429.21	251.07
ESTRIBO 2	-76.39	-260.76

PASO SUPERIOR 712+620

MOMENTOS TORSORES
****

Unidades : mtn
Positivo : giro devogiro en la cara frontal de una rebanada

CARGAS PERMANENTES (EXCL. PESO PROPIO Y PAVIMENTO)
  Distancia al borde izquierdo del tablero : 1.10 m
  Distancia al borde derecho del tablero   : 1.10 m
EJE DEL TREN DE CARGAS
  Distancia al borde izquierdo del tablero : 2.10 m
  Distancia al borde derecho del tablero   : 2.10 m

TREN EN CENTRO DE VANO
==========

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	-105.00	105.00	0.00	0.00	0.00	0.00
PILA 1 IZQ	105.00	-105.00	0.00	0.00	0.00	0.00
PILA 1 DER	0.00	0.00	-105.00	105.00	0.00	0.00
PILA 2 IZQ	0.00	0.00	105.00	-105.00	0.00	0.00
PILA 2 DER	0.00	0.00	0.00	0.00	-105.00	105.00
ESTRIBO 2	0.00	0.00	0.00	0.00	105.00	-105.00

SOBRECARGA
==========

APOYO	CARGA VANO 1 IZQ.	CARGA VANO 1 DER.	CARGA VANO 2 IZQ.	CARGA VANO 2 DER.	CARGA VANO 3 IZQ.	CARGA VANO 3 DER.
ESTRIBO 1	-38.49	38.49	0.00	0.00	0.00	0.00
PILA 1 IZQ	38.49	-38.49	0.00	0.00	0.00	0.00
PILA 1 DER	0.00	0.00	-71.28	71.28	0.00	0.00
PILA 2 IZQ	0.00	0.00	71.28	-71.28	0.00	0.00
PILA 2 DER	0.00	0.00	0.00	0.00	-38.49	38.49
ESTRIBO 2	0.00	0.00	0.00	0.00	38.49	-38.49

CARGA PERMANENTE, SOBRECARGA Y TREN
==========

APOYO	C.PERM.	SC.UNIF.IZQ.	SC.UNIF.DER.	TREN IZQ.	TREN DER.
ESTRIBO 1	0.00	-38.49	38.49	-186.65	186.65
PILA 1 IZQ	0.00	38.49	-38.49	186.65	-186.65
PILA 1 DER	0.00	-71.28	71.28	-200.97	200.97
PILA 2 IZQ	0.00	71.28	-71.28	200.97	-200.97
PILA 2 DER	0.00	-38.49	38.49	-186.65	186.65
ESTRIBO 2	0.00	38.49	-38.49	186.65	-186.65

PASO SUPERIOR 712+620

ARMADURA PASIVA DEL TABLERO
****

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
  Resistencia caracteristica : 400.00 Kp/cm2
  Coeficiente de minoracion :   1.50
ACERO
  Resistencia caracteristica : 5100.00 Kp/cm2
  Coeficiente de minoracion :   1.15
  Recubrimiento   :   0.04 m
ACCIONES
  Coeficiente de mayoracion :   1.60

ARMADURA A FLEXION POR FISURACION Y DESCOMPRESION
==========

AREA : area de la seccion (m2)
Amin : armadura minima por fisuracion (cm2)
Asup y Ainf : armadura por aparicion de fisuras de traccion
              en las caras superior e inferior (cm2)

VANO	BANDA	AREA	Amin	Asup	Ainf
1	0.00 - 13.50	9.605	96.05	0.00	0.60
2	0.00 - 2.00	9.605	96.05	0.00	0.00
2	2.00 - 23.00	8.193	81.93	0.00	10.15
2	23.00 - 25.00	9.605	96.05	0.00	0.00
3	0.00 - 13.50	9.605	96.05	0.00	0.60

ARMADURA A CORTANTE
==========

Bw : ancho eficaz (m)
Du : canto util (m)
Vu1 : esfuerzo cortante de agotamiento por compresion oblicua en el alma (tn)
Vrd : esfuerzo cortante de calculo (tn)
Vu2a: esfuerzo cortante de agotamiento por traccion en el alma (tn)
An : armadura necesaria (cm2/m)
Am : armadura minima (cm2/m)

VANO	BANDA	Bw	Du	Vu1	Vrd	Vu2a	An	Am
1	0.00 - 13.50	6.80	1.16	6310.40	-669.08	402.53	5.71	86.35
2	0.00 - 2.00	6.80	1.16	6310.40	775.63	402.53	30.01	86.35
2	2.00 - 23.00	6.80	1.16	6310.40	672.86	402.53	6.57	86.35
2	23.00 - 25.00	6.80	1.16	6310.40	-775.63	402.53	30.01	86.35
3	0.00 - 13.50	6.80	1.16	6310.40	669.08	402.53	5.71	86.35

ARMADURA A TORSION
==========

B : ancho del alma (m)
H : canto del alma (m)
Td : momento torsor de calculo (m.t.)
Tu1 : momento torsor de agotamiento por compresion del hormigon (m.t.)
AT : armadura transversal (cm2/m)
AL : armadura longitudinal (cm2)
RT : rigidez torsional unitaria (m.t.)

VANO	BANDA	B	H	Td	Tu1	AT	AL	RT
1	0.00 - 13.50	6.80	1.20	-360.22	1188.00	6.50	93.53	1.75

2	0.00 - 2.00	6.80	1.20	435.61	1188.00	7.86	113.11	1.75
2	2.00 - 23.00	6.80	1.20	391.63	1188.00	7.06	101.69	1.00
2	23.00 - 25.00	6.80	1.20	-435.61	1188.00	7.86	113.11	1.75
3	0.00 - 13.50	6.80	1.20	-360.22	1188.00	6.50	93.53	1.75

COMPROBACION DE CORTANTE Y TORSION
==========

VANO	BANDA	Vd/Vu1	Td/Tu1	SUMA
1	0.00 - 13.50	0.106	0.303	0.409
2	0.00 - 2.00	0.123	0.367	0.490
2	2.00 - 23.00	0.107	0.330	0.436
2	23.00 - 25.00	0.123	0.367	0.490
3	0.00 - 13.50	0.106	0.303	0.409

ARMADURA DEL VOLADIZO
==========

Longitud : 2.10 m
Canto mayor : 0.40 m
Canto menor : 0.25 m

CARGAS PERMANENTES .-

Voladizo : 1.706 t/m a 1.131 m del borde
Pavimento : 0.134 t/m a 1.750 m del borde
Resto c.p. : 1.800 t/m a 1.100 m del borde

SOBRECARGAS .-

Uniforme vertical : 0.700 t/m a 1.225 m del borde
0.035 t/m a 0.175 m del borde
Uniforme horizontal : 0.150 t/m a 1.000 m del pavimento
Concentrada : carro de 60.00 tn con la primera carga
a 1.10 m del borde

ARMADURA LONGITUDINAL .-

Momento de calculo : 22.996 m.t.
Armadura necesaria : 15.04 cm2

ARMADURA TRANSVERSAL .-

Esfuerzo cortante de calculo : 23.001 t.
Contribucion del hormigon : 29.394 t.
No es necesaria armadura

ARMADURA LONGITUDINAL ELEGIDA .-

8 redondos de 16 mm
Comprobada la fisuracion para el tipo de ambiente 2

ARMADURA EN ANCLAJES ACTIVOS
==========

Coeficiente de seguridad del acero : 2.50

Numero de placas : 10
Dimension de la placa paralela al paramento inferior de la losa : 0.32 m
Dimension de la placa perpendicular al paramento inf de la losa : 0.32 m
Distancia paralela al paramento inferior entre ejes de cables : 0.32 m

Armadura total necesaria : 26.86 cm2
Las tracciones criticas se extienden de 0.19 a 1.11 m
a partir del paramento

PASO SUPERIOR 712+620

DEFINICION DE LOS APOYOS
****

CARACTERISTICAS DE LOS MATERIALES
==========

HORMIGON
Resistencia caracteristica en estribos : 250.00 Kp/cm2
Resistencia caracteristica en pilas : 300.00 Kp/cm2
Coeficiente de minoracion : 1.50
ACERO
Resistencia caracteristica : 5100.00 Kp/cm2
Coeficiente de minoracion : 1.15
Recubrimiento : 0.04 m
ACCIONES
Coeficiente de mayoracion : 1.60

SISTEMAS DE EJES
==========

Las ordenadas son ortogonales a las abscisas
en el sentido contrario a las agujas del reloj

Ejes generales del puente.
X : estribo 1 - estribo 2
Y
Ejes locales de los apoyos.
X1
Y1 : eje de apoyos (lado mayor del apoyo)

GEOMETRIA DE LOS APOYOS
==========

ESTRIBO NUMERO 1

Altura : 3.00 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 247.77437 m4
Momento de inercia respecto al eje Y1 : 6.07837 m4

ESTRIBO NUMERO 2

Altura : 3.00 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 247.77437 m4
Momento de inercia respecto al eje Y1 : 6.07837 m4

PILA NUMERO 1

SECCION CIRCULAR

Numero de fustes : 2
Diametro : 1.10 m
Distancia entre fustes : 5.50 m

Altura : 13.50 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.
Momento de inercia respecto al eje X1 : 14.51751 m4
Momento de inercia respecto al eje Y1 : 0.14374 m4

PILA NUMERO 2

SECCION CIRCULAR

Numero de fustes : 2
Diametro : 1.10 m
Distancia entre fustes : 5.50 m

Altura : 14.00 m
Angulo que forma el eje Y1 con el eje longitudinal del puente : 100.00 grados cent.

Momento de inercia respecto al eje X1 : 14.51751 m4
Momento de inercia respecto al eje Y1 : 0.14374 m4

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FUERZAS HORIZONTALES

CONTRACCION

Coeficiente de contraccion : 0.00000

VIENTO

SI se considera el efecto del viento
Altura de las aceras : 0.20 m
SI existen barandillas

SISMO

Coeficiente sismico vertical : 0.00
Coeficiente sismico horizontal : 0.00

Sobrecarga de uso : 0.00 %
Viento : 0.00 %

Combinaciones de las componentes sismicas

No existen hipotesis

F.CENTRIFUGA

Velocidad especifica : 100.00 Km/h

CARACTERISTICAS DE LOS ELASTOMEROS

Modulo de elasticidad instantaneo : 200.00 t/m2
Modulo de elasticidad diferido : 100.00 t/m2
Compresion media minima : 30.00 Kp/cm2

DEFINICION DE LAS PLACAS

APOYO	TIPO DE PLACA	NUMERO PLACAS	COMPRESION ADMISIBLE	SEPARACION
ESTRIBO 1	CIRCULAR	2	150.00	5.50
PILA 1	CIRCULAR	2	150.00	5.50
PILA 2	CIRCULAR	2	150.00	5.50
ESTRIBO 2	CIRCULAR	2	150.00	5.50

Unidades : compresion admisible, Kp/cm2
separacion, metros

PASO SUPERIOR 712+620

FUERZAS EN CABEZA DE ELEMENTOS
****

CARACTERISTICAS DE LOS APOYOS
==========

X,Y : Coordenadas de las placas de apoyo en los ejes generales del puente (m)
B : Angulo que forma el eje Y1 con el eje X (grados cent.)
Ix1,Iy1 : Momentos de inercia de los apoyos respecto de los ejes locales (m4)
H : Altura del apoyo (m)
Sn : Area del neopreno (m2)
Hn : Altura neta del neopreno (m)

APOYO	X	Y	B	Ix1	Iy1	H	Sn	Hn
1	0.000	2.750	100.0000	247.7744	6.0784	3.00	0.2827	0.060
2	0.000	-2.750	100.0000	247.7744	6.0784	3.00	0.2827	0.060
3	13.500	2.750	100.0000	14.5175	0.1437	13.50	0.2827	0.020
4	13.500	-2.750	100.0000	14.5175	0.1437	13.50	0.2827	0.020
5	38.500	2.750	100.0000	14.5175	0.1437	14.00	0.2827	0.020
6	38.500	-2.750	100.0000	14.5175	0.1437	14.00	0.2827	0.020
7	52.000	2.750	100.0000	247.7744	6.0784	3.00	0.2827	0.060
8	52.000	-2.750	100.0000	247.7744	6.0784	3.00	0.2827	0.060

CONTRACCION
==========

Coeficiente de contraccion : 0.00087

APOYO	FX	FY	FX1	FY1
1	10.568	-1.127	10.568	-1.127
2	10.568	1.127	10.568	1.127
3	3.493	-3.274	3.493	-3.274
4	3.493	3.274	3.493	3.274
5	-3.319	-3.262	-3.319	-3.262
6	-3.319	3.262	-3.319	3.262
7	-10.742	-1.127	-10.742	-1.127
8	-10.742	1.127	-10.742	1.127

VIENTO
======

Fuerza : 29.18 tn

APOYO	FX	FY	FX1	FY1
1	0.000	1.886	0.000	1.886
2	0.000	1.886	0.000	1.886
3	0.000	5.421	0.000	5.421
4	0.000	5.421	0.000	5.421
5	0.000	5.395	0.000	5.395
6	0.000	5.395	0.000	5.395
7	0.000	1.886	0.000	1.886
8	0.000	1.886	0.000	1.886

FRENADO
=======

Fuerza : 14.10 tn

APOYO	FX	FY	FX1	FY1
1	2.307	0.000	2.307	0.000
2	2.307	0.000	2.307	0.000
3	1.274	0.000	1.274	0.000
4	1.274	0.000	1.274	0.000
5	1.164	0.000	1.164	0.000
6	1.164	0.000	1.164	0.000
7	2.307	0.000	2.307	0.000
8	2.307	0.000	2.307	0.000

PASO SUPERIOR 712+620

FUERZAS ACTUANTES SOBRE LOS APOYOS
****

Hipotesis de reaccion minima.
1.- Carga vertical minima y momento torsor asociado
2.- Momento torsor maximo y carga vertical minima asociada si es mas desfavorable
Hipotesis de reaccion maxima.
3.- Carga vertical maxima y momento torsor asociado
4.- Momento torsor maximo y carga vertical maxima asociada si es mas desfavorable

Las placas se numeran de izquierda a derecha
Unidades : tn

ESTRIBO NUMERO 1
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	42.63	42.63	121.67	39.80	143.48	75.61	143.96	62.09
2	42.63	42.63	39.80	121.67	75.61	143.48	62.09	143.96

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	10.568	3.000	0.000
	FY1	-1.127	0.000	1.886
2	FX1	10.568	3.000	0.000
	FY1	1.127	0.000	1.886

PILA NUMERO 1
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	287.08	287.08	353.99	280.91	420.74	347.66	420.74	347.66
2	287.08	287.08	280.91	353.99	347.66	420.74	347.66	420.74

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	3.493	3.000	0.000
	FY1	-3.274	0.000	5.421
2	FX1	3.493	3.000	0.000
	FY1	3.274	0.000	5.421

PILA NUMERO 2
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	287.08	287.08	353.99	280.91	420.74	347.66	420.74	347.66
2	287.08	287.08	280.91	353.99	347.66	420.74	347.66	420.74

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	3.319	3.000	0.000
	FY1	-3.262	0.000	5.395
2	FX1	3.319	3.000	0.000
	FY1	3.262	0.000	5.395

ESTRIBO NUMERO 2
==========

FUERZAS VERTICALES

PLACA	HIPOTESIS 1 IZQ.	HIPOTESIS 1 DER.	HIPOTESIS 2 IZQ.	HIPOTESIS 2 DER.	HIPOTESIS 3 IZQ.	HIPOTESIS 3 DER.	HIPOTESIS 4 IZQ.	HIPOTESIS 4 DER.
1	42.63	42.63	121.67	39.80	143.48	75.61	143.96	62.09
2	42.63	42.63	39.80	121.67	75.61	143.48	62.09	143.96

FUERZAS HORIZONTALES

PLACA		CONTRACCION	FRENADO	VIENTO
1	FX1	-10.742	3.000	0.000
	FY1	-1.127	0.000	1.886
2	FX1	-10.742	3.000	0.000
	FY1	1.127	0.000	1.886

PASO SUPERIOR 712+620

DIMENSIONAMIENTO DE LAS PLACAS DE APOYO
****

MODULOS DE ELASTICIDAD
==========

ELASTOMEROS

Instantaneo : 200.00 t/m2
Diferido : 100.00 t/m2

HORMIGON EN ESTRIBOS

Instantaneo : 3320391.54 t/m2
Diferido : 2213594.36 t/m2

HORMIGON EN PILAS

Instantaneo : 3637306.70 t/m2
Diferido : 2424871.13 t/m2

ESTRIBO NUMERO 1
==========

PLACA CIRCULAR : 600 x 115 (60 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 143.96 tn
Carga vertical minima : 39.80 tn
Fuerza horizontal maxima : 3.54 tn
Corrimientos impuestos : 2.26 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 50.92 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 14.08 Kp/cm2
Compresion media minima : 30.00 Kp/cm2
Coeficiente de rozamiento elastomero-hormigon : 0.53
Apoyo ANCLADO

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.38 < 0.50 (valido)
Acciones totales
Distorsion : 0.44 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 10.00

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 1.27 mm
Espesor considerado : 6.00 mm

6. Verificacion final

Distorsion : 1.52 < 5.00 (valido)

PILA NUMERO 1
==========

PLACA CIRCULAR : 600 x 30 (20 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 420.74 tn
Carga vertical minima : 280.91 tn
Fuerza horizontal maxima : 6.20 tn
Corrimientos impuestos : 0.34 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 148.81 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 99.35 Kp/cm2
Compresion media minima : 30.00 Kp/cm2

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.17 < 0.50 (valido)
Acciones totales
Distorsion : 0.28 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 30.00

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 4.96 mm
Espesor considerado : 5.00 mm

6. Verificacion final

Distorsion : 3.36 < 5.00 (valido)

PILA NUMERO 2
==========

PLACA CIRCULAR : 600 x 30 (20 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 420.74 tn
Carga vertical minima : 280.91 tn
Fuerza horizontal maxima : 6.17 tn
Corrimientos impuestos : 0.33 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 148.81 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 99.35 Kp/cm2
Compresion media minima : 30.00 Kp/cm2

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.16 < 0.50 (valido)
Acciones totales
Distorsion : 0.27 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 30.00

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 4.96 mm
Espesor considerado : 5.00 mm

6. Verificacion final

Distorsion : 3.36 < 5.00 (valido)

ESTRIBO NUMERO 2
==========

PLACA CIRCULAR : 600 x 115 (60 neto) mm

SOLICITACIONES Y MOVIMIENTOS.

Carga vertical maxima : 143.96 tn
Carga vertical minima : 39.80 tn
Fuerza horizontal maxima : 3.54 tn
Corrimientos impuestos : 2.29 cm

COMPROBACION.

1. Compresion maxima inferior a la compresion admisible

Compresion maxima : 50.92 Kp/cm2
Compresion admisible : 150.00 Kp/cm2

2. Seguridad al deslizamiento

Compresion minima : 14.08 Kp/cm2
Compresion media minima : 30.00 Kp/cm2
Coeficiente de rozamiento elastomero-hormigon : 0.53
Apoyo ANCLADO

3. Distorsion admisible

Acciones de larga duracion
Distorsion : 0.38 < 0.50 (valido)
Acciones totales
Distorsion : 0.44 < 0.70 (valido)

4. Estabilidad

Relacion entre menor dimension en planta y espesor neto : 10.00

5. Placas de acero de zunchado

Limite elastico del acero : 2400.00 Kp/cm2
Espesor minimo : 1.27 mm
Espesor considerado : 6.00 mm

6. Verificacion final

Distorsion : 1.53 < 5.00 (valido)

PASO SUPERIOR 712+620

APOYO	ANCHO TRAVIESA	ANCHO ALMA
ESTRIBO 1	1.00	6.80
PILA 1	1.00	6.80
PILA 2	1.00	6.80
ESTRIBO 2	1.00	6.80

PASO SUPERIOR 712+620

ARMADURA DE LAS TRAVIESAS
****

ESTRIBO 1
=========

Placas de apoyo : 2 a 5.50 m

Ancho del alma : 6.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 26.47 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura longitudinal inferior.
Momento de calculo : 363.37 mtn
Armadura necesaria : 75.59 cm2

Armadura transversal.
Cortante de calculo : 283.52 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 43.06 cm2/m

PILA 1
=======

Placas de apoyo : 2 a 5.50 m

Ancho del alma : 6.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 3.00 m

Armadura longitudinal superior.
Momento de calculo : 90.70 mtn
Armadura necesaria : 83.70 cm2
Armadura minima : 100.80 cm2

Armadura longitudinal inferior.
Momento de calculo :1280.75 mtn
Armadura necesaria : 270.03 cm2

Armadura transversal.
Cortante de calculo : 997.42 tn
Contribucion del hormigon : 284.14 tn
Armadura necesaria : 162.67 cm2/m

PILA 2
=======

Placas de apoyo : 2 a 5.50 m

Ancho del alma : 6.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 3.00 m

Armadura longitudinal superior.
Momento de calculo : 90.70 mtn
Armadura necesaria : 83.70 cm2
Armadura minima : 100.80 cm2

Armadura longitudinal inferior.
Momento de calculo :1280.75 mtn
Armadura necesaria : 270.03 cm2

Armadura transversal.
Cortante de calculo : 997.42 tn
Contribucion del hormigon : 284.14 tn
Armadura necesaria : 162.67 cm2/m

ESTRIBO 2

=========

Placas de apoyo : 2 a 5.50 m

Ancho del alma : 6.80 m
Peso del voladizo : 0.81 t/m2
Ancho de traviesa : 1.00 m

Armadura longitudinal superior.
Momento de calculo : 26.47 mtn
Armadura necesaria : 27.90 cm2
Armadura minima : 33.60 cm2

Armadura longitudinal inferior.
Momento de calculo : 363.37 mtn
Armadura necesaria : 75.59 cm2

Armadura transversal.
Cortante de calculo : 283.52 tn
Contribucion del hormigon : 94.71 tn
Armadura necesaria : 43.06 cm2/m

PASO SUPERIOR 712+620

DATOS DEL ARMADO DE FUSTES

Cuantia geometrica minima de armadura pasiva : 0.40 %

ALFA : Coeficiente de pandeo
NS : numero de secciones
R : relacion entre las areas de acero siguientes :
Tipo R.- lados mayor y menor de la base
Tipo O.- lado mayor y semicirculo de la base
Tipo C.- no existe relacion

PILA	ALFA	NS	R
1	1.20	3	0.00
2	1.20	3	0.00

No existen secciones adicionales

PASO SUPERIOR 712+620

ARMADURA DE LOS FUSTES

En la hipotesis de carga minima, las cargas permanentes estan afectadas por el coeficiente de carga favorable, y en la hipotesis de carga maxima, las cargas permanentes estan afectadas por el coeficiente de carga desfavorable

En las excentricidades esta incluido el pandeo y las excentricidades minima y accidental

Unidades. Axil : tn
Excentricidades : m

CARACTERISTICAS DE LOS MATERIALES

HORMIGON
Resistencia caracteristica : 300.00 Kp/cm2
Coeficiente de minoracion : 1.50
Coef. hormigonado vertical : 0.90
ACERO
Resistencia caracteristica : 5100.00 Kp/cm2
Coeficiente de minoracion : 1.15
Recubrimiento : 4.00 cm
ACCIONES
Coeficiente de mayoracion : 1.60

PILA NUMERO 1

FUSTE CIRCULAR

Numero de fustes : 2
Distancia entre fustes : 5.50 m
Diametro de la base : 1.10 m
Altura del fuste : 13.50 m
Coeficiente de pandeo : 1.20

SECCION A 4.50 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	259.75	0.370	0.000
2	DER	MINIMA	VIENTO	233.15	0.432	0.000
3	DER	MINIMA	CP + SC	249.88	0.378	0.000
4	DER	MINIMA	VIENTO	224.26	0.442	0.000
5	DER	MAXIMA	CP + SC	694.08	0.228	0.000
6	DER	MAXIMA	VIENTO	624.04	0.256	0.000

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 38.01 cm2
Cuantia geometrica : 0.40 %

SECCION A 9.00 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	269.38	0.553	0.000
2	DER	MINIMA	VIENTO	241.81	0.664	0.000
3	DER	MINIMA	CP + SC	259.51	0.567	0.000
4	DER	MINIMA	VIENTO	232.92	0.682	0.000
5	DER	MAXIMA	CP + SC	711.19	0.312	0.000
6	DER	MAXIMA	VIENTO	639.44	0.359	0.000

Hipotesis de calculo mas desfavorable : 5
Armadura necesaria : 53.66 cm2

Cuantia geometrica : 0.56 %

SECCION A 13.50 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	279.00	0.715	0.000
2	DER	MINIMA	VIENTO	250.47	0.874	0.000
3	DER	MINIMA	CP + SC	269.13	0.734	0.000
4	DER	MINIMA	VIENTO	241.58	0.898	0.000
5	DER	MAXIMA	CP + SC	728.30	0.383	0.000
6	DER	MAXIMA	VIENTO	654.83	0.449	0.000

Hipotesis de calculo mas desfavorable : 6
Armadura necesaria : 114.80 cm2
Cuantia geometrica : 1.21 %

PILA NUMERO 2

FUSTE CIRCULAR

Numero de fustes : 2
Distancia entre fustes : 5.50 m
Diametro de la base : 1.10 m
Altura del fuste : 14.00 m
Coeficiente de pandeo : 1.20

SECCION A 4.67 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	260.11	0.385	0.000
2	DER	MINIMA	VIENTO	233.47	0.451	0.000
3	DER	MINIMA	CP + SC	250.24	0.394	0.000
4	DER	MINIMA	VIENTO	224.59	0.462	0.000
5	DER	MAXIMA	CP + SC	694.72	0.241	0.000
6	DER	MAXIMA	VIENTO	624.61	0.271	0.000

Hipotesis de calculo mas desfavorable : 1
Armadura necesaria : 38.01 cm2
Cuantia geometrica : 0.40 %

SECCION A 9.33 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	270.09	0.571	0.000
2	DER	MINIMA	VIENTO	242.45	0.688	0.000
3	DER	MINIMA	CP + SC	260.22	0.585	0.000
4	DER	MINIMA	VIENTO	233.57	0.706	0.000
5	DER	MAXIMA	CP + SC	712.46	0.326	0.000
6	DER	MAXIMA	VIENTO	640.58	0.377	0.000

Hipotesis de calculo mas desfavorable : 5
Armadura necesaria : 62.77 cm2
Cuantia geometrica : 0.66 %

SECCION A 14.00 m DE LA BASE SUPERIOR

HIPOTESIS DE CARGA	EXTREMO CARGADO	CARGA VERTICAL	CARGA HORIZONTAL	AXIL DE CALCULO	Ex1	Ey1
1	DER	MINIMA	CP + SC	280.07	0.734	0.000
2	DER	MINIMA	VIENTO	251.43	0.900	0.000
3	DER	MINIMA	CP + SC	270.20	0.753	0.000
4	DER	MINIMA	VIENTO	242.55	0.925	0.000
5	DER	MAXIMA	CP + SC	730.20	0.399	0.000
6	DER	MAXIMA	VIENTO	656.55	0.468	0.000

Hipotesis de calculo mas desfavorable : 6
Armadura necesaria : 125.86 cm2
Cuantia geometrica : 1.32 %

PASO SUPERIOR 712+620

DATOS DE LAS ZAPATAS

HORMIGON
- Resistencia característica : 250.00 Kp/cm2
- Coeficiente de minoración : 1.50

ACERO
- Resistencia característica : 5100.00 Kp/cm2
- Coeficiente de minoración : 1.15
- Recubrimiento inferior : 0.05 m
- Recubrimiento superior : 0.05 m

TERRENO
- Tensión (coef. de punta) : 1.25
- Tensión (coef. de sismo) : 0.00
- Peso específico : 2.20 tn/m3

ACCIONES
- Coeficiente de mayoración : 1.60

HIPOTESIS DE CARGA PARA TENSIONES
Se consideran los coeficientes de simultaneidad de acciones

FISURACION
Caso numero 3

ZAPATA	TENSION ADMISIBLE (Kp/cm2)	ALTURA TIERRAS (m)	VUELO MINIMO (m)	CANTO MINIMO (m)
1	4.00	1.00	0.50	0.50
2	4.00	1.00	0.50	0.50

PASO SUPERIOR 712+620

DIMENSIONES Y ARMADURA DE LAS ZAPATAS

Se dimensiona para que la armadura de cortante no sea necesaria

CARACTERISTICAS DE LOS MATERIALES

HORMIGON
- Resistencia característica : 250.00 Kp/cm2
- Coeficiente de minoración : 1.50

ACERO
- Resistencia característica : 5100.00 Kp/cm2
- Coeficiente de minoración : 1.15
- Recubrimiento : 0.05 m

TERRENO
- Tensión (coef. de punta) : 1.25
- Peso específico : 2.20 tn/m3

ACCIONES
- Coeficiente de mayoración : 1.60

HIPOTESIS DE CARGA PARA TENSIONES
Se consideran los coeficientes de simultaneidad de acciones

FISURACION
Caso numero 3

ZAPATA NUMERO 1

Altura de tierras sobre cara superior de zapata : 1.00 m
Tensión admisible del terreno : 4.00 Kp/cm2

Canto : 1.65 m
Longitud : 8.90 m
Anchura : 3.40 m

DIMENSIONAMIENTO

Hipótesis de cálculo más desfavorable : cargas permanentes y sobrecargas

Fuerza vertical : 1019.77 tn
Excentricidad según el eje paralelo al lado menor : 19.32 cm
Excentricidad según el eje paralelo al lado mayor : 19.71 cm

Base comprimida : 100.00 %
Tensión media : 3.37 Kp/cm2
Tensión máxima : 4.97 Kp/cm2

ARMADURA

Hipótesis de cálculo más desfavorable : cargas permanentes y sobrecargas

Fuerza vertical de cálculo : 1639.20 tn
Excentricidad según el eje paralelo al lado menor : 19.23 cm
Excentricidad según el eje paralelo al lado mayor : 19.62 cm

Tensión máxima : 7.97 Kp/cm2

Armadura longitudinal.
Momento de cálculo en apoyo 1 : 100.89 mtn/m
Armadura necesaria : 24.05 cm2/m
Armadura elegida : 8 barras de 20 mm
Momento de cálculo en vano 1 :-163.11 mtn/m
Armadura necesaria : 24.05 cm2/m
Armadura elegida : 8 barras de 20 mm

ZAPATA NUMERO 2

Altura de tierras sobre cara superior de zapata : 1.00 m
Tensión admisible del terreno : 4.00 Kp/cm2

3.3. Pasos Inferiores

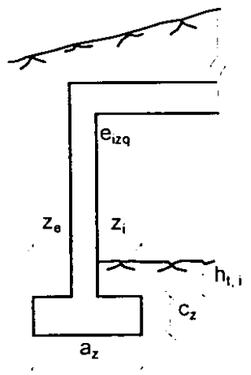
Pórtico en P.K. 701+400

CÁLCULO DE LA ZAPATA IZQUIERDA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	1,45 m
z_i =	1,35 m
e_{izq} =	0,80 m
a_z =	3,60 m
c_z =	0,80 m
$h_{t,i}$ =	1,70 m
recubrimiento de armaduras=	0,05 m

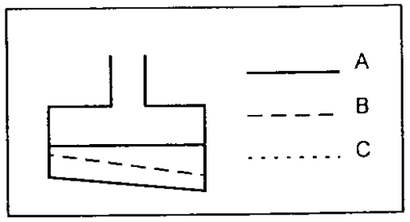


TERRENO

$(\sigma_{med})_{adm}$ =	35,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	35,0	31,5	15,9	-----
$\sigma_{máx}$ (t/m²)	43,8	37,5	24,8	-----
l_{comp} (m)		3,60	3,60	-----



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	16,9
zarpa interior	48,4	47,5

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

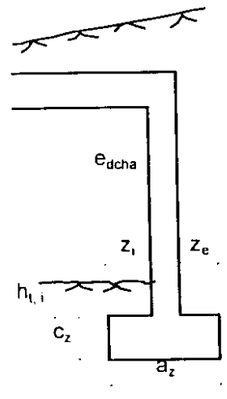
armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,150	13,4	11,3	0,00	0,34
inferior	20	0,150	20,9	16,3	0,24	0,32

CÁLCULO DE LA ZAPATA DERECHA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	1,45 m
z_i =	1,35 m
e_{dcha} =	0,80 m
a_z =	3,60 m
c_z =	0,80 m
$h_{t,i}$ =	1,70 m
recubrimiento de armaduras=	0,05 m

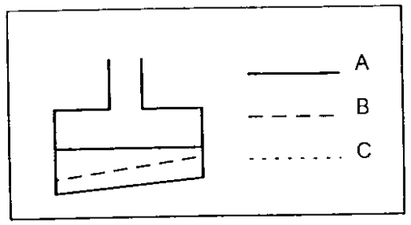


TERRENO

$(\sigma_{med})_{adm}$ =	35,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	35,0	30,7	16,4	-----
$\sigma_{máx}$ (t/m²)	43,8	36,5	25,3	-----
l_{comp} (m)		3,60	3,60	-----



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	15,9
zarpa interior	48,4	46,0

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,150	13,4	11,3	0,00	0,34
inferior	20	0,150	20,9	15,8	0,22	0,32

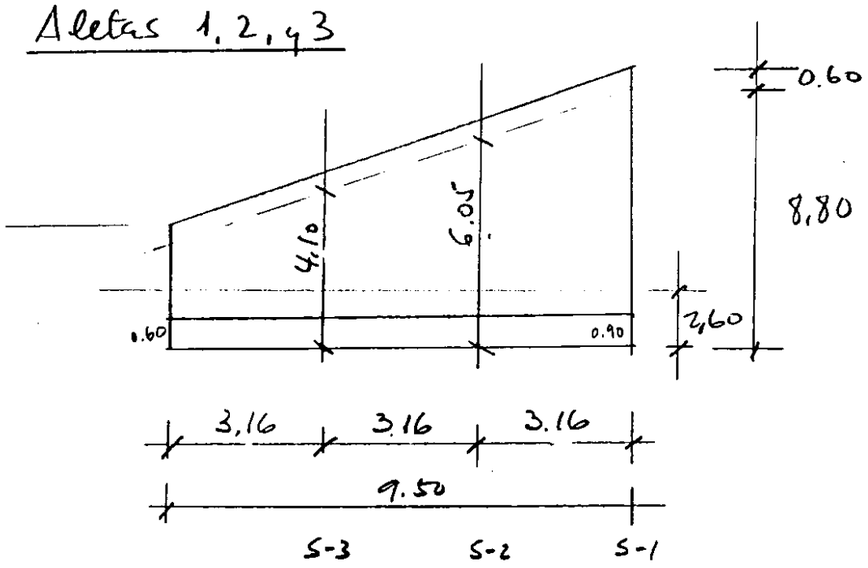
TYPSA INGENIEROS CONSULTORES Y ARQUITECTOS	PROYECTO:	Nº:
	DOCUMENTO: 6.3.1	Nº EDICION

ALETAS

Tensión admisible del terreno = 35 T/m2

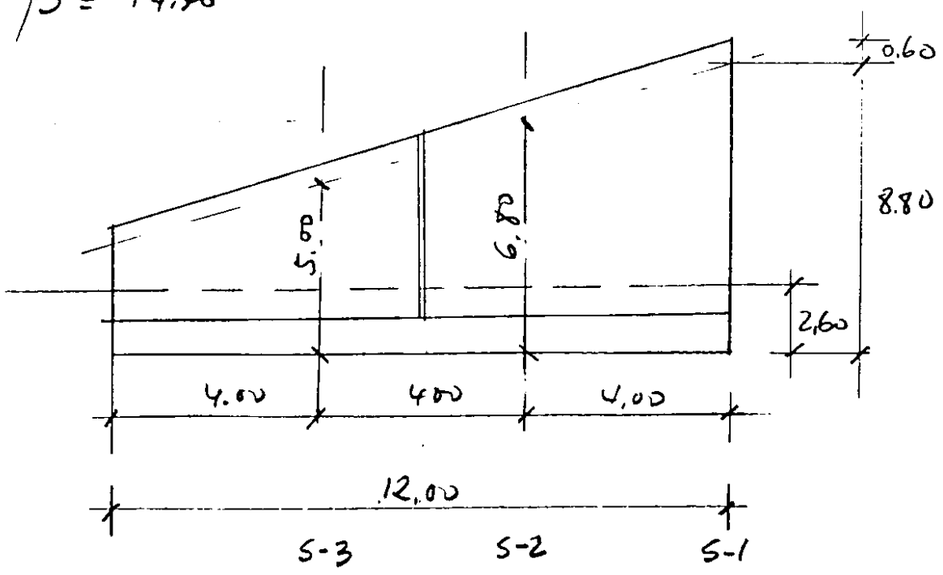
Estructura PK 701+440

Aletas 1, 2, y 3



Aleta 4

B = 14,20



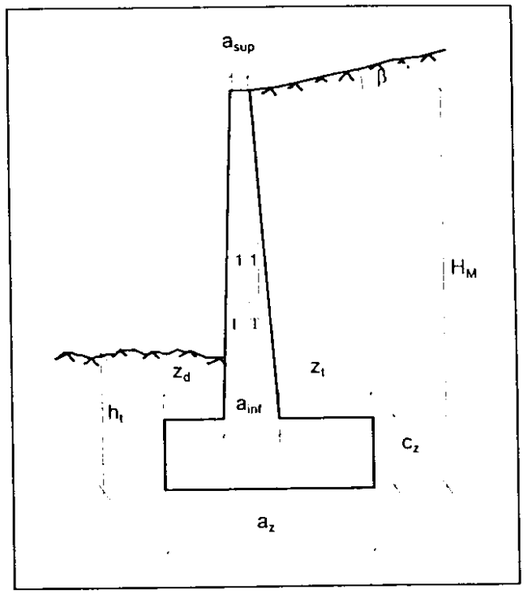
REALIZADO POR:	FECHA		COMPROBADO POR:	FECHA		HOJA	DE
	FIRMA			FIRMA			

TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 701+440 ALETAS 1 2 Y 3 S-1

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	8,80 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	4,10 m
c_Z=	0,90 m
I=	0,00
T=	0,08
a_{inf}=	0,93 m
z_d=	0,80 m
z_t=	2,37 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

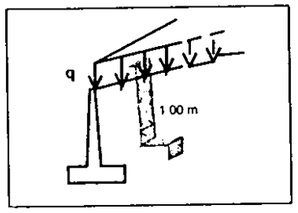
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,33 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	16,73 t/m²	$(\sigma_{med})_{adm}$ =	35,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	41,84 t/m²	$(\sigma_{máx})_{adm}$ =	43,75 t/m²	l_c = 3,28 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,53	$(\gamma_d)_{adm}$=	1,50
γ_v=	1,95	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

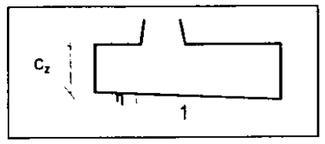
peso específico
del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

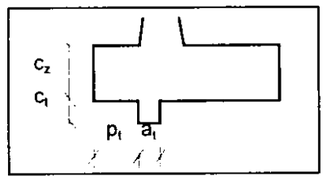
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

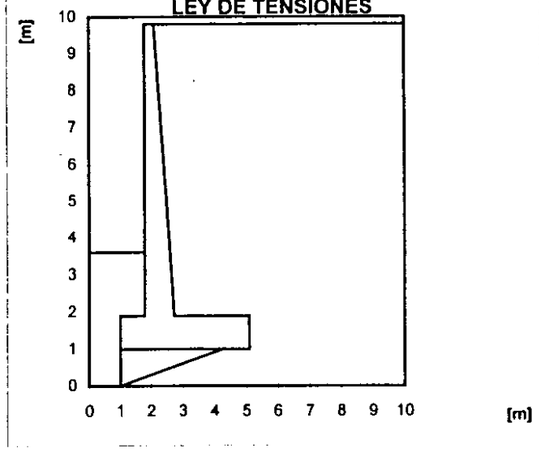
p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250
γ_c = 1,50
ACERO AEH-500
γ_s = 1,15
recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 36,31 t
Vd= 25,21 t

en zarpa trasera
Vcu= 54,87 t
Vd= 40,80 t

en base de muro
Vcu= 55,28 t
Vd= 33,88 t

CÁLCULO A FLEXIÓN DE ZAPATA

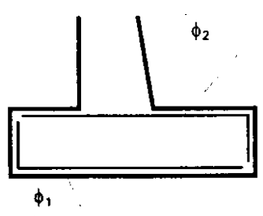
AmIn= 12,8 cm²/m.a. de armadura en tracción (cuantía mecánica)
20,2 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 28,0 mt
Anec= 7,5 cm²/m.a. por flexión

ϕ_1(mm)	20
sep(m)	0,150
Adisp	20,9 cm²/m.a.

zarpa trasera
Md= 80,4 mt
Anec= 22,1 cm²/m.a. por flexión

ϕ_2(mm)	25
sep(m)	0,150
Adisp	32,7 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II

zarpa delantera
M= 17,5 mt
w_{adm}= 0,30 mm
$w_{máx}$= mm No hay fisuración

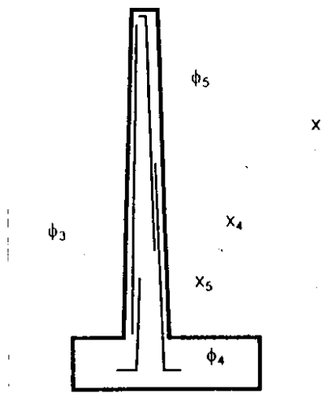
zarpa trasera
M= 50,3 mt
w_{adm}= 0,30 mm
$w_{máx}$= 0,17 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 103,9 mt
y mínimo Nd= 10,7 t Anec 21,5 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	25	20
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	32,7	cm²/m.a.

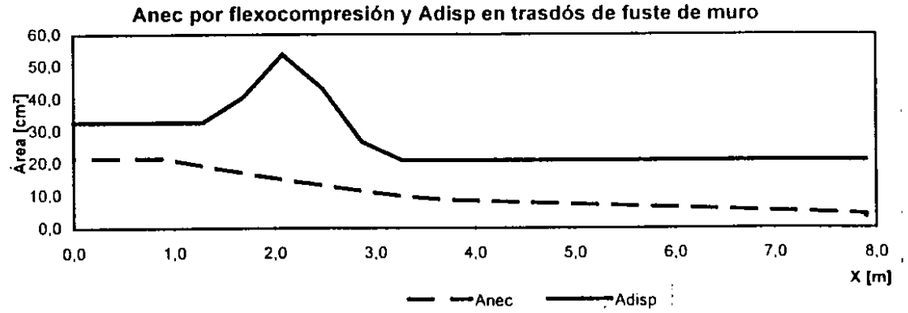
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	1,50

longitud de anclaje para ϕ_4= 0,78 m
longitud de anclaje para ϕ_5= 0,49 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



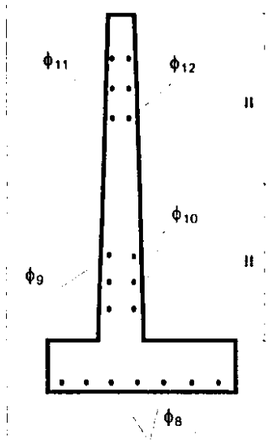
COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m
h= 0,93 m
M= 64,93 mt
N= 11,85 t
w_{adm}= 0,22 mm
$w_{máx}$= 0,23 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	6,5	14,9		9,9	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

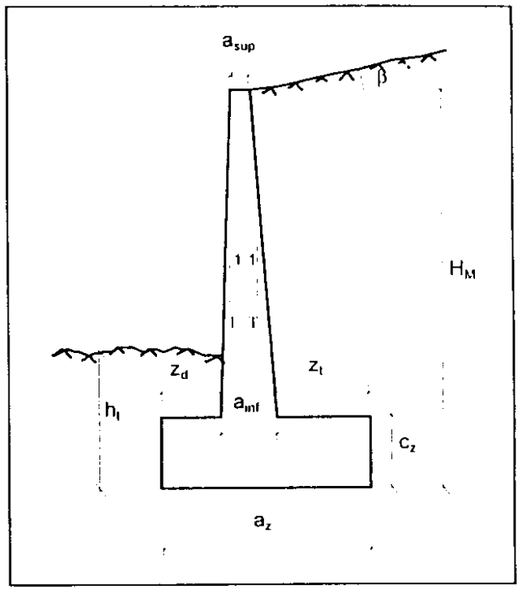
(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	6,05 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	3,00 m
c_Z=	0,80 m
I=	0,00
T=	0,08
a_{inf}=	0,72 m
z_d=	0,60 m
z_t=	1,68 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

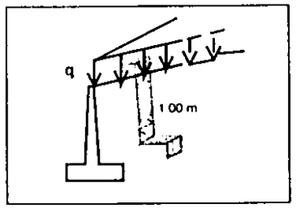
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,33 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	12,08 t/m²	$(\sigma_{med})_{adm}$ =	35,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	28,40 t/m²	$(\sigma_{máx})_{adm}$ =	43,75 t/m²	l_c = 2,55 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,63	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,14	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

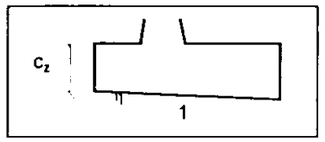
peso específico
del terreno γ_f = t/m³

SEGURIDAD AL DESLIZAMIENTO

(●) base de zapata horizontal

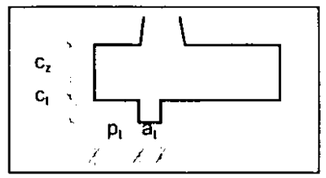
( ) base de zapata inclinada

η = 0,10



( ) zapata con tacón

p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



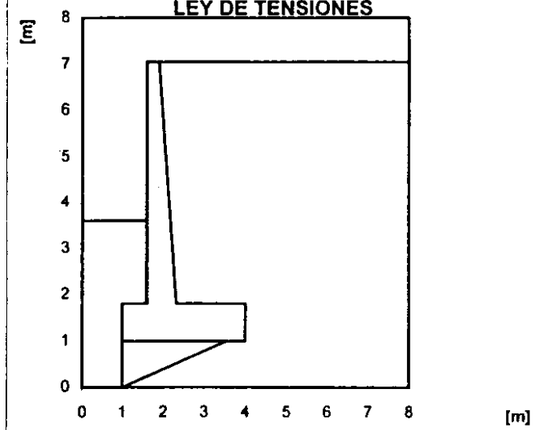
MATERIALES

HORMIGÓN H-250 ▼
γ_c = 1,50

ACERO AEH-500 ▼
γ_s = 1,15

recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 21,79 t
Vd= 9,57 t

en zarpa trasera
Vcu= 48,41 t
Vd= 17,11 t

en base de muro
Vcu= 42,14 t
Vd= 15,85 t

CÁLCULO A FLEXIÓN DE ZAPATA

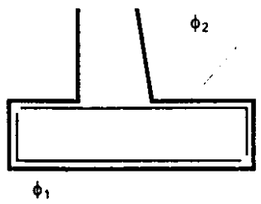
Amín= 11,3 cm²/m.a. de armadura en tracción (cuantía mecánica)
17,9 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 9,9 mt
Anec= 3,0 cm²/m.a. por flexión

ϕ_1(mm)	16 ▼
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera
Md= 27,6 mt
Anec= 8,4 cm²/m.a. por flexión

ϕ_2(mm)	16 ▼
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II ▼

zarpa delantera
M= 6,2 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

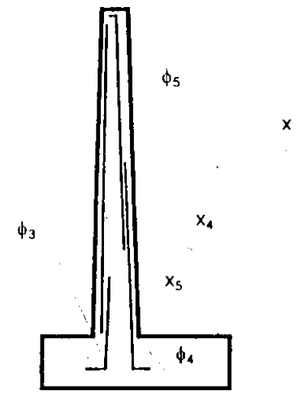
zarpa trasera
M= 17,2 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 32,9 mt
y mínimo Nd= 5,9 t Anec 8,9 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12 ▼	20 ▼	16 ▼
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	20,9	cm²/m.a.

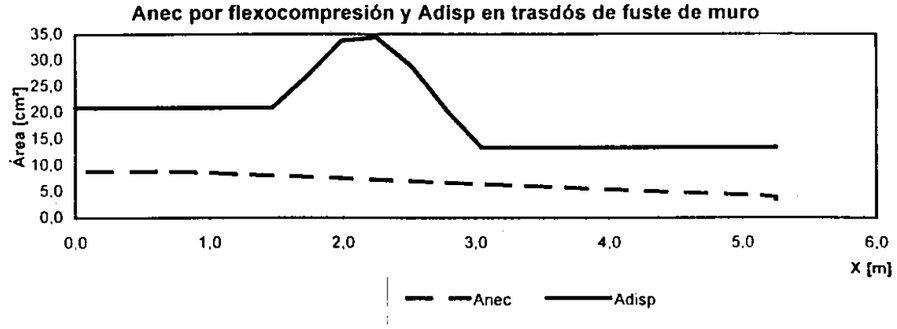
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	1,50

longitud de anclaje para ϕ_4= 0,66 m
longitud de anclaje para ϕ_5= 0,51 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



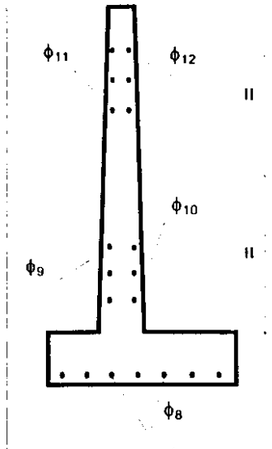
COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m
h= 0,72 m
M= 20,59 mt
N= 6,56 t
w_{adm}= 0,24 mm
$w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

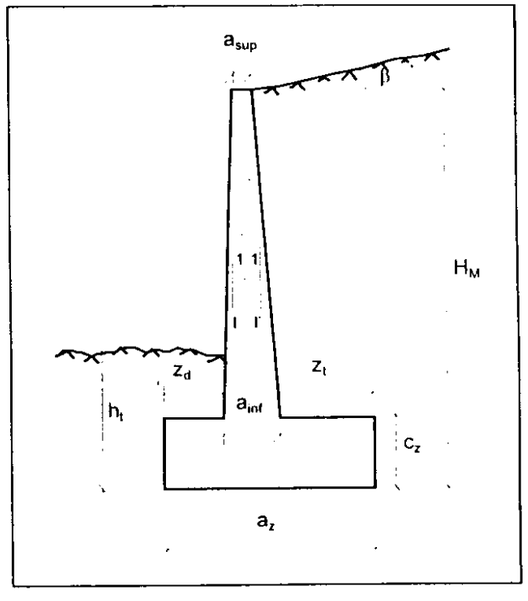
Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	5,8	11,5		8,2	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA



H_M=	4,10 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	2,20 m
c_Z=	0,80 m
I=	0,00
T=	0,08
a_{inf}=	0,56 m
z_d=	0,40 m
z_t=	1,24 m
β =	0,0 °

CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

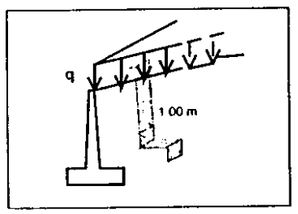
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,33 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	8,92 t/m²	$(\sigma_{med})_{adm}$ =	35,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	19,90 t/m²	$(\sigma_{máx})_{adm}$ =	43,75 t/m²	l_c = 1,97 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,80	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,41	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

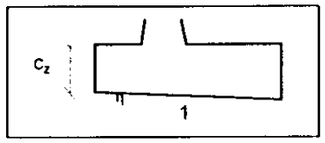
peso específico
del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

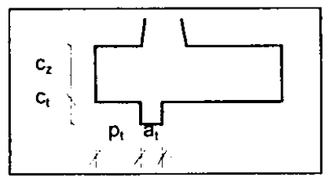
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250
γ_c = 1,50
ACERO AEH-500
γ_s = 1,15
recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

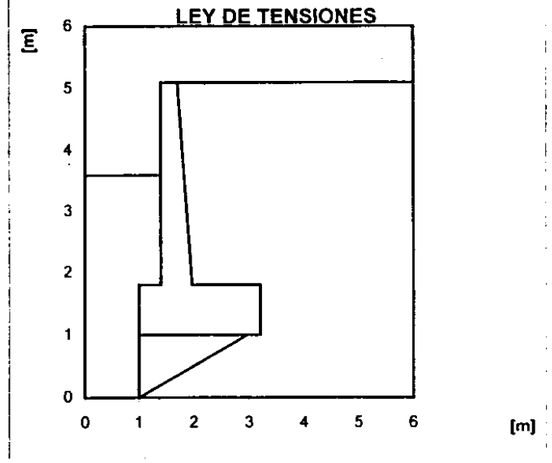
coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 2,42 t
Vd= 0,71 t

en zarpa trasera
Vcu= 48,41 t
Vd= 10,34 t

en base de muro
Vcu= 32,47 t
Vd= 6,88 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

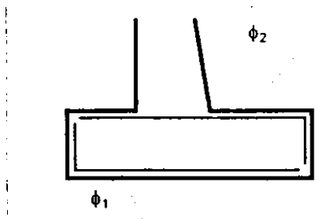
Amín= 11,3 cm²/m.a. de armadura en tracción (cuantía mecánica)
17,9 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 3,0 mt
Anec= 0,9 cm²/m.a. por flexión

ϕ_1(mm)	12
sep(m)	0,150
Adisp	7,5 cm²/m.a.

zarpa trasera
Md= 9,8 mt
Anec= 3,0 cm²/m.a. por flexión

ϕ_2(mm)	12
sep(m)	0,150
Adisp	7,5 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II

zarpa delantera
M= 1,8 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

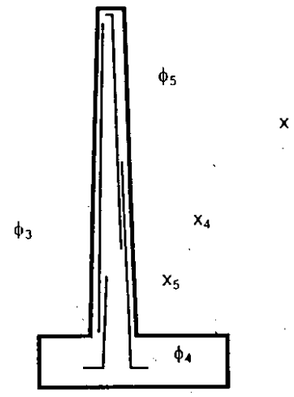
zarpa trasera
M= 6,2 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 9,3 mt
y mínimo Nd= 3,2 t Anec 6,8 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

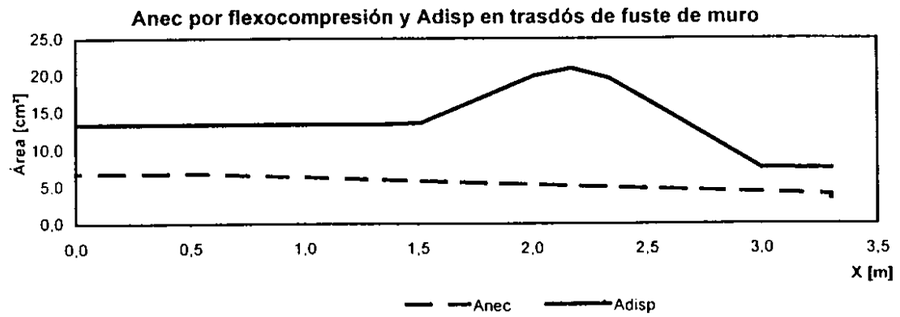
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	1,50

longitud de anclaje para ϕ_4= 0,74 m
longitud de anclaje para ϕ_5= 0,59 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



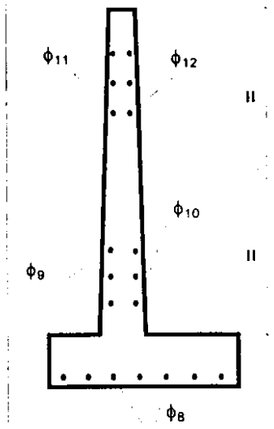
COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m
h= 0,56 m
M= 5,78 mt
N= 3,51 t
w_{adm}= 0,26 mm
w_{max}= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec[(*)] (cm²)	5,8	9,0		6,9	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

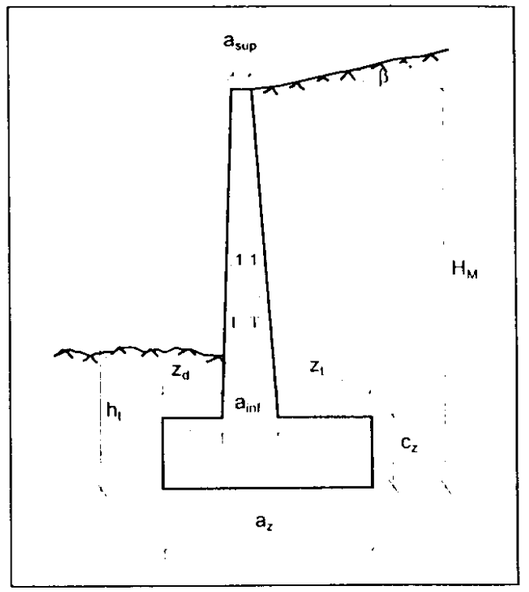
(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	8,80 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	4,70 m
c_Z=	1,00 m
I=	0,00
T=	0,09
a_{inf}=	1,00 m
z_d=	0,80 m
z_t=	2,90 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

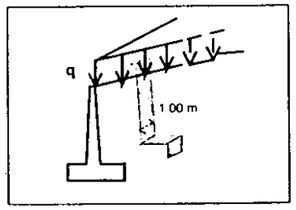
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,34 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q

	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	17,07 t/m²	$(\sigma_{med})_{adm}$ =	35,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	34,28 t/m²	$(\sigma_{máx})_{adm}$ =	43,75 t/m²	l_c = 4,68 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,78	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,58	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

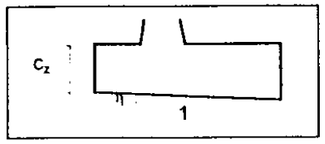
peso específico
del terreno γ_f = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

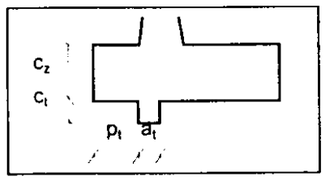
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250 ▼
γ_c = 1,50

ACERO AEH-500 ▼
γ_s = 1,15

recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

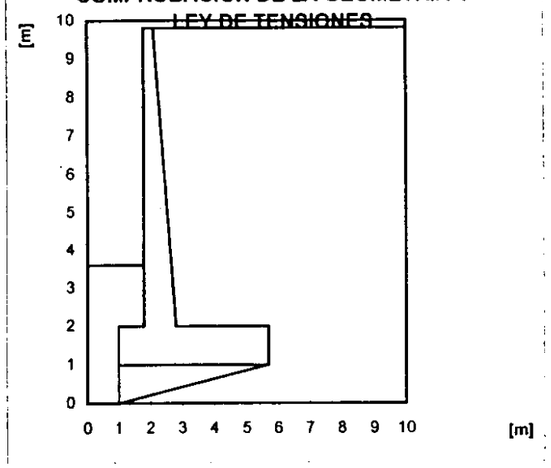
coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 31,47 t
Vd= 16,33 t

en zarpa trasera
Vcu= 61,32 t
Vd= 41,86 t

en base de muro
Vcu= 59,30 t
Vd= 33,46 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

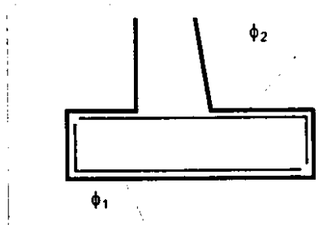
Amín= 14,3 cm²/m.a. de armadura en tracción (cuantía mecánica)
22,4 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 21,7 mt
Anec= 5,2 cm²/m.a. por flexión

ϕ_1(mm)	20 ▼
sep(m)	0,150
Adisp	20,9 cm²/m.a.

zarpa trasera
Md= 94,8 mt
Anec= 23,3 cm²/m.a. por flexión

ϕ_2(mm)	25 ▼
sep(m)	0,150
Adisp	32,7 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II ▼

zarpa delantera
M= 13,6 mt
w_{adm}= 0,30 mm
$w_{máx}$= mm No hay fisuración

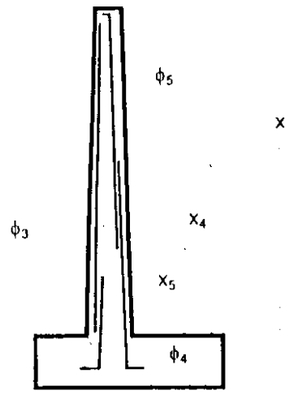
zarpa trasera
M= 59,2 mt
w_{adm}= 0,30 mm
w_{max}= 0,16 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 101,4 mt
y mínimo Nd= 11,1 t Anec 19,1 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12 ▼	25 ▼	20 ▼
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	32,7	cm²/m.a.

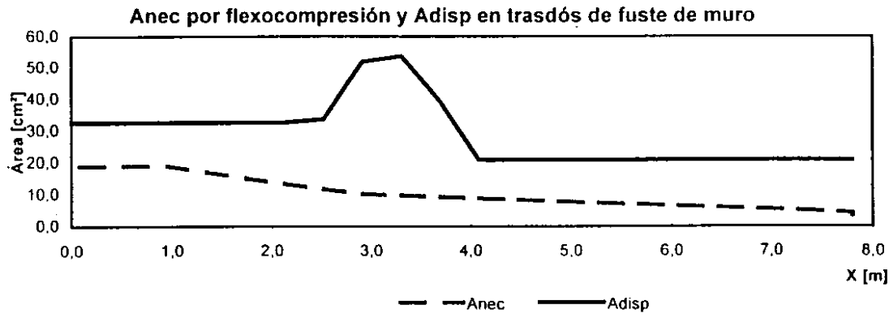
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	4,00
x_5 (m)	2,50

longitud de anclaje para ϕ_4= 0,55 m
longitud de anclaje para ϕ_5= 0,45 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

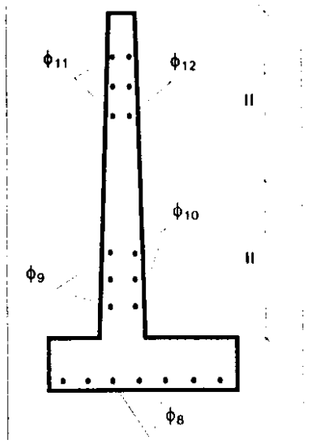
En x= 0,0 m
h= 1,00 m
M= 63,35 mt
N= 12,35 t

w_{adm}= 0,22 mm
$w_{máx}$= 0,14 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec[(*)] (cm²)	7,2	16,0		10,4	
ϕ(mm)	12	12	16	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	20,9		11,3	

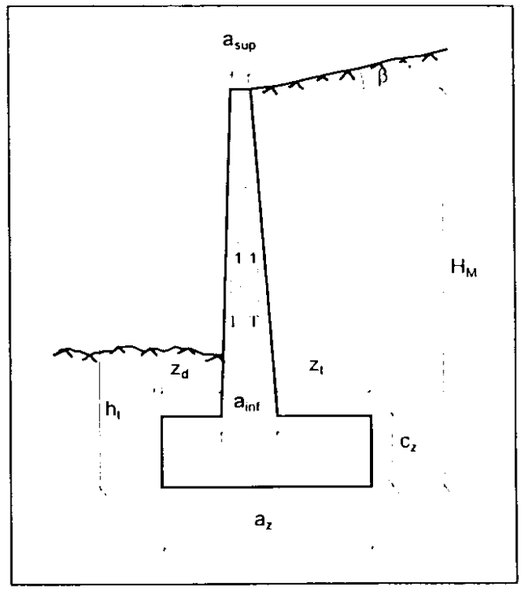
(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	6,80 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	3,70 m
c_Z=	0,80 m
I=	0,00
T=	0,08
a_{inf}=	0,78 m
z_d=	0,70 m
z_t=	2,22 m
β =	14,7 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

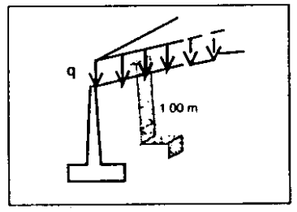
peso especifico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	35 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,40 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,36 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	13,40 t/m²	$(\sigma_{med})_{adm}$ =	35,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	30,72 t/m²	$(\sigma_{máx})_{adm}$ =	43,75 t/m²	l_c = 3,23 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,51	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,19	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

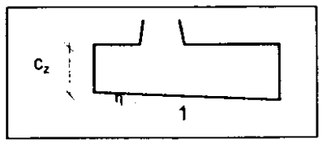
peso específico
del terreno γ_f = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

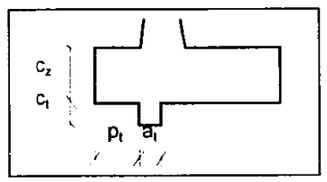
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

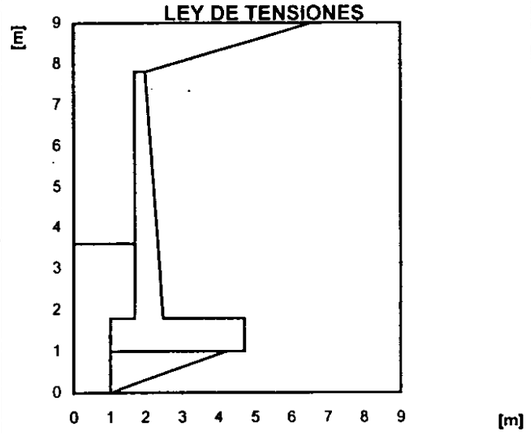
p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250 ▼
γ_c = 1,50
ACERO AEH-500 ▼
γ_s = 1,15
recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 31,47 t
Vd= 14,92 t

en zarpa trasera
Vcu= 48,41 t
Vd= 29,65 t

en base de muro
Vcu= 45,86 t
Vd= 24,30 t

CÁLCULO A FLEXIÓN DE ZAPATA

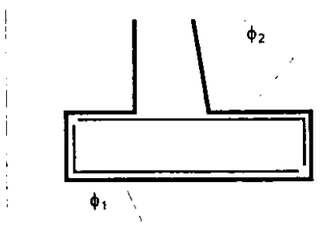
Amín= 11,3 cm²/m.a. de armadura en tracción (cuantía mecánica)
17,9 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 14,6 mt
Anec= 4,4 cm²/m.a. por flexión

ϕ_1(mm)	12 ▼
sep(m)	0,150
Adisp	7,5 cm²/m.a.

zarpa trasera
Md= 51,0 mt
Anec= 15,8 cm²/m.a. por flexión

ϕ_2(mm)	20 ▼
sep(m)	0,150
Adisp	20,9 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II ▼

zarpa delantera
M= 9,1 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

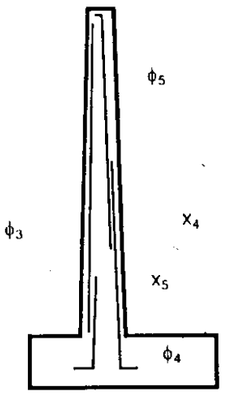
zarpa trasera
M= 31,9 mt
w_{adm}= 0,30 mm
$w_{máx}$= 0,18 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 57,4 mt
y mínimo Nd= 7,1 t Anec 14,3 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12 ▼	20 ▼	16 ▼
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	20,9	cm²/m.a.

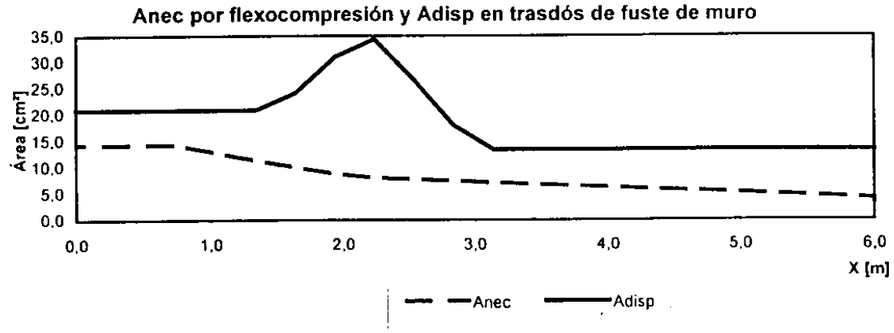
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	1,50

longitud de anclaje para ϕ_4= 0,73 m
longitud de anclaje para ϕ_5= 0,59 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



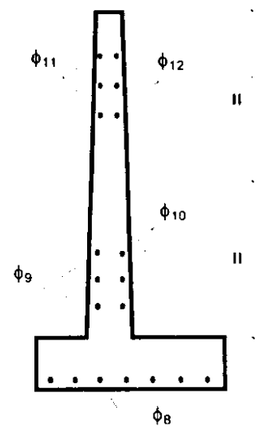
COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m
h= 0,78 m
M= 35,89 mt
N= 7,92 t
w_{adm}= 0,24 mm
$w_{máx}$= 0,17 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	5,8	12,5		8,6	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

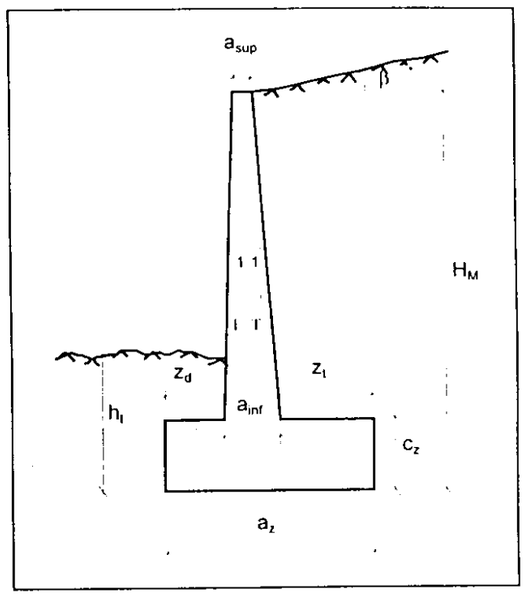
(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	5,00 m
h_t=	2,60 m
a_{sup}=	0,30 m
a_Z=	2,80 m
c_Z=	0,60 m
I=	0,00
T=	0,08
a_{inf}=	0,65 m
z_d=	0,60 m
z_t=	1,55 m
β =	14,7 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

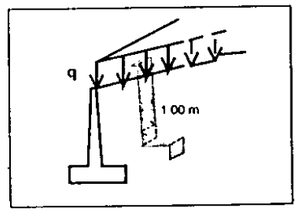
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	25 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,40 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,36 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	10,16 t/m²	$(\sigma_{med})_{adm}$ =	25,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	23,48 t/m²	$(\sigma_{máx})_{adm}$ =	31,25 t/m²	l_c = 2,42 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,53	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,22	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

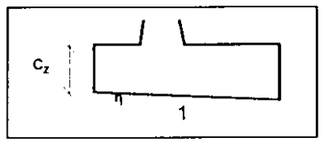
peso específico
del terreno γ_t = t/m³

SEGURIDAD AL DESLIZAMIENTO

(●) base de zapata horizontal

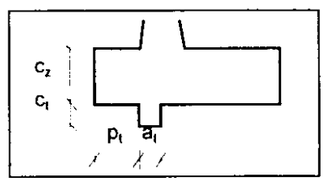
( ) base de zapata inclinada

η = 0,10



( ) zapata con tacón

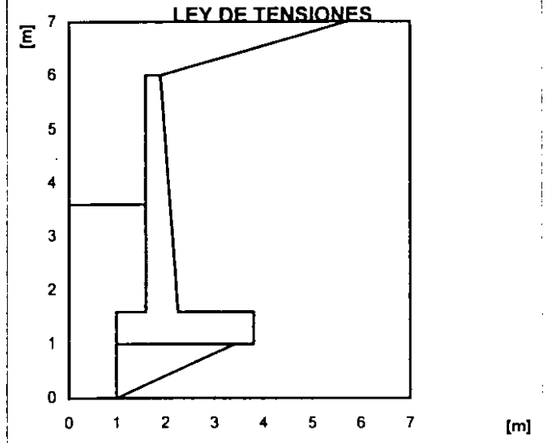
p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250
γ_c = 1,50
ACERO AEH-500
γ_s = 1,15
recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 31,47 t
Vd= 10,39 t

en zarpa trasera
Vcu= 35,50 t
Vd= 15,52 t

en base de muro
Vcu= 37,92 t
Vd= 13,80 t

CÁLCULO A FLEXIÓN DE ZAPATA

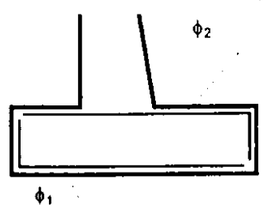
Amín= 8,3 cm²/m.a. de armadura en tracción (cuantía mecánica)
13,4 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 7,4 mt
Anec= 3,1 cm²/m.a. por flexión

ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera
Md= 19,6 mt
Anec= 8,2 cm²/m.a. por flexión

ϕ_2(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II

zarpa delantera
M= 4,6 mt
w_{adm}= 0,30 mm
$w_{máx}$= mm No hay fisuración

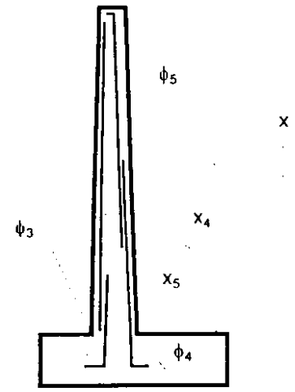
zarpa trasera
M= 12,2 mt
w_{adm}= 0,30 mm
$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 24,3 mt
y mínimo Nd= 4,6 t Anec 8,0 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

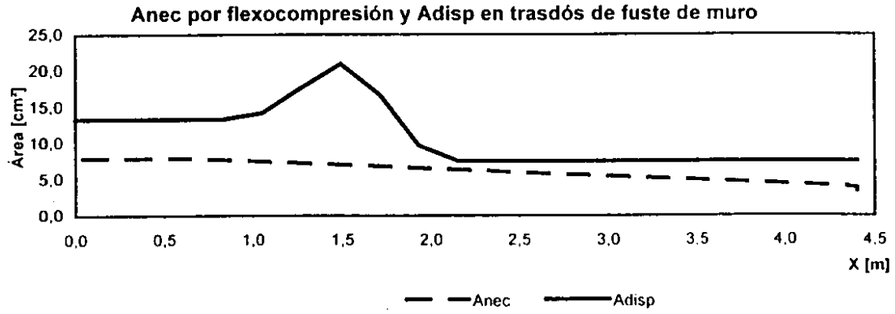
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	2,00
x_5 (m)	1,00

longitud de anclaje para ϕ_4= 0,42 m
longitud de anclaje para ϕ_5= 0,48 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

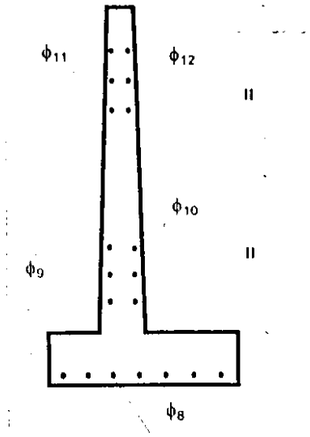
En x= 0,0 m
h= 0,65 m
M= 15,21 mt
N= 5,14 t

w_{adm}= 0,26 mm
$w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec[(*)] (cm²)	4,3	10,4		7,6	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica



Paso Inferior en P.K. 704+680

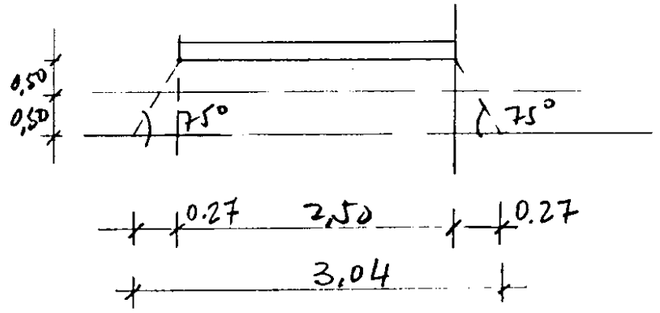
SOBRECARGA UNIFORMEMENTE REPARTIDA SEGUN EUROCODIGO

Sobrecarga sobre el dintel de 15 t/m

Peso del balasto mas vias = 3,26 t/m

Relleno 0.50 m.

La situacion de la carga repartida es:



La sobrecarga repartida será 15.00/3.04 = 4,93 t/m²

Considerando el impacto tenemos 2x 4.93 = 9.86 t/m²

Scd = 3,26 + 9.86 = 13,12 t/m²

TYPSA INGENIEROS CONSULTORES Y ARQUITECTOS
PROYECTO: — Nº
DOCUMENTO: PASO INFERIOR 704+680 — Nº EDICION.

En el tramo lateral los esfuerzos del último metro, serán resistidos con la viga de borde.

Estos esfuerzos son:

Md sup. = − 112.2 m-t. } At-est < Amin. = 29,40 cm² ϕ 6ϕ25

Md inf. = + 149.8 " }

Wk = 0.19 mm.

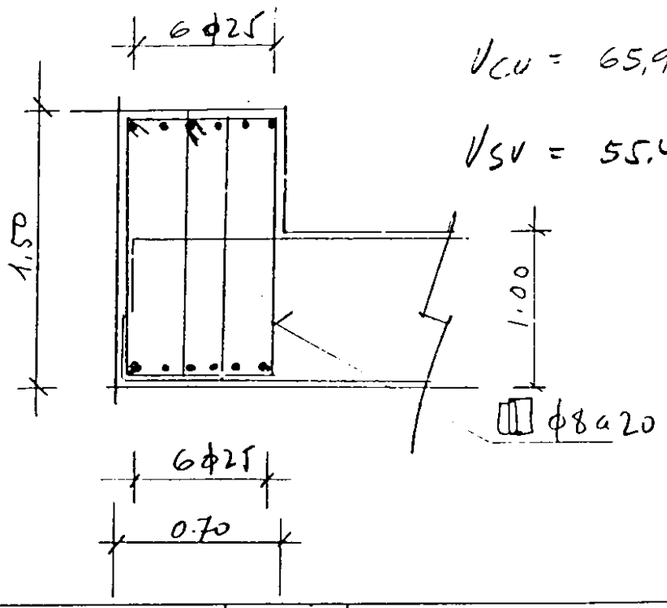
Vd = 111.2 Tn

Ag0-est = 8,61 cm²

Vu1 = 511.0 Mp

Vcu = 65,97 "

Vsu = 55.48 "



ϕ 8 a 20 (4 RAMAS)

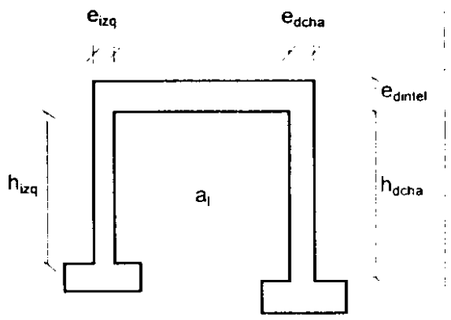
634ECCRE TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 704+680

CÁLCULO DE PÓRTICOS BAJO FERROCARRIL

GEOMETRÍA

TYPSA

a_l =	8,00 m
h_{izq} =	6,00 m
h_{dcha} =	6,00 m
e_{dintel} =	1,00 m
e_{izq} =	0,80 m
e_{dcha} =	0,80 m
longitud del pórtico =	29,50 m

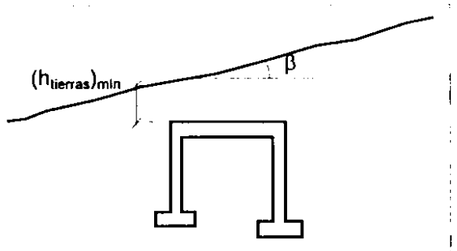


MATERIALES

HORMIGÓN | H-250 ▼

CARACTERÍSTICAS DEL RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

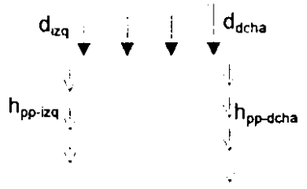
$(h_{tierras})_{mín}$ =	0,50 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m^3
$\gamma_{sumergido}$ =	1,0 t/m^3



HIPÓTESIS SIMPLES CONSIDERADAS

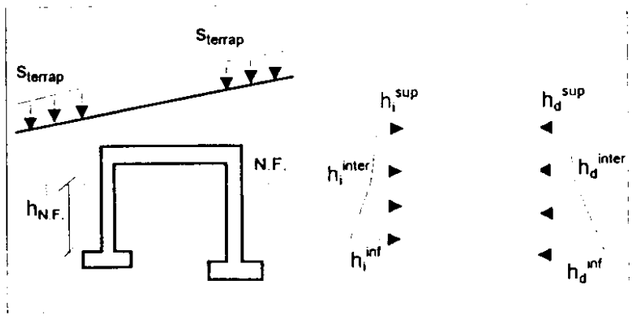
☑ PESO PROPIO DE PÓRTICO Y TIERRAS SOBRE DINTEL

d_{izq} =	3,50 t/m
d_{dcha} =	3,50 t/m
$h_{pp\text{-}izq}$ =	2,00 t/m
$h_{pp\text{-}dcha}$ =	2,00 t/m



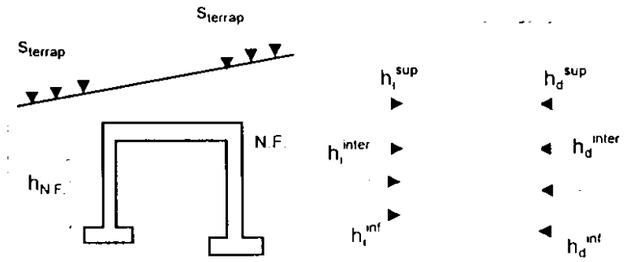
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	3,24 t/m
h_i^{inter} =	9,25 t/m
h_i^{inf} =	9,25 t/m
h_d^{sup} =	3,24 t/m
h_d^{inter} =	9,25 t/m
h_d^{inf} =	9,25 t/m



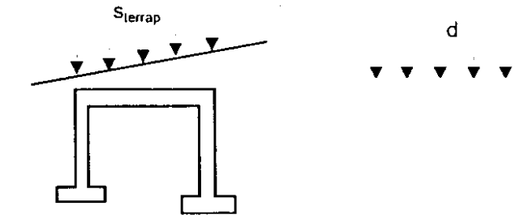
☑ EMPUJE DE TIERRAS ACTIVO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	2,11 t/m
h_i^{inter} =	6,02 t/m
h_i^{inf} =	6,02 t/m
h_d^{sup} =	2,11 t/m
h_d^{inter} =	6,02 t/m
h_d^{inf} =	6,02 t/m



☑ SOBRECARGA SOBRE DINTEL DE PÓRTICO

s_{terrap} =	13,12 t/m
d =	13,12 t/m

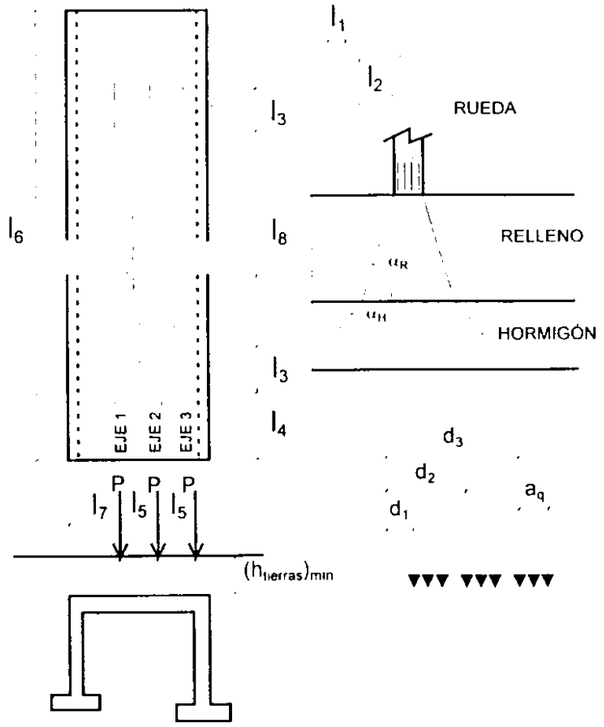


☐ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	60,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	6,50 m
l_5 =	1,60 m
l_6 =	29,50 m
a_q =	1,53 m

☑ considerar un segundo vehiculo pesado

l_8 =	3,17 m



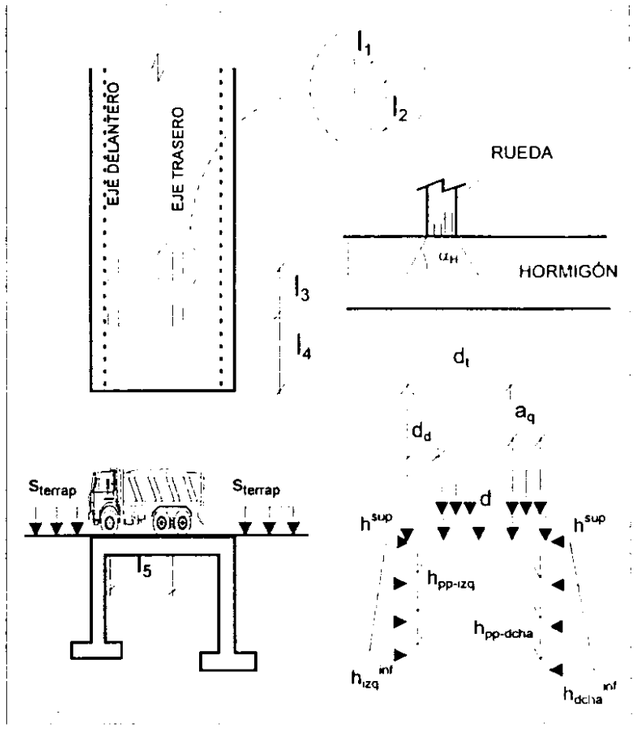
posiciones del tren y ancho eficaz de cada eje:

					ancho eficaz(m) VEHÍCULO 1			ancho eficaz(m) VEHÍCULO 2		
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	eje 1	eje 2	eje 3	eje 1	eje 2	eje 3
1	1,75	0,99	2,59	4,19	5,73	7,13	7,53	5,73	7,13	7,53
2	2,65	1,89	3,49	5,09	6,64	7,48	7,32	6,64	7,48	7,32
3	3,40	2,64	4,24	5,84	7,16	7,53	6,91	7,16	7,53	6,91

☑ HIPÓTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30^{TON} COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
s_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
h_{pp-izq} =	2,00 t/m
$h_{pp-dcha}$ =	2,00 t/m



empuje	h^{sup}(t/m)	h_{izq}^{inf}(t/m)	h_{dcha}^{inf}(t/m)
reposo	0,46	6,48	6,48
activo	0,30	4,21	4,21

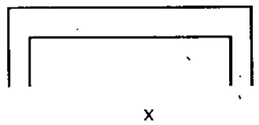
COMBINACIONES DE HIPÓTESIS SIMPLES

CREAR CUADRO DE COMBINACIONES DE HIPÓTESIS

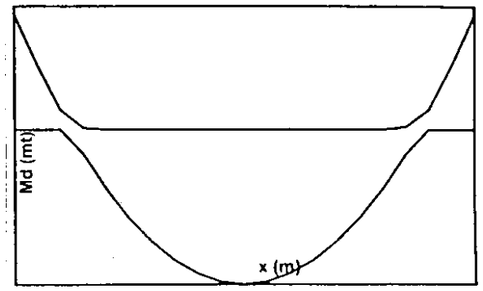
HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª						
P. P. DE PORTICO Y TIERRAS SOBRE DINTEL	1,60	1,60									
EMPUJE DE TIERRAS AL REPOSO	1,60										
EMPUJE DE TIERRAS ACTIVO		1,60									
SOBRECARGA SOBRE DINTEL DE PORTICO	1,60	1,60									
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)			1,60								
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)				1,60							

ENVOLVENTE DE ESFUERZOS

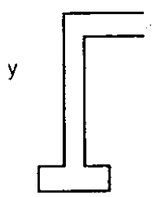
envolvente de esfuerzos en dintel



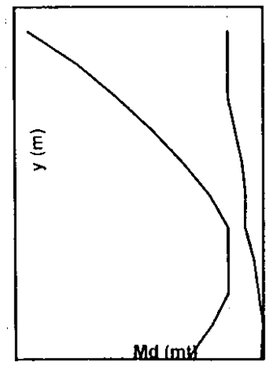
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-112,2	0,0	111,2
0,44	-63,3	0,0	99,5
0,88	-19,5	0,0	87,8
1,32	-2,2	23,6	76,1
1,76	0,0	57,1	64,4
2,20	0,0	85,4	52,7
2,64	0,0	108,6	41,0
3,08	0,0	126,6	29,3
3,52	0,0	139,5	17,5
3,96	0,0	147,2	5,8
4,40	0,0	149,8	5,8
4,84	0,0	147,2	5,8
5,28	0,0	139,5	17,5
5,72	0,0	126,6	29,2
6,16	0,0	108,6	41,0
6,60	0,0	85,4	52,7
7,04	-0,3	57,1	64,4
7,48	-2,9	23,6	76,1
7,92	-19,5	0,0	87,8
8,36	-63,3	0,0	99,5
8,80	-112,2	0,0	111,2



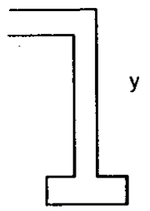
envolvente de esfuerzos en hastial izquierdo



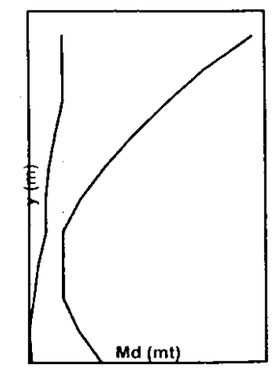
y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,3	28,5	18,3	136,8	21,2
0,65	-9,5	26,4	19,6	134,7	15,1
1,30	0,0	0,0	17,2	132,6	9,6
1,95	0,0	0,0	14,7	130,5	14,3
2,60	0,0	0,0	9,7	20,1	18,9
3,25	-10,3	126,4	10,0	18,0	23,3
3,90	-25,4	124,3	8,0	16,0	29,1
4,55	-42,9	122,2	4,0	13,9	34,4
5,20	-62,6	120,1	0,0	0,0	39,0
5,85	-84,3	118,1	0,0	0,0	43,0
6,50	-112,2	118,1	0,0	0,0	43,0



envolvente de esfuerzos en hastial derecho



y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,1	31,7	18,3	136,8	21,2
0,65	-9,3	29,6	19,7	134,7	15,1
1,30	0,0	0,0	17,2	132,6	9,6
1,95	0,0	0,0	14,7	130,5	14,3
2,60	0,0	0,0	9,9	23,4	18,9
3,25	-10,4	126,4	10,2	21,3	23,3
3,90	-25,4	124,3	8,2	19,2	29,1
4,55	-42,9	122,2	4,3	17,1	34,4
5,20	-62,6	120,1	0,0	0,0	39,0
5,85	-84,3	118,1	0,0	0,0	43,0
6,50	-112,2	118,1	0,0	0,0	43,0



634ECCRE TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 704+680

ARMADURA DE PORTICOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN H-250

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO AEH-500

γ_s = 1,15

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

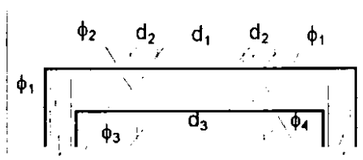
FISURACIÓN

Ambiente tipo II

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel

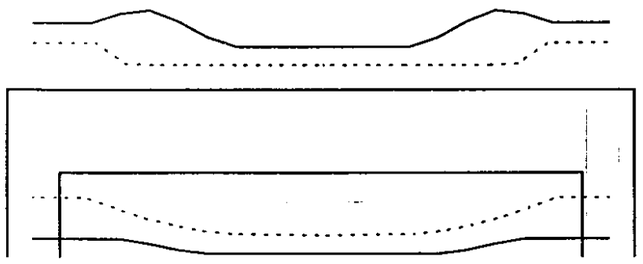


d_1 = 3,00 m

d_2 = 2,00 m

d_3 = 6,00 m

	ϕ(mm)	sep(m)
ϕ_1	25	0,125
ϕ_2	20	0,125
ϕ_3	25	0,125
ϕ_4	12	0,125



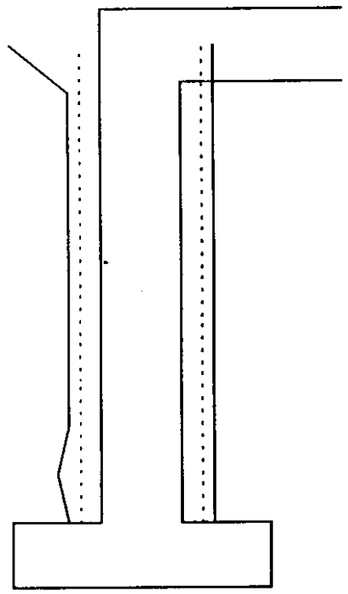
fisuración

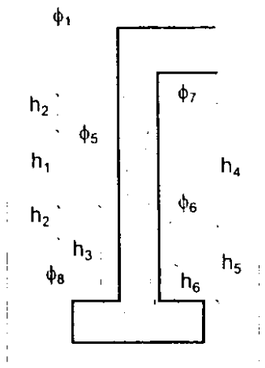
sección	$W_{máx}$ (mm)	W_{adm} (mm)
izquierda	0,18	0,22
central	0,16	0,22
derecha	0,18	0,22

armadura necesaria

armadura dispuesta

armadura en hastial izquierdo





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_5	16	0,125
ϕ_6	16	0,125
ϕ_7	0	0,125
ϕ_8	16	0,125

h_1 = 5,00 m

h_2 = 0,70 m

h_3 = 1,00 m

h_4 = 0,00 m

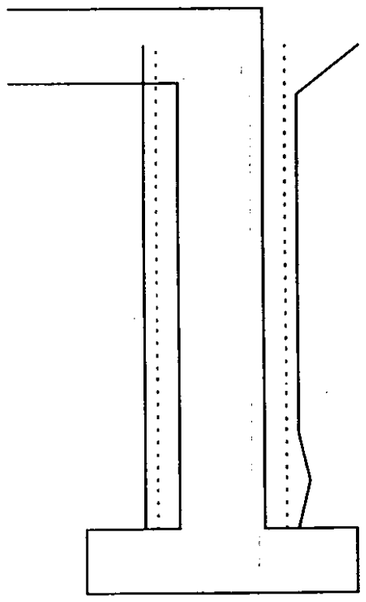
h_5 = 2,00 m

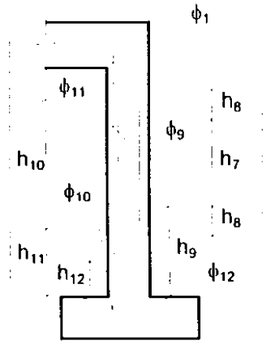
h_6 > 0,41 m

fisuración

sección	W_{max} (mm)	W_{adm} (mm)
superior	0,21	0,22
central	0,00	0,26
inferior	0,00	0,26

armadura en hastial derecho





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_9	16	0,125
ϕ_{10}	16	0,125
ϕ_{11}	0	0,125
ϕ_{12}	16	0,125

h_7 = 5,00 m

h_8 = 0,70 m

h_9 = 1,00 m

h_{10} = 0,00 m

h_{11} = 2,00 m

h_{12} > 0,41 m

fisuración

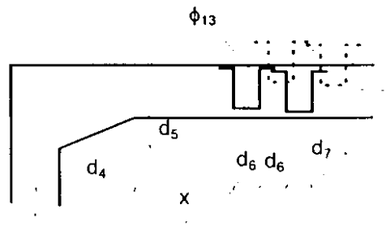
sección	$W_{máx}$ (mm)	W_{adm} (mm)
superior	0,21	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

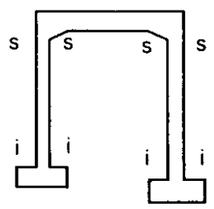
x =	1,01 m	(d = 1,01 m)
V_d =	73,7 ton	
$V_{u2} = V_{cu} + V_{su}$ =	77,2 ton	
d_4 =	0,05 m	
d_5 =	0,05 m	

ϕ_{13}(mm)	d_6	d_7
8	0,400	0,300



comprobación en hastiales

hastial	izquierdo	derecho
V_d^{s-s} (ton)	38,9	38,9
V_d^{H} (ton)	14,2	14,2
V_{cu} (ton)	49,1	49,1

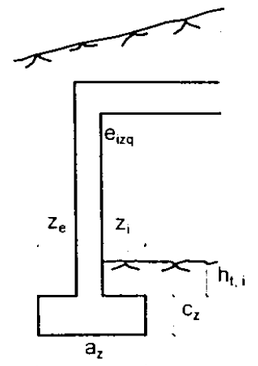


CÁLCULO DE LA ZAPATA IZQUIERDA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	0,90 m
z_i =	0,90 m
e_{izq} =	0,80 m
a_z =	2,60 m
c_z =	0,80 m
$h_{t,i}$ =	0,60 m
recubrimiento de armaduras=	0,05 m

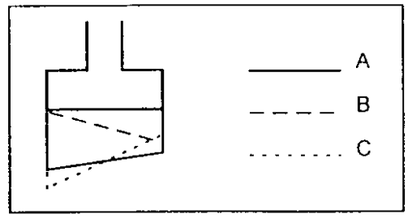


TERRENO

$(\sigma_{med})_{adm}$ =	70,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	70,0	42,2	14,4	42,2
$\sigma_{máx}$ (t/m²)	87,5	49,0	27,4	64,2
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	38,0
zarpa interior	48,4	43,2

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
armadura superior	16	0,125	16,1	11,3	0,00	0,34
armadura inferior	16	0,125	16,1	12,4	0,00	0,34

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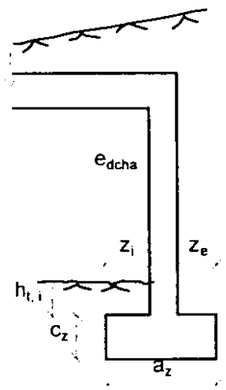
CÁLCULO DE LA ZAPATA DERECHA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	0,90 m
z_i =	0,90 m
e_{dcha} =	0,80 m
a_z =	2,60 m
c_z =	0,80 m
$h_{t,i}$ =	0,60 m
recubrimiento de armaduras=	0,05 m

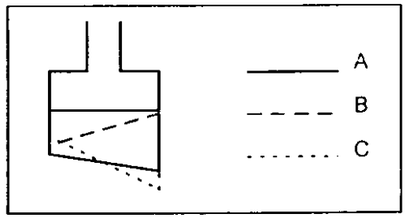


TERRENO

$(\sigma_{med})_{adm}$ =	70,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	70,0	42,2	15,2	42,2
$\sigma_{máx}$ (t/m²)	87,5	49,0	28,1	64,2
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	38,0
zarpa interior	48,4	19,8

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,125	16,1	11,3	0,00	0,34
inferior	16	0,125	16,1	12,4	0,00	0,34

SOBRECARGAS PUNTUALES S/ INSTRUCCION ESPAÑOLA

Además de las sobrecargas puntuales, lleva la sobrecarga uniforme debida al peso del balasto mas las vías de 3,26 t/m²

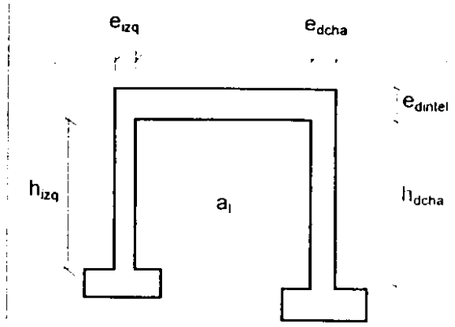
634IECPU TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 704+680

CÁLCULO DE PÓRTICOS BAJO FERROCARRIL

GEOMETRÍA

TYPSA

a_l =	8,00 m
h_{izq} =	6,00 m
h_{dcha} =	6,00 m
e_{dintel} =	1,00 m
e_{izq} =	0,80 m
e_{dcha} =	0,80 m
longitud del pórtico =	29,50 m

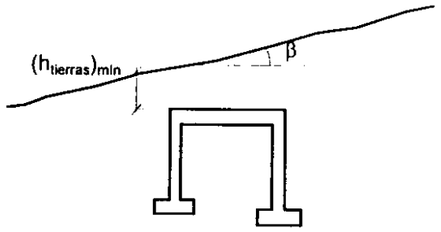


MATERIALES

HORMIGÓN | H-250

CARACTERÍSTICAS DEL RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

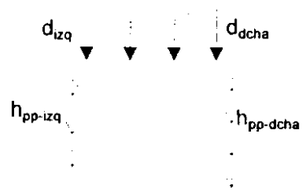
$(h_{tierras})_{min}$ =	0,50 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m^3
$\gamma_{sumergido}$ =	1,0 t/m^3



HIPÓTESIS SIMPLES CONSIDERADAS

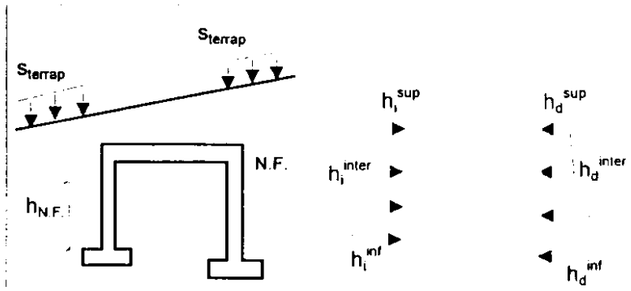
☑ PESO PROPIO DE PÓRTICO Y TIERRAS SOBRE DINTEL

d_{izq} =	3,50 t/m
d_{dcha} =	3,50 t/m
$h_{pp\text{-}izq}$ =	2,00 t/m
$h_{pp\text{-}dcha}$ =	2,00 t/m



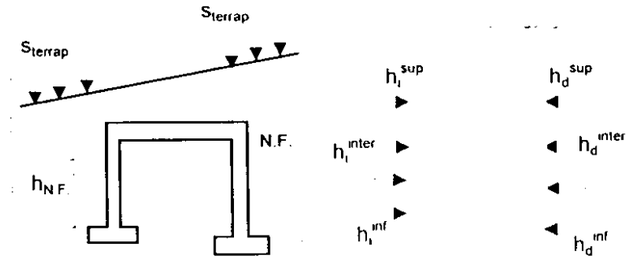
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	2,31 t/m
h_i^{inter} =	8,33 t/m
h_i^{inf} =	8,33 t/m
h_d^{sup} =	2,31 t/m
h_d^{inter} =	8,33 t/m
h_d^{inf} =	8,33 t/m



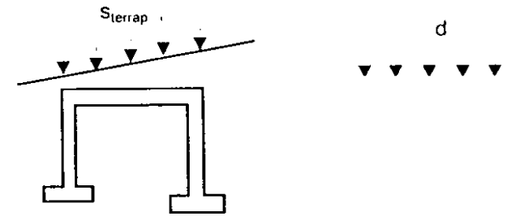
☑ EMPUJE DE TIERRAS ACTIVO

s_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	1,50 t/m
h_i^{inter} =	5,42 t/m
h_i^{inf} =	5,42 t/m
h_d^{sup} =	1,50 t/m
h_d^{inter} =	5,42 t/m
h_d^{inf} =	5,42 t/m



☑ SOBRECARGA SOBRE DINTEL DE PÓRTICO

s_{terrap} =	3,26 t/m
d =	3,26 t/m

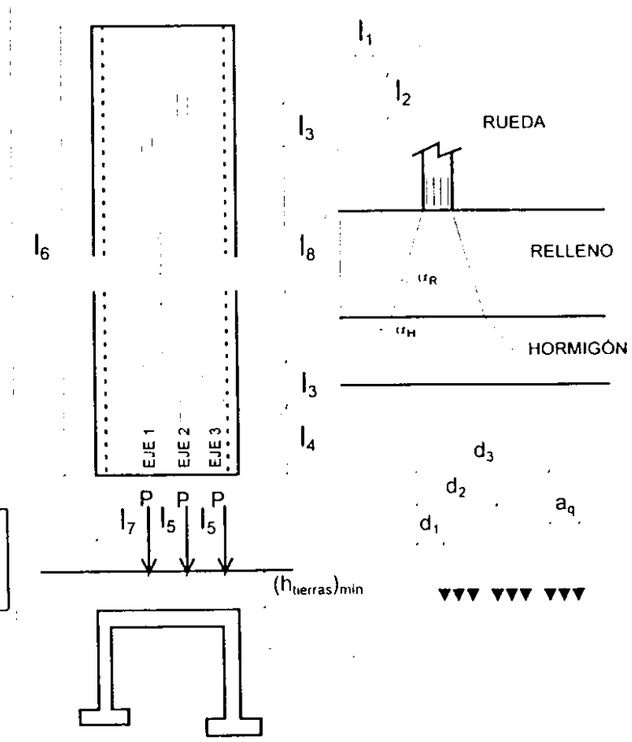


☑ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	60,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	6,00 m
l_5 =	1,60 m
l_6 =	29,50 m
a_q =	1,53 m

☑ considerar un segundo vehículo pesado

l_8 =	3,17 m



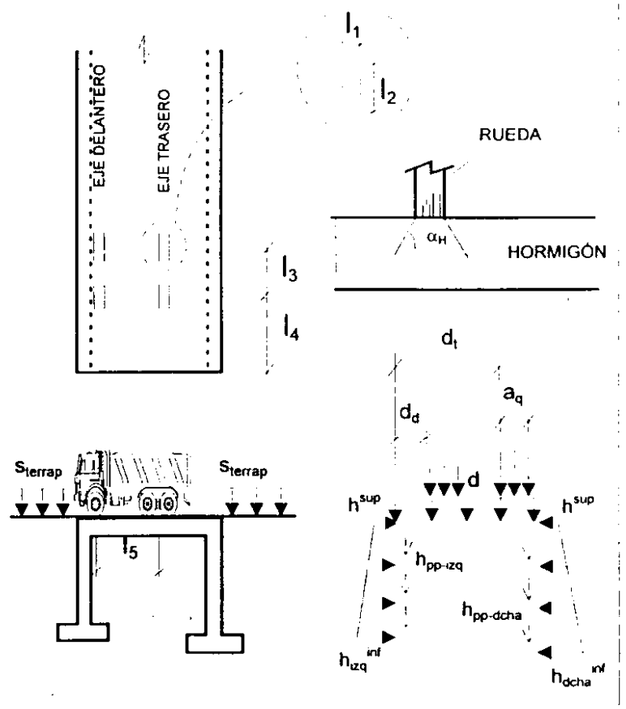
posiciones del tren y ancho eficaz de cada eje:

					ancho eficaz(m)					
					VEHÍCULO 1			VEHÍCULO 2		
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	eje 1	eje 2	eje 3	eje 1	eje 2	eje 3
1	1,75	0,99	2,59	4,19	5,73	7,13	7,53	5,73	7,13	7,53
2	2,65	1,89	3,49	5,09	6,64	7,48	7,32	6,64	7,48	7,32
3	3,40	2,64	4,24	5,84	7,16	7,53	6,91	7,16	7,53	6,91

☑ HIPÓTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30 TON COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
S_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
h_{pp-izq} =	2,00 t/m
$h_{pp-dcha}$ =	2,00 t/m



empuje	h^{sup}(t/m)	h_{izq}^{inf}(t/m)	h_{dcha}^{inf}(t/m)
reposo	0,46	6,48	6,48
activo	0,30	4,21	4,21

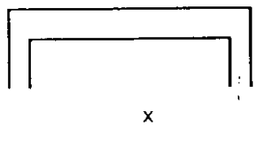
COMBINACIONES DE HIPÓTESIS SIMPLES

CREAR CUADRO DE COMBINACIONES DE HIPÓTESIS

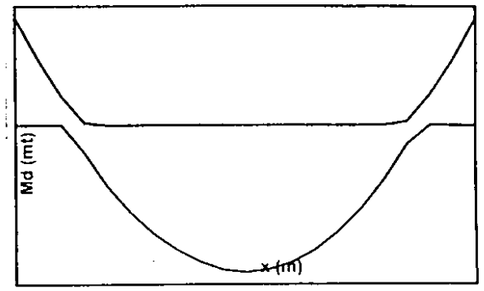
HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª	6ª	7ª	8ª	9ª		
P. P. DE PORTICO Y TIERRAS SOBRE DINTEL	1,60	1,60	1,60	1,60	1,60	1,60					
EMPUJE DE TIERRAS AL REPOSO	1,60	1,60	1,60								
EMPUJE DE TIERRAS ACTIVO				1,60	1,60	1,60					
SOBRECARGA SOBRE DINTEL DE PORTICO	1,60	1,60	1,60	1,60	1,60	1,60					
TREN DE CARGAS EN POSICIÓN 1	1,60			1,60							
TREN DE CARGAS EN POSICIÓN 2		1,60			1,60						
TREN DE CARGAS EN POSICIÓN 3			1,60			1,60					
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)							1,60				
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)								1,60			

ENVOLVENTE DE ESFUERZOS

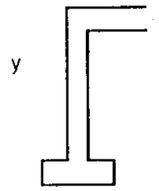
envolvente de esfuerzos en dintel



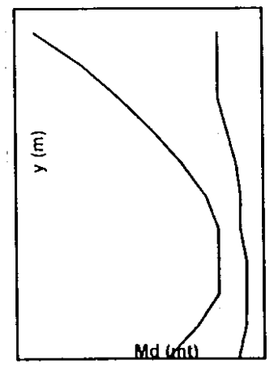
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-81,3	0,0	76,7
0,44	-50,3	0,0	72,0
0,88	-22,2	0,0	67,2
1,32	-2,2	20,0	57,3
1,76	0,0	45,1	52,6
2,20	0,0	65,7	44,8
2,64	0,0	81,8	35,3
3,08	0,0	93,7	25,7
3,52	0,0	102,7	16,2
3,96	0,0	108,8	6,6
4,40	0,0	110,8	11,0
4,84	0,0	108,7	11,0
5,28	0,0	103,4	20,4
5,72	0,0	93,9	29,8
6,16	0,0	80,4	34,5
6,60	0,0	62,5	42,8
7,04	-0,3	40,4	52,2
7,48	-2,9	14,1	59,8
7,92	-23,5	0,0	64,6
8,36	-49,9	0,0	69,3
8,80	-81,2	0,0	74,1



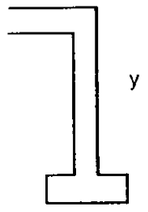
envolvente de esfuerzos en hastial izquierdo



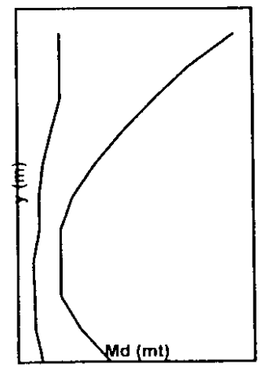
y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,3	28,5	8,5	90,7	21,2
0,65	-9,5	26,4	12,1	88,7	15,1
1,30	0,0	0,0	12,3	86,6	9,6
1,95	0,0	0,0	12,4	84,5	9,0
2,60	0,0	0,0	9,7	20,1	13,0
3,25	-5,4	88,5	10,0	18,0	16,9
3,90	-16,1	81,3	8,0	16,0	21,8
4,55	-29,0	79,2	4,0	13,9	26,0
5,20	-43,7	77,1	0,0	0,0	29,7
5,85	-60,0	75,0	0,0	0,0	32,7
6,50	-81,3	75,0	0,0	0,0	32,7



envolvente de esfuerzos en hastial derecho



y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,1	31,7	8,4	93,4	21,2
0,65	-9,3	29,6	11,9	91,3	15,1
1,30	0,0	0,0	12,3	81,1	9,6
1,95	0,0	0,0	12,9	79,0	9,0
2,60	0,0	0,0	10,0	76,9	13,0
3,25	-5,6	85,8	10,2	21,3	16,9
3,90	-16,3	83,8	8,2	19,2	21,8
4,55	-29,1	81,7	4,3	17,1	26,0
5,20	-43,8	79,6	0,0	0,0	29,7
5,85	-60,0	74,7	0,0	0,0	32,7
6,50	-81,2	74,7	0,0	0,0	32,7



634IECPU TREN DE ALTA VELOCIDAD SUBTRAMO VII. PORTICO PK 704+680

ARMADURA DE PORTICOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN | H-250 ▼

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO | AEH-500 ▼

γ_s = 1,15

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

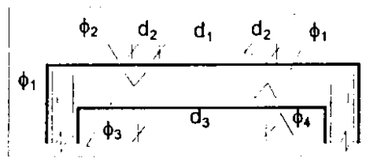
FISURACIÓN

Ambiente tipo | II ▼

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel

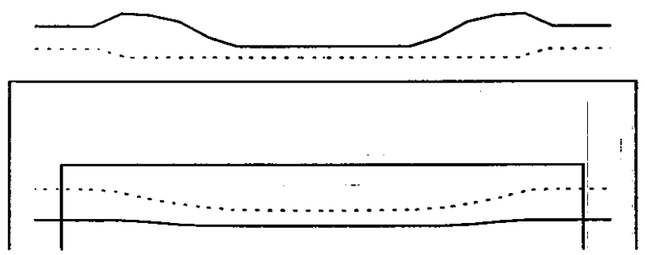


d_1 = 3,00 m

d_2 = 2,00 m

d_3 = 6,00 m

	ϕ(mm)	sep(m)
ϕ_1	25 ▼	0,150
ϕ_2	20 ▼	0,150
ϕ_3	25 ▼	0,150
ϕ_4	8 ▼	0,150



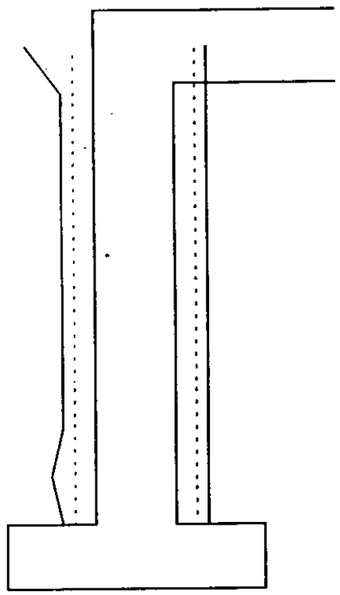
fisuración

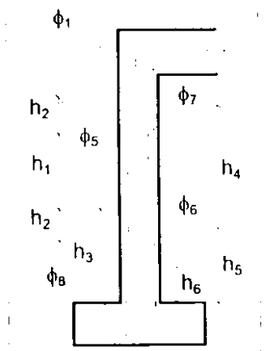
sección	$w_{máx}$ (mm)	w_{adm} (mm)
izquierda	0,12	0,22
central	0,12	0,22
derecha	0,12	0,22

armadura necesaria

armadura dispuesta

armadura en hastial izquierdo





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_5	16 ▼	0,125
ϕ_6	16 ▼	0,125
ϕ_7	0 ▼	0,125
ϕ_8	16 ▼	0,125

h_1 = 5,00 m

h_2 = 0,70 m

h_3 = 1,00 m

h_4 = 0,00 m

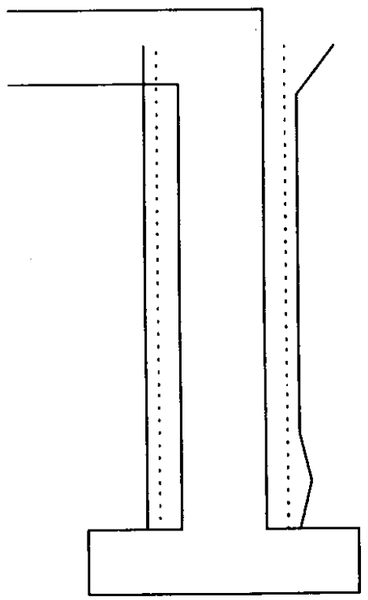
h_5 = 2,00 m

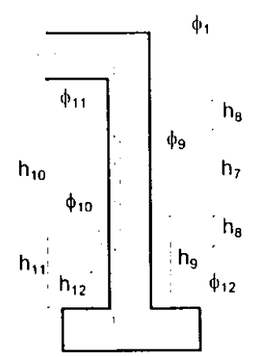
h_6 > 0,41 m

fisuración

sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,16	0,22
central	0,00	0,26
inferior	0,00	0,26

armadura en hastial derecho





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_9	16 ▼	0,125
ϕ_{10}	16 ▼	0,125
ϕ_{11}	0 ▼	0,125
ϕ_{12}	16 ▼	0,125

h_7 = 5,00 m

h_8 = 0,70 m

h_9 = 1,00 m

h_{10} = 0,00 m

h_{11} = 2,00 m

h_{12} > 0,41 m

fisuración

sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,16	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

x = 1,01 m (d = 1,01 m)

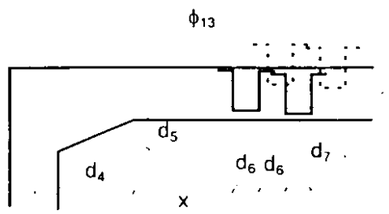
V_d = 58,3 ton

$V_{u2} = V_{cu} + V_{su}$ = 77,2 ton

d_4 = 0,05 m

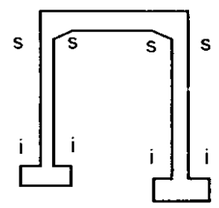
d_5 = 0,05 m

ϕ_{13}(mm)	d_6	d_7
8	0,400	0,300



comprobación en hastiales

hastial	izquierdo	derecho
V_d^{s-s} (ton)	29,7	29,7
V_d^{H} (ton)	14,2	14,2
V_{cu} (ton)	49,1	49,1



CÁLCULO DE LA ZAPATA IZQUIERDA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e = 0,90 m

z_i = 0,90 m

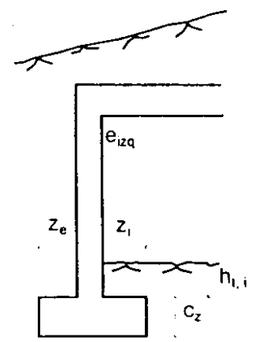
e_{izq} = 0,80 m

a_z = 2,60 m

c_z = 0,80 m

$h_{l,i}$ = 0,60 m

recubrimiento de armaduras= 0,05 m



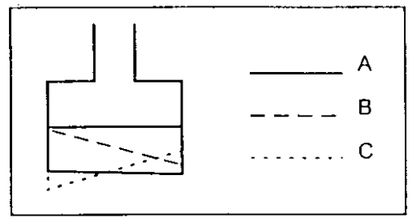
TERRENO

$(\sigma_{med})_{adm}$ = 70,00 t/m²

f_p = 1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	70,0	32,4	14,4	30,5
$\sigma_{máx}$ (t/m²)	87,5	33,7	27,4	44,1
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	23,6
zarpa interior	48,4	43,2

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,125	16,1	11,3	0,00	0,34
inferior	16	0,125	16,1	11,4	0,00	0,34

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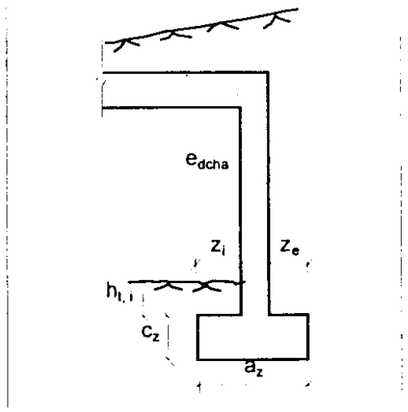
CÁLCULO DE LA ZAPATA DERECHA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	0,90 m
z_i =	0,90 m
e_{dcha} =	0,80 m
a_z =	2,60 m
c_z =	0,80 m
$h_{t,l}$ =	0,60 m
recubrimiento de armaduras=	0,05 m

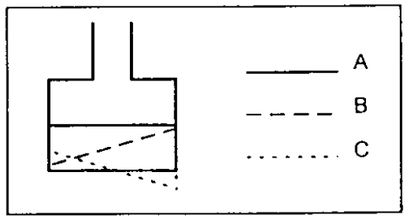


TERRENO

$(\sigma_{med})_{adm}$ =	70,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	70,0	31,8	15,2	31,1
$\sigma_{máx}$ (t/m²)	87,5	31,9	28,1	44,7
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	24,1
zarpa interior	48,4	18,7

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

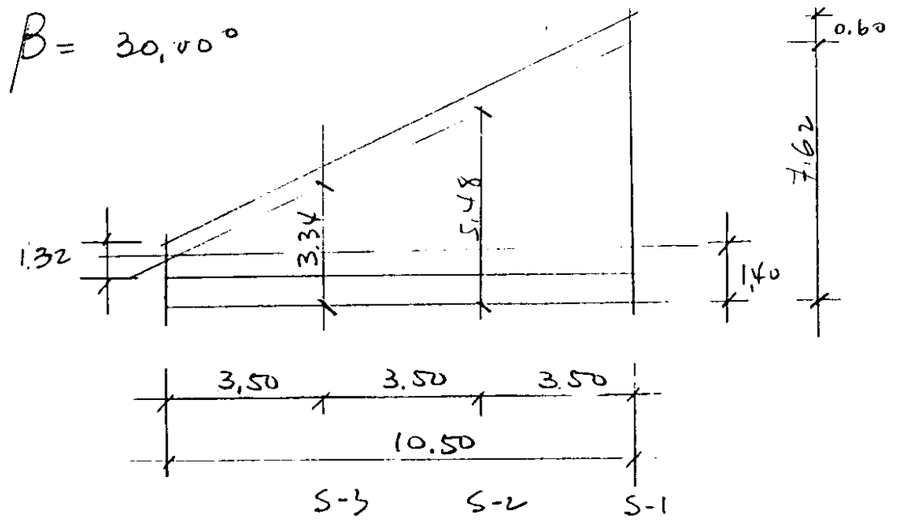
	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
armadura						
superior	16	0,125	16,1	11,3	0,00	0,34
inferior	25	0,125	39,3	11,3	0,00	0,30

ALETAS

Tensión admisible del terreno = 70 T/m.2

Estructura PK 704+680

Aletas 1 y 2

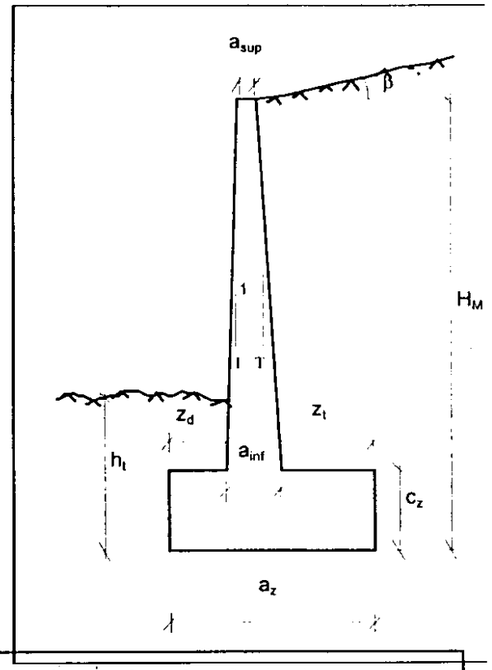


TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 704+680 ALETAS 1 Y 2 S-1

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	7,62 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_Z=	4,50 m
c_Z=	0,85 m
I=	0,00
T=	0,09
a_{inf}=	0,91 m
z_d=	0,60 m
z_t=	2,99 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

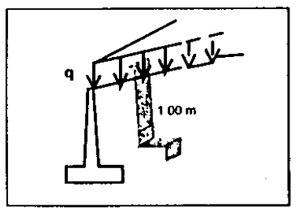
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	70 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,34 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q

	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	15,07 t/m²	$(\sigma_{med})_{adm}$ =	70,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	27,21 t/m²	$(\sigma_{máx})_{adm}$ =	87,50 t/m²	l_c =	4,50 m

DESLIZAMIENTO Y VUELCO

γ_d=	2,38	$(\gamma_d)_{adm}$=	1,50
γ_v=	3,12	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

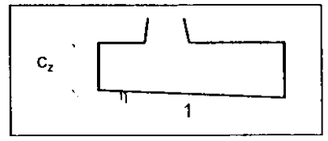
peso específico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◯ base de zapata horizontal

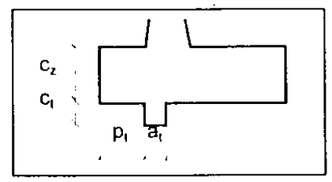
◉ base de zapata inclinada

η = 0,10



◯ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

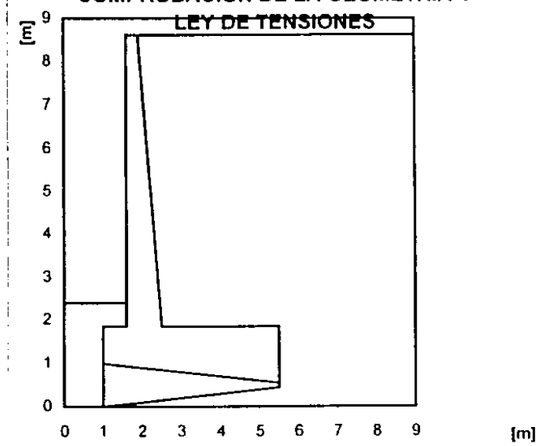
HORMIGÓN H-250 γ_c = 1,50

ACERO AEH-500 γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu=	19,36 t
Vd=	8,30 t

en zarpa trasera

Vcu=	66,55 t
Vd=	30,19 t

en base de muro

Vcu=	53,59 t
Vd=	25,66 t

CÁLCULO A FLEXIÓN DE ZAPATA

Amín= 14,1 cm²/m.a. de armadura en tracción (cuantía mecánica)

22,1 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 10,9 mt

Anec= 2,8 cm²/m.a. por flexión

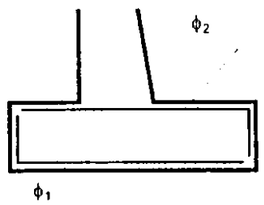
ϕ_1(mm)	20
sep(m)	0,150
Adisp	20,9 cm²/m.a.

zarpa trasera

Md= 69,7 mt

Anec= 17,2 cm²/m.a. por flexión

ϕ_2(mm)	20
sep(m)	0,150
Adisp	20,9 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo : II

zarpa delantera

M= 6,8 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 43,6 mt

w_{adm}= 0,30 mm

$w_{máx}$= 0,27 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

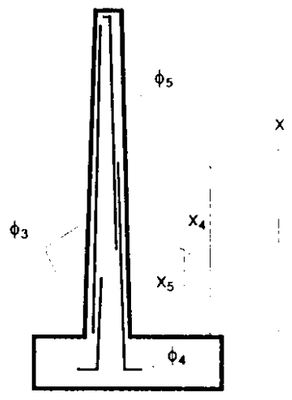
En base de alzado (x=0)

Para Md= 67,9 mt

y mínimo Nd= 9,0 t Anec 14,0 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	20	16
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	20,9	cm²/m.a.

(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base

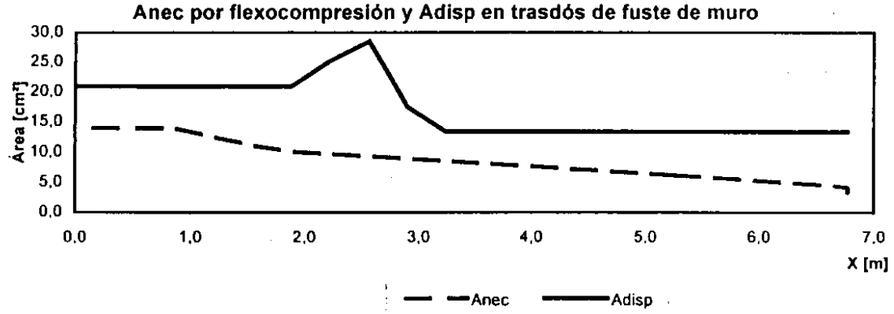


Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	2,00

longitud de anclaje para ϕ_4= 0,52 m

longitud de anclaje para ϕ_5= 0,70 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,91 m

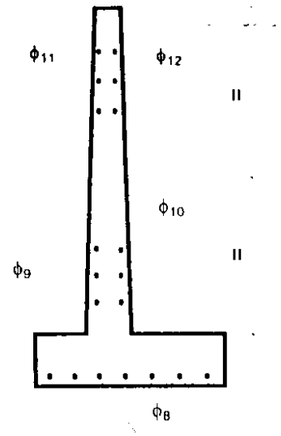
M= 42,44 mt w_{adm}= 0,24 mm

N= 9,98 t $w_{máx}$= 0,17 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*)(cm²)	6,2	14,5		9,7	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica

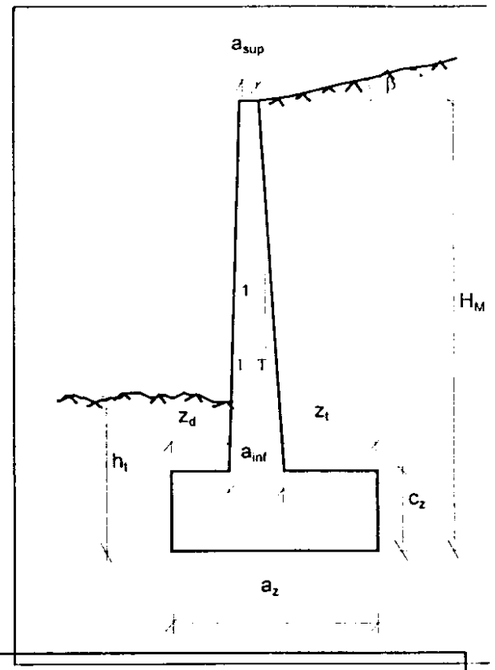


TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 704+680 ALETAS 1 Y 2 S-2

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	5,48 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_Z=	3,70 m
c_Z=	0,70 m
I=	0,00
T=	0,09
a_{inf}=	0,73 m
z_d=	0,50 m
z_t=	2,47 m
β =	30,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

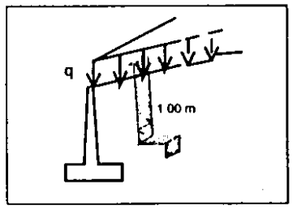
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	70 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,59 Kav = 0,05 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,52 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	11,17 t/m²	$(\sigma_{med})_{adm}$ =	70,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	25,94 t/m²	$(\sigma_{máx})_{adm}$ =	87,50 t/m²	l_c =	3,19 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,53	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,19	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

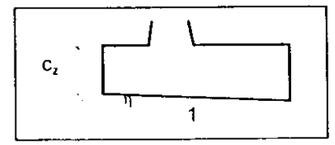
peso especifico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◯ base de zapata horizontal

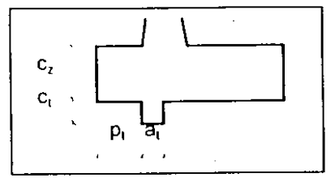
◉ base de zapata inclinada

η = 0,10



◯ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

HORMIGÓN H-250 γ_c = 1,50

ACERO AEH-500 γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu= 16,94 t

Vd= 7,81 t

en zarpa trasera

Vcu= 54,09 t

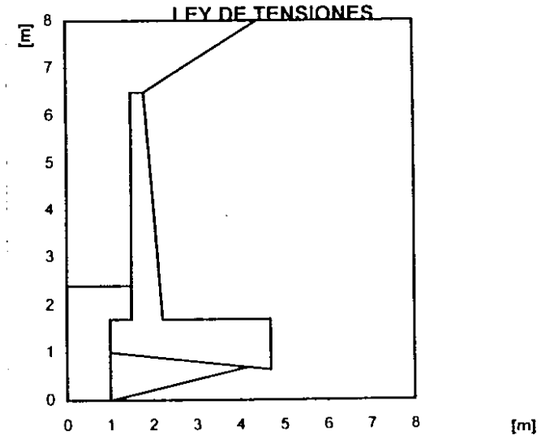
Vd= 28,07 t

en base de muro

Vcu= 42,55 t

Vd= 24,41 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

Amin= 11,5 cm²/m.a. de armadura en tracción (cuantía mecánica)

18,2 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 7,9 mt

Anec= 2,5 cm²/m.a. por flexión

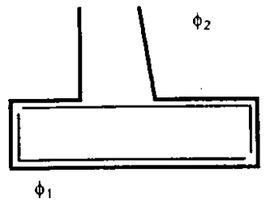
ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera

Md= 49,1 mt

Anec= 14,9 cm²/m.a. por flexión

ϕ_2(mm)	20
sep(m)	0,150
Adisp	20,9 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo | II

zarpa delantera

M= 4,9 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 30,7 mt

w_{adm}= 0,30 mm

$w_{máx}$= 0,24 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

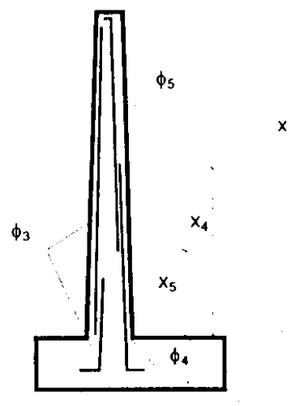
En base de alzado (x=0)

Para Md= 46,9 mt

y mínimo Nd= 5,4 t Anec 12,7 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base

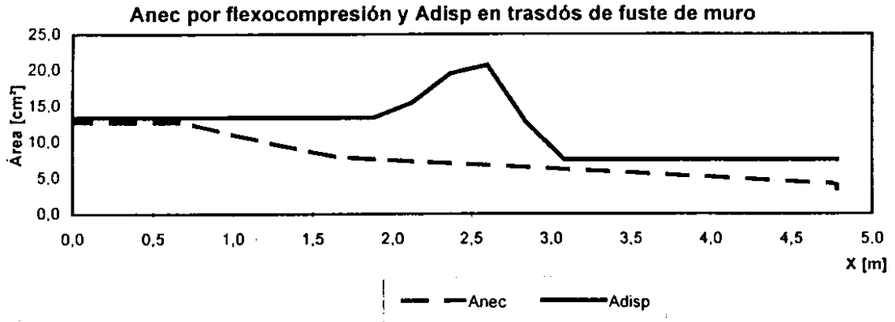


Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	2,00

longitud de anclaje para ϕ_4= 0,41 m

longitud de anclaje para ϕ_5= 0,45 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,73 m

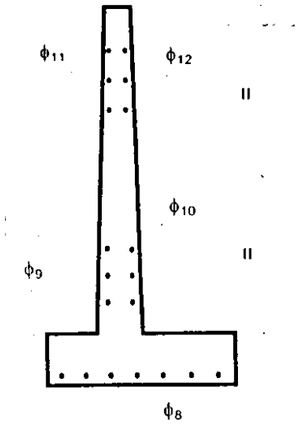
M= 29,28 mt w_{adm}= 0,26 mm

N= 6,03 t $w_{máx}$= 0,25 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	5,1	11,7		8,2	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica

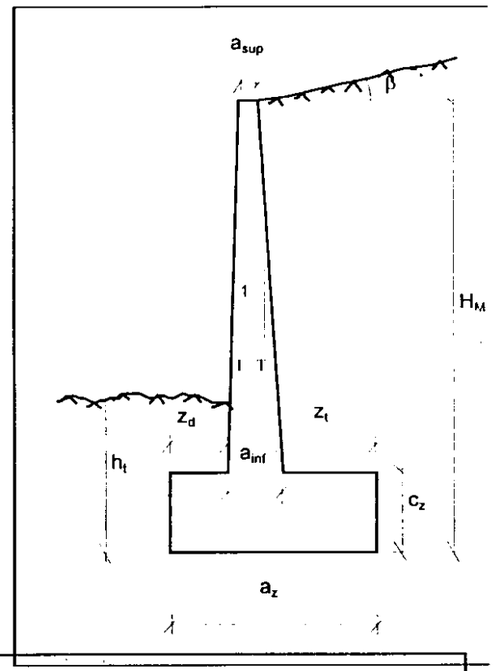


TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 704+680 ALETAS 1 Y 2 S-3

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	3,34 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_Z=	2,80 m
c_Z=	0,50 m
I=	0,00
Γ=	0,09
a_{inf}=	0,56 m
z_d=	0,50 m
z_t=	1,74 m
β =	30,0 °



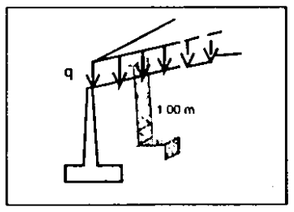
CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	70 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah =	0,59	Kav =	0,05	(Para el trasdós inclinado en agotamiento y fisuración)
Kah =	0,52	Kav =	0,00	(Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q

	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	7,06 t/m²	$(\sigma_{med})_{adm}$ =	70,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	13,22 t/m²	$(\sigma_{máx})_{adm}$ =	87,50 t/m²	l_c =	2,80 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,76	$(\gamma_d)_{adm}$=	1,50
γ_v=	3,05	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

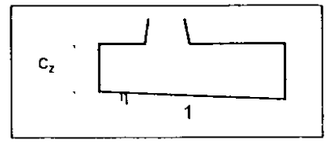
peso específico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

○ base de zapata horizontal

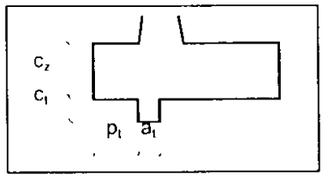
◉ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

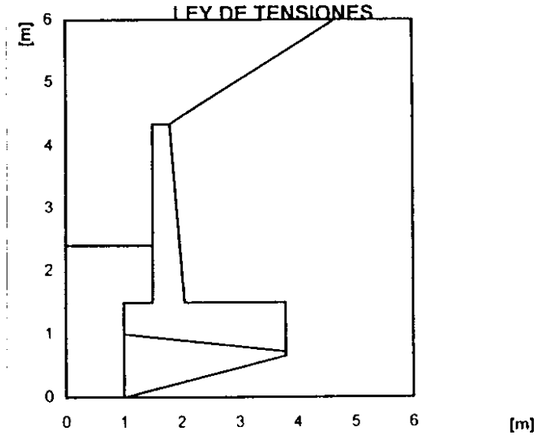
HORMIGÓN H-250 γ_c = 1,50

ACERO AEH-500 γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu=	26,63 t
Vd=	4,79 t

en zarpa trasera

Vcu=	38,77 t
Vd=	9,50 t

en base de muro

Vcu=	31,78 t
Vd=	9,81 t

CÁLCULO A FLEXIÓN DE ZAPATA

Amin= 8,2 cm²/m.a. de armadura en tracción (cuantía mecánica)

13,4 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 2,9 mt

Anec= 1,3 cm²/m.a. por flexión

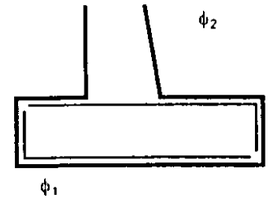
ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera

Md= 12,6 mt

Anec= 5,3 cm²/m.a. por flexión

ϕ_2(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo: II

zarpa delantera

M= 1,8 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 7,9 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

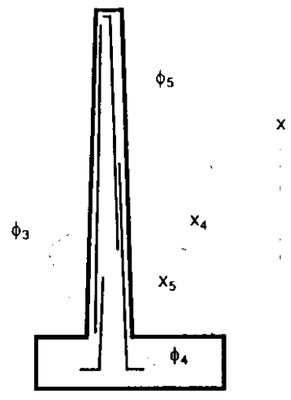
En base de alzado (x=0)

Para Md= 11,6 mt

y mínimo Nd= 2,7 t Anec 6,7 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	12	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	7,5	cm²/m.a.

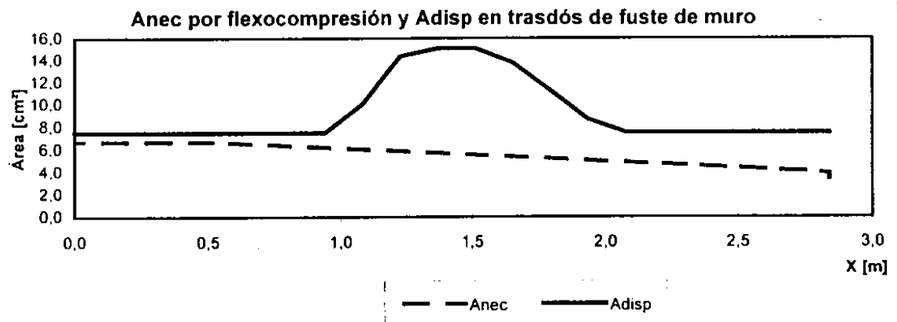
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	2,00
x_5 (m)	1,00

longitud de anclaje para ϕ_4= 0,42 m

longitud de anclaje para ϕ_5= 0,25 m



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,56 m

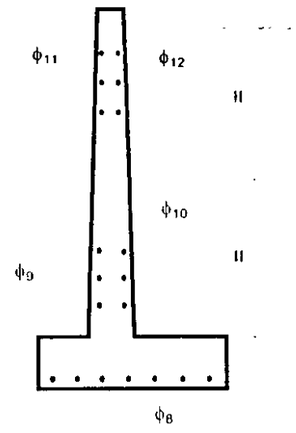
M= 7,26 mt w_{adm}= 0,27 mm

N= 2,99 t $w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	3,6	8,9		6,8	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica



Paso Inferior en P.K. 709+140

ANEJO DE CALCULOS DE TABLERO DE PUENTE PARA FERROCARRIL

1.- Programa de cálculo :

Los cálculos del tablero se han desarrollado mediante el programa **"Puente - FC"** 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
Balasto : 1,60 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 Ferrocarril" **(Orden del M.O.P. de 25 de Junio de 1.975)**

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 e intermedia , 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)
COEF. IMP. = Coeficiente de impacto.

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 = Semiancho 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 balasto, traviesas y carril.
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 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 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 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 mínima por apoyo.
COEF. 2 : Carga horizontal de frenado más hormigón en Tn/m², dividido por carga vertical máxima por apoyo.

DATOS GEOMETRICOS

Solucion ..... = 12 N- 90
Luz de Calculo .....[m] = 12.9
Intereje .....[m] = 1.19
Dis. eje V.Borde a Ex.Tablero [m] = .45

Ancho del Tablero .....[m] = 14
Ancho de Aceras .....[m] = 1.75
Ancho Eficaz [B0] .....[m] = 14.18132

Angulo de Esviaje .....[g] = 80
Espesor de la Losa .....[m] = .25
Canto Total .....[m] = 1.15
Peso Aceras y Barandilla .[Tn/ml] = .8

Ancho de Via ..... = RENFE
Numero de Vias ..... = 2
Dis. 1a. carga al eje Tablero [m] = 3.425
Espesor del Balasto .....[cm] = 60
Radio de la Curva .....[m] = 1E+15
Velocidad del Tren .....[Km/h] = 260
Peralte .....[%] = 0
Coeficiente de Impacto ..... = 1.423
Distancia entre las Vias .....[m] = 2.75

CARGAS [Tn/ml]

P1 = 0.5650
P2 = 0.7438
P3 = 1.1424
P3'= -0.8800

CARACTERISTICAS MECANICAS

[INICIALES]

VaI .... [m] = .4778
VbI .... [m] = .4222
AREA .. [m2] = .237
INERCIA [m4] = .027281

[FINALES]

VIGA No. 1

VaF ..... [m] = 0.201201
VbF ..... [m] = 0.698799
VcF ..... [m] = 0.451201
INER.FIN. [m4] = 0.067844
K (rasante)... = 1.004901

VIGA CENTRAL

Vaf ..... [m] = 0.181675
Vbf ..... [m] = 0.718324
Vcf ..... [m] = 0.431675
INER.FIN. [m4] = 0.070778
K (rasante)... = 1.031230

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REPARTO TRANSVERSAL

K (Flexion) = 1.428978
K (Torsion) = 0.384238

	C A R G A A C E R A	T R E N
Y 1	.8702054	.4830299
Y 2	-.8702054	.2376366
Y 3		-.1501976
Y 4		-.395591

COEFICIENTES EXCENTRICIDAD

Numero VIGA	C A R G A A C E R A	C A R G A T R E N
1	2.9458	.11359
2	1.94662	.55775
3	.99101	1.04986
4	.3446	1.44018
5	-.00468	1.61052
6	-.14718	1.60782
7	-.14772	1.61626
8	-.00662	1.53822
9	.34054	1.26396
10	.98418	.79794
11	1.93774	.35341
12	2.93845	-.01189

R 1 = 1 R 2 = 1

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SFUERZOS LONGITUDINALES [MTn.]

	VIGA DE BORDE]	[VIGA NO. 7]
1 =	11.7527	11.7527
2 =	13.5858	15.4709
3 =	23.7633	23.7633
3'=	-8.9872	0.4507
5 =	6.7248	95.6860

ENSIONES

ENSIONES DE FLEXION DEBIDO A LAS CARGAS EXTERIORES SIN PRETENSADO [Tn/m2]

Resumen

	EN FABRICA		EN SERVICIO			CON CARGAS MAXIMAS			
UNTO	SA	SB	SA	SB	SC	SA	SB	SC	
6.45	205.8	181.9-	538.9	667.1-	147.6	784.5	1638.2-	731.2	L/2
5.95	204.6	180.8-	535.7	663.1-	146.7	779.8	1628.4-	726.8	
5.45	200.8	177.6-	525.9	651.1-	144.1	765.6	1598.8-	713.6	
4.94	194.7	172.1-	509.8	631.0-	139.6	742.1	1549.6-	691.7	
4.44	186.0	164.4-	487.1	603.0-	133.4	709.1	1480.7-	660.9	
3.94	174.9	154.6-	457.9	566.9-	125.4	666.6	1392.1-	621.4	
3.44	161.3	142.6-	422.3	522.8-	115.7	614.8	1283.8-	573.0	
2.94	145.2	128.4-	380.2	470.7-	104.1	553.5	1155.9-	515.9	
2.44	126.6	112.0-	331.6	410.6-	90.8	482.8	1008.2-	450.0	
1.94	105.6	93.4-	276.6	342.4-	75.7	402.6	840.8-	375.3	
1.44	82.1	72.6-	215.0	266.3-	58.9	313.0	653.8-	291.8	
0.94	56.1	49.7-	147.0	182.1-	40.2	214.0	447.1-	199.5	
0.44	27.7	24.5-	72.5	89.9-	19.8	105.6	220.7-	98.4	
.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	3/8								
TRAZADO	RECTO	RECTO							N	EX
COTA->	4	86							(TN)	(Cm)
X	Num.	Num.								
6.45	11	4							246	28

No se consideran los entubados cuya longitud es menor de 0.5 metros

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ENSIONES EN DIFERENTES PUNTOS A LO LARGO DE LA VIGA [Tn/m2]

ABRICA ..... = Peso Propio + Pretensado con Perdidas a Corto Plazo
ERVICIO ..... = Cargas Permanentes + Pretensado con Perdidas Totales
ARGAS MAXIMAS = Servicio + Sobrecargas Maximas

IGA MAS DESFAVORABLE = VIGA n. 7

Resumen

UNTO	EN FABRICA SA	EN FABRICA SB	EN SERVICIO SA	EN SERVICIO SB	EN SERVICIO SC	CON CARGAS MAXIMAS SA	CON CARGAS MAXIMAS SB	CON CARGAS MAXIMAS SC	
6.45	45.4	1819.2	403.8	1018.1	147.6	649.4	47.0	731.2	L/2
5.95	44.2	1820.3	400.6	1022.1	146.7	644.7	56.8	726.8	
.45	40.4	1823.5	390.8	1034.1	144.1	630.5	86.4	713.6	
94	34.3	1829.0	374.7	1054.2	139.6	607.0	135.6	691.7	
4.44	25.6	1836.7	352.0	1082.2	133.4	574.0	204.5	660.9	
3.94	14.5	1846.5	322.8	1118.3	125.4	531.5	293.1	621.4	
3.44	0.9	1858.5	287.2	1162.4	115.7	479.7	401.4	573.0	
2.94	15.2-	1872.7	245.1	1214.5	104.1	418.4	529.3	515.9	
2.44	33.8-	1889.1	196.5	1274.6	90.8	347.7	677.0	450.0	
1.94	54.8-	1907.7	141.5	1342.8	75.7	267.5	844.4	375.3	
1.44	78.3-	1928.5	79.9	1418.9	58.9	177.9	1031.4	291.8	
0.94	104.3-	1951.4	11.9	1503.1	40.2	78.9	1238.1	199.5	
0.44	132.7-	1976.6	62.6-	1595.3	19.8	29.5-	1464.5	98.4	
0.00	160.4-	2001.1	135.1-	1685.2	0.0	135.1-	1685.2	0.0	APOYO

alculo de las tensiones con el entubado real

ESISTENCIA DE HORMIGONES [Tn/m2]

L DESTESAR .. = 3201.88
LOS 28 DIAS = 1039.23 se dispone Hormigon de 4500
N LOSA ..... = 1170.02 '' '' '' '' 2500

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ARMADURAS DE CORTANTES [EP-93]

Acero Fy ..... [Kg/cm2] >= 5100
Espesor del Alma ... [cm] = 11.0
Fct'K .....[Kg/cm2] = 264.2536
Vcuo ..... [Tn] = 10.8467
Armadura Minima..[cm2/ml] = 2.1353

ARMADURAS DE CORTANTES

PTO	X	U	URD	SIGMA	COTAG	Z	VCU	A90	Diam	S
1	0	45.61	72.99	-168.53	1.37	AB	—	10.9	10	10
2	.94	39.06	62.49	-97	1.53	AB	—	8.07	10	15
3	1.94	32.5	52	-34	1.67	AB	—	5.91	8	15
4	2.94	26.3	42.09	16.4	1.77	AB	—	4.23	8	20
5	3.94	20.46	32.74	54.2	1.84	C	1.84	4.03	8	20

S I M B O L O G I A

PTO = Punto numero
X = Distancia al apoyo en m.
U = Cortante en seccion considerada en Tn.
URD = Cortante mayorado en Tn.
SIGMA = Tension normal en fibra extrema en Kg/cm2 (Art. 48.1.3.3)
COTAG = Cotangente (Art. 48.1.2)
Z = Zona de comprobacion (Art. 48.1.3.3)
VCU = Contribucion hormigon 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 = 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	37.17	57.5	73.25	0	--	--
2	.94	31.86	49.28	48.83	.44	6	30
3	1.94	26.61	41.17	30.9	10.26	6	20
4	2.94	21.72	33.6	23.18	10.41	6	20
5	3.94	17.19	26.59	23.18	3.41	6	30

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	2.0243	-.20244
FLEXION LOCALIZADA	.66379	-.6638
T O T A L E S	2.68809	-.86622

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= 21.02877 Tn/ml se dispone 4 Φ 16 por ml
Armadura Reparto = 5.257192 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] = 15.9497
Carga Maxima en Apoyo..... [Tn] = 45.6197
Carga de Frenado en Apoyo..... [Tn] = 1.5319
Giro de Apoyo..... [Min.] = 8.5366
Des. Hori.[Retra. Fluen. Temp.] [cm]= 0.4515

=== APOYO de 150 mm X 300 mm. en Planta y 19 mm. de Altura ===

[COMPROBACION]

Tension Minima de Compresion [Kg/cm2] = 35.4437
Tension Maxima de Compresion [Kg/cm2] = 101.3772
Giro por Cargas Lentas TG ..... = 0.4515
Giro de Frenado TG..... = 0.1702
Giro Total TG..... = 0.6217
Fuerza Horizontal Carga Lenta [Kg] = 1625.4000
Coeficiente 1 = 0.1019
Coeficiente 2 = 0.0692
Giro Admisible de Apoyo .....[Min] = 45.8267

[PLACA VALIDA]

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CALCULO A ROTURA

```
Pasiva en Traccion ..... [Tn] =   0.00
Armadura Activa ........ [Tn] = 239.40
Capacidad total en traccion N.. [Tn] = 239.40
Pasiva en Compresion ..... [Tn] =   0.00
Recubrimiento Pasiva Compresion [cm] =   5.00
Zona ..................................  =   I
Ancho Eficaz ..................... [m] =   1.19
Capa Compresion ................. [cm] =  25.00
Dis. CDG Compre. a Fibra Super. [cm] =   7.10
Profundidad de Compresiones ... [cm] =  14.20
Dis. CDG Trac. a Fibra Inferior [cm] =   4.00
Canto Resistente ................ [m] =   1.04
Momento de Rotura  ( MR+ ) .. [MTn.] = 248.74
```

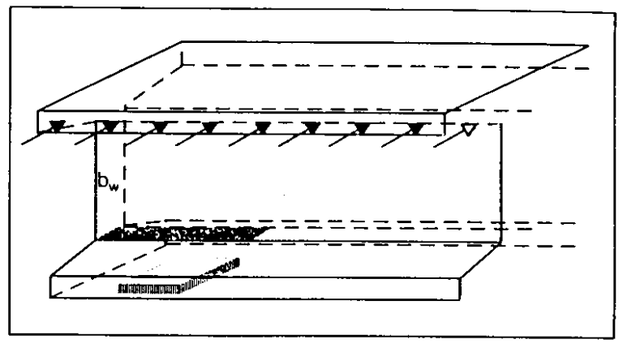
COEFICIENTE DE SEGURIDAD A ROTURA = [1.69]

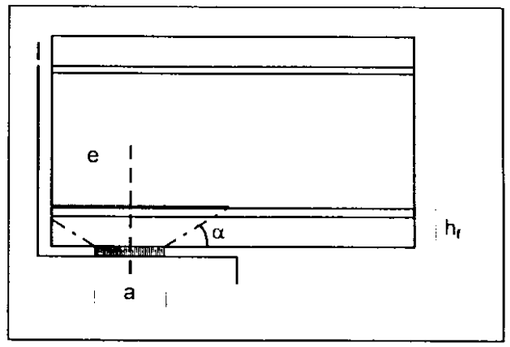
[MOMENTOS [MTn.]]

```
M1 ... =   11.752
M2 ... =   15.470
M3 ... =   23.763
M3'... =    0.450
M4 ... =    0.000
M5 ... =   95.685
M TOTAL=  147.123
```

PASO INFERIOR 709+140 AVE MADRID-ZARAGOZA

COMPROBACIÓN DE RASANTE EN ALMA DE VIGA PREFABRICADA





a=	0.20	m
h_f=	0.23	m
b_w=	0.11	m
e=	0.30	m
α=	45	°
f_{ck}=	450	kg/cm²
γ_c =	1.40	
carga de viento por apoyo H_w=	0.93	ton
γ_f =	1.44	
V_d=	1.34	ton
f_{cv}=	89.6	t/m²
V_{cu}=	6.21	ton
ξ =	1.49	
ρ_1 =	0.02	
Esfuerzo cortante de agotamiento para placas sin armadura transversal $V_{u2,a}$=	9.26	ton

PASO INFERIOR 709+140
ESTRIBOS

CÁLCULO DE CARGAS HORIZONTALES EN CABEZA DE ELEMENTOS

MATERIALES

Módulos de deformación longitudinal del hormigón:

$E_{instantáneo}$ = 3040586 t/m²

$E_{diferido}$ = 1126143 t/m²

Módulos de deformación transversal del elastómero:

$G_{instantáneo}$ = 200 t/m²

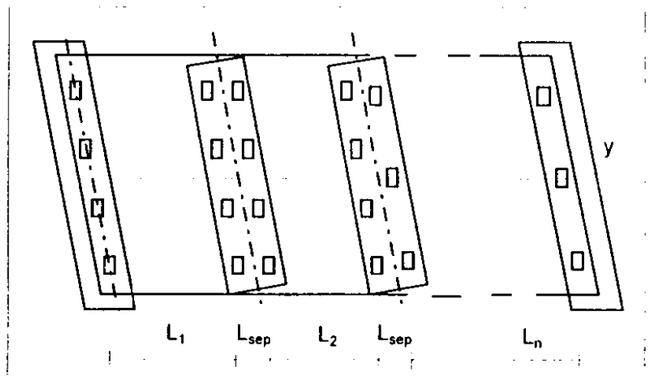
$G_{diferido}$ = 100 t/m²

GEOMETRÍA Y APOYOS

Nº de vanos= 1

L_{sep} = 0.40 m

Tipo de Apoyos
- (●) Rectangulares
- ( ) Circulares



L1
12.9m

Elemento bajo apoyos		1º	2º
Línea de apoyos			
Nº de apoyos por línea		12	12
CARACTERÍSTICAS MECÁNICAS Y GEOMÉTRICAS DEL ELEMENTO BAJO APOYOS	I_X (m⁴)	1.167	1.167
	I_Y (m⁴)	228.7	228.7
	H (m)	6.33	6.33
CARACTERÍSTICAS GEOMÉTRICAS DEL APOYO	Espesor neto (mm)	21	21
	Ancho (mm)	200	200
	Largo (mm)	250	250

CONTRACCIÓN

ε = 7.0E-04

Elemento bajo apoyos	1º	2º
Línea de apoyos		
Desplazamiento impuesto (mm)	4	-4

FRENADO

F_F = 38.5 ton

Elemento bajo apoyos	1º	2º
Línea de apoyos		
Reacción longitudinal por apoyo (ton)	1.60	1.60

COMPROBACIÓN DE APOYOS ELASTOMÉRICOS ARMADOS

MATERIALES

$G_{diferido}$ = 100 t/m²

$G_{instantáneo}$ = 200 t/m²

σ_{adm} = 150 kp/cm²

$(\tau_{H\ larga\ duración})_{adm}$ = 0.50 $G_{diferido}$

$(\tau_{H\ total})_{adm}$ = 0.70 $G_{diferido}$

$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ = 5 $G_{diferido}$, siendo:

$(\tau_{H\ larga\ duración})_{adm}$: tensión tangencial admisible para desplazamientos impuestos

$(\tau_{H\ total})_{adm}$: tensión tangencial admisible para (desplazamientos impuestos + cargas horizontales instantáneas)

$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$: tensión tangencial admisible para (cargas verticales + desplazamientos impuestos + cargas horizontales instantáneas + giros impuestos)

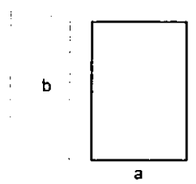
GEOMETRÍA

TIPO DE APOYO
- (●) Rectangular
- ( ) Circular

espesor neto = 21 mm

a = 200 mm (a < b)

b = 250 mm



Eje longitudinal del puente

DESPLAZAMIENTOS IMPUESTOS Y CARGAS

sismo ☐

$\delta_{longitudinal}$ = 3.8 mm

$\delta_{transversal}$ = 0.0 mm

$V_{máx}$ = 45.62 ton

V_{min} = 14.64 ton $H_{concomitante}$ = 0.00 ton

$(H_{longitudinal})_{máx}$ = 1.60 ton $(H_{transversal})_{concomitante}$ = 0.93 ton

con sismo

$V_{máx}$ = ton

V_{min} = ton $H_{concomitante}$ = ton

$(H_{longitudinal})_{máx}$ = ton $(H_{transversal})_{concomitante}$ = ton

COMPROBACIÓN DE TENSIONES NORMALES

$\sigma_{máx}$ = 91 kp/cm² σ_{adm} = 150 kp/cm²

σ_{min} = 29 kp/cm²

con sismo

$\sigma_{máx}$ = kp/cm² σ_{adm} = kp/cm²

σ_{min} = kp/cm²

COMPROBACIÓN DE SEGURIDAD AL DESLIZAMIENTO

$$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2} = 0.31 \qquad (\sigma_{mínima}\ en\ Nw/mm^2)$$

Para V_{min} se tiene $H_{concomitante}$ = 0.00 ton siendo $H_{adm} = f * V_{min}$ = 4.48 ton

con sismo

$$f = 1 - \frac{\sqrt[4]{10\sigma_{mínima} - 5}}{3.2} = \qquad (\sigma_{mínima}\ en\ Nw/mm^2)$$

Para V_{min} se tiene $H_{concomitante}$ = ton siendo $H_{adm} = f * V_{min}$ = ton

NO ES PRECISO ANCLAR EL APOYO

COMPROBACIÓN DE TENSIÓN TANGENCIAL EN EL CONTACTO NEOPRENO-CHAPA DE ACERO

TIPO DE COMPROBACIÓN

◉ simplificada : se obtiene la tensión tangencial producida sólo por la carga horizontal máxima ($H_{máx}$) y por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$)

○ completa : se obtiene la tensión tangencial producida por la carga horizontal máxima ($H_{máx}$), por los desplazamientos impuestos ($\delta_{longitudinal}$ y $\delta_{transversal}$) y por la carga vertical ($V_{concomitante}$) y los giros impuestos ($\alpha_{longitudinal}$ y $\alpha_{transversal}$) coincidentes con la carga horizontal máxima

$V_{concomitante}$ = ton

$\alpha_{longitudinal}$ = rad/1000

$\alpha_{transversal}$ = rad/1000

con sismo

$V_{concomitante}$ = ton

$\alpha_{longitudinal}$ = rad/1000

$\alpha_{transversal}$ = rad/1000

NOTA.- $\alpha_{longitudinal}$ es giro del apoyo alrededor de un eje paralelo al eje del puente y $\alpha_{transversal}$ es giro alrededor de un eje perpendicular al eje del puente

$\tau_{H\ larga\ duración}$ =	1.8 kp/cm²	$(\tau_{H\ larga\ duración})_{adm}$ =	5.0 kp/cm²
$\tau_{H\ total}$ =	3.5 kp/cm²	$(\tau_{H\ total})_{adm}$ =	7.0 kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

con sismo

$\tau_{H\ total}$ =	kp/cm²	$(\tau_{H\ total})_{adm}$ =	kp/cm²
$\tau_N + \tau_{H\ total} + \tau_{\alpha\ total}$ =	kp/cm²	$(\tau_N + \tau_{H\ total} + \tau_{\alpha\ total})_{adm}$ =	kp/cm²

COMPROBACIÓN DE ESTABILIDAD

a/10 = 20 mm

espesor neto = 21 mm

a/5 = 40 mm

SE CUMPLE LA CONDICIÓN a/10 ≤ espesor neto ≤ a/5

CÁLCULO DE REFUERZO BAJO APOYOS

APOYO DE NEOPRENO

a_0 = 0.25 m ($a_0 > b_0$)

b_0 = 0.20 m

ELEMENTO ESTRUCTURAL BAJO APOYO

m= 0.30 m

n= 1.19 m

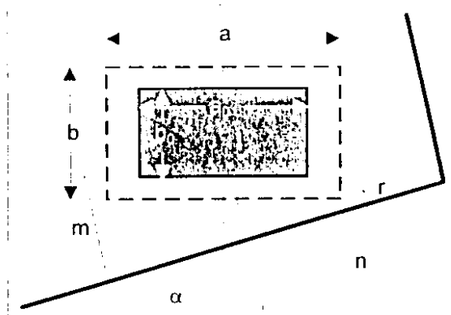
α= 89.6 g

r= 0.05 m

dimensiones del rectángulo homotético

a= 0.53 m

b= 0.42 m



AXIL

N= 45.62 ton

γ_f= 1.6

MATERIALES

f_{ck}= 250 kp/cm²

f_{yk}= 5100 kp/cm²

γ_s= 1.15

TENSIÓN MÁXIMA DE TRACCIÓN

$\sigma_{máx}$= 48.7 t/m²

$f_{ct,k}$ / 2= 89.3 t/m²

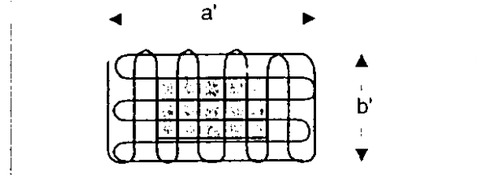
ARMADURA NECESARIA

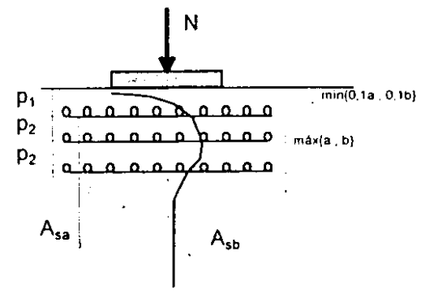
$(A_{sa})_{nec} = (A_{sb})_{nec}$ = 2.6 cm²

GEOMETRIA REFUERZO

mín{ 0.1a , 0.1b }= 0.04 m

máx{ a, b }= 0.53 m





ARMADURA DISPUESTA

número de parrillas= 2

p_1 = 0.10 m

p_2 = 0.15 m

PARALELA A "a" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	b' (m)	b (m)
6	8	0.10	b'>b	0.42

Total $(A_{sa})_{disp}$= 6.0cm²

PARALELA A "b" EN CADA PARRILLA

nº	Ø(mm)	sep.(m)	a' (m)	a (m)
6	8	0.10	0.50	0.53

Total $(A_{sb})_{disp}$= 6.0cm²

ACCIONES EN ESTRIBOS Y CÁLCULO DE PLACAS

ACCIONES VERTICALES MÁXIMAS Y MÍNIMAS POR APOYO

p.p. de viga=	0.57	t/m
p.p. de losa de compresión=	0.63	t/m²
p.p. de aceras y barandilla=	0.80	t/m por cada acera
entrega de viga=	0.35	m
luz entre apoyos de la viga=	12.90	m
nº de vigas=	12	
ancho de losa=	14.00	m
ancho de plataforma=	14.00	m (incluso aceras)
ancho total de aceras=	4.10	m
espesor de balasto=	0.60	m
sob. u. en paseos de servicio=	0.40	t/m²
s.u. tren tipo B=	12.00	t/m
coeficiente de impacto=	1.42	

carga vertical máxima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que en la posición de los dos trenes tipo B que hace máxima la reacción en un apoyo, éste se lleva el 6.5% del peso total de ambos

$V_{máx}$=	3.84	de p.p. de viga
	4.96	de p.p. de losa de compresión
	0.45	de p.p. de aceras y barandilla
	5.39	de p.p. de balasto
	0.93	de sobrecarga uniforme en paseos de servicio
	30.05	de dos trenes tipo B con coeficiente de impacto
	45.62	ton

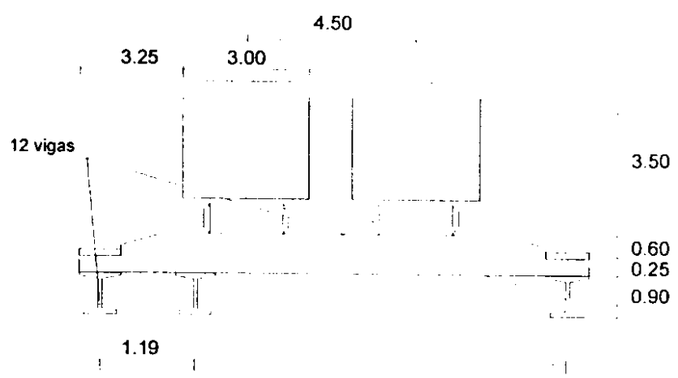
carga vertical mínima por apoyo

Se supone que las sobrecargas no producen levantamiento de los extremos de viga y que la reacción mínima se produce cuando no hay sobrecarga uniforme ni ningún tren en el tablero

$V_{mín}$=	3.84	de p.p. de viga
	4.96	de p.p. de losa de compresión
	0.45	de p.p. de aceras y barandilla
	5.39	de p.p. de balasto
	14.64	ton

ACCIONES DE VIENTO POR APOYO

f_w=	0.20	t/m²
A_0=	71.40	m²
λ_{viga}=	1	
Ψ_{viga}=	0.264	
A_{viga}=	12.24	m²
λ_{tren}=	1	
$\Psi_{2º\ tren}$=	0.086	
$A_{2º\ tren}$=	47.60	m²
A=	111.08	m²
W = f_w * A =	22.2	ton

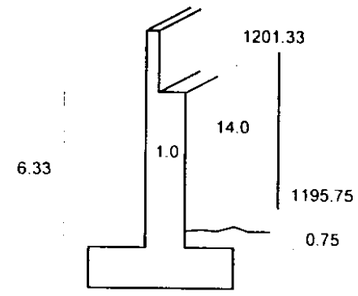


$H_{máx}$= 0.93 ton/apoyo

HIPÓTESIS DE CARGA SOBRE ESTRIBO

En adelante se utilizan cargas horizontales obtenidas del "CÁLCULO DE CARGAS EN CABEZA DE ELEMENTOS" con las siguientes premisas:

- los apoyos de neopreno, para las cargas verticales arriba obtenidas y para las horizontales de contracción y frenado, tienen por dimensiones 200 x 250 x 30 mm (neto 21 mm)
- las dimensiones de los estribos que afectan al reparto de cargas horizontales en cabeza de elementos son



Se consideran dos hipótesis de carga para el cálculo del estribo con las siguientes cargas:

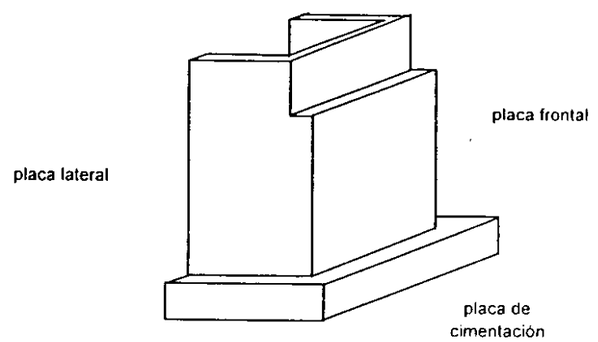
1) Carga vertical máxima sobre la línea de apoyos del estribo (con sobrecarga en paseos de servicio y dos trenes tipo B en el tablero), frenado de los dos trenes con las reducciones que permite la Instrucción de cargas, y sobrecarga en trasdós

$V_E)_{cp}$=	12.55	t/m.a.
$(H_E)_{contracción}$=	0.78	t/m.a.
$V_E)_{sc}$=	12.45	t/m.a.
$(H_E)_{frenado}$=	1.37	t/m.a.
$s.s._T$ =	3.50	t/m²

2) Carga vertical mínima sobre la línea de apoyos del estribo y sobrecarga en trasdós

$V_E)_{cp}$=	12.55	t/m.a.
$(H_E)_{contracción}$=	0.78	t/m.a.
$V_E)_{sc}$=	0.00	t/m.a.
$(H_E)_{frenado}$=	0.00	t/m.a.
$s.s._T$ =	3.50	t/m²

DISCRETIZACIÓN EN PLACAS



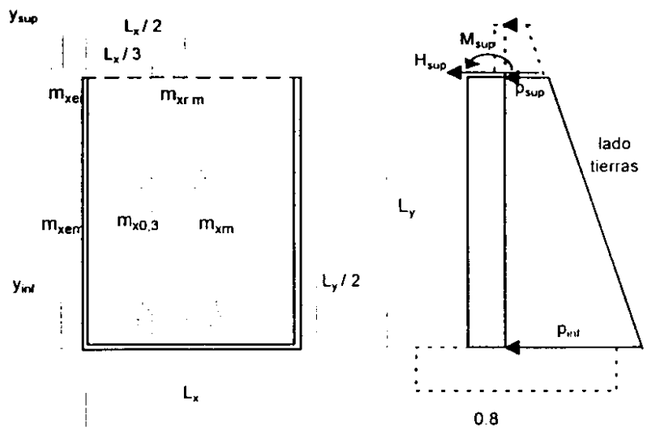
MATERIALES

f_{ck}=	250	kp/cm²
γ_c=	1.50	
f_{yk}=	5100	kp/cm²
γ_s=	1.15	

CÁLCULO DE ARMADURAS DE PLACA FRONTAL

Se considera una hipótesis de carga en trasdós de placa y dos tipos de coacción en borde de placa rectangular. La hipótesis de carga incluye el empuje de tierras al reposo producido por (peso de las tierras + sobrecarga uniforme en trasdós de la placa) y la reacción horizontal procedente de tablero

L_x=	14.00	m
y_{sup}=	1201.53	m
y_{inf}=	1195.00	m
L_y=	6.53	m
espesor placa =	0.95	m
coeficiente de empuje K_r =	0.36	
p_{sup}=	2.17	t/m²
p_{inf}=	7.07	t/m²
H_{sup} (*) =	3.70	t/m.a.
M_{sup}=	0.73	mt/m.a.
γ_f =	1.60	
L_y/L_x=	0.47	



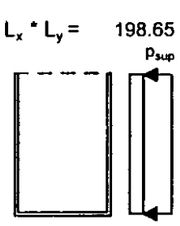
(*) Incluye la reacción horizontal procedente del tablero y debida a efectos reológicos y frenado

En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.

$M_i > 0$ si produce tracciones en intradós

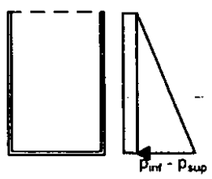
esfuerzos para coacción

$K = p_{sup} * L_x * L_y$ = 198.65



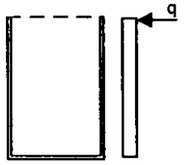
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-6.9	-15.8	21.3	45.6	65.8	-9.9	-12.0	175.0	235.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-28.96	-12.57	9.33	4.36	3.02	-20.15	-16.55	1.14	0.85

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 223.91



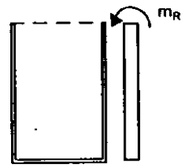
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-15.0	-20.3	38.9	74.2	96.1	-11.7	-14.3	70 8	84.4
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-14.93	-11.03	5.76	3.02	2.33	-19.14	-15.66	3.16	2.65

$K = q * L_x$ = 51.84

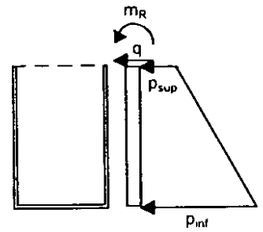


m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-2.2	-11.8	8.5	22.4	39.4	-7.8	-11.8	-16.7	-19.6
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-23.35	-4.39	6.14	2.31	1.32	-6.68	-4.39	-3.10	-2.64

$K = m_R$ = 0.73 mt/m.a.



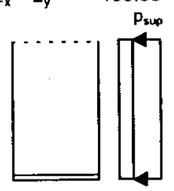
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-0.6	15.4	3.1	14.1	67.1	29.2	14.0	-2.6	-3.2
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
-1.32	0.05	0.24	0.05	0.01	0.02	0.05	-0.28	-0.23



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
-68.6	-27.9	21.5	9.7	6.7	-45.9	-36.6	0.9	0.6

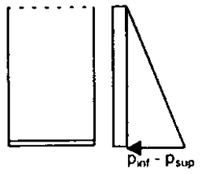
esfuerzos para coacción

$K = p_{sup} * L_x * L_y$ = 198.65



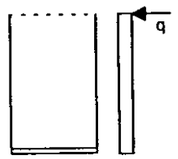
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	19.4	48.0	45.7	-6.8	-7.6	1E+10	80.0
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	10.24	4.14	4.35	-29.13	-26.17	0.00	2.48

$K = (p_{inf}-p_{sup}) * L_x * L_y /2$ = 223.91



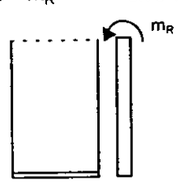
m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	35.2	80.5	70.8	-8.9	-10.1	87.8	90.5
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	6.36	2.78	3.16	-25.05	-22.17	2.55	2.47

$K = q * L_x$ = 51.84



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	7.7	22.1	23.9	-4.4	-5.3	-13.3	-15.8
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	6.72	2.35	2.17	-11.84	-9.74	-3.90	-3.28

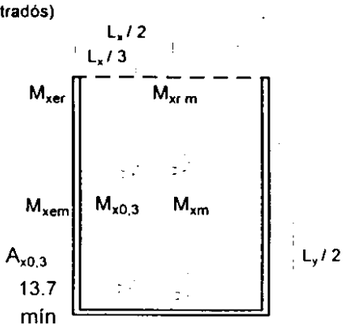
$K = m_R$ = 0.73 mt/m.a.



m_{xer}	m_{xem}	$m_{xr\,m}$	m_{xm}	$m_{x0,3}$	m_{yem}	m_{ye}	m_{ym}	$m_{y0,3}$
------	------	2.9	12.3	17.9	-5.9	-8.1	-2.3	-2.8
M_{xer}	M_{xem}	$M_{xr\,m}$	M_{xm}	$M_{x0,3}$	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
0.00	0.00	0.25	0.06	0.04	-0.12	-0.09	-0.32	-0.26

envolvente de momentos según Y (los momentos son positivos si producen tracciones en intradós)

	M_{yem}	M_{ye}	M_{ym}	$M_{y0,3}$
momentos positivos (mt/m.a.)	0.0	0.0	0.9	1.4
momentos negativos (mt/m.a.)	-66.1	-58.2	-1.7	0.0



armado según X

por cuantía geométrica A_{min}= 15.2 cm²/m.a. a repartir entre las dos caras

	A_{xer}	A_{xem}	$A_{xr\,m}$	A_{xm}	$A_{x0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	13.7	13.7	13.7
armadura necesaria en trasdós (cm²/m.a.)	28.4	13.7	mín	mín	mín

armado según Y

por cuantía geométrica A_{min}= 8.6 cm²/m.a. a repartir entre las dos caras

	A_{yem}	A_{ye}	A_{ym}	$A_{y0,3}$
armadura necesaria en intradós (cm²/m.a.)	mín	mín	13.7	13.7
armadura necesaria en trasdós (cm²/m.a.)	27.3	23.9	mín	mín

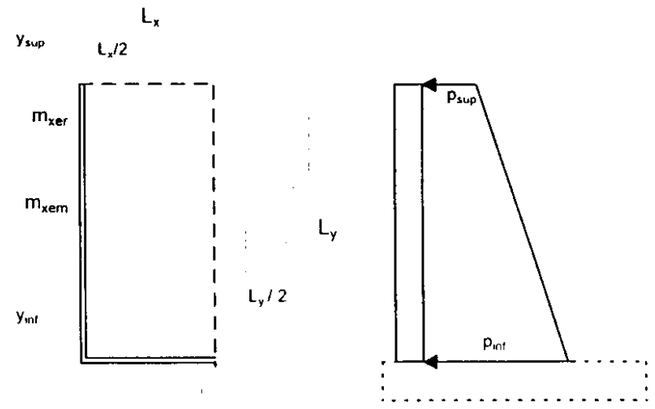
p_{inf}= 2.17 t/m²

M_{yem}= 1.18 mt/m.a.

armadura nec. en trasdós A_{yem}= 3.91 cm²/m.a.

armado de sector 2

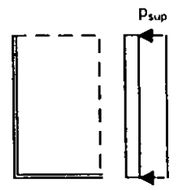
L_x=	3.15 m
y_{sup}=	1201.73 m
y_{inf}=	1195.00 m
L_y=	6.73 m
espesor placa =	0.80 m
p_{sup}=	2.17 t/m²
p_{inf}=	7.22 t/m²
γ_f =	1.60
L_y/L_x=	2.14



En adelante los momentos se obtendrán a partir de los coeficientes m_i con la expresión $M_i = K * m_i$ quedando M_i en mt/m.a.

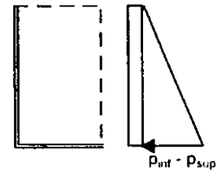
$M_i > 0$ si produce tracciones en intradós

$K = p_{sup} * L_x * L_y$ = 46.06



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-4.18	-5.90	-4.88	-12.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-11.0	-7.8	-9.4	-3.7

$K = (p_{inf}-p_{sup}) * L_x * L_y / 2$ = 53.51



m_{xer}	m_{xem}	m_{yer}	m_{yem}
-10.30	-6.76	-4.75	-10.40
M_{xer}	M_{xem}	M_{yer}	M_{yem}
-5.2	-7.9	-11.3	-5.1

armado según X

por cuantía geométrica A_{min}= 12.8 cm²/m.a. a repartir entre las dos caras

M_{xm}= -29.4 mt/m.a.

armadura nec. cara inf. A_{xm}= 14.4 cm²/m.a.

ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
20	0.150	20.9	0.24	0.00

$M_{x0,3}$= -1.6 mt/m.a.

armadura nec. cara inf. $A_{x0,3}$= 14.4 cm²/m.a.

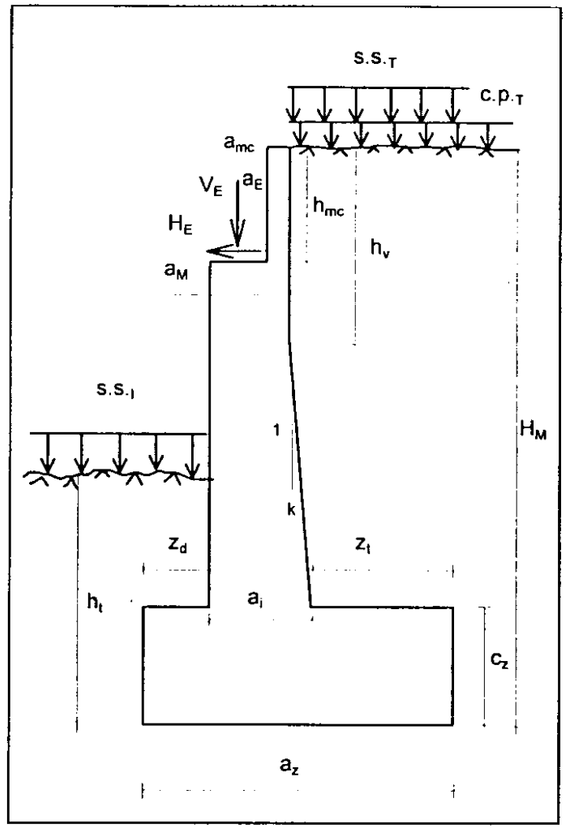
ϕ(mm)	sep(m)	Adisp	w_{adm}	w_K
20	0.150	20.9	0.24	0.00

M_{ym}= -17.0 mt/m.a.

CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	8.96	m
h_t=	1.75	m
h_v=	7.96	m
h_{mc}=	1.23	m
a_{mc}=	0.30	m
a_M=	0.95	m
a_Z=	5.10	m
c_Z=	1.00	m
k=	0.00	
a_i=	0.95	m
z_d=	1.00	m
z_t=	3.15	m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2.10	t/m³
angulo de rozamiento del relleno ϕ =	40	°
angulo de rozamiento contacto relleno-muro δ_M =	0.0	°
angulo de rozamiento contacto terreno-muro δ_T =	40	°
cohesión =	0	t/m²
σ_{adm} =	50	t/m²
f_p=	1.25	

CARGAS

$c.p._T$ =	0.00	t/m²
$s.s._T$ =	3.50	t/m²
$s.s._I$ =	0.00	t/m²
$(V_E)_{cp}$=	12.55	t/m.a.
$(H_E)_{contracción}$=	0.78	t/m.a.
$(V_E)_{sc}$=	12.45	t/m.a.
$(H_E)_{frenado}$=	1.37	t/m.a.
$(H_E)_{sismo}$=	0.00	t/m.a.
a_E =	0.35	m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	23.5 t/m²	$(\sigma_{med})_{adm}$ =	50.0 t/m²	longitud comprimida
$\sigma_{máx}$ =	60.4 t/m²	$(\sigma_{máx})_{adm}$ =	62.5 t/m²	l_c= 3.97 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.32	$(\gamma_d)_{adm}$=	1.50
γ_v=	2.01	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

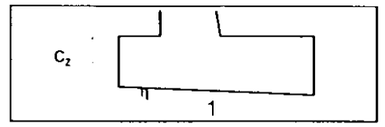
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

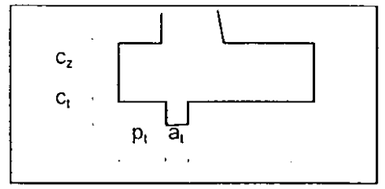
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00	m
c_t=	0.00	m
a_t=	0.00	m
K_p=	3.00	
Vcu=	0.00	t
Vd=	0.00	t



MATERIALES

HORMIGÓN H-250 ▼ γ_c = 1.50

ACERO AEH-500 ▼ γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

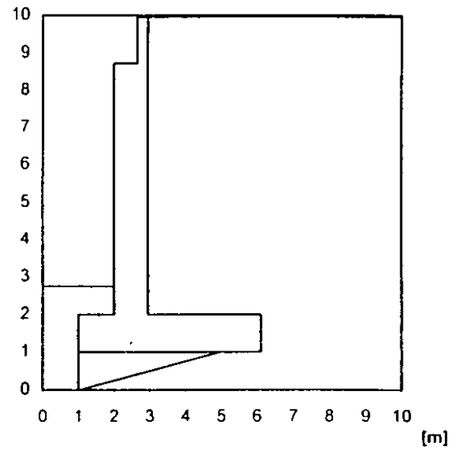
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 50.83 t

Vd= 45.89 t

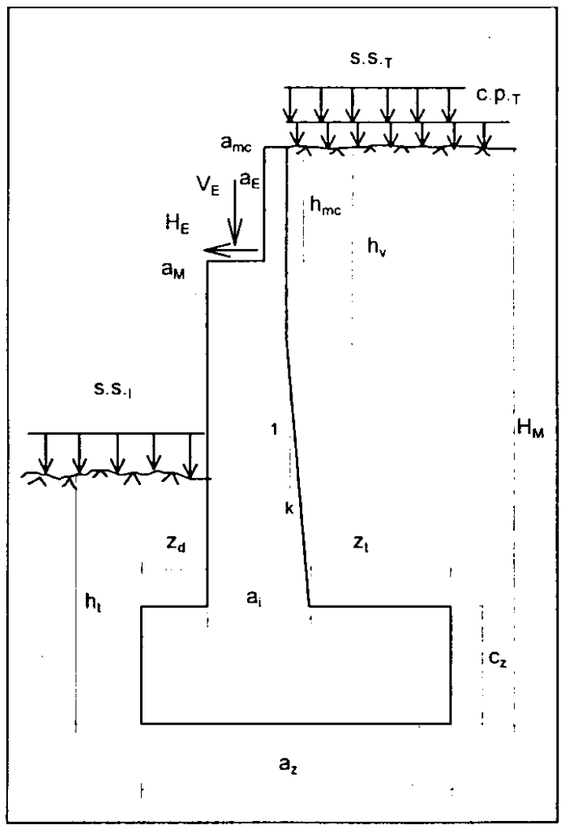
COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO DE ESTRIBO

GEOMETRÍA

H_M=	8.96 m
h_t=	1.75 m
h_v=	7.96 m
h_{mc}=	1.23 m
a_{mc}=	0.30 m
a_M=	0.95 m
a_Z=	5.10 m
c_Z=	1.00 m
k=	0.00
a_i=	0.95 m
z_d=	1.00 m
z_t=	3.15 m



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_f=	2.10 t/m³
angulo de rozamiento del relleno ϕ =	40 °
angulo de rozamiento contacto relleno-muro δ_M =	0.0 °
angulo de rozamiento contacto terreno-muro δ_T =	40 °
cohesión =	0 t/m²
σ_{adm} =	50 t/m²
f_p=	1.25

CARGAS

$c.p._T$ =	0.00 t/m²
$s.s._T$ =	3.50 t/m²
$s.s._I$ =	0.00 t/m²
$(V_E)_{cp}$=	12.55 t/m.a.
$(H_E)_{contracción}$=	0.78 t/m.a.
$(V_E)_{sc}$=	0.00 t/m.a.
$(H_E)_{frenado}$=	0.00 t/m.a.
$(H_E)_{sismo}$=	0.00 t/m.a.
a_E =	0.35 m

sismo ☐

coeficiente sísmico horizontal s= 0.000

coeficiente sísmico vertical v= 0.000

considera sobrecargas de explotación en el cálculo sísmico? ☐

COEFICIENTES DE EMPUJE

	empuje activo ○	empuje reposo ◉
trasdós: vertical Krh =	0.36	0.00
	0.36	0.00

coeficiente de mayoración de empujes = 1/1

TENSIONES EN EL TERRENO

σ_{med} =	21.1 t/m²	$(\sigma_{med})_{adm}$ =	50.0 t/m²
$\sigma_{máx}$ =	50.3 t/m²	$(\sigma_{máx})_{adm}$ =	62.5 t/m²

longitud comprimida l_c= 4.27 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.14	$(\gamma_d)_{adm}$=	1.50
γ_v=	2.05	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p= 3.00

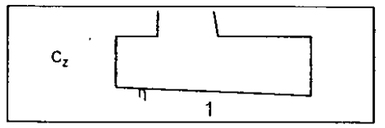
peso específico del terreno γ_T = 2.10 t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

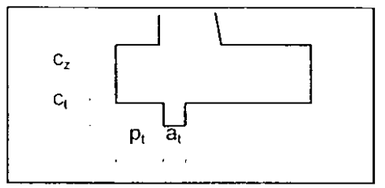
○ base de zapata inclinada

η = 0.10



○ zapata con tacón

p_t=	0.00 m
c_t=	0.00 m
a_t=	0.00 m
K_p=	3.00
Vcu=	0.00 t
Vd=	0.00 t



MATERIALES

HORMIGÓN H-250 ▾ γ_c = 1.50

ACERO AEH-500 ▾ γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

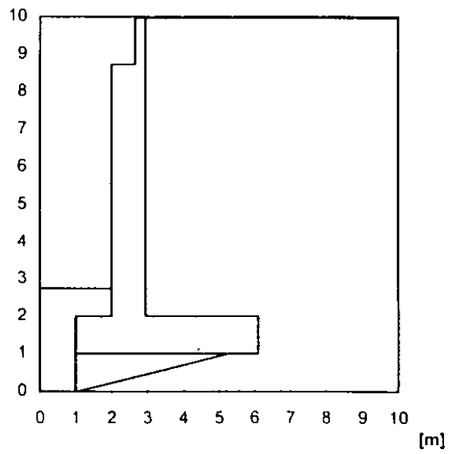
coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 50.83 t

Vd= 37.49 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES

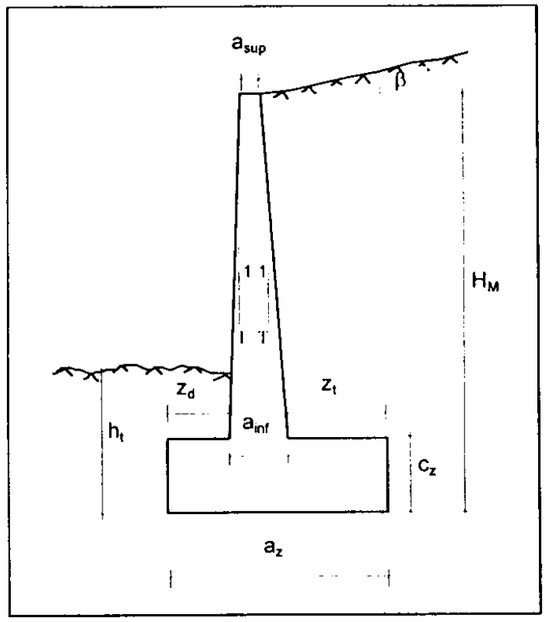


ALETA DE PASO INFERIOR 709+140 **AVE MADRID-ZARAGOZA**

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	7.96 m
h_t=	1.55 m
a_{sup}=	0.80 m
a_Z=	3.60 m
c_Z=	0.80 m
I=	0.00
T=	0.00
a_{inf}=	0.80 m
z_d=	0.75 m
z_t=	2.05 m
β =	0.0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

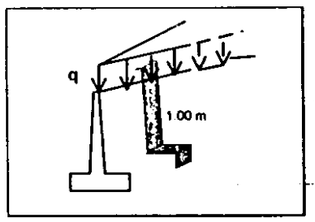
peso específico del relleno γ_r=	2.10 t/m³
angulo de rozamiento del relleno ϕ_r =	40 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	40 °
cohesión =	0 t/m²
σ_{adm} =	50 t/m²
f_p=	1.25

Coeficientes de empuje activo (Coulomb)

Kah = 0.22 Kav = 0.00 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0.22 Kav = 0.00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0.50	3.00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	16.86 t/m²	$(\sigma_{med})_{adm}$ =	50.00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	41.20 t/m²	$(\sigma_{máx})_{adm}$ =	62.5 t/m²	l_c =	2.95 m

DESLIZAMIENTO Y VUELCO

γ_d=	2.48	$(\gamma_d)_{adm}$=	1.50
γ_v=	2.04	$(\gamma_v)_{adm}$=	1.80

considera empuje pasivo en puntera? ☐

K_p=

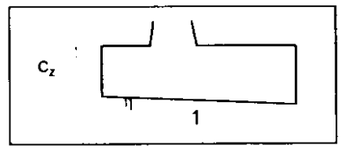
peso especifico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

(●) base de zapata horizontal

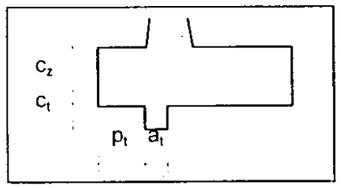
( ) base de zapata inclinada

η = 0.10



( ) zapata con tacón

p_t=	1.00 m
c_t=	0.50 m
a_t=	0.40 m
K_p=	0.00
Vcu=	22.59 t
Vd=	0.00 t



MATERIALES

HORMIGÓN H-250 γ_c = 1.50

ACERO AEH-500 γ_s = 1.15

recubrimiento zapata= 0.05 m

recubrimiento muro= 0.04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1.60

en zarpa delantera

Vcu= 36.31 t

Vd= 21.83 t

en zarpa trasera

Vcu= 48.41 t

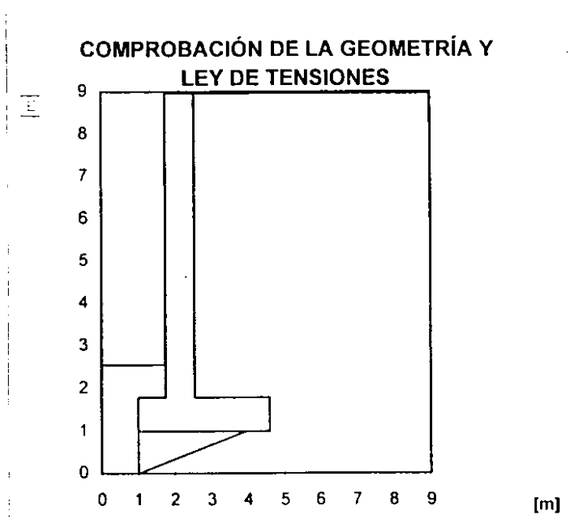
Vd= 37.30 t

en base de muro

Vcu= 49.06 t

Vd= 25.18 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

Amín= 11.3 cm²/m.a. de armadura en tracción (cuantía mecánica)

17.9 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 21.1 mt

Anec= 6.4 cm²/m.a. por flexión

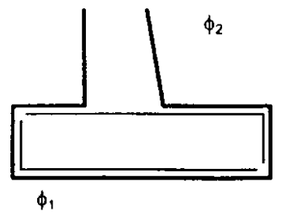
ϕ_1(mm)	16
sep(m)	0.150
Adisp	13.4 cm²/m.a.

zarpa trasera

Md= 62.6 mt

Anec= 19.5 cm²/m.a. por flexión

ϕ_2(mm)	20
sep(m)	0.150
Adisp	20.9 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo | II

zarpa delantera

M= 13.2 mt

w_{adm}= 0.30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 39.2 mt

w_{adm}= 0.30 mm

$w_{máx}$= 0.25 mm

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

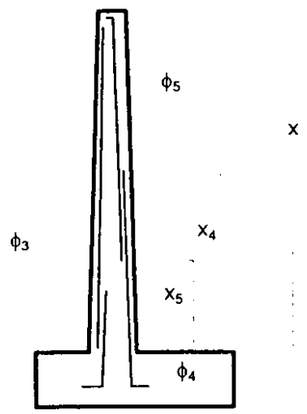
En base de alzado (x=0)

Para Md= 76.0 mt

y mínimo Nd= 12.9 t Anec= 17.8 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	25	16
sep(m)	0.150	0.150	0.150
Adisp(*)	7.5	32.7	cm²/m.a.

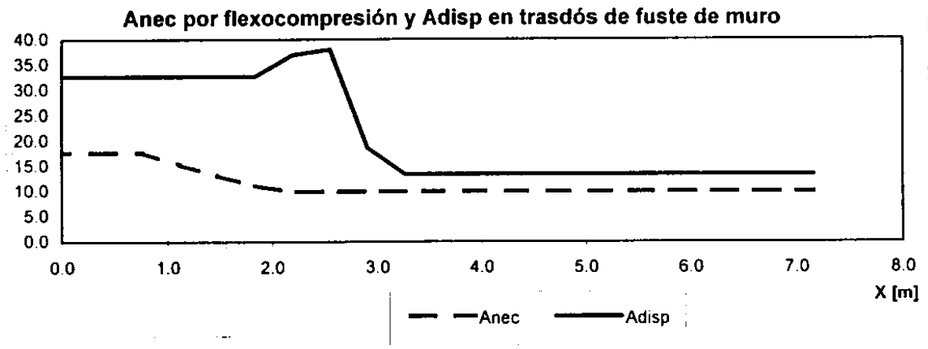
(*) Se ha comprobado que se supera la cuantia geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3.00
x_5 (m)	2.00

longitud de anclaje para ϕ_4= 0.57 m

longitud de anclaje para ϕ_5= 0.60 m



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0.0 m

h= 0.80 m

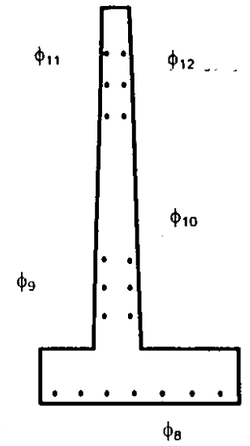
M= 47.48 mt w_{adm}= 0.22 mm

N= 14.32 t $w_{máx}$= 0.18 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*)(cm²)	5.8	12.8		12.8	
ϕ(mm)	12	12	12	12	12
sep(m)	0.150	0.150	0.150	0.150	0.150
Adisp (cm²)	7.5	15.1		15.1	

(*) Armadura necesaria estrictamente por cuantia geométrica



PRUEBA DE CARGA PASO INFERIOR 709+140

PRUEBAS DE CARGA
****

1. Datos del calculo :

Luz de calculo.....= 12.900 m.
Semiancho de tablero.....= 7.000 m.
Ancho de aceras.....= 2.050 m. y 2.050 m.
Numero de vigas.....= 12
Separacion entre vigas.....= 1.191 m.
Distancia de viga 1 al borde.= 0.450 m.
Tren de carga puntual.....= 20. Tn/eje
(3 ejes a 1.5 m)
Sobrecarga uniforme.....= 0.400 Tn/m2

2. Datos de la prueba :

Caracteristicas del camion de la prueba
Vuelo delantero: 1.32 m.
Vuelo trasero: 1.36 m.
Distancia entre ejes 1 y 2: 3.84 m.
Distancia entre ejes 2 y 3: 1.36 m.
Carga eje delantero: 10.00 Tn.
Cargas ejes traseros: 11.50 Tn. y 11.50 Tn.
Ancho total del camion: 2.45 m.
Via: 2.04 m.

3. Resultados :

Los resultados que a continuacion se indican corresponden a la viga 7.
Numero de trenes : 3.
Numero de camiones por tren : 2.
Camiones en posicion simetrica respecto del centro del vano.
Distancia del eje longitudinal del tren al borde derecho: 3.62 m.
Distancia entre ejes longitudinales de camiones: 2.95 m.

PRIMERA FASE
==========
1.1 Esfuerzos :

	Tren de carga Instruccion	Tren de carga Prueba	Posicion (m.)
Momento Centro vano (mxTn)	44.44	10.37	0.00

M.Prueba/M.Instr. 23.33 %

Reaccion maxima (Tn)	14.26	2.35	0.00

R.Prueba/R.Instr. 16.48 %

1.2 Deformaciones :

Flecha centro de vano (mm)	1.30	0.56	0.00

Giro apoyo izquierdo (rad)	Posicion del tren (m)	Giro apoyo derecho (rad)
0.000136	0.00	-0.000136

SEGUNDA FASE
==========
1.1 Esfuerzos :

	Tren de carga Instruccion	Tren de carga Prueba	Posicion (m.)
Momento Centro vano (mxTn)	44.44	31.40	0.00

M.Prueba/M.Instr. 70.66 %

Reaccion maxima (Tn)	14.26	7.12	0.00

R.Prueba/R.Instr. 49.92 %

1.2 Deformaciones :

Flecha centro de vano (mm)	1.30	1.70	0.00

Giro apoyo izquierdo (rad)	Posicion del tren (m)	Giro apoyo derecho (rad)
0.000411	0.00	-0.000411

TERCERA FASE
==========
1.1 Esfuerzos :

	Tren de carga Instruccion	Tren de carga Prueba	Posicion (m.)
Momento Centro vano (mxTn)	44.44	40.89	0.00

M.Prueba/M.Instr. 92.01 %

Reaccion maxima (In)	14.26	9.27	0.00

R.Prueba/R.Instr. 65.00 %

1.2 Deformaciones :

Flecha centro de vano (mm)	1.30	2.21	0.00

Giro apoyo izquierdo (rad)	Posicion del tren (m)	Giro apoyo derecho (rad)
0.000535	0.00	-0.000535

*Por posicion del tren se entiende la distancia desde el apoyo izquierdo al primer eje del tren de la prueba.

PASO INFERIOR 709+140 CARGA DE FERROCARRIL

1.CARACTERISTICAS MECANICAS DEL TABLERO

1.-Datos del tablero:

Luz de calculo.= 12.900 m. Semiancho....= 7.000 m.
No. de vigas= 12 Distancia w..= 0.450 m.
Separacion..= 1.191 m.
Canto losa..= 0.250 m. Coef. Poisson= 0.200
Fck losa....=250. Kg/cm2 Fck vigas....=450. Kg/cm2

2.-Datos de cada viga:(en metros)

A(1).= 0.900 A(2).= 0.030 A(3).= 0.600
A(4).= 0.100 A(5).= 0.900 A(6).= 0.110
A(7).= 0.050 A(8).= 0.070 A(9).= 0.060
A(10)= 0.070 A(11)= 0.320 A(12)= 0.220
A(13)= 0.050 A(14)= 0.050

3.-Caracteristicas mecanicas viga simple:

Area.....= 0.2259 m2
Inercia flexion= 0.025832 m4
VS.....= 0.465 m.
VI.....= 0.435 m.
Inercia torsion= 0.000475 m4

4.-Caracteristicas mecanicas viga c.central:

Area.....= 0.4478 m2
Inercia flexion= 0.065895 m4
VS.....= 0.422 m.
Vi.....= 0.728 m.
Inercia torsion= 0.002786 m4

5.-Caracteristicas mecanicas viga c.de borde:

Area.....= 0.4207 m2
Inercia flexion= 0.063203 m4
VS.....= 0.442 m.
VI.....= 0.708 m.
Inercia torsion= 0.002504 m4

6.-Caracteristicas mecanicas del tablero:

Ancho efectivo del tablero = 7.096794 m
Inercia Flexion Longitudinal Unitaria= 0.056097 m4/ml
Inercia Flexion Transversal Unitaria= 0.001302 m4/ml
Inercia Torsion Longitudinal Unitaria= 0.002348 m4/ml
Inercia Torsion Transversal Unitaria= 0.002604 m4/ml

4	0.846	0.677	0.508	0.339	0.169	0.000
5	0.341	0.273	0.205	0.137	0.068	0.000
6	0.100	0.080	0.060	0.040	0.020	0.000
7	0.100	0.080	0.060	0.040	0.020	0.000
8	0.341	0.273	0.205	0.137	0.068	0.000
9	0.846	0.677	0.508	0.339	0.169	0.000
10	1.580	1.264	0.948	0.632	0.316	0.000
11	2.348	1.879	1.409	0.939	0.470	0.000
12	2.660	2.128	1.596	1.064	0.532	0.000

4.-Total esfuerzos longitudinales(sobrecargas)

4.1 Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	5.444	9.679	12.703	14.518	15.123
2	0.000	14.501	25.779	33.836	38.669	40.280
3	0.000	23.416	41.628	54.636	62.442	65.043
4	0.000	31.334	55.704	73.112	83.557	87.038
5	0.000	35.503	63.116	82.840	94.674	98.619
6	0.000	38.407	68.279	89.616	102.419	106.686
7	0.000	38.546	68.527	89.941	102.790	107.073
8	0.000	36.390	64.693	84.909	97.039	101.083
9	0.000	32.338	57.490	75.456	86.235	89.828
10	0.000	25.111	44.641	58.591	66.961	69.752
11	0.000	15.970	28.391	37.264	42.587	44.362
12	0.000	6.444	11.456	15.036	17.184	17.900

4.2 Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	4.689	3.751	2.814	1.876	0.938	0.000
2	12.490	9.992	7.494	4.996	2.498	0.000
3	20.168	16.135	12.101	8.067	4.034	0.000
4	26.989	21.591	16.193	10.795	5.398	0.000
5	30.579	24.464	18.348	12.232	6.116	0.000
6	33.081	26.465	19.849	13.232	6.616	0.000
7	33.201	26.561	19.921	13.280	6.640	0.000
8	31.343	25.075	18.806	12.537	6.269	0.000
9	27.854	22.283	16.712	11.141	5.571	0.000
10	21.628	17.303	12.977	8.651	4.326	0.000
11	13.756	11.004	8.253	5.502	2.751	0.000
12	5.550	4.440	3.330	2.220	1.110	0.000

5.-Reparto de las cargas muertas

5.1 Peso propio losa y viga:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	9.193	16.342	21.450	24.514	25.535
2	0.000	9.876	17.558	23.045	26.337	27.435
3	0.000	9.876	17.557	23.044	26.336	27.433
4	0.000	9.879	17.562	23.050	26.343	27.441
5	0.000	9.880	17.564	23.053	26.346	27.444
6	0.000	9.880	17.565	23.054	26.347	27.445
7	0.000	9.880	17.565	23.054	26.347	27.445
8	0.000	9.880	17.564	23.053	26.346	27.444
9	0.000	9.879	17.562	23.050	26.343	27.441
10	0.000	9.876	17.557	23.044	26.336	27.433
11	0.000	9.876	17.558	23.045	26.337	27.435
12	0.000	9.193	16.342	21.450	24.514	25.535

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	7.918	6.334	4.751	3.167	1.584	0.000
2	8.507	6.805	5.104	3.403	1.701	0.000
3	8.506	6.805	5.104	3.403	1.701	0.000
4	8.509	6.807	5.105	3.404	1.702	0.000
5	8.510	6.808	5.106	3.404	1.702	0.000
6	8.510	6.808	5.106	3.404	1.702	0.000
7	8.510	6.808	5.106	3.404	1.702	0.000
8	8.510	6.808	5.106	3.404	1.702	0.000
9	8.509	6.807	5.105	3.404	1.702	0.000
10	8.506	6.805	5.104	3.403	1.701	0.000
11	8.507	6.805	5.104	3.403	1.701	0.000
12	7.918	6.334	4.751	3.167	1.584	0.000

5.2 Peso balasto:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.213	0.378	0.496	0.567	0.591
2	0.000	2.132	3.790	4.975	5.686	5.923
3	0.000	4.272	7.594	9.967	11.391	11.866
4	0.000	6.321	11.237	14.749	16.856	17.558
5	0.000	7.729	13.741	18.035	20.612	21.471
6	0.000	8.403	14.939	19.607	22.408	23.342
7	0.000	8.403	14.939	19.607	22.408	23.342
8	0.000	7.729	13.741	18.035	20.612	21.471
9	0.000	6.321	11.237	14.749	16.856	17.558
10	0.000	4.272	7.594	9.967	11.391	11.866
11	0.000	2.132	3.790	4.975	5.686	5.923
12	0.000	0.213	0.378	0.496	0.567	0.591

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.183	0.147	0.110	0.073	0.037	0.000
2	1.836	1.469	1.102	0.735	0.367	0.000
3	3.679	2.943	2.208	1.472	0.736	0.000
4	5.444	4.355	3.267	2.178	1.089	0.000
5	6.658	5.326	3.995	2.663	1.332	0.000
6	7.238	5.790	4.343	2.895	1.448	0.000
7	7.238	5.790	4.343	2.895	1.448	0.000
8	6.658	5.326	3.995	2.663	1.332	0.000
9	5.444	4.355	3.267	2.178	1.089	0.000
10	3.679	2.943	2.208	1.472	0.736	0.000
11	1.836	1.469	1.102	0.735	0.367	0.000
12	0.183	0.147	0.110	0.073	0.037	0.000

5.3 Peso de aceras:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.965	1.716	2.252	2.574	2.681
2	0.000	0.852	1.515	1.988	2.272	2.367
3	0.000	0.573	1.019	1.338	1.529	1.593

4	0.000	0.307	0.546	0.717	0.819	0.853
5	0.000	0.124	0.220	0.289	0.330	0.344
6	0.000	0.036	0.064	0.085	0.097	0.101
7	0.000	0.036	0.064	0.085	0.097	0.101
8	0.000	0.124	0.220	0.289	0.330	0.344
9	0.000	0.307	0.546	0.717	0.819	0.853
10	0.000	0.573	1.019	1.338	1.529	1.593
11	0.000	0.852	1.515	1.988	2.272	2.367
12	0.000	0.965	1.716	2.252	2.574	2.681

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.831	0.665	0.499	0.333	0.166	0.000
2	0.734	0.587	0.440	0.294	0.147	0.000
3	0.494	0.395	0.296	0.198	0.099	0.000
4	0.264	0.212	0.159	0.106	0.053	0.000
5	0.107	0.085	0.064	0.043	0.021	0.000
6	0.031	0.025	0.019	0.012	0.006	0.000
7	0.031	0.025	0.019	0.012	0.006	0.000
8	0.107	0.085	0.064	0.043	0.021	0.000
9	0.264	0.212	0.159	0.106	0.053	0.000
10	0.494	0.395	0.296	0.198	0.099	0.000
11	0.734	0.587	0.440	0.294	0.147	0.000
12	0.831	0.665	0.499	0.333	0.166	0.000

5.4 Cargas en barandillas:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000

5.5 Total carga muerta:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	10.371	18.437	24.198	27.655	28.807
2	0.000	12.861	22.863	30.008	34.295	35.724
3	0.000	14.721	26.171	34.349	39.256	40.892
4	0.000	16.507	29.345	38.515	44.018	45.852
5	0.000	17.733	31.526	41.378	47.289	49.259
6	0.000	18.320	32.568	42.746	48.852	50.888
7	0.000	18.320	32.568	42.746	48.852	50.888
8	0.000	17.733	31.526	41.378	47.289	49.259
9	0.000	16.507	29.345	38.515	44.018	45.852
10	0.000	14.721	26.171	34.349	39.256	40.892
11	0.000	12.861	22.863	30.008	34.295	35.724
12	0.000	10.371	18.437	24.198	27.655	28.807

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	8.932	7.146	5.359	3.573	1.786	0.000
2	11.077	8.862	6.646	4.431	2.215	0.000
3	12.680	10.144	7.608	5.072	2.536	0.000
4	14.218	11.374	8.531	5.687	2.844	0.000
5	15.274	12.219	9.164	6.110	3.055	0.000
6	15.779	12.623	9.467	6.312	3.156	0.000
7	15.779	12.623	9.467	6.312	3.156	0.000
8	15.274	12.219	9.164	6.110	3.055	0.000
9	14.218	11.374	8.531	5.687	2.844	0.000
10	12.680	10.144	7.608	5.072	2.536	0.000
11	11.077	8.862	6.646	4.431	2.215	0.000
12	8.932	7.146	5.359	3.573	1.786	0.000

3.CALCULO DE REACCIONES

****

1.-Datos del Tablero:

Parametro de entrecruzamiento= 1.40944
Parametro de torsion.....= 0.12072
Luz de calculo.....= 12.900 m.
Semiancho del tablero.....= 7.000 m.
Ancho de aceras.....= 3.050 m. y 3.050 m.
Altura de acera.....= 0.050 m.
Espesor de balasto.....= 0.600 m.
Carga en acera.....= 0.000 T/m
Numero de vigas.....= 12
Separacion entre vigas.....= 1.191 m.
Distancia viga 1 al borde....= 0.450 m.
Tren de carga uniforme.....= 12. Tn/m
Coeficiente de impacto.....= 1.423
Sobrecarga en paseos.....= 0.400 T/m2

2.-Reacciones debidas al tren:

Reacciones para cada viga

Posicion	Via	1	2	3	4	5	6	7	8	9	10	11	12
II	1	-0.32	-0.31	0.03	1.07	3.36	7.35	12.63	16.72	16.66	12.37	6.66	1.13
II	1	-0.24	-0.30	-0.10	0.71	2.65	6.22	11.33	16.14	17.14	13.75	8.02	2.03

4	0.000	0.307	0.546	0.717	0.819	0.853
5	0.000	0.124	0.220	0.289	0.330	0.344
6	0.000	0.036	0.064	0.085	0.097	0.101
7	0.000	0.036	0.064	0.085	0.097	0.101
8	0.000	0.124	0.220	0.289	0.330	0.344
9	0.000	0.307	0.546	0.717	0.819	0.853
10	0.000	0.573	1.019	1.338	1.529	1.593
11	0.000	0.852	1.515	1.988	2.272	2.367
12	0.000	0.965	1.716	2.252	2.574	2.681

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.831	0.665	0.499	0.333	0.166	0.000
2	0.734	0.587	0.440	0.294	0.147	0.000
3	0.494	0.395	0.296	0.198	0.099	0.000
4	0.264	0.212	0.159	0.106	0.053	0.000
5	0.107	0.085	0.064	0.043	0.021	0.000
6	0.031	0.025	0.019	0.012	0.006	0.000
7	0.031	0.025	0.019	0.012	0.006	0.000
8	0.107	0.085	0.064	0.043	0.021	0.000
9	0.264	0.212	0.159	0.106	0.053	0.000
10	0.494	0.395	0.296	0.198	0.099	0.000
11	0.734	0.587	0.440	0.294	0.147	0.000
12	0.831	0.665	0.499	0.333	0.166	0.000

5.4 Cargas en barandillas:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000

5.5 Total carga muerta:

Momentos flectores:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	0.000	10.371	18.437	24.198	27.655	28.807
2	0.000	12.861	22.863	30.008	34.295	35.724
3	0.000	14.721	26.171	34.349	39.256	40.892
4	0.000	16.507	29.345	38.515	44.018	45.852
5	0.000	17.733	31.526	41.378	47.289	49.259
6	0.000	18.320	32.568	42.746	48.852	50.888
7	0.000	18.320	32.568	42.746	48.852	50.888
8	0.000	17.733	31.526	41.378	47.289	49.259
9	0.000	16.507	29.345	38.515	44.018	45.852
10	0.000	14.721	26.171	34.349	39.256	40.892
11	0.000	12.861	22.863	30.008	34.295	35.724
12	0.000	10.371	18.437	24.198	27.655	28.807

Esfuerzos cortantes:

Viga	0.0	0.1	0.2	0.3	0.4	0.5
1	8.932	7.146	5.359	3.573	1.786	0.000
2	11.077	8.862	6.646	4.431	2.215	0.000
3	12.680	10.144	7.608	5.072	2.536	0.000
4	14.218	11.374	8.531	5.687	2.844	0.000
5	15.274	12.219	9.164	6.110	3.055	0.000
6	15.779	12.623	9.467	6.312	3.156	0.000
7	15.779	12.623	9.467	6.312	3.156	0.000
8	15.274	12.219	9.164	6.110	3.055	0.000
9	14.218	11.374	8.531	5.687	2.844	0.000
10	12.680	10.144	7.608	5.072	2.536	0.000
11	11.077	8.862	6.646	4.431	2.215	0.000
12	8.932	7.146	5.359	3.573	1.786	0.000

3.CALCULO DE REACCIONES

****

1.-Datos del Tablero:

Parametro de entrecruzamiento= 1.40944
Parametro de torsion.....= 0.12072
Luz de calculo.....= 12.900 m.
Semiancho del tablero.....= 7.000 m.
Ancho de aceras.....= 3.050 m. y 3.050 m.
Altura de acera.....= 0.050 m.
Espesor de balasto.....= 0.600 m.
Carga en acera.....= 0.000 T/m
Numero de vigas.....= 12
Separacion entre vigas.....= 1.191 m.
Distancia viga 1 al borde....= 0.450 m.
Tren de carga uniforme.....= 12. Tn/m
Coeficiente de impacto.....= 1.423
Sobrecarga en paseos.....= 0.400 T/m2

2.-Reacciones debidas al tren:

Reacciones para cada viga

Posicion	Via	1	2	3	4	5	6	7	8	9	10	11	12
II	1	-0.32	-0.31	0.03	1.07	3.36	7.35	12.63	16.72	16.66	12.37	6.66	1.13
II	1	-0.24	-0.30	-0.10	0.71	2.65	6.22	11.33	16.14	17.14	13.75	8.02	2.03

	1	-0.41	-0.30	0.20	1.51	4.19	8.56	13.88	17.01	15.87	10.96	5.45	0.43
II	2	0.66	5.87	11.46	16.19	16.94	13.45	8.12	3.88	1.34	0.13	-0.31	-0.38
II	2	0.07	4.75	10.06	15.21	17.06	14.61	9.38	4.78	1.84	0.34	-0.29	-0.48
	2	1.43	7.13	12.86	16.86	16.55	12.17	6.94	3.10	0.93	-0.02	-0.31	-0.29
II	1y2	0.33	5.55	11.49	17.26	20.30	20.80	20.76	20.60	18.00	12.50	6.35	0.75
II	1y2	-0.17	4.44	9.96	15.92	19.71	20.83	20.71	20.92	18.98	14.09	7.73	1.55
II	1y2	-0.25	4.44	10.09	16.28	20.43	21.96	22.02	21.49	18.50	12.70	6.37	0.65
II	1y2	-0.34	4.44	10.26	16.72	21.25	23.18	23.26	21.79	17.71	11.29	5.16	-0.05
II	1y2	1.10	6.82	12.89	17.93	19.91	19.52	19.57	19.82	17.59	12.35	6.35	0.84
II	1y2	0.42	5.56	11.36	16.90	19.58	19.66	19.45	20.02	18.48	13.88	7.71	1.65
II	1y2	0.24	5.56	11.66	17.70	21.12	22.01	22.00	20.89	17.22	11.09	5.14	0.05
II	1y2	1.01	6.82	13.06	18.37	20.74	20.74	20.81	20.11	16.81	10.94	5.14	0.14

3.-Reacciones debidas al tren (con impacto):

		Reacciones para cada viga											
sicion	Via	1	2	3	4	5	6	7	8	9	10	11	12
I	1	-0.46	-0.44	0.04	1.52	4.79	10.46	17.98	23.79	23.71	17.60	9.48	1.61
II	1	-0.34	-0.43	-0.14	1.01	3.77	8.84	16.12	22.97	24.40	19.57	11.41	2.89
	1	-0.59	-0.43	0.28	2.14	5.96	12.18	19.75	24.20	22.59	15.59	7.76	0.61
II	2	0.94	8.35	16.30	23.04	24.10	19.14	11.56	5.53	1.91	0.19	-0.44	-0.54
II	2	0.10	6.76	14.31	21.65	24.28	20.80	13.35	6.80	2.61	0.48	-0.41	-0.68
II	2	2.03	10.14	18.30	24.00	23.55	17.32	9.87	4.41	1.33	-0.03	-0.44	-0.42
I II	1y2	0.47	7.90	16.34	24.56	28.89	29.59	29.54	29.32	25.62	17.79	9.04	1.07
II II	1y2	-0.25	6.32	14.18	22.66	28.05	29.64	29.47	29.77	27.01	20.05	11.00	2.21
I II	1y2	-0.36	6.31	14.36	23.17	29.07	31.25	31.33	30.59	26.32	18.08	9.07	0.93
II	1y2	-0.49	6.32	14.60	23.79	30.24	32.98	33.10	31.00	25.20	16.07	7.35	-0.07
I II	1y2	1.57	9.70	18.35	25.52	28.34	27.78	27.85	28.20	25.04	17.57	9.04	1.19
I II	1y2	0.59	7.92	16.17	24.05	27.87	27.98	27.68	28.49	26.30	19.76	10.97	2.35
II	1y2	0.35	7.91	16.59	25.18	30.06	31.32	31.31	29.73	24.50	15.78	7.32	0.07
II	1y2	1.44	9.71	18.59	26.14	29.51	29.51	29.62	28.61	23.92	15.56	7.32	0.19

4.-Reacciones debidas a la sobrecarga uniforme:

	Reacciones para cada viga											
:ion	1	2	3	4	5	6	7	8	9	10	11	12
:a	2.66	2.35	1.58	0.85	0.34	0.10	0.10	0.34	0.85	1.58	2.35	2.66

5.-Reacciones totales maximas:

		Reacciones para cada viga											
sicion	Via	1	2	3	4	5	6	7	8	9	10	11	12
I	1	2.20	1.91	1.62	2.37	5.13	10.56	18.08	24.13	24.56	19.18	11.83	4.27
II	1	2.32	1.92	1.44	1.86	4.11	8.94	16.22	23.31	25.24	21.15	13.76	5.55
	1	2.07	1.92	1.86	2.99	6.30	12.28	19.85	24.55	23.44	17.17	10.11	3.27
II	2	3.60	10.69	17.88	23.89	24.44	19.24	11.66	5.87	2.75	1.77	1.91	2.12
II	2	2.76	9.10	15.90	22.49	24.62	20.90	13.45	7.14	3.46	2.06	1.94	1.98
II	2	4.69	12.49	19.89	24.85	23.89	17.42	9.97	4.75	2.17	1.55	1.91	2.24
I II	1y2	3.13	10.25	17.92	25.41	29.23	29.69	29.64	29.66	26.46	19.37	11.39	3.73
II II	1y2	2.42	8.67	15.76	23.51	28.39	29.74	29.57	30.11	27.85	21.63	13.35	4.87
I II	1y2	2.30	8.66	15.94	24.02	29.41	31.35	31.43	30.93	27.17	19.66	11.42	3.59
II	1y2	2.17	8.67	16.18	24.64	30.58	33.08	33.20	31.34	26.05	17.65	9.70	2.59
I	1y2	4.23	12.05	19.93	26.37	28.68	27.88	27.95	28.54	25.88	19.15	11.39	3.85
I II	1y2	3.25	10.26	17.75	24.90	28.21	28.08	27.78	28.84	27.15	21.34	13.32	5.01
II	1y2	3.01	10.26	18.17	26.03	30.40	31.42	31.41	30.07	25.34	17.36	9.67	2.73

II II	1y2	4.10	12.06	20.17	26.99	29.85	29.61	29.72	28.96	24.76	17.14	9.67	2.85

6.-Reacciones debidas a la carga muerta:

6.1 Peso propio losa y viga:

	Reacciones para cada viga											
Posicion	1	2	3	4	5	6	7	8	9	10	11	12
unica	7.92	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	8.51	7.92

6.2 Peso balasto:

	Reacciones para cada viga											
Posicion	1	2	3	4	5	6	7	8	9	10	11	12
unica	0.18	1.84	3.68	5.44	6.66	7.24	7.24	6.66	5.44	3.68	1.84	0.18

6.3 Peso de aceras:

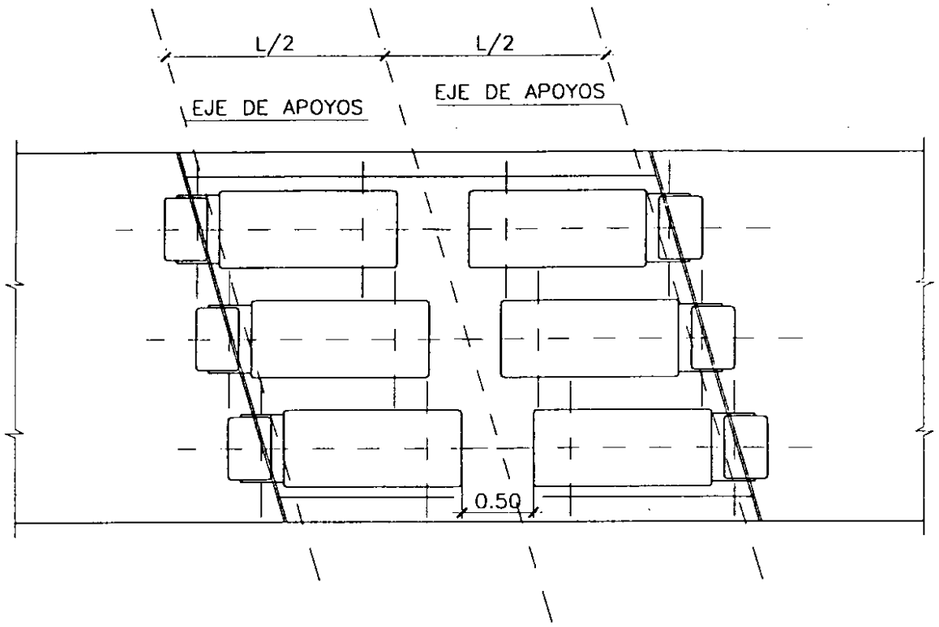
	Reacciones para cada viga											
Posicion	1	2	3	4	5	6	7	8	9	10	11	12
unica	0.83	0.73	0.49	0.26	0.11	0.03	0.03	0.11	0.26	0.49	0.73	0.83

6.4 Carga en barandillas:

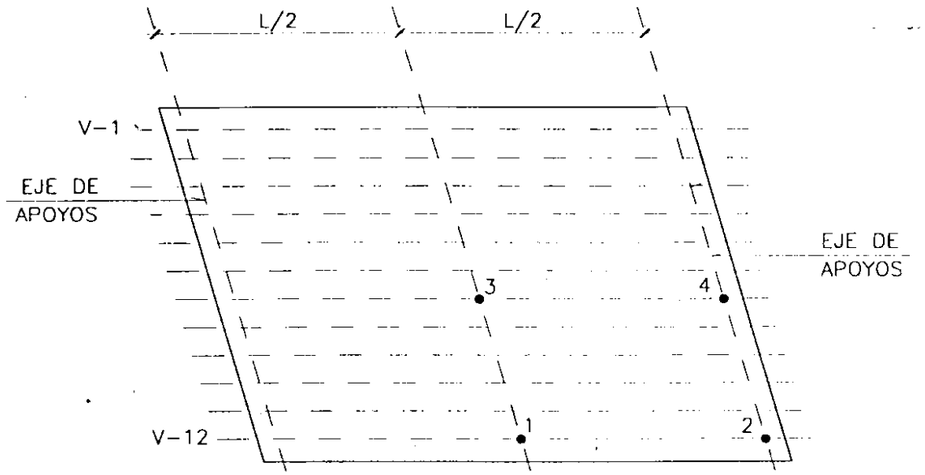
	Reacciones para cada viga											
Posicion	1	2	3	4	5	6	7	8	9	10	11	12
unica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

6.5 Total carga muerta:

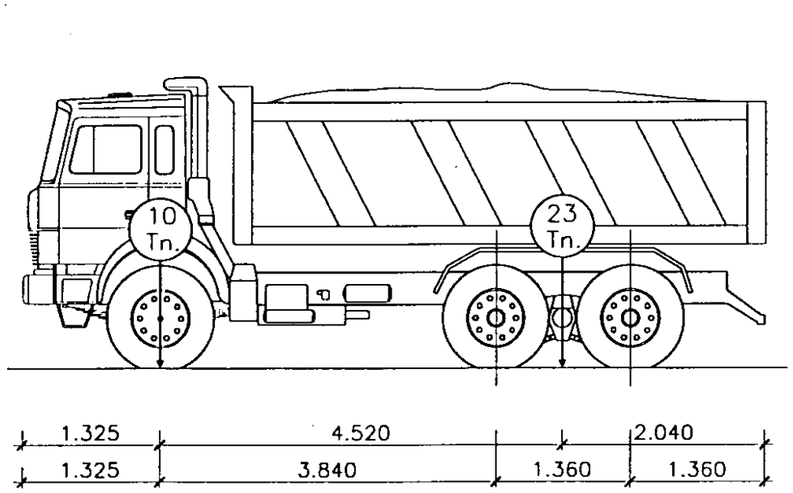
	Reacciones para cada viga											
Posicion	1	2	3	4	5	6	7	8	9	10	11	12
unica	8.93	11.08	12.68	14.22	15.27	15.78	15.78	15.27	14.22	12.68	11.08	8.93



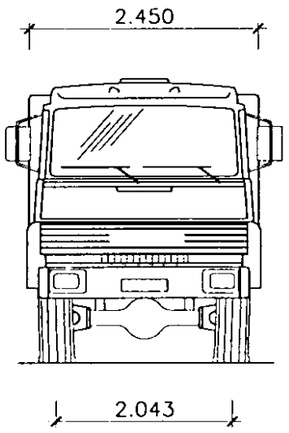
PLANTA

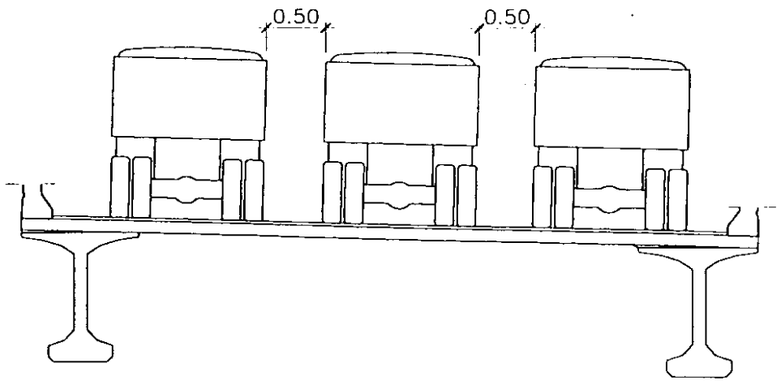


POSICION DE APARATOS DE MEDIDA



CAMION TIPO





SECCION

MOMENTO MAXIMO (m. Tn.) PRODUCIDO EN EL TREN DE CARGAS DE :		FLECHAS TEORICAS (mm.) PRODUCIDO EN EL TREN DE CARGAS DE :
INSTRUCCION	PRUEBA DE CARGA	PRUEBA DE CARGA
106.7	40.9	2.21

-LOS VALORES DE MOMENTOS Y FLECHAS SE DAN PARA CENTRO DE VANO DE LA VIGA 7

PRUEBA DE CARGA

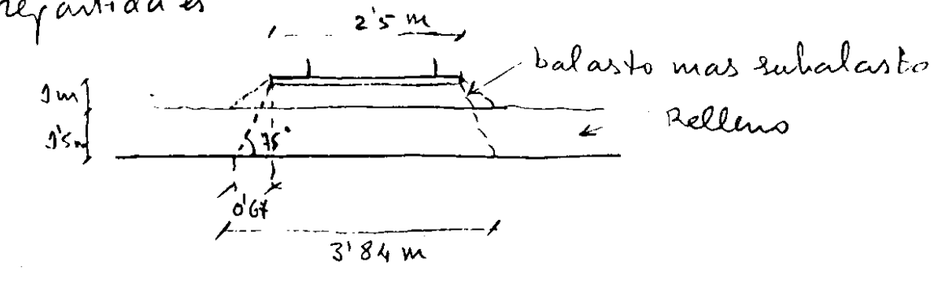
PASO INFERIOR 709+140

Paso Inferior en P.K. 714+140

Sobrecarga sobre el dintel para el caso de la sobrecarga repartida de 15T/m que señala el Eurocódigo.

Peso de balasto mas vias 3'26 T/m

Relleno 1'5m ⇒ la situación de la sobrecarga repartida es:



⇒ la sobrecarga es 15/3'84 = 3'91 T/m

Considerando el impacto 3'91 . 2 = 7'81

S_{cd} = 3'26 + 7'81 = 11'07

Coeficiente de balasto del terreno de apoyo

K_{30} = 5000 t/m³

$$K = \frac{2}{3} K_{30} \cdot \left(1 + \frac{b}{2 \cdot l}\right) = \frac{2}{3} \times 5000 \left(1 + \frac{9.60}{2 \times 26.00}\right) = 3948 \ t/m3$$

En el tramo lateral los esfuerzos del último metro, serán resistidos con la viga de borde.

Estos esfuerzos son:

Md sup. = − 119,4 m-t.
Md inf. = + 152,7 "

} At-est < Amin = 29,40 cm² ⌀ 6⌀25

Wk = 0.19 mm.

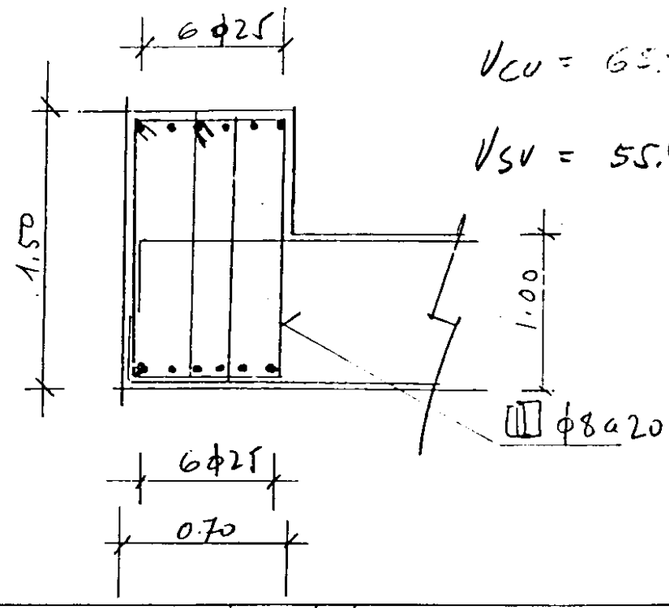
Vd = 113,5 Tn

$A_{90\text{-}est}$ = 8,61 cm²

V_{u1} = 511.0 Mp

V_{cu} = 65.97 "

V_{su} = 55.48 "



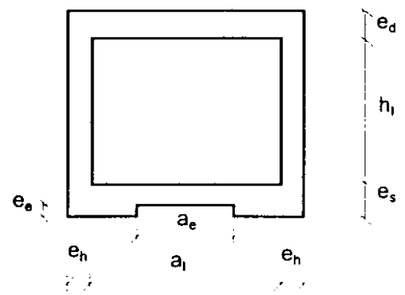
⌀8a20 (4 RAMAS)

637ECCRE TREN DE ALTA VELOCIDAD SUBTRAMO VII MARCO PK 714+140

CÁLCULO DE MARCOS BAJO FERROCARRIL

GEOMETRÍA

a_l =	8,00 m
h_l =	6,50 m
e_s =	0,80 m
e_d =	1,00 m
e_h =	0,80 m
a_e =	0,00 m
e_e =	0,00 m
longitud del marco =	37,65 m



MATERIALES

HORMIGÓN | H-250

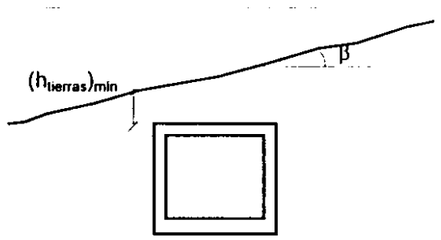
TERRENO BAJO SOLERA Y RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

caracteristicas del relleno sobre dintel y en trasdoses

$(h_{tierras})_{min}$ =	1,70 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m^3
$\gamma_{sumergido}$ =	1,0 t/m^3

caracteristicas del terreno bajo solera

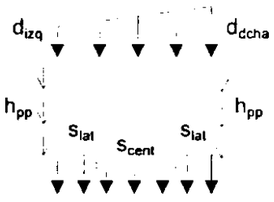
$K_{balasto}$ =	3948 t/m^3



HIPÓTESIS SIMPLES CONSIDERADAS

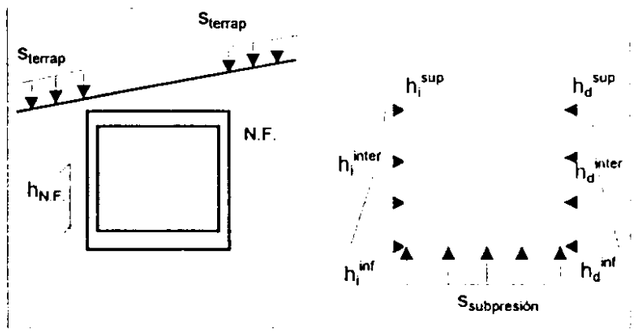
☑ PESO PROPIO DE MARCO Y TIERRAS SOBRE DINTEL

d_{izq} =	5,90 t/m
d_{dcha} =	5,90 t/m
h_{pp} =	2,00 t/m
s_{lat} =	2,00 t/m
s_{cent} =	2,00 t/m



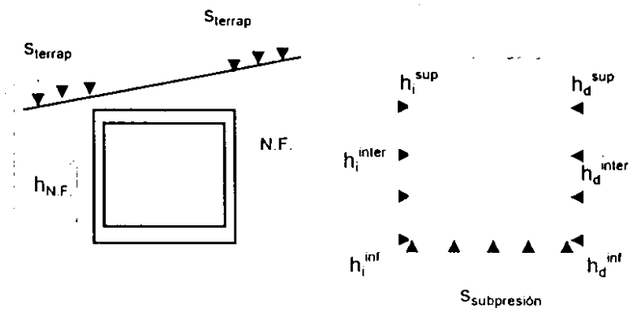
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	4,35 t/m
h_i^{inter} =	10,83 t/m
h_i^{inf} =	11,41 t/m
h_d^{sup} =	4,35 t/m
h_d^{inter} =	10,83 t/m
h_d^{inf} =	11,41 t/m
$s_{subpresión}$ =	0,00 t/m



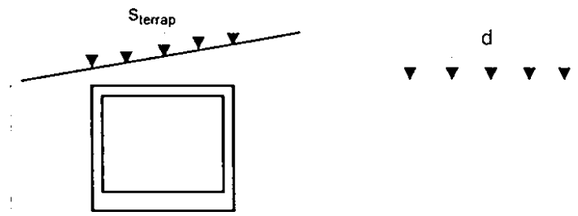
☑ EMPUJE DE TIERRAS ACTIVO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	2,83 t/m
h_i^{inter} =	7,04 t/m
h_i^{inf} =	7,56 t/m
h_d^{sup} =	2,83 t/m
h_d^{inter} =	7,04 t/m
h_d^{inf} =	7,56 t/m
$s_{subpresión}$ =	0,00 t/m



☑ SOBRECARGA SOBRE DINTEL DE MARCO

s_{terrap} =	11,07 t/m
d =	11,07 t/m

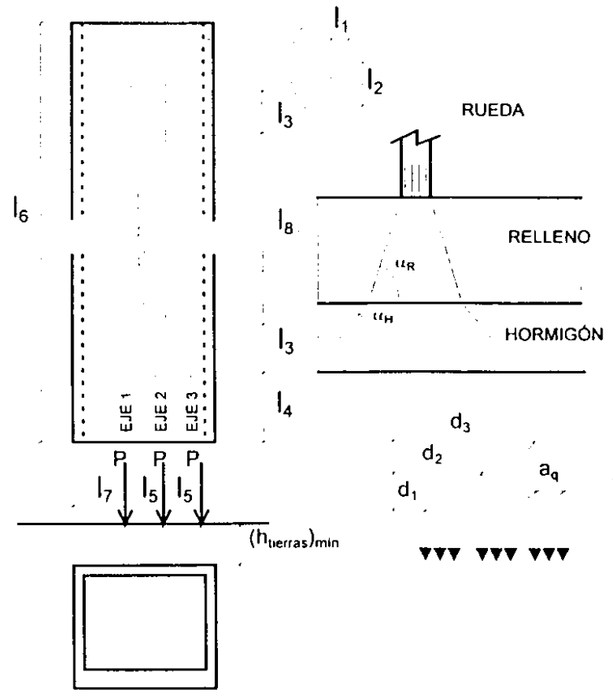


☐ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	30,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	6,50 m
l_5 =	1,50 m
l_6 =	37,65 m
a_q =	2,17 m

☐ considerar un segundo vehículo pesado

l_8 =	3,17 m



posiciones del tren y ancho eficaz de cada eje:

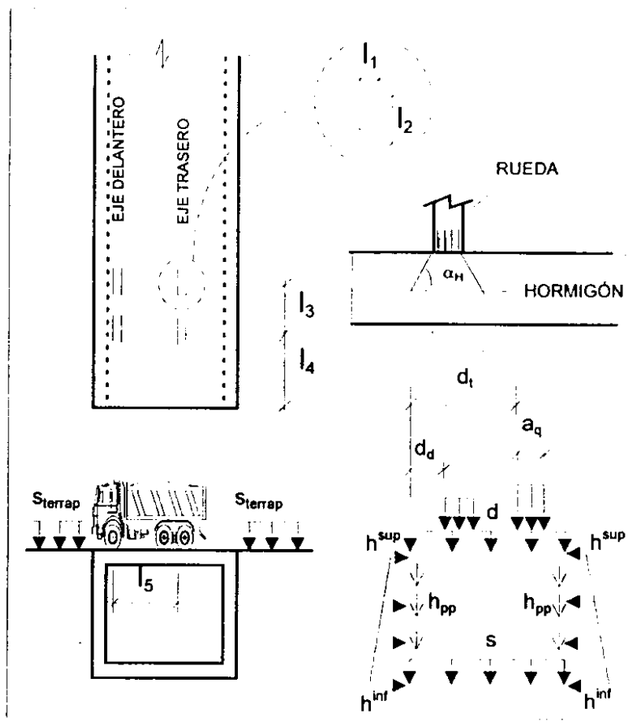
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	ancho eficaz(m) VEHÍCULO 1 eje 1	VEHÍCULO 1 eje 2	VEHÍCULO 1 eje 3	VEHÍCULO 2 eje 1	VEHÍCULO 2 eje 2	VEHÍCULO 2 eje 3
1	1,75	0,66	2,16	3,66	6,29	7,57	8,02			
2	2,65	1,56	3,06	4,56	7,16	7,94	7,89			

3	3,40	2,31	3,81	5,31	7,66	8,02	7,54			

☑ HIPÓTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30^{TON} COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
s_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
s =	2 t/m
h_{pp} =	2,00 t/m



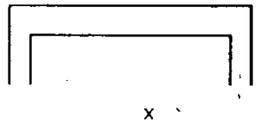
empuje	h^{sup}(t/m)	h^{inf}(t/m)
reposo	0,46	7,31
activo	0,30	4,76

COMBINACIONES DE HIPÓTESIS SIMPLES

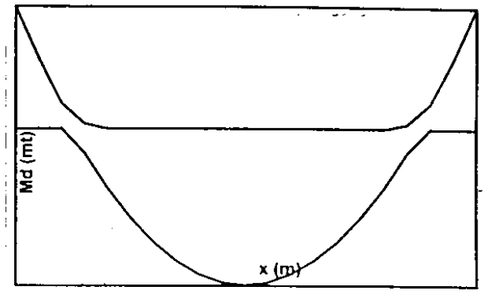
HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª						
P. P. DE MARCO Y TIERRAS SOBRE DINTEL	1,60	1,60									
EMPUJE DE TIERRAS AL REPOSO	1,60										
EMPUJE DE TIERRAS ACTIVO		1,60									
SOBRECARGA SOBRE DINTEL DE MARCO	1,60	1,60									
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)			1,60								
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)				1,60							

ENVOLVENTE DE ESFUERZOS

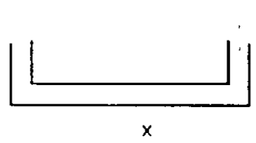
envolvente de esfuerzos en dintel



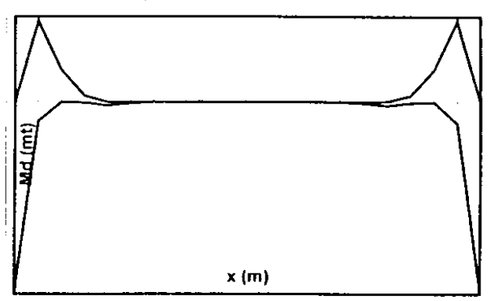
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-119,4	0,0	113,5
0,44	-69,4	0,0	101,6
0,88	-24,7	0,0	89,6
1,32	-5,1	23,8	77,7
1,76	0,0	58,0	65,7
2,20	0,0	86,9	53,8
2,64	0,0	110,6	41,9
3,08	0,0	129,0	29,9
3,52	0,0	142,2	17,9
3,96	0,0	150,0	6,0
4,40	0,0	152,7	6,0
4,84	0,0	150,1	6,0
5,28	0,0	142,2	17,9
5,72	0,0	129,0	30,0
6,16	0,0	110,6	41,8
6,60	0,0	86,9	53,8
7,04	0,0	58,0	65,8
7,48	-4,4	23,8	77,7
7,92	-24,7	0,0	89,6
8,36	-69,4	0,0	101,6
8,80	-119,4	0,0	113,5



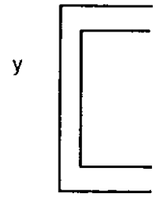
envolvente de esfuerzos en solera



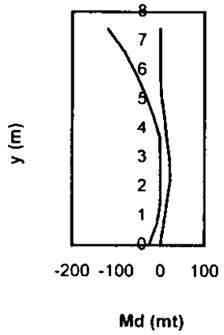
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-26,5	0,0	72,4
0,44	-2,7	11,6	17,5
0,88	0,0	4,6	9,1
1,32	-0,1	0,9	2,4
1,76	-0,5	0,0	0,8
2,20	-0,2	0,0	0,3
2,64	0,0	0,0	0,1
3,08	0,0	0,0	0,0
3,52	0,0	0,0	0,0
3,96	0,0	0,0	0,0
4,40	0,0	0,0	0,0
4,84	0,0	0,0	0,0
5,28	0,0	0,0	0,0
5,72	0,0	0,0	0,0
6,16	0,0	0,0	0,1
6,60	-0,2	0,0	0,3
7,04	-0,5	0,1	0,8
7,48	-0,1	0,9	2,4
7,92	0,0	4,6	9,1
8,36	-3,0	11,6	17,5
8,80	-26,5	0,0	72,4



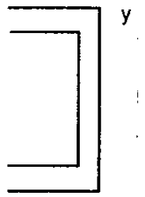
envolvente de esfuerzos en hastial izquierdo



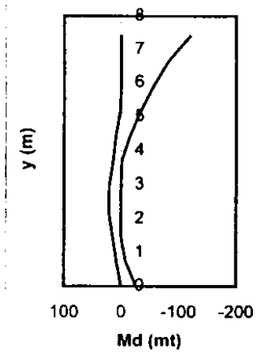
y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-26,5	142,0	0,0	0,0	33,7
0,74	-7,7	46,7	7,9	139,6	21,3
1,48	0,0	0,0	14,2	137,3	10,0
2,22	0,0	0,0	21,4	134,9	7,0
2,96	0,0	0,0	20,5	132,5	13,5
3,70	-1,6	130,1	13,8	37,2	20,4
4,44	-16,0	127,8	9,1	34,8	28,8
5,18	-34,5	125,4	1,7	32,4	36,4
5,92	-56,6	123,1	0,0	0,0	43,1
6,66	-83,0	120,7	0,0	0,0	49,1
7,40	-119,4	120,7	0,0	0,0	49,1



envolvente de esfuerzos en hastial derecho



y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-26,5	142,0	0,0	0,0	33,7
0,74	-7,9	43,4	7,9	139,6	21,3
1,48	0,0	0,0	14,2	137,3	10,0
2,22	0,0	0,0	21,4	134,9	7,0
2,96	0,0	0,0	20,5	132,5	13,5
3,70	-1,6	130,2	13,6	33,9	20,4
4,44	-16,0	127,8	9,0	31,5	28,8
5,18	-34,5	125,4	1,5	29,2	36,4
5,92	-56,6	123,1	0,0	0,0	43,1
6,66	-83,0	120,7	0,0	0,0	49,1
7,40	-119,4	120,7	0,0	0,0	49,1



637ECCRE TRE DE ALTA VELOCIDAD SUBTRAMO VII MARCO PK 714+140

ARMADURA DE MARCOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN H-250

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO AEH-500

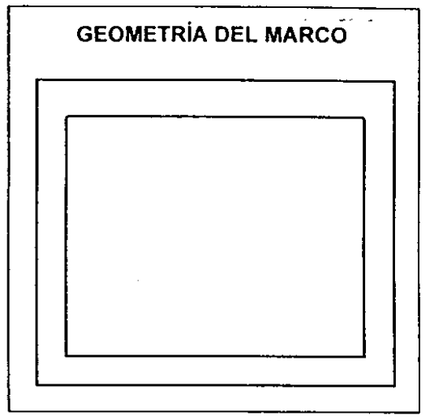
γ_s = 1,15

recubrimiento solera = 0,05 m

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

GEOMETRÍA DEL MARCO



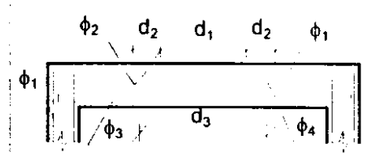
FISURACIÓN

Ambiente tipo II

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel



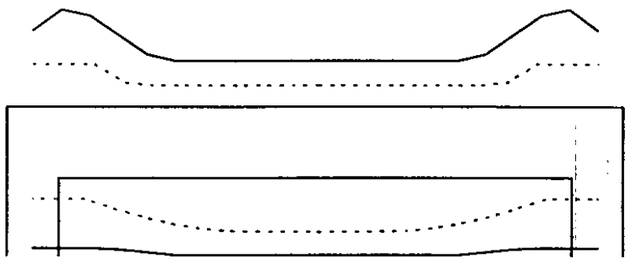
d_1 = 5,00 m

d_2 = 2,00 m

d_3 = 6,50 m

	ϕ(mm)	sep(m)
ϕ_1	25	0,100
ϕ_2	20	0,100
ϕ_3	25	0,100
ϕ_4	8	0,100

fisuración

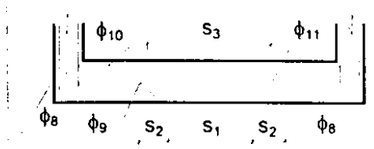


sección	$w_{máx}$ (mm)	w_{adm} (mm)
izquierda	0,14	0,22
central	0,12	0,22
derecha	0,14	0,22

armadura necesaria

armadura dispuesta

armadura en solera



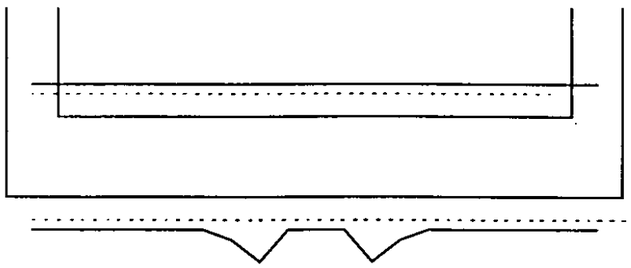
s_1 = 1,00 m

s_2 = 1,00 m

s_3 = 0,00 m

	ϕ(mm)	sep(m)
ϕ_8	16	0,125
ϕ_9	16	0,125
ϕ_{10}	16	0,125
ϕ_{11}	0	0,125

fisuración



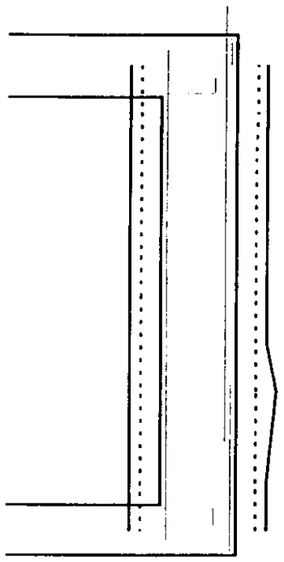
sección	$w_{máx}$ (mm)	w_{adm} (mm)
izquierda	0,00	0,34
central	0,00	0,34
derecha	0,00	0,34

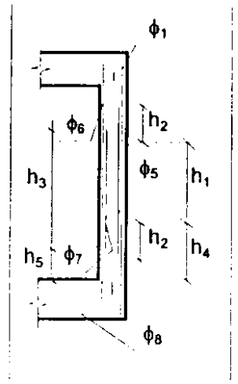
armadura necesaria

armadura dispuesta

Sobrecarga sobre el dintel para el caso de carga puntual que indica la instrucción española.
Será debida únicamente al peso del balasto mas las vias, es decir 3'26 T/m

armadura en hastiales





	ϕ(mm)	sep(m)
ϕ5	16	0,125
ϕ6	16	0,125
ϕ7	0	0,125

h_1 = 5,00 m
h_2 = 1,00 m
h_3 = 0,00 m
h_4 = 2,00 m
h_5 = 0,00 m

armadura necesaria
armadura dispuesta

fisuración

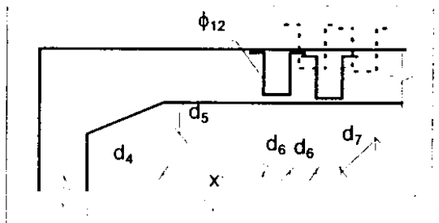
sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,16	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

x = 1,01 m (d = 1,01 m)
V_d = 75,3 ton
V_{u1} = 480,0 ton
V_{u2} = 85,7 ton
d_4 = 0,05 m
d_5 = 0,05 m

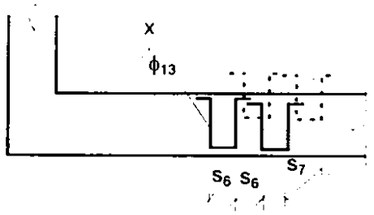
ϕ_{12}(mm)	d_6	d_7
10	0,300	0,400



comprobación en solera

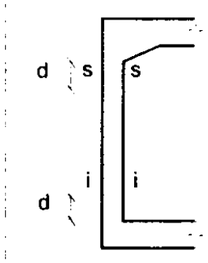
x = 0,75 m (d = 0,75 m)
V_d = 5,0 ton
V_{u1} = 375,0 ton
V_{u2} = 48,4 ton

ϕ_{13}(mm)	s_6	s_7
0	0,300	0,400



comprobación en hastiales

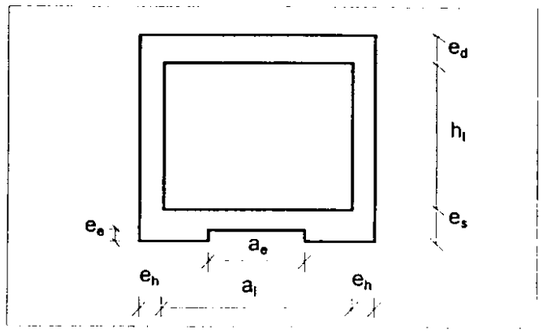
V_d^{s-s} = 44,5 ton
V_d^{H} = 14,9 ton
V_{u1} = 380,0 ton
V_{u2} = 49,1 ton



CÁLCULO DE MARCOS BAJO FERROCARRIL

GEOMETRÍA

a_l =	8,00 m
h_l =	6,50 m
e_s =	0,80 m
e_d =	1,00 m
e_h =	0,80 m
a_e =	0,00 m
e_e =	0,00 m
longitud del marco =	37,65 m



MATERIALES

HORMIGÓN H-250

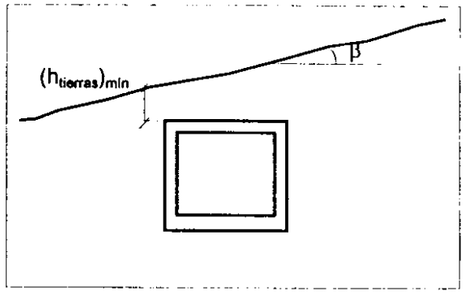
TERRENO BAJO SOLERA Y RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

características del relleno sobre dintel y en trasdoses

$(h_{tierras})_{min}$ =	1,70 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m^3
$\gamma_{sumergido}$ =	1,0 t/m^3

características del terreno bajo solera

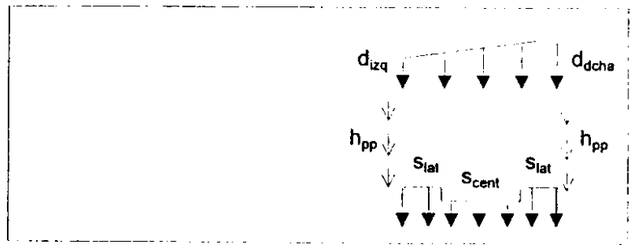
$K_{balasto}$ =	3948 t/m^3



HIPÓTESIS SIMPLES CONSIDERADAS

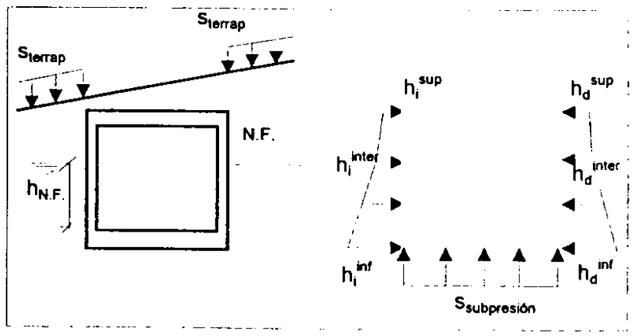
☑ PESO PROPIO DE MARCO Y TIERRAS SOBRE DINTEL

d_{izq} =	5,90 t/m
d_{dcha} =	5,90 t/m
h_{pp} =	2,00 t/m
s_{lat} =	2,00 t/m
s_{cent} =	2,00 t/m



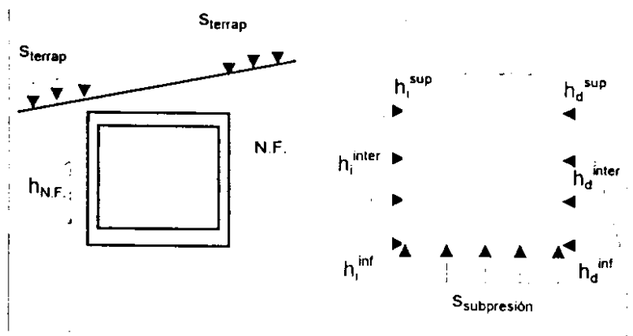
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	3,42 t/m
h_i^{inter} =	9,90 t/m
h_i^{inf} =	10,49 t/m
h_d^{sup} =	3,42 t/m
h_d^{inter} =	9,90 t/m
h_d^{inf} =	10,49 t/m
$s_{subpresión}$ =	0,00 t/m



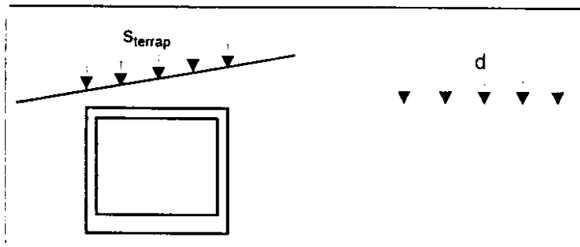
☑ EMPUJE DE TIERRAS ACTIVO

s_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	2,23 t/m
h_i^{inter} =	6,44 t/m
h_i^{inf} =	6,96 t/m
h_d^{sup} =	2,23 t/m
h_d^{inter} =	6,44 t/m
h_d^{inf} =	6,96 t/m
$s_{subpresión}$ =	0,00 t/m



☑ SOBRECARGA SOBRE DINTEL DE MARCO

s_{terrap} =	3,26 t/m
d =	3,26 t/m

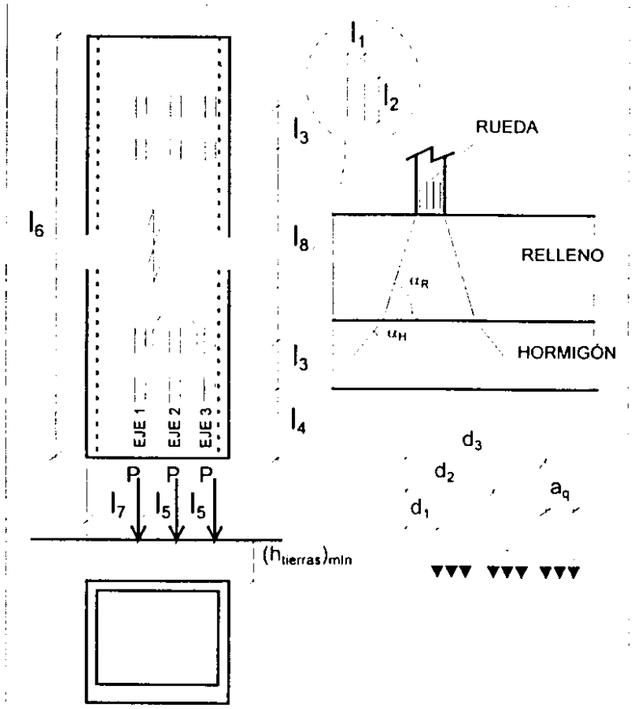


☑ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	60,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	6,50 m
l_5 =	1,50 m
l_6 =	37,65 m
a_q =	2,17 m

☐ considerar un segundo vehículo pesado

l_8 =	3,17 m



posiciones del tren y ancho eficaz de cada eje:

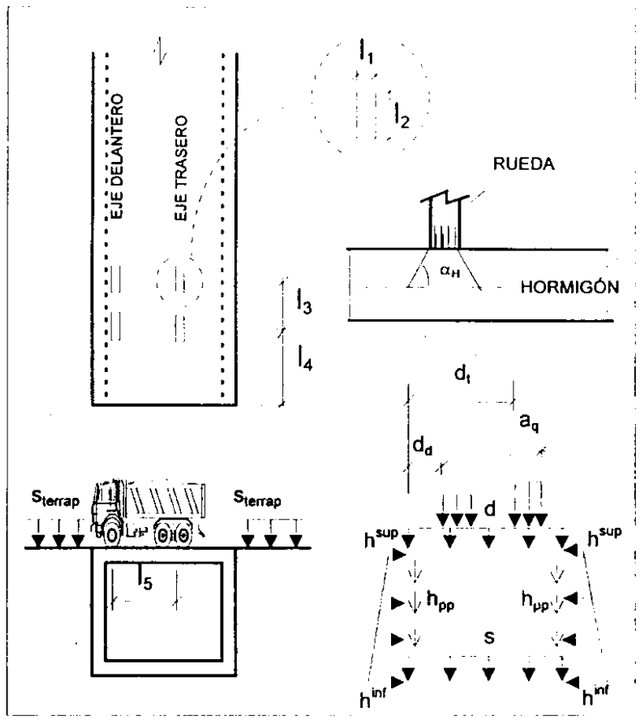
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	ancho eficaz(m) VEHÍCULO 1 eje 1	eje 2	eje 3	VEHÍCULO 2 eje 1	eje 2	eje 3
1	1,75	0,66	2,16	3,66	6,29	7,57	8,02			
2	2,65	1,56	3,06	4,56	7,16	7,94	7,89			

3	3,40	2,31	3,81	5,31	7,66	8,02	7,54			

☑ HIPÓTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30TON COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
S_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
s =	2 t/m
h_{pp} =	2,00 t/m



empuje	h^{sup}(t/m)	h^{inf}(t/m)
reposo	0,46	7,31
activo	0,30	4,76

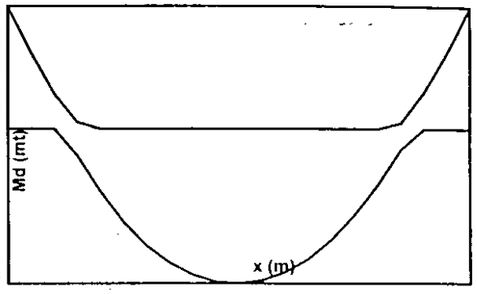
COMBINACIONES DE HIPÓTESIS SIMPLES

HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª	6ª	7ª	8ª	9ª		
P. P. DE MARCO Y TIERRAS SOBRE DINTEL	1,60	1,60	1,60	1,60	1,60	1,60					
EMPUJE DE TIERRAS AL REPOSO	1,60	1,60	1,60								
EMPUJE DE TIERRAS ACTIVO				1,60	1,60	1,60					
SOBRECARGA SOBRE DINTEL DE MARCO	1,60	1,60	1,60	1,60	1,60	1,60					
TREN DE CARGAS EN POSICIÓN 1	1,60			1,60							
TREN DE CARGAS EN POSICIÓN 2		1,60			1,60						
TREN DE CARGAS EN POSICIÓN 3			1,60			1,60					
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)							1,60				
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)								1,60			

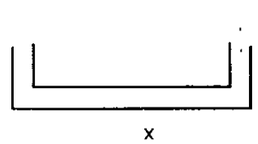
ENVOLVENTE DE ESFUERZOS

envolvente de esfuerzos en dintel

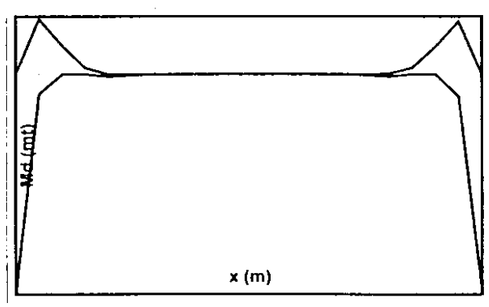
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-93,3	0,0	87,6
0,44	-58,1	0,0	81,2
0,88	-26,8	0,0	71,6
1,32	-5,1	20,7	62,5
1,76	0,0	48,0	53,4
2,20	0,0	71,1	45,3
2,64	0,0	88,9	36,3
3,08	0,0	101,4	27,3
3,52	0,0	110,5	18,3
3,96	0,0	115,7	6,9
4,40	0,0	116,9	10,1
4,84	0,0	114,8	10,1
5,28	0,0	108,9	18,9
5,72	0,0	99,1	27,8
6,16	0,0	84,3	36,7
6,60	0,0	65,4	44,1
7,04	0,0	42,6	53,1
7,48	-4,4	15,8	60,9
7,92	-28,1	0,0	69,9
8,36	-58,4	0,0	76,3
8,80	-92,8	0,0	82,8



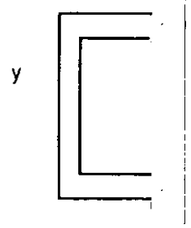
envolvente de esfuerzos en solera



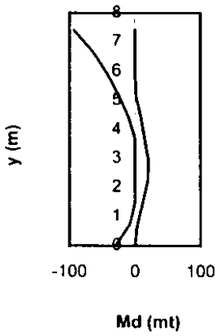
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-29,6	0,0	71,9
0,44	-2,7	7,5	10,8
0,88	0,0	3,9	7,1
1,32	0,0	0,9	2,5
1,76	-0,3	0,0	0,5
2,20	-0,1	0,0	0,3
2,64	0,0	0,0	0,1
3,08	0,0	0,0	0,0
3,52	0,0	0,0	0,0
3,96	0,0	0,0	0,0
4,40	0,0	0,0	0,0
4,84	0,0	0,0	0,0
5,28	0,0	0,0	0,0
5,72	0,0	0,0	0,0
6,16	0,0	0,0	0,1
6,60	-0,1	0,0	0,3
7,04	-0,3	0,1	0,4
7,48	0,0	0,9	2,4
7,92	0,0	3,8	6,8
8,36	-3,0	7,2	11,4
8,80	-29,1	0,0	70,1



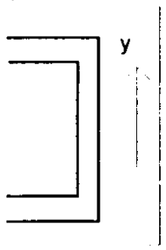
envolvente de esfuerzos en hastial izquierdo



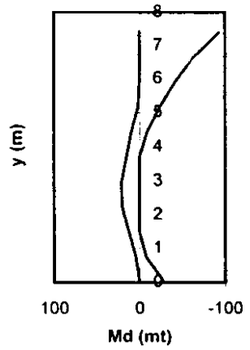
y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-29,6	113,3	0,0	0,0	32,8
0,74	-7,7	46,7	4,0	100,9	21,4
1,48	0,0	0,0	11,6	98,5	10,9
2,22	0,0	0,0	19,6	96,1	4,0
2,96	0,0	0,0	20,4	93,8	9,8
3,70	0,0	0,0	14,6	91,4	16,0
4,44	-9,6	99,1	9,1	34,8	23,3
5,18	-24,2	96,8	1,7	32,4	29,8
5,92	-41,9	94,4	0,0	0,0	35,5
6,66	-63,4	86,3	0,0	0,0	40,3
7,40	-93,3	86,3	0,0	0,0	40,3



envolvente de esfuerzos en hastial derecho



y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-29,1	108,5	0,0	0,0	32,8
0,74	-7,9	43,4	4,3	98,8	21,4
1,48	0,0	0,0	11,9	96,4	10,9
2,22	0,0	0,0	20,0	94,0	4,0
2,96	0,0	0,0	20,8	91,6	9,9
3,70	0,0	0,0	15,1	89,3	16,0
4,44	-9,2	94,3	9,0	31,5	23,3
5,18	-23,9	91,9	1,5	29,2	29,8
5,92	-41,6	89,6	0,0	0,0	35,5
6,66	-63,1	87,2	0,0	0,0	40,3
7,40	-92,8	83,3	0,0	0,0	40,3



ARMADURA DE MARCOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN H-250

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO AEH-500

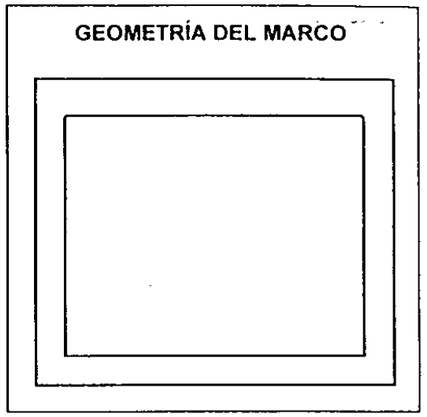
γ_s = 1,15

recubrimiento solera = 0,05 m

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

GEOMETRÍA DEL MARCO



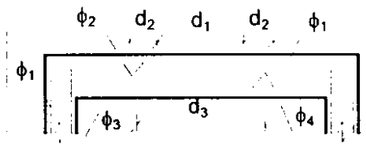
FISURACIÓN

Ambiente tipo II

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel



d_1 = 5,00 m

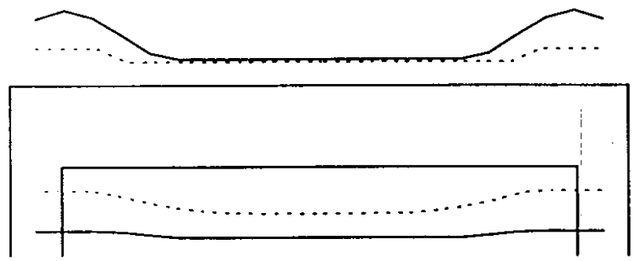
d_2 = 2,00 m

d_3 = 6,50 m

	ϕ(mm)	sep(m)
ϕ_1	25	0,125
ϕ_2	16	0,125
ϕ_3	25	0,125
ϕ_4	8	0,125

fisuración

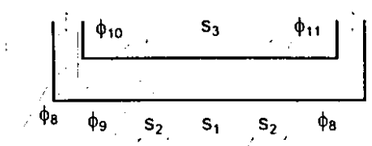
sección	$W_{máx}$ (mm)	W_{adm} (mm)
izquierda	0,10	0,22
central	0,10	0,22
derecha	0,10	0,22



armadura necesaria

armadura dispuesta

armadura en solera



s_1 = 5,00 m

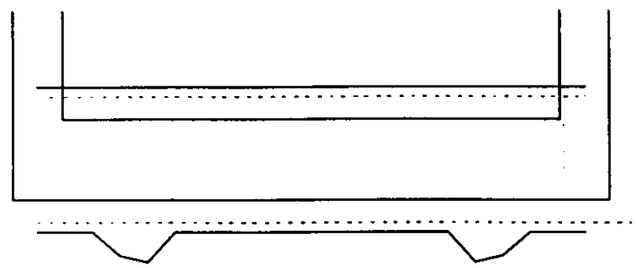
s_2 = 1,00 m

s_3 = 0,00 m

	ϕ(mm)	sep(m)
ϕ_8	16	0,125
ϕ_9	16	0,125
ϕ_{10}	16	0,125
ϕ_{11}	0	0,125

fisuración

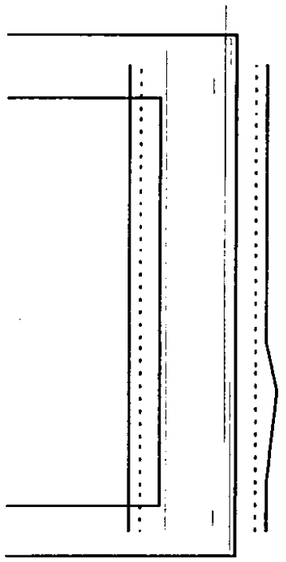
sección	$W_{máx}$ (mm)	W_{adm} (mm)
izquierda	0,00	0,34
central	0,00	0,34
derecha	0,00	0,34

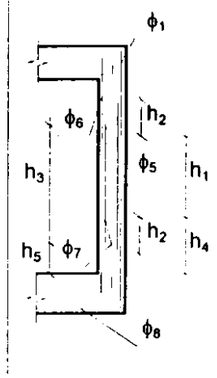


armadura necesaria

armadura dispuesta

armadura en hastiales





	ϕ(mm)	sep(m)
ϕ_5	16	0,125
ϕ_6	16	0,125
ϕ_7	0	0,125

h_1 = 5,00 m
h_2 = 1,00 m
h_3 = 0,00 m
h_4 = 2,00 m
h_5 = 0,00 m

armadura necesaria
armadura dispuesta

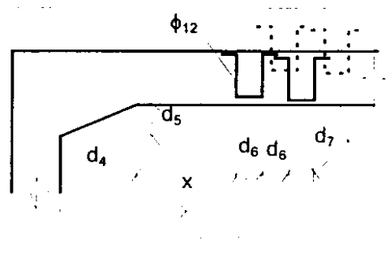
fisuración

sección	$W_{máx}$ (mm)	W_{adm} (mm)
superior	0,16	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

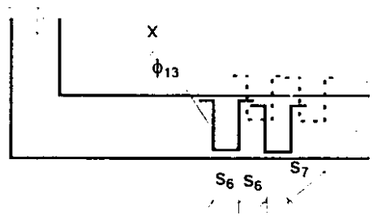
x = 1,01 m (d = 1,01 m)
V_d = 60,7 ton
V_{u1} = 480,0 ton
V_{u2} = 85,7 ton
d_4 = 0,05 m
d_5 = 0,05 m



ϕ_{12}(mm)	d_6	d_7
10	0,300	0,400

comprobación en solera

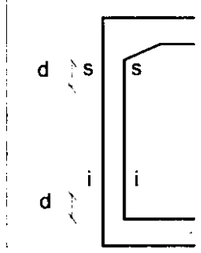
x = 0,75 m (d = 0,75 m)
V_d = 4,3 ton
V_{u1} = 375,0 ton
V_{u2} = 48,4 ton



ϕ_{13}(mm)	s_6	s_7
0	0,300	0,400

comprobación en hastiales

V_d^{s-s} = 36,6 ton
V_d^{H} = 15,4 ton
V_{u1} = 380,0 ton
V_{u2} = 49,1 ton



TYPSA
INGENIEROS CONSULTORES Y ARQUITECTOS

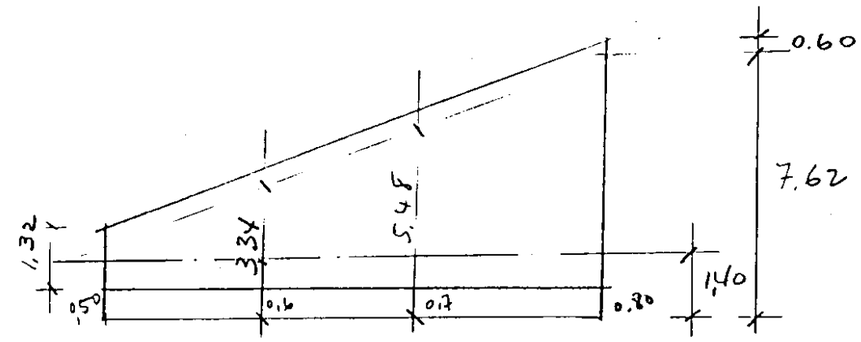
PROYECTO: | N:
DOCUMENTO: 6.3.7 | N: EDICION:

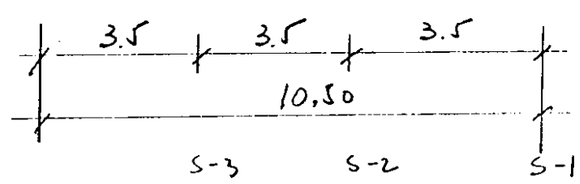
ALETAS

Tensión admisible del terreno = 25 t/m²

Estructura PK 714+140

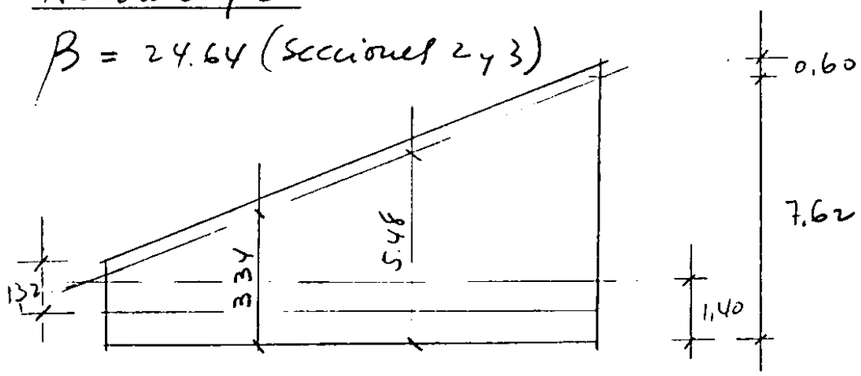
Aletas 1 y 4

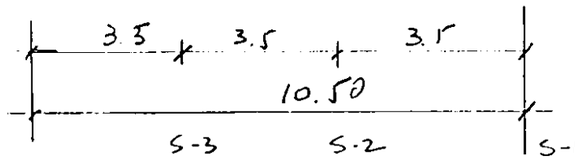




Aletas 2 y 3

B = 24.64 (Secciones 2 y 3)





REALIZADO POR: FECHA FIRMA | COMPROBADO POR FECHA FIRMA | HOJA DE

TYPSA INGENIEROS CONSULTORES Y ARQUITECTOS	PROYECTO:	Nº
	DOCUMENTO:	Nº EDICION

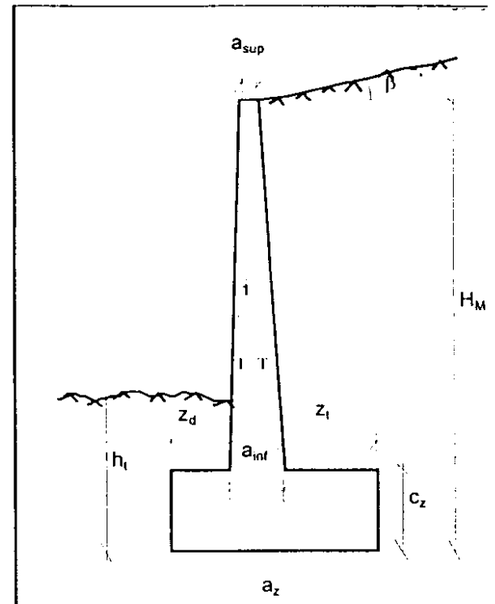
Las aletas 1 y 4 tienen las mismas dimensiones en sección y armado que las aletas 1 y 2 del PK 704+360.

Las aletas 2 y 3 se calculan a continuación.

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	7,62 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_z=	4,10 m
c_z=	0,85 m
I=	0,00
T=	0,09
a_{inf}=	0,91 m
z_d=	0,50 m
z_t=	2,69 m
β =	0,0 º



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

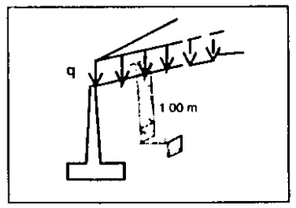
peso especifico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 º
angulo de rozamiento contacto relleno-muro δ_M =	0 º
angulo de rozamiento contacto terreno-muro δ_T =	30 º
cohesión =	0 t/m²
σ_{adm} =	25 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,34 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	15,24 t/m²	$(\sigma_{med})_{adm}$ =	25,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	31,01 t/m²	$(\sigma_{máx})_{adm}$ =	31,25 t/m²	l_c = 4,03 m

DESLIZAMIENTO Y VUELCO

γ_d=	2,20	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,60	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

REALIZADO POR:	FECHA / FIRMA		COMPROBADO POR:	FECHA / FIRMA		HOJA	DE

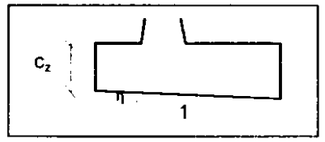
peso específico
del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

○ base de zapata horizontal

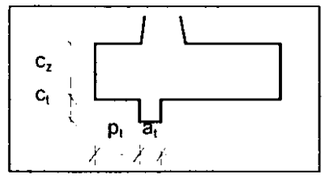
◉ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



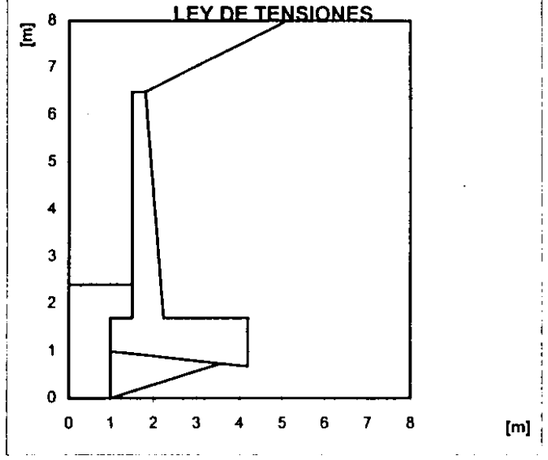
MATERIALES

HORMIGÓN | H-250 | γ_c = 1,50

ACERO | AEH-500 | γ_s = 1,15

recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 16,94 t
Vd= 8,60 t

en zarpa trasera
Vcu= 54,09 t
Vd= 22,30 t

en base de muro
Vcu= 42,55 t
Vd= 19,88 t

CÁLCULO A FLEXIÓN DE ZAPATA

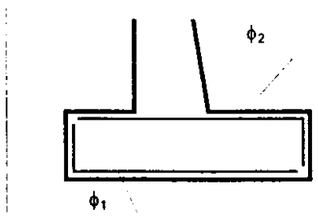
Amín= 11,5 cm²/m.a. de armadura en tracción (cuantía mecánica)
18,2 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 8,5 mt
Anec= 2,7 cm²/m.a. por flexión

ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera
Md= 34,7 mt
Anec= 10,5 cm²/m.a. por flexión

ϕ_2(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo | II

zarpa delantera
M= 5,3 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

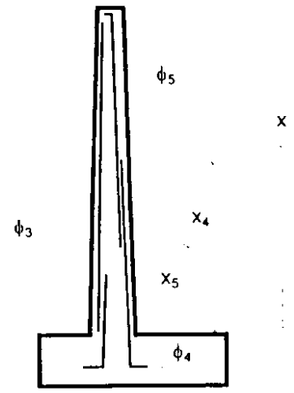
zarpa trasera
M= 21,7 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 38,0 mt
y mínimo Nd= 5,4 t Anec 10,2 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

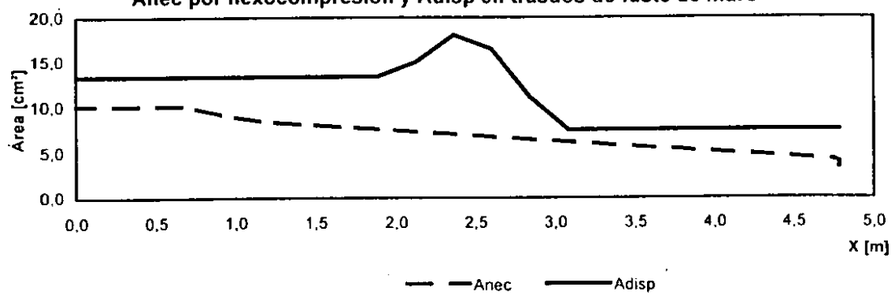
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	2,00

longitud de anclaje para ϕ_4= 0,60 m
longitud de anclaje para ϕ_5= 0,59 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

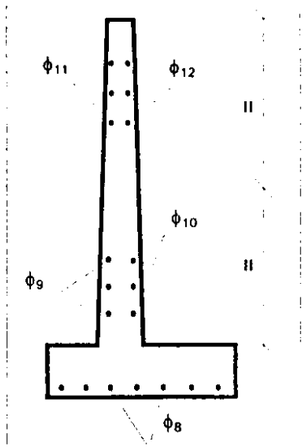
En x= 0,0 m
h= 0,73 m
M= 23,77 mt
N= 6,03 t

w_{adm}= 0,26 mm
$w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec[(*)] (cm²)	5,1	11,7		8,2	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

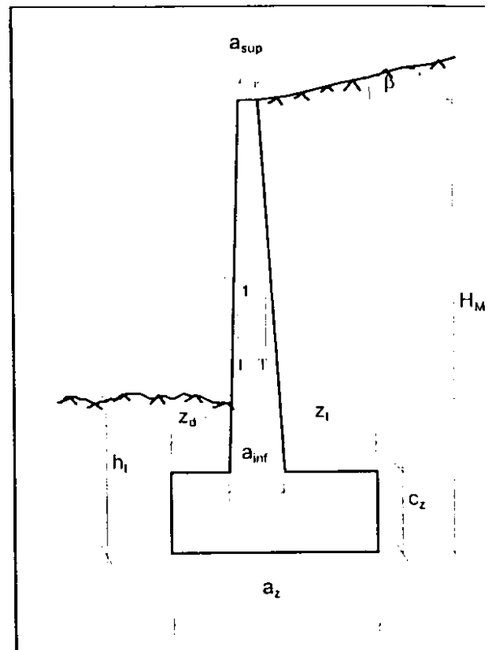
(*) Armadura necesaria estrictamente por cuantía geométrica



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	3,34 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_z=	2,20 m
c_z=	0,50 m
I=	0,00
T=	0,09
a_{inf}=	0,56 m
z_d=	0,40 m
z_I=	1,24 m
β =	24,6 °



Coeficientes de empuje activo (Coulomb)

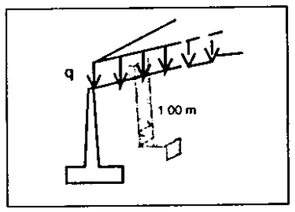
Kah = 0,49 Kav = 0,04 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,43 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	25 t/m²
f_p=	1,25

CARGAS



carga uniforme indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	7,05 t/m²	$(\sigma_{med})_{adm}$ =	25,00 t/m²	longitud comprimida
$\sigma_{máx}$ =	15,73 t/m²	$(\sigma_{máx})_{adm}$ =	31,25 t/m²	l_c = 1,97 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,70	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,33	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

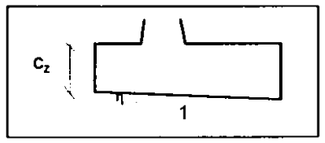
peso específico
del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

○ base de zapata horizontal

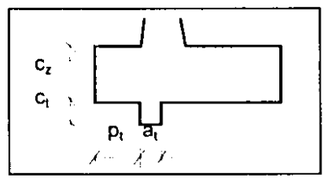
◉ base de zapata inclinada

η = 0,10



○ zapata con tacón

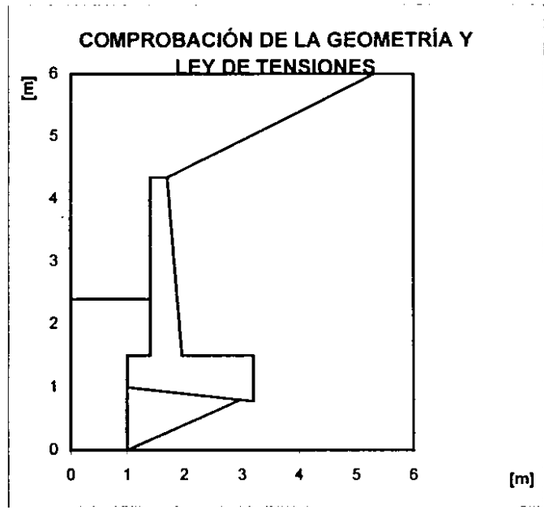
p_t= 1,00 m
c_t= 0,50 m
a_t= 0,40 m
K_p= 0,00
Vcu= 22,59 t
Vd= 0,00 t



MATERIALES

HORMIGÓN H-250 ▼
γ_c = 1,50
ACERO AEH-500 ▼
γ_s = 1,15
recubrimiento zapata= 0,05 m
recubrimiento muro= 0,04 m

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



COMPROBACIÓN A CORTANTE

coeficiente de mayoración de
acciones γ_f= 1,60

en zarpa delantera
Vcu= 16,94 t
Vd= 4,15 t

en zarpa trasera
Vcu= 38,12 t
Vd= 8,41 t

en base de muro
Vcu= 31,78 t
Vd= 7,95 t

CÁLCULO A FLEXIÓN DE ZAPATA

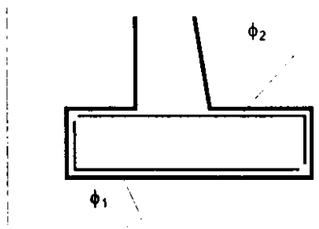
Amín= 8,1 cm²/m.a. de armadura en tracción (cuantía mecánica)
13,1 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera
Md= 2,6 mt
Anec= 1,2 cm²/m.a. por flexión

ϕ_1(mm)	16 ▼
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera
Md= 8,6 mt
Anec= 3,6 cm²/m.a. por flexión

ϕ_2(mm)	16 ▼
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo II ▼

zarpa delantera
M= 1,6 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

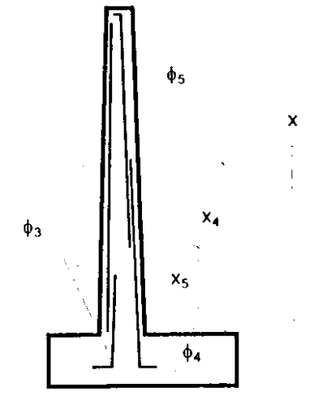
zarpa trasera
M= 5,4 mt
w_{adm}= 0,30 mm
w_{max}= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

En base de alzado (x=0)
Para Md= 9,4 mt
y mínimo Nd= 2,7 t Anec 6,7 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12 ▼	12 ▼	12 ▼
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	7,5	cm²/m.a.

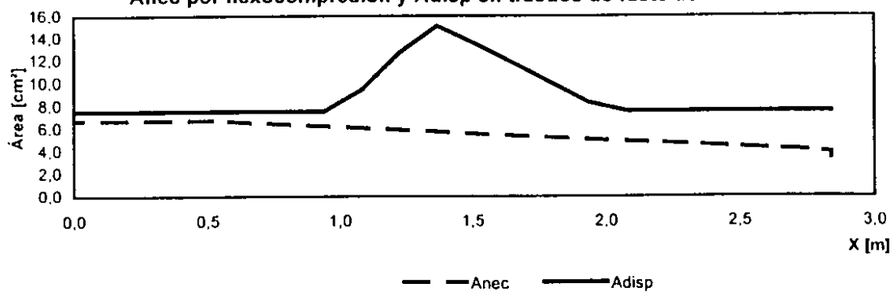
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	2,00
x_5 (m)	1,00

longitud de anclaje para ϕ_4= 0,62 m
longitud de anclaje para ϕ_5= 0,33 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



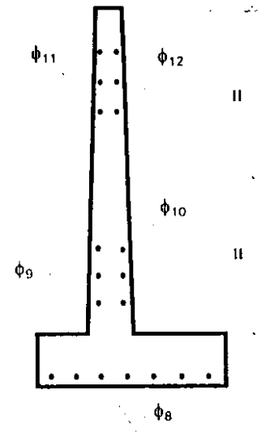
COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m
h= 0,56 m
M= 5,86 mt
N= 2,99 t
w_{adm}= 0,27 mm
$w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	3,6	8,9		6,8	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica



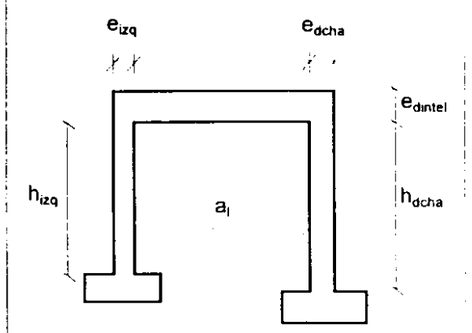
Paso Inferior en P.K. 714+695

CÁLCULO DE PÓRTICOS BAJO FERROCARRIL

GEOMETRÍA

TYPSA

a_l =	8,00 m
h_{izq} =	6,00 m
h_{dcha} =	6,00 m
e_{dintel} =	1,00 m
e_{izq} =	0,80 m
e_{dcha} =	0,80 m
longitud del pórtico =	19,20 m

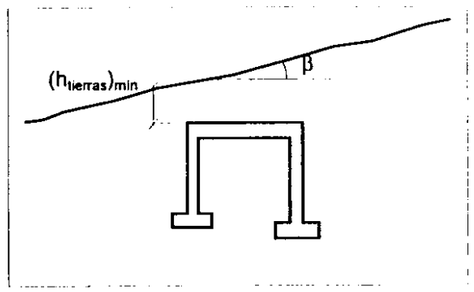


MATERIALES

HORMIGÓN | H-250 ▼

CARACTERÍSTICAS DEL RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

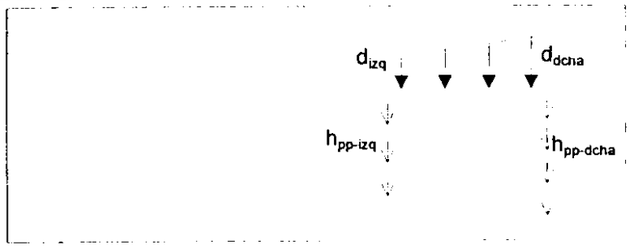
$(h_{tierras})_{min}$ =	1,00 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m^3
$\gamma_{sumergido}$ =	1,0 t/m^3



HIPÓTESIS SIMPLES CONSIDERADAS

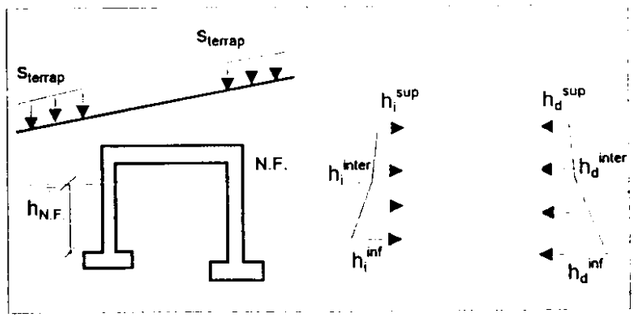
☑ PESO PROPIO DE PÓRTICO Y TIERRAS SOBRE DINTEL

d_{izq} =	4,50 t/m
d_{dcha} =	4,50 t/m
$h_{pp\text{-}izq}$ =	2,00 t/m
$h_{pp\text{-}dcha}$ =	2,00 t/m



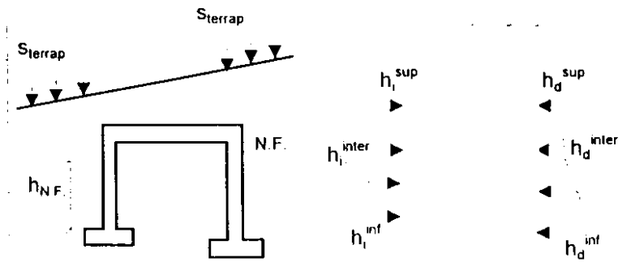
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	3,70 t/m
h_i^{inter} =	9,72 t/m
h_i^{inf} =	9,72 t/m
h_d^{sup} =	3,70 t/m
h_d^{inter} =	9,72 t/m
h_d^{inf} =	9,72 t/m



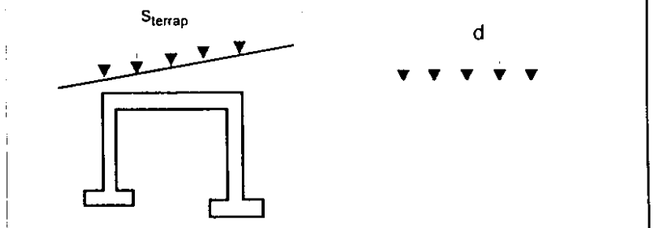
☑ EMPUJE DE TIERRAS ACTIVO

s_{terrap} =	5,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	2,41 t/m
h_i^{inter} =	6,32 t/m
h_i^{inf} =	6,32 t/m
h_d^{sup} =	2,41 t/m
h_d^{inter} =	6,32 t/m
h_d^{inf} =	6,32 t/m



☑ SOBRECARGA SOBRE DINTEL DE PÓRTICO

s_{terrap} =	11,60 t/m
d =	11,60 t/m

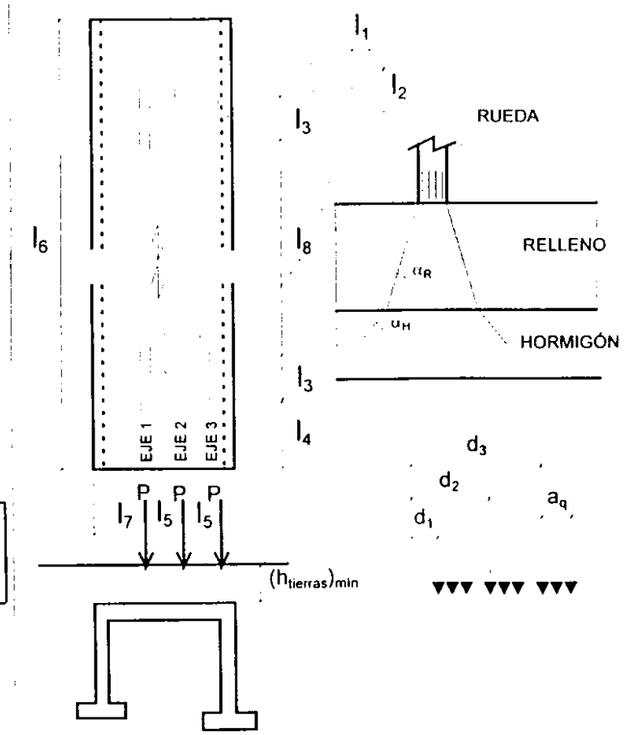


☐ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	60,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	6,50 m
l_5 =	1,60 m
l_6 =	19,20 m
a_q =	1,80 m

☑ considerar un segundo vehiculo pesado

l_8 =	3,17 m



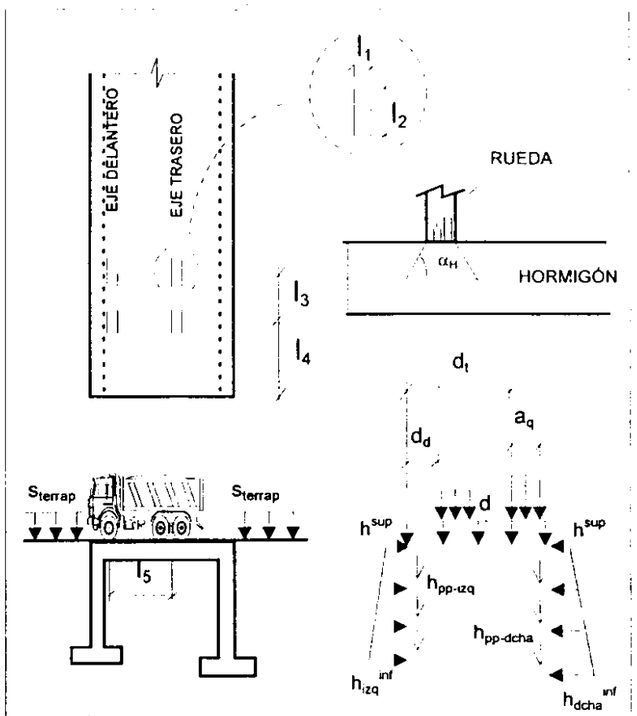
posiciones del tren y ancho eficaz de cada eje:

					ancho eficaz(m) VEHÍCULO 1			ancho eficaz(m) VEHÍCULO 2		
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	eje 1	eje 2	eje 3	eje 1	eje 2	eje 3
1	1,75	0,85	2,45	4,05	5,96	7,34	7,74	5,96	7,34	7,74
2	2,65	1,75	3,35	4,95	6,86	7,68	7,53	6,86	7,68	7,53
3	3,40	2,50	4,10	5,70	7,36	7,73	7,12	7,36	7,73	7,12

☑ HIPÓTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30 TON COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
s_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
h_{pp-izq} =	2,00 t/m
$h_{pp-dcha}$ =	2,00 t/m



empuje	h^{sup}(t/m)	h_{izq}^{inf}(t/m)	h_{dcha}^{inf}(t/m)
reposo	0,46	6,48	6,48
activo	0,30	4,21	4,21

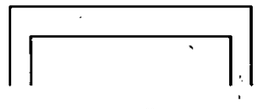
COMBINACIONES DE HIPÓTESIS SIMPLES

CREAR CUADRO DE COMBINACIONES DE HIPÓTESIS

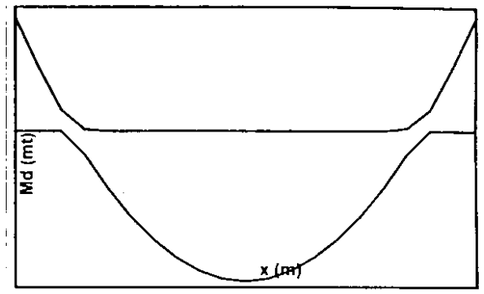
HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª						
P. P. DE PORTICO Y TIERRAS SOBRE DINTEL	1,60	1,60									
EMPUJE DE TIERRAS AL REPOSO	1,60										
EMPUJE DE TIERRAS ACTIVO		1,60									
SOBRECARGA SOBRE DINTEL DE PORTICO	1,60	1,60									
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)			1,60								
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)				1,60							

ENVOLVENTE DE ESFUERZOS

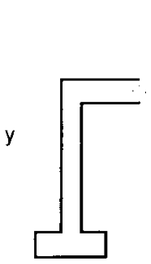
envolvente de esfuerzos en dintel



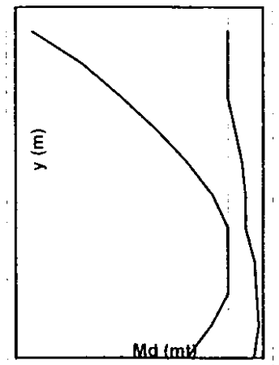
x (m)	M_d<0 (mt)	M_d>0 (mt)	V_d (ton)
0,00	-110,2	0,0	107,7
0,44	-62,8	0,0	96,3
0,88	-20,4	0,0	85,0
1,32	-2,2	21,9	73,7
1,76	0,0	54,3	62,3
2,20	0,0	81,8	51,0
2,64	0,0	104,2	39,7
3,08	0,0	121,7	28,4
3,52	0,0	134,2	17,0
3,96	0,0	141,6	5,7
4,40	0,0	144,1	5,7
4,84	0,0	141,6	5,7
5,28	0,0	134,2	17,0
5,72	0,0	121,7	28,4
6,16	0,0	104,2	39,7
6,60	0,0	81,8	51,0
7,04	-0,3	54,4	62,4
7,48	-2,9	21,9	73,7
7,92	-20,4	0,0	85,0
8,36	-62,8	0,0	96,3
8,80	-110,2	0,0	107,7



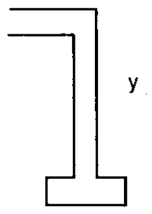
envolvente de esfuerzos en hastial izquierdo



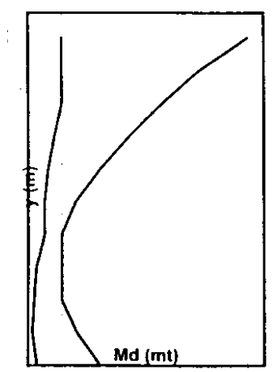
y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,3	28,5	14,6	133,1	21,2
0,65	-9,5	26,4	17,4	131,0	15,1
1,30	0,0	0,0	16,3	128,9	9,6
1,95	0,0	0,0	15,1	126,9	12,8
2,60	0,0	0,0	10,0	124,8	17,8
3,25	-8,5	122,7	10,0	18,0	22,4
3,90	-23,0	120,6	8,0	16,0	28,8
4,55	-40,2	118,5	4,0	13,9	34,5
5,20	-59,8	116,5	0,0	0,0	39,6
5,85	-81,6	114,4	0,0	0,0	44,1
6,50	-110,2	114,4	0,0	0,0	44,1



envolvente de esfuerzos en hastial derecho



y (m)	M_d<0 (mt)	$(N_d)_{con}$ (ton)	M_d>0 (mt)	$(N_d)_{con}$ (ton)	V_d (ton)
0,00	-23,1	31,7	14,6	133,1	21,2
0,65	-9,3	29,6	17,5	131,0	15,1
1,30	0,0	0,0	16,3	128,9	9,6
1,95	0,0	0,0	15,1	126,9	12,9
2,60	0,0	0,0	10,0	124,8	17,8
3,25	-8,5	122,7	10,2	21,3	22,4
3,90	-23,0	120,6	8,2	19,2	28,8
4,55	-40,2	118,6	4,3	17,1	34,5
5,20	-59,8	116,5	0,0	0,0	39,6
5,85	-81,6	114,4	0,0	0,0	44,1
6,50	-110,2	114,4	0,0	0,0	44,1



638ECCRE TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 714+605

ARMADURA DE PORTICOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN | H-250

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO | AEH-500

γ_s = 1,15

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

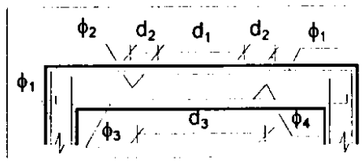
FISURACIÓN

Ambiente tipo | II

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel

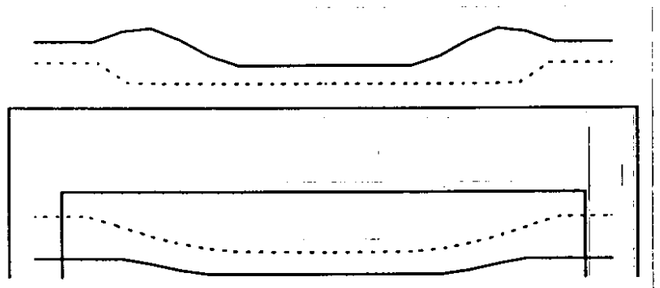


d_1 = 3,00 m

d_2 = 2,00 m

d_3 = 6,00 m

	ϕ(mm)	sep(m)
ϕ_1	25	0,125
ϕ_2	20	0,125
ϕ_3	25	0,125
ϕ_4	12	0,125



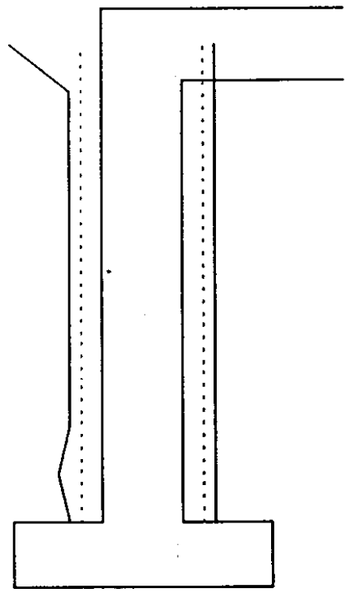
fisuración

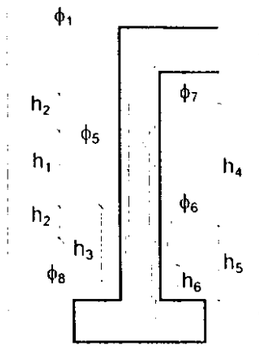
sección	$w_{máx}$ (mm)	w_{adm} (mm)
izquierda	0,17	0,22
central	0,15	0,22
derecha	0,17	0,22

armadura necesaria

armadura dispuesta

armadura en hastial izquierdo





	ϕ(mm)	sep(m)
ϕ_5	16	0,125
ϕ_6	16	0,125
ϕ_7	0	0,125
ϕ_8	16	0,125

h_1 = 5,00 m

h_2 = 0,70 m

h_3 = 1,00 m

h_4 = 0,00 m

h_5 = 2,00 m

h_6 > 0,41 m

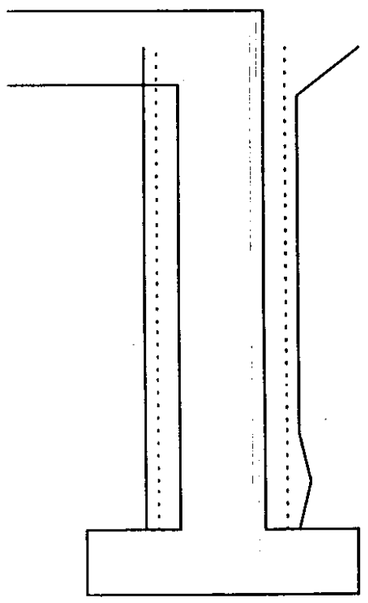
armadura necesaria

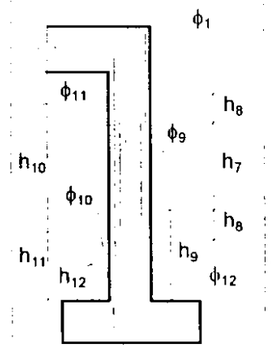
armadura dispuesta

fisuración

sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,20	0,22
central	0,00	0,26
inferior	0,00	0,26

armadura en hastial derecho





	ϕ(mm)	sep(m)
ϕ_9	16	0,125
ϕ_{10}	16	0,125
ϕ_{11}	0	0,125
ϕ_{12}	16	0,125

h_7 = 5,00 m

h_8 = 0,70 m

h_9 = 1,00 m

h_{10} = 0,00 m

h_{11} = 2,00 m

h_{12} > 0,41 m

armadura necesaria

armadura dispuesta

fisuración

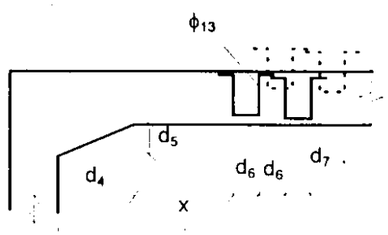
sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,20	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

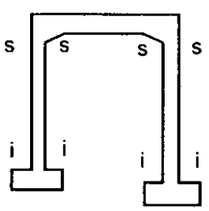
$x =$	1,01 m	($d =$ 1,01 m)
$V_d =$	71,4 ton	
$V_{u2} = V_{cu} + V_{su} =$	77,2 ton	
$d_4 =$	0,05 m	
$d_5 =$	0,05 m	

ϕ_{13}(mm)	d_6	d_7
8	0,400	0,300



comprobación en hastiales

hastial	izquierdo	derecho
V_d^{s-s} (ton)	39,5	39,5
V_d^{H} (ton)	14,2	14,2
V_{cu} (ton)	49,1	49,1

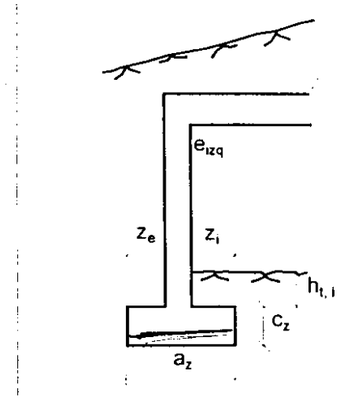


CÁLCULO DE LA ZAPATA IZQUIERDA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

$z_e =$	0,90 m
$z_i =$	0,90 m
$e_{izq} =$	0,80 m
$a_z =$	2,60 m
$c_z =$	0,80 m
$h_{t,i} =$	0,60 m
recubrimiento de armaduras=	0,05 m

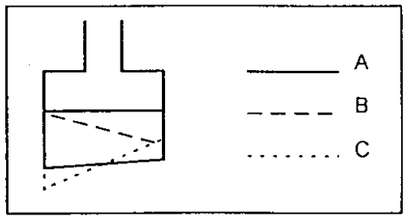


TERRENO

$(\sigma_{med})_{adm} =$	60,00 t/m²
$f_p =$	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	60,0	41,7	14,4	41,7
$\sigma_{máx}$ (t/m²)	75,0	45,0	27,4	61,2
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	35,4
zarpa interior	48,4	43,2

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

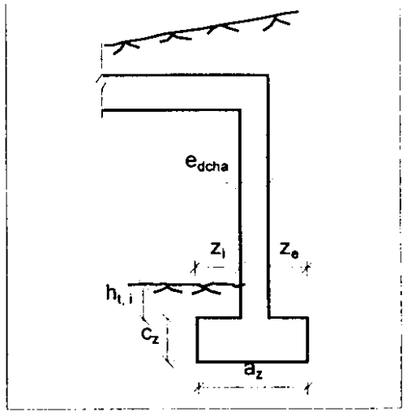
armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,125	16,1	11,3	0,00	0,34
inferior	16	0,125	16,1	12,0	0,00	0,34

CÁLCULO DE LA ZAPATA DERECHA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	0,90 m
z_i =	0,90 m
e_{dcha} =	0,80 m
a_z =	2,60 m
c_z =	0,80 m
$h_{t,i}$ =	0,60 m
recubrimiento de armaduras=	0,05 m

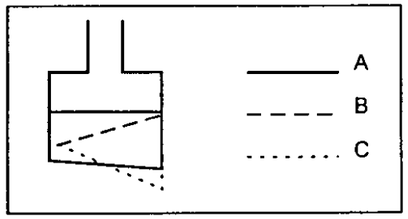


TERRENO

$(\sigma_{med})_{adm}$ =	60,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	60,0	41,7	15,2	41,7
$\sigma_{máx}$ (t/m²)	75,0	45,0	28,1	61,2
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	35,4
zarpa interior	48,4	21,2

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

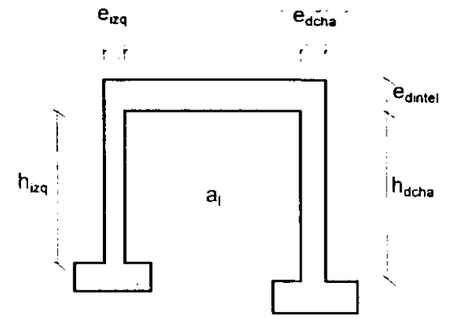
	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
armadura						
superior	16	0,125	16,1	11,3	0,00	0,34
inferior	16	0,125	16,1	12,0	0,00	0,34

CÁLCULO DE PÓRTICOS BAJO FERROCARRIL

GEOMETRÍA

TYPSA

a_l =	8,00 m
h_{izq} =	6,00 m
h_{dcha} =	6,00 m
e_{dintel} =	1,00 m
e_{izq} =	0,80 m
e_{dcha} =	0,80 m
longitud del pórtico =	18,00 m

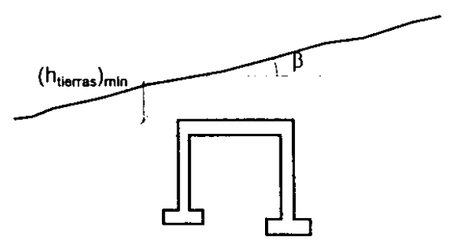


MATERIALES

. HORMIGÓN H-250

CARACTERÍSTICAS DEL RELLENO SOBRE DINTEL Y EN TRASDÓS DE HASTIALES

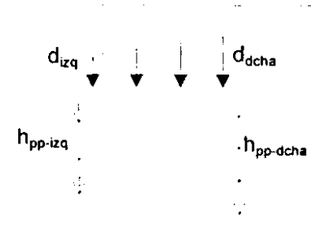
$(h_{tierras})_{min}$ =	1,00 m
β =	0,0 °
φ =	32,5 °
$\gamma_{aparente}$ =	2,0 t/m³
$\gamma_{sumergido}$ =	1,0 t/m³



HIPÓTESIS SIMPLES CONSIDERADAS

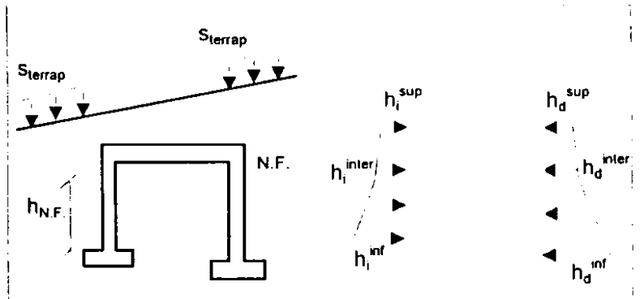
☑ PESO PROPIO DE PÓRTICO Y TIERRAS SOBRE DINTEL

d_{izq} =	4,50 t/m
d_{dcha} =	4,50 t/m
$h_{pp\text{-}izq}$ =	2,00 t/m
$h_{pp\text{-}dcha}$ =	2,00 t/m



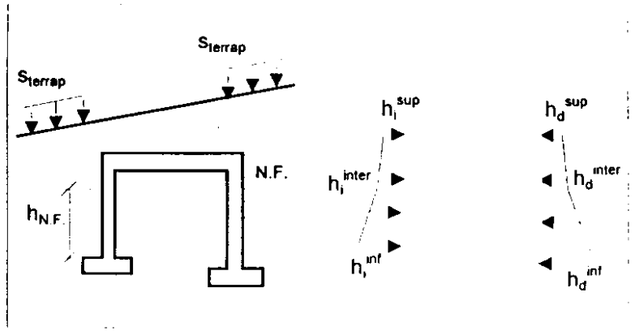
☑ EMPUJE DE TIERRAS AL REPOSO

s_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{reposo} =	0,46
h_i^{sup} =	2,78 t/m
h_i^{inter} =	8,79 t/m
h_i^{inf} =	8,79 t/m
h_d^{sup} =	2,78 t/m
h_d^{inter} =	8,79 t/m
h_d^{inf} =	8,79 t/m



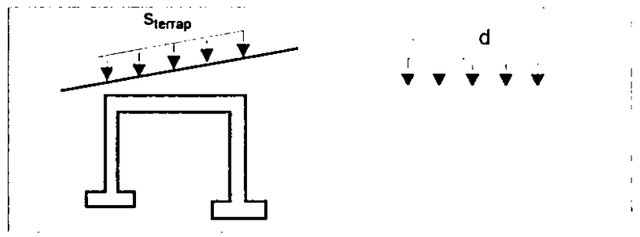
☑ EMPUJE DE TIERRAS ACTIVO

S_{terrap} =	3,00 t/m
$h_{N.F.}$ =	0,00 m
K_{activo}^{izq} =	0,30
K_{activo}^{dcha} =	0,30
h_i^{sup} =	1,81 t/m
h_i^{inter} =	5,72 t/m
h_i^{inf} =	5,72 t/m
h_d^{sup} =	1,81 t/m
h_d^{inter} =	5,72 t/m
h_d^{inf} =	5,72 t/m



☑ SOBRECARGA SOBRE DINTEL DE PÓRTICO

S_{terrap} =	3,26 t/m
d =	3,26 t/m

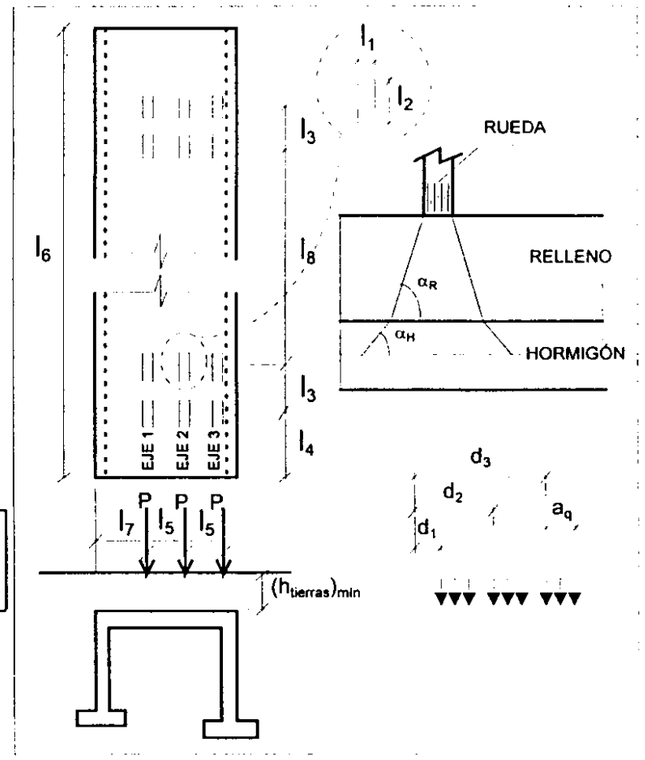


☑ VEHÍCULO PESADO

α_R =	75 °
α_H =	45 °
P =	60,0 ton
l_1 =	0,26 m
l_2 =	1,25 m
l_3 =	1,25 m
l_4 =	7,00 m
l_5 =	1,60 m
l_6 =	18,00 m
a_q =	1,80 m

☑ considerar un segundo vehículo pesado

l_8 =	3,17 m



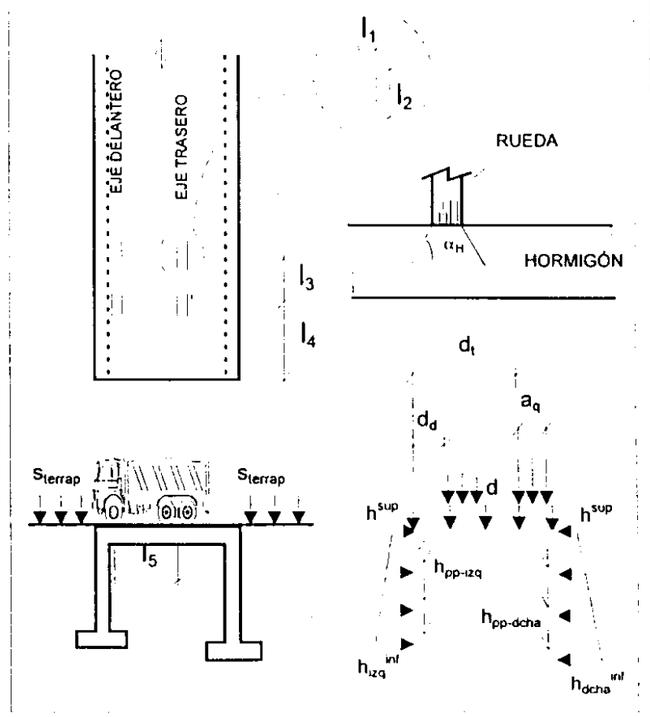
posiciones del tren y ancho eficaz de cada eje:

					ancho eficaz(m)					
					VEHÍCULO 1			VEHÍCULO 2		
posición	l_7 (m)	d_1 (m)	d_2 (m)	d_3 (m)	eje 1	eje 2	eje 3	eje 1	eje 2	eje 3
1	1,75	0,85	2,45	4,05	5,96	7,34	7,74	5,96	7,34	7,74
2	2,65	1,75	3,35	4,95	6,86	7,68	7,53	6,86	7,68	7,53
3	3,40	2,50	4,10	5,70	7,36	7,73	7,12	7,36	7,73	7,12

☑ HIPOTESIS EN FASE DE CONSTRUCCIÓN

(INCLUYE EL EMPUJE DE TIERRAS EN LOS HASTIALES TENIENDO EL RELLENO TALUDES HORIZONTALES, ASÍ COMO EL PESO PROPIO DEL MARCO Y EL PESO DE UN CAMIÓN DE 30 TON COLOCADO SOBRE EL DINTEL EN POSICIÓN QUE PRODUZCA LA MÁXIMA FLEXIÓN EN EL CENTRO DE ÉSTE)

α_H =	45 °
K_{reposo} =	0,46
K_{activo} =	0,30
S_{terrap} =	1,00 t/m
carga en eje delantero =	10 ton
carga en eje trasero =	23 ton
l_1 =	0,20 m
l_2 =	0,60 m
l_3 =	2,00 m
l_4 =	0,30 m
l_5 =	4,52 m
a_q =	0,70 m
d_d =	-0,14 m
d_t =	4,73 m
ancho eficaz eje delantero=	2,97 m
ancho eficaz eje trasero=	4,88 m
d =	2,50 t/m
h_{pp-izq} =	2,00 t/m
$h_{pp-dcha}$ =	2,00 t/m



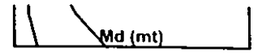
empuje	h^{sup}(t/m)	h_{izq}^{inf}(t/m)	h_{dcha}^{inf}(t/m)
reposo	0,46	6,48	6,48
activo	0,30	4,21	4,21

COMBINACIONES DE HIPÓTESIS SIMPLES

CREAR CUADRO DE COMBINACIONES DE HIPÓTESIS

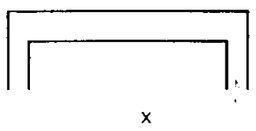
HIPÓTESIS	COEFICIENTES DE MAYORACIÓN DE HIPÓTESIS EN COMBINACIÓN:										
	1ª	2ª	3ª	4ª	5ª	6ª	7ª	8ª	9ª		
P. P. DE PORTICO Y TIERRAS SOBRE DINTEL	1,60	1,60	1,60	1,60	1,60	1,60					
EMPUJE DE TIERRAS AL REPOSO	1,60	1,60	1,60								
EMPUJE DE TIERRAS ACTIVO				1,60	1,60	1,60					
SOBRECARGA SOBRE DINTEL DE PORTICO	1,60	1,60	1,60	1,60	1,60	1,60					
TREN DE CARGAS EN POSICIÓN 1	1,60			1,60							
TREN DE CARGAS EN POSICIÓN 2		1,60			1,60						
TREN DE CARGAS EN POSICIÓN 3			1,60			1,60					
HIPOTESIS CONSTRUCTIVA(EMPUJE AL REPOSO)							1,60				
HIPOTESIS CONSTRUCTIVA(EMPUJE ACTIVO)								1,60			

5,85	-64,2	86,0	0,0	0,0	35,8
6,50	-87,3	79,9	0,0	0,0	35,8

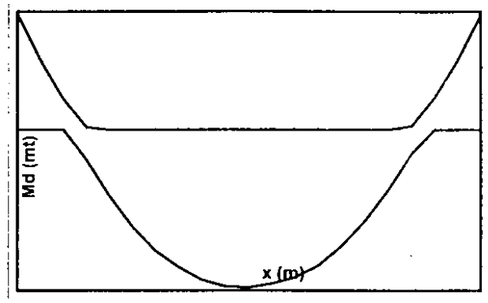


ENVOLVENTE DE ESFUERZOS

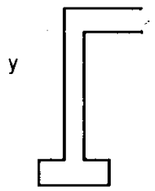
envolvente de esfuerzos en dintel



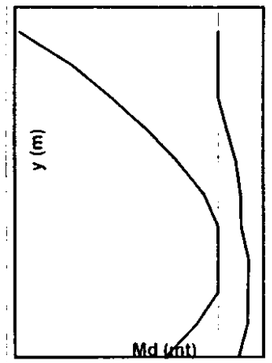
x	M_d<0	M_d>0	V_d
(m)	(mt)	(mt)	(ton)
0,00	-87,9	0,0	86,8
0,44	-53,8	0,0	81,4
0,88	-23,9	0,0	71,4
1,32	-2,2	22,4	63,5
1,76	0,0	49,4	53,8
2,20	0,0	72,0	46,1
2,64	0,0	90,3	36,7
3,08	0,0	102,3	27,2
3,52	0,0	111,7	17,7
3,96	0,0	116,7	8,3
4,40	0,0	117,6	10,3
4,84	0,0	114,9	10,3
5,28	0,0	110,4	19,7
5,72	0,0	101,7	29,0
6,16	0,0	87,1	38,3
6,60	0,0	68,4	44,8
7,04	-0,3	45,4	54,3
7,48	-2,9	18,2	61,8
7,92	-25,0	0,0	71,3
8,36	-53,9	0,0	76,8
8,80	-87,3	0,0	82,2



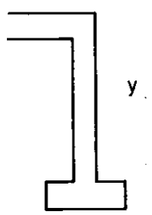
envolvente de esfuerzos en hastial izquierdo



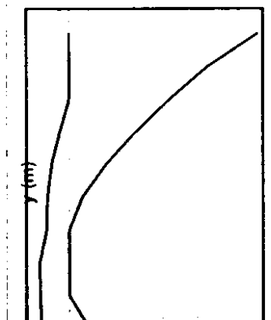
y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-23,3	28,5	8,9	95,9	21,2
0,65	-9,5	26,4	12,9	93,8	15,1
1,30	0,0	0,0	13,2	91,8	9,6
1,95	0,0	0,0	13,5	89,7	9,5
2,60	0,0	0,0	10,2	87,6	13,9
3,25	-6,1	98,9	10,0	18,0	18,0
3,90	-17,5	96,8	8,0	16,0	23,4
4,55	-31,2	87,8	4,0	13,9	28,1
5,20	-47,0	85,7	0,0	0,0	32,3
5,85	-64,6	83,6	0,0	0,0	35,8
6,50	-87,9	83,6	0,0	0,0	35,8



envolvente de esfuerzos en hastial derecho



y	M_d<0	$(N_d)_{con}$	M_d>0	$(N_d)_{con}$	V_d
(m)	(mt)	(ton)	(mt)	(ton)	(ton)
0,00	-23,1	31,7	9,1	93,6	21,2
0,65	-9,3	29,6	13,1	91,5	15,1
1,30	0,0	0,0	13,5	89,4	9,6
1,95	0,0	0,0	13,8	87,4	9,6
2,60	0,0	0,0	10,6	85,3	13,9
3,25	-5,9	94,3	10,2	21,3	18,0
3,90	-17,3	92,2	8,2	19,2	23,4
4,55	-31,0	90,2	4,3	17,1	28,1
5,20	-46,7	88,1	0,0	0,0	32,3



638IECPU TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 714+600

ARMADURA DE PORTICOS BAJO FERROCARRIL

MATERIALES

HORMIGÓN | H-250 |

γ_c = 1,50

coeficiente de hormigonado vertical = 0,90

ACERO | AEH-500 |

γ_s = 1,15

recubrimiento dintel = 0,04 m

recubrimiento hastiales = 0,04 m

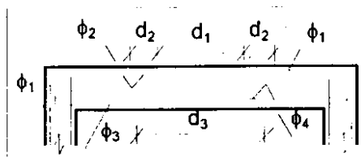
FISURACIÓN

Ambiente tipo | II |

ARMADURA A FLEXIÓN Y A FLEXOCOMPRESIÓN

☑ Desplazar un canto útil las leyes de armadura necesaria

armadura en dintel

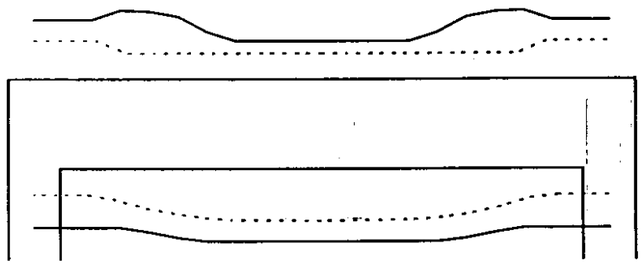


d_1 = 3,00 m

d_2 = 2,00 m

d_3 = 6,00 m

	ϕ(mm)	sep(m)
ϕ_1	25	0,150
ϕ_2	20	0,150
ϕ_3	25	0,150
ϕ_4	12	0,150



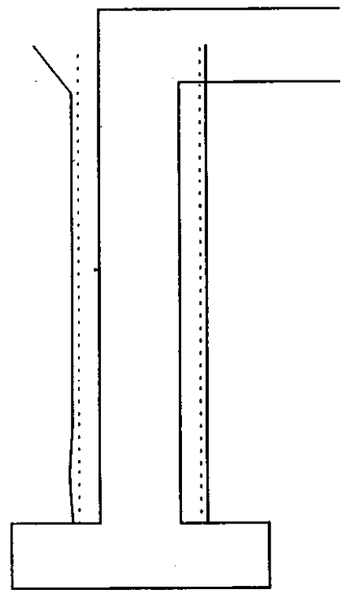
fisuración

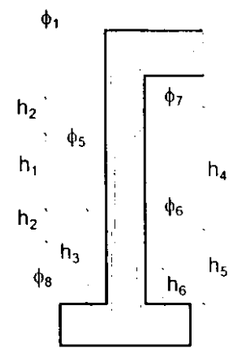
sección	$w_{máx}$ (mm)	w_{adm} (mm)
izquierda	0,13	0,22
central	0,13	0,22
derecha	0,13	0,22

armadura necesaria

armadura dispuesta

armadura en hastial izquierdo





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_5	16	0,150
ϕ_6	16	0,150
ϕ_7	0	0,150
ϕ_8	16	0,150

h_1 = 5,00 m

h_2 = 0,70 m

h_3 = 1,00 m

h_4 = 0,00 m

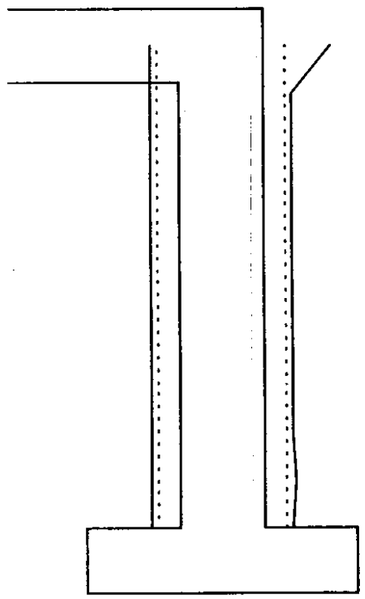
h_5 = 2,00 m

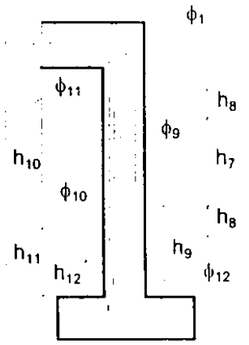
h_6 > 0,41 m

fisuración

sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,19	0,22
central	0,00	0,26
inferior	0,00	0,26

armadura en hastial derecho





armadura necesaria

armadura dispuesta

	ϕ(mm)	sep(m)
ϕ_9	16	0,150
ϕ_{10}	16	0,150
ϕ_{11}	0	0,150
ϕ_{12}	16	0,150

h_7 = 5,00 m

h_8 = 0,70 m

h_9 = 1,00 m

h_{10} = 0,00 m

h_{11} = 2,00 m

h_{12} > 0,41 m

fisuración

sección	$w_{máx}$ (mm)	w_{adm} (mm)
superior	0,19	0,22
central	0,00	0,26
inferior	0,00	0,26

COMPROBACIÓN A CORTANTE

comprobación en dintel

x = 1,01 m (d = 1,01 m)

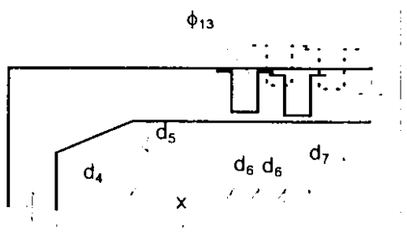
V_d = 61,6 ton

$V_{u2} = V_{cu} + V_{su}$ = 77,2 ton

d_4 = 0,05 m

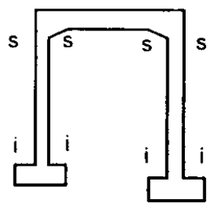
d_5 = 0,05 m

ϕ_{13}(mm)	d_6	d_7
8	0,400	0,300



comprobación en hastiales

hastial	izquierdo	derecho
V_d^{S-S} (ton)	32,2	32,2
V_d^{H} (ton)	14,2	14,2
V_{cu} (ton)	49,1	49,1



CÁLCULO DE LA ZAPATA IZQUIERDA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e = 0,90 m

z_i = 0,90 m

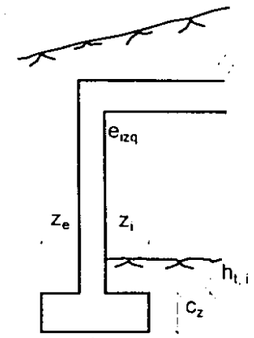
e_{izq} = 0,80 m

a_z = 2,60 m

c_z = 0,80 m

$h_{t,i}$ = 0,60 m

recubrimiento de armaduras= 0,05 m



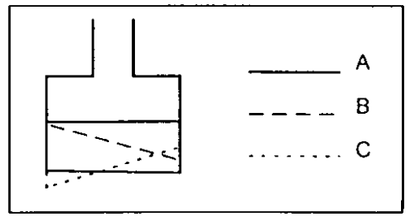
TERRENO

$(\sigma_{med})_{adm}$ = 60,00 t/m²

f_p = 1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	60,0	35,3	14,4	32,1
$\sigma_{máx}$ (t/m²)	75,0	36,2	27,4	46,3
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	24,9
zarpa interior	48,4	43,2

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

armadura	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
superior	16	0,150	13,4	11,3	0,00	0,34
inferior	16	0,150	13,4	11,4	0,00	0,34

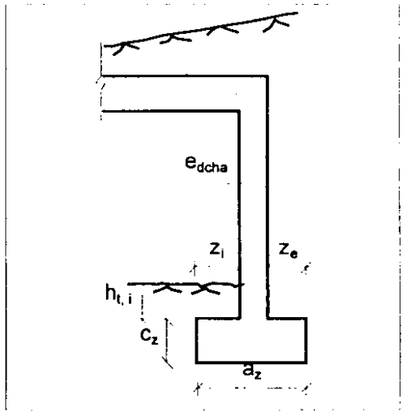
638IECPU TREN DE ALTA VELOCIDAD SUBTRAMO VII PORTICO PK 714+695

CÁLCULO DE LA ZAPATA DERECHA

NOTA: para el cálculo de la zapata se han considerado tres de las combinaciones de hipótesis utilizadas en la obtención de la envolvente. La A, que produce el máximo axil en la cara superior de zapata, la B, que produce el máximo momento negativo en la cara superior de zapata (comprime el extremo de la zarpa interior) y la C, que produce el máximo momento positivo en la cara superior de zapata (comprime el extremo de la zarpa exterior).

GEOMETRÍA

z_e =	0,90 m
z_i =	0,90 m
e_{dcha} =	0,80 m
a_z =	2,60 m
c_z =	0,80 m
$h_{t,i}$ =	0,60 m
recubrimiento de armaduras=	0,05 m

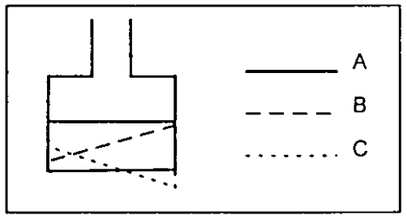


TERRENO

$(\sigma_{med})_{adm}$ =	60,00 t/m²
f_p =	1,25

TENSIONES BAJO ZAPATA

	valor admisible	combinación A	B	C
σ_{media} (t/m²)	60,0	34,2	15,2	31,5
$\sigma_{máx}$ (t/m²)	75,0	34,7	28,1	45,8
l_{comp} (m)		2,60	2,60	2,60



COMPROBACIÓN A CORTANTE EN ZAPATA

	V_{cu} (ton)	$(V_d)_{máx}$ (ton)
zarpa exterior	48,4	24,4
zarpa interior	48,4	26,3

CÁLCULO A FLEXIÓN Y COMPROBACIÓN A FISURACIÓN

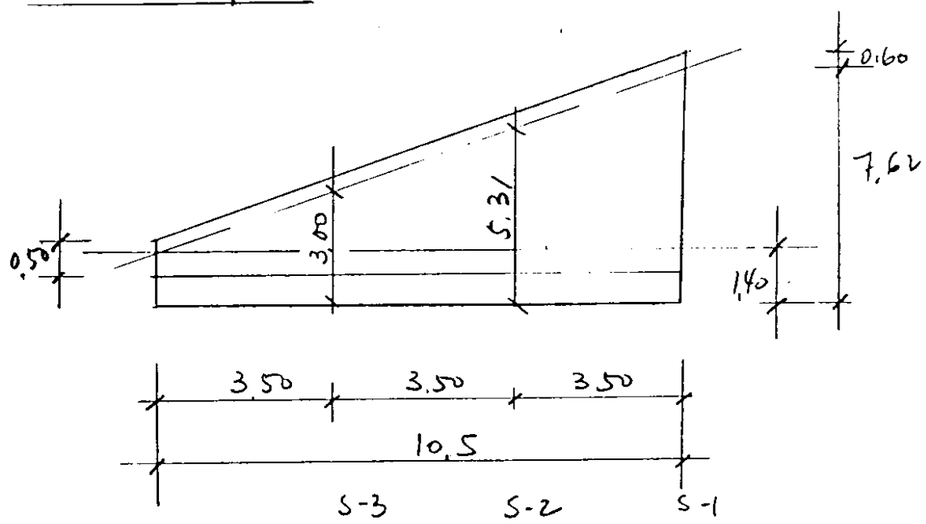
	ϕ (mm)	sep (m)	A_{disp} (cm²)	A_{nec} (cm²)	$w_{máx}$ (mm)	w_{adm} (mm)
armadura superior	16	0,150	13,4	11,3	0,00	0,34
armadura inferior	16	0,150	13,4	11,3	0,00	0,34

ALETAS

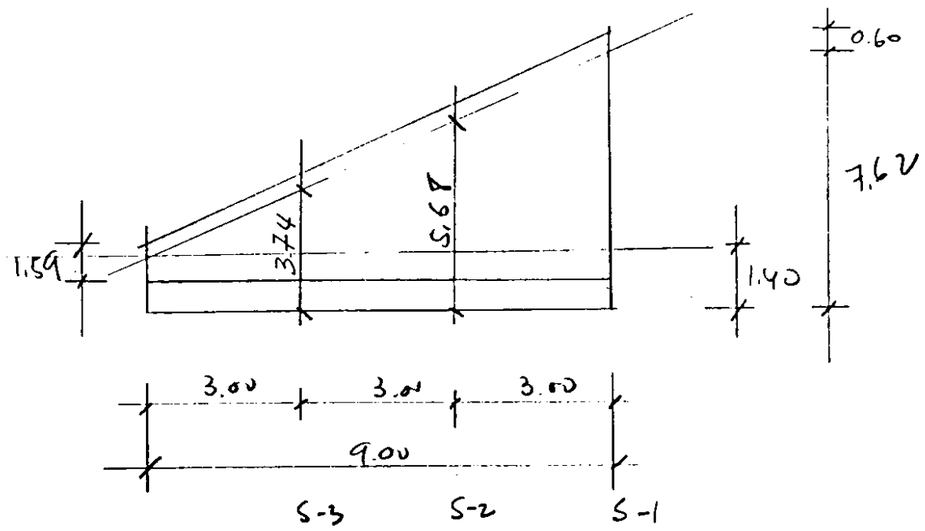
Tension admisible del terreno = 60 t/m2

Estructura PK 714+695

Aletas 1 y 2



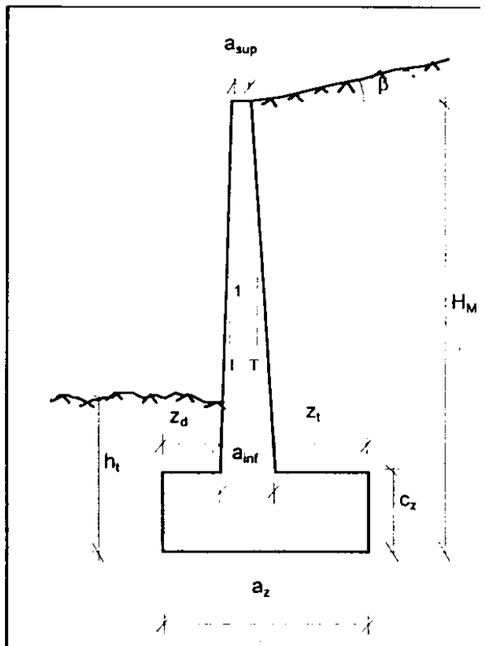
Aletas 3 y 4



CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	7,62 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_Z=	4,10 m
c_Z=	0,90 m
I=	0,00
T=	0,08
a_{inf}=	0,84 m
z_d=	0,80 m
z_t=	2,46 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

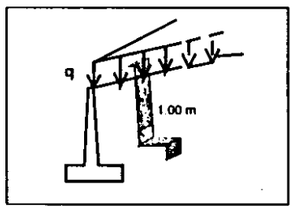
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	60 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,33 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q

	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	14,27 t/m²	$(\sigma_{med})_{adm}$ =	60,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	27,96 t/m²	$(\sigma_{máx})_{adm}$ =	75,00 t/m²	l_c =	4,10 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,71	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,56	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

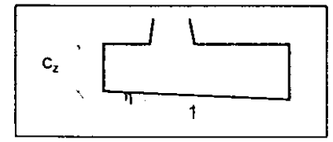
peso específico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

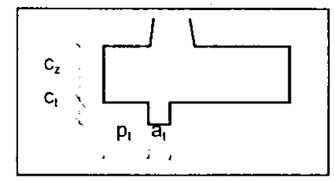
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

HORMIGÓN H-250 γ_c = 1,50

ACERO AEH-500 γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu= 36,31 t

Vd= 15,75 t

en zarpa trasera

Vcu= 54,87 t

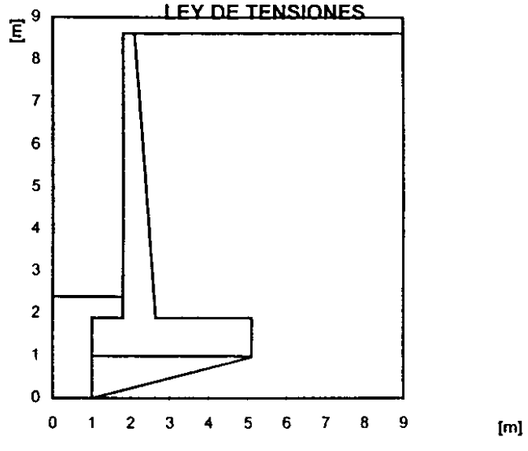
Vd= 30,27 t

en base de muro

Vcu= 49,43 t

Vd= 25,02 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

Amin= 12,8 cm²/m.a. de armadura en tracción (cuantia mecánica)

20,2 cm²/m.a. de armadura en tracción + compresión (cuantia geométrica)

zarpa delantera

Md= 17,3 mt

Anec= 4,6 cm²/m.a. por flexión

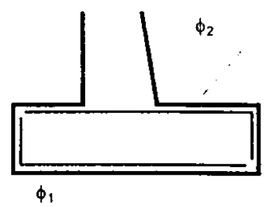
ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera

Md= 59,5 mt

Anec= 16,2 cm²/m.a. por flexión

ϕ_2(mm)	20
sep(m)	0,150
Adisp	20,9 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo | II

zarpa delantera

M= 10,8 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 37,2 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

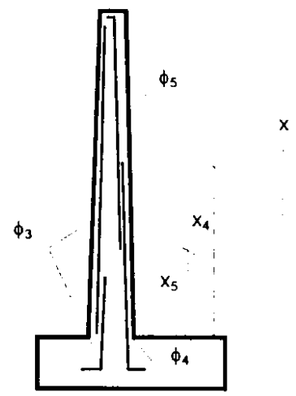
En base de alzado (x=0)

Para Md= 65,7 mt

y mínimo Nd= 8,4 t Anec 15,0 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	20	16
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	20,9	cm²/m.a.

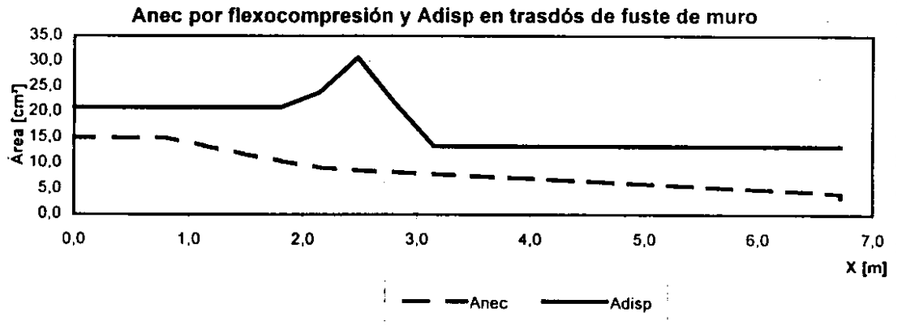
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	2,00

longitud de anclaje para ϕ_4= 0,48 m

longitud de anclaje para ϕ_5= 0,65 m



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,84 m

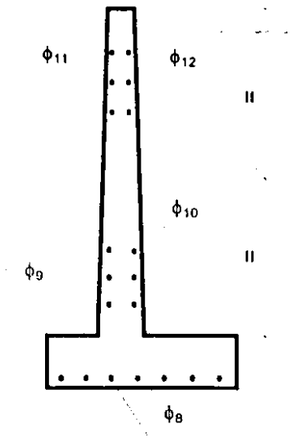
M= 41,08 mt w_{adm}= 0,24 mm

N= 9,33 t $w_{máx}$= 0,18 mm

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*)(cm²)	6,5	13,4		9,1	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica

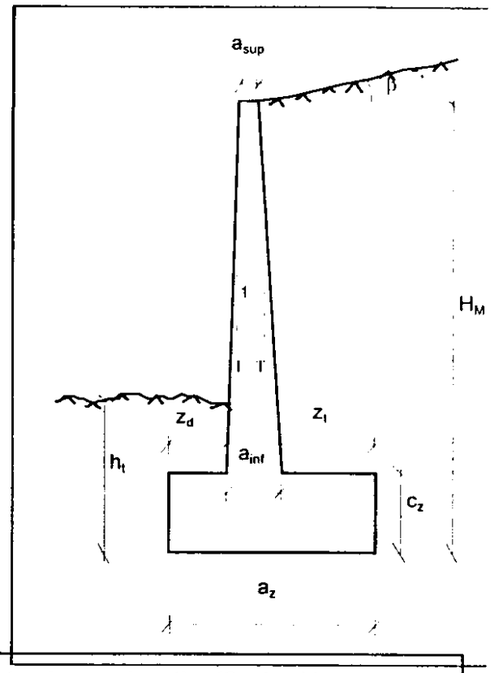


TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 714+605 ALETAS 1 A 4 S-2

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	5,68 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_z=	3,20 m
c_z=	0,80 m
I=	0,00
T=	0,08
a_{inf}=	0,69 m
z_d=	0,70 m
z_t=	1,81 m
β =	0,0 °



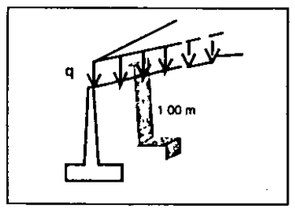
CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	60 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah =	0,33	Kav =	0,03	(Para el trasdós inclinado en agotamiento y fisuración)
Kah =	0,30	Kav =	0,00	(Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme

indefinida q	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	10,79 t/m²	$(\sigma_{med})_{adm}$ =	60,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	20,44 t/m²	$(\sigma_{máx})_{adm}$ =	75,00 t/m²	l_c =	3,20 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,75	$(\gamma_d)_{adm}$=	1,50
γ_v=	2,71	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

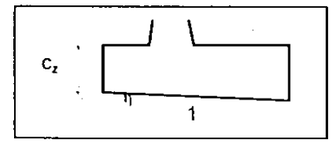
peso específico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

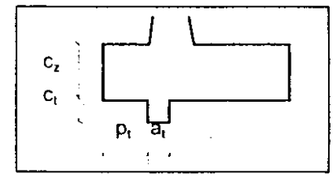
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

HORMIGÓN H-250 ▼ γ_c = 1,50

ACERO AEH-500 ▼ γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu= 31,47 t

Vd= 9,39 t

en zarpa trasera

Vcu= 48,41 t

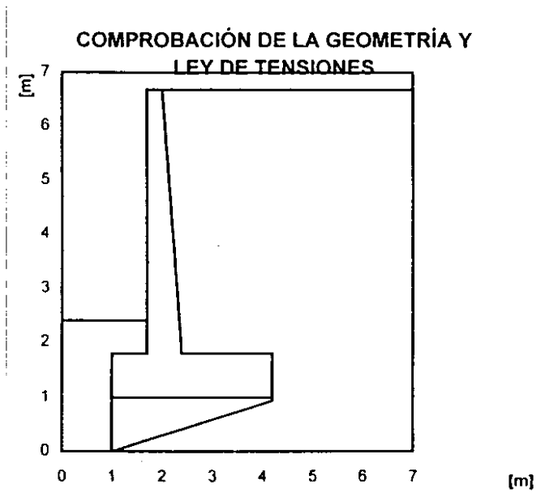
Vd= 15,51 t

en base de muro

Vcu= 40,30 t

Vd= 13,87 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

Amín= 11,3 cm²/m.a. de armadura en tracción (cuantía mecánica)

17,9 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 8,9 mt

Anec= 2,7 cm²/m.a. por flexión

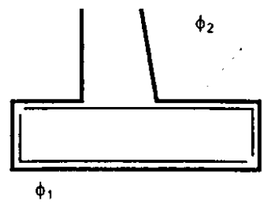
ϕ_1(mm) ▼	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera

Md= 24,4 mt

Anec= 7,4 cm²/m.a. por flexión

ϕ_2(mm) ▼	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo | II

zarpa delantera

M= 5,6 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 15,2 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

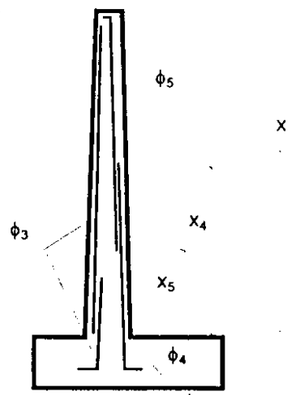
En base de alzado (x=0)

Para Md= 26,9 mt

y mínimo Nd= 5,3 t Anec 8,5 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base

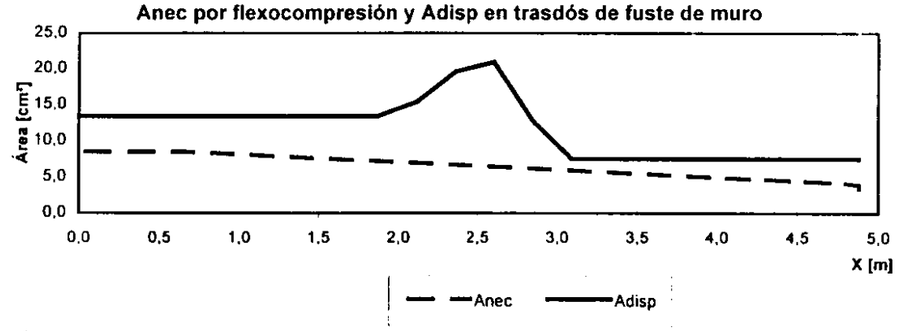


Intervalos de armadura	
x_4 (m)	3,00
x_5 (m)	2,00

longitud de anclaje para ϕ_4= 0,39 m

longitud de anclaje para ϕ_5= 0,44 m

Anec por flexocompresión y Adisp en trasdós de fuste de muro



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,69 m

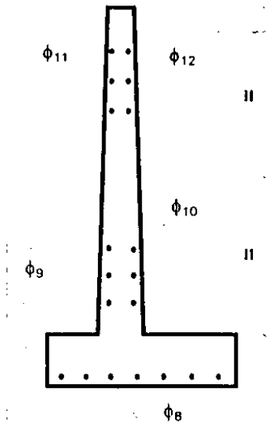
M= 16,82 mt w_{adm}= 0,26 mm

N= 5,92 t $w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	5,8	11,0		7,9	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica

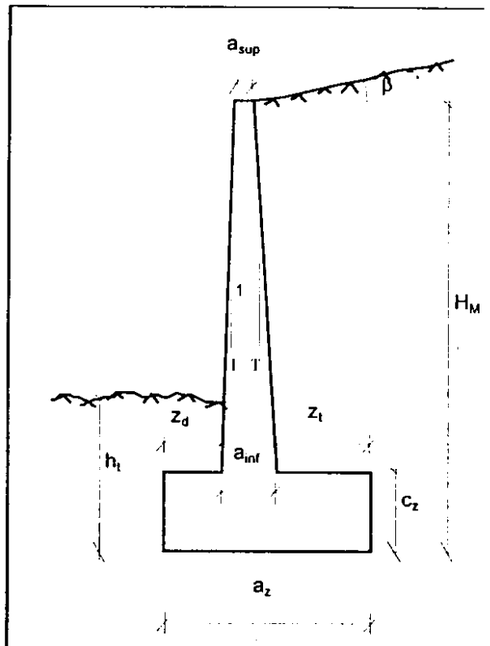


TREN DE ALTA VELOCIDAD SUBTRAMO VII ESTRUCTURA PK 714+605 ALETAS 1 A 4 S-3

CÁLCULO DE MURO MÉNSULA

GEOMETRÍA

H_M=	3,74 m
h_t=	1,40 m
a_{sup}=	0,30 m
a_z=	2,40 m
c_z=	0,60 m
I=	0,00
T=	0,08
a_{inf}=	0,55 m
z_d=	0,60 m
z_t=	1,25 m
β =	0,0 °



CARACTERÍSTICAS DEL TERRENO DE APOYO Y DEL RELLENO

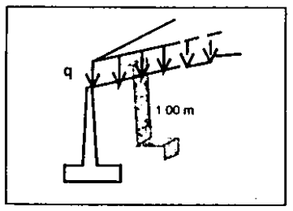
peso específico del relleno γ_r=	2,00 t/m³
angulo de rozamiento del relleno ϕ_r =	32,5 °
angulo de rozamiento contacto relleno-muro δ_M =	0 °
angulo de rozamiento contacto terreno-muro δ_T =	30 °
cohesión =	0 t/m²
σ_{adm} =	60 t/m²
f_p=	1,25

Coeficientes de empuje activo (Coulomb)

Kah = 0,33 Kav = 0,03 (Para el trasdós inclinado en agotamiento y fisuración)

Kah = 0,30 Kav = 0,00 (Para el trasdós vertical y para el trasdós inclinado en estabilidad)

CARGAS



carga uniforme indefinida q

	q_1	q_2
q (t/m.l. de talud)	0,00	1,00
c.p./sc. (P/S)	P	S

sismo ☐

coeficiente sísmico horizontal s=

coeficiente sísmico vertical v=

considera sobrecargas de explotación en el cálculo sísmico? ☐

TENSIONES EN EL TERRENO

σ_{med} =	7,39 t/m²	$(\sigma_{med})_{adm}$ =	60,00 t/m²	longitud comprimida	
$\sigma_{máx}$ =	12,67 t/m²	$(\sigma_{máx})_{adm}$ =	75,00 t/m²	l_c =	2,40 m

DESLIZAMIENTO Y VUELCO

γ_d=	1,92	$(\gamma_d)_{adm}$=	1,50
γ_v=	3,28	$(\gamma_v)_{adm}$=	1,80

considera empuje pasivo en puntera? ☐

K_p=

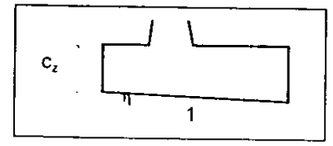
peso específico del terreno γ_T = t/m³

SEGURIDAD AL DESLIZAMIENTO

◉ base de zapata horizontal

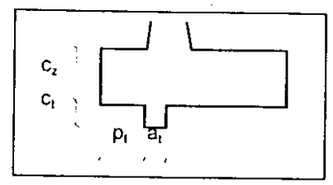
○ base de zapata inclinada

η = 0,10



○ zapata con tacón

p_t=	1,00 m
c_t=	0,50 m
a_t=	0,40 m
K_p=	0,00
Vcu=	22,59 t
Vd=	0,00 t



MATERIALES

HORMIGÓN H-250 γ_c = 1,50

ACERO AEH-500 γ_s = 1,15

recubrimiento zapata= 0,05 m

recubrimiento muro= 0,04 m

COMPROBACIÓN A CORTANTE

coeficiente de mayoración de acciones γ_f= 1,60

en zarpa delantera

Vcu= 31,47 t

Vd= 5,03 t

en zarpa trasera

Vcu= 35,50 t

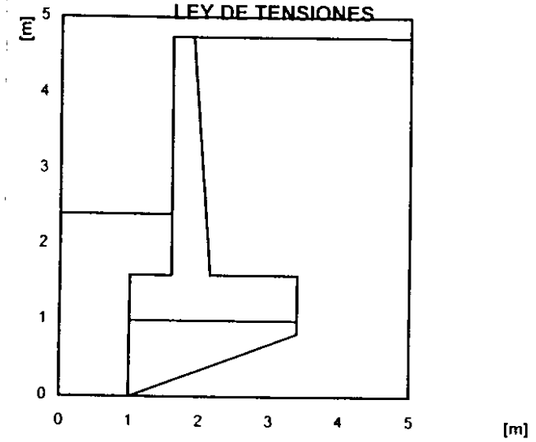
Vd= 6,20 t

en base de muro

Vcu= 31,68 t

Vd= 6,31 t

COMPROBACIÓN DE LA GEOMETRÍA Y LEY DE TENSIONES



CÁLCULO A FLEXIÓN DE ZAPATA

Amín= 8,3 cm²/m.a. de armadura en tracción (cuantía mecánica)

13,4 cm²/m.a. de armadura en tracción + compresión (cuantía geométrica)

zarpa delantera

Md= 3,5 mt

Anec= 1,4 cm²/m.a. por flexión

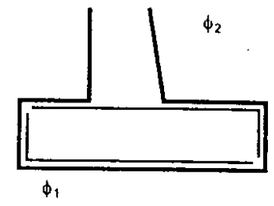
ϕ_1(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.

zarpa trasera

Md= 7,2 mt

Anec= 3,0 cm²/m.a. por flexión

ϕ_2(mm)	16
sep(m)	0,150
Adisp	13,4 cm²/m.a.



COMPROBACIÓN A FISURACIÓN EN ZAPATA

Ambiente tipo IIa

zarpa delantera

M= 2,2 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

zarpa trasera

M= 4,5 mt

w_{adm}= 0,30 mm

$w_{máx}$= mm No hay fisuración

CÁLCULO A FLEXOCOMPRESIÓN DE ALZADO

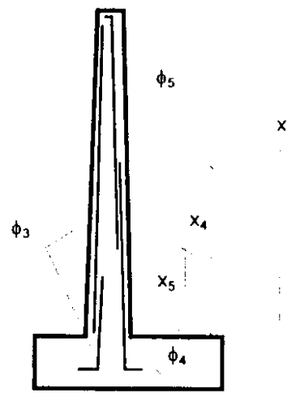
En base de alzado (x=0)

Para Md= 8,1 mt

y mínimo Nd= 3,0 t Anec 6,7 cm²/m.a.

Familia	ϕ_3	ϕ_4	ϕ_5
ϕ(mm)	12	16	12
sep(m)	0,150	0,150	0,150
Adisp(*)	7,5	13,4	cm²/m.a.

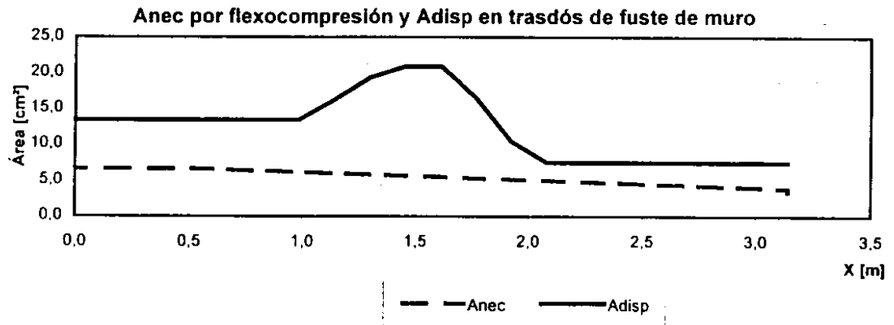
(*) Se ha comprobado que se supera la cuantía geométrica mínima para la armadura vertical en la base



Intervalos de armadura	
x_4 (m)	2,00
x_5 (m)	1,00

longitud de anclaje para ϕ_4= 0,34 m

longitud de anclaje para ϕ_5= 0,37 m



COMPROBACIÓN A FISURACIÓN EN ALZADO

En x= 0,0 m

h= 0,55 m

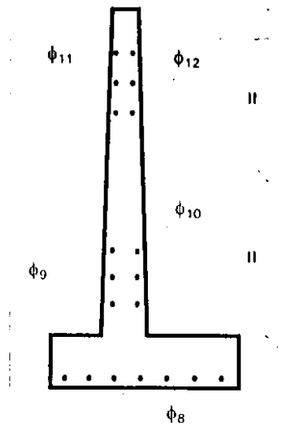
M= 5,06 mt w_{adm}= 0,26 mm

N= 3,29 t $w_{máx}$= mm No hay fisuración

RESTO DE ARMADURA EN ZAPATA Y ALZADO

Familia	ϕ_8	ϕ_9 + ϕ_{10}		ϕ_{11} + ϕ_{12}	
Anec(*) (cm²)	4,3	8,8		6,8	
ϕ(mm)	12	12	12	12	12
sep(m)	0,150	0,150	0,150	0,200	0,200
Adisp (cm²)	7,5	15,1		11,3	

(*) Armadura necesaria estrictamente por cuantía geométrica



Proyecto Construido

4. Cálculos

Viaductos

VIADUCTOS

El estudio en profundidad del conjunto de los dos viaductos existentes en este Subtramo, el proceso constructivo mediante empuje y su relación con el terreno, en cuanto a las características de cimentación, ha permitido, mediante la adopción de nuevas luces, llegar a soluciones de menor impacto ambiental, más integradas en el entorno. Ello comporta también la adopción de una sección transversal diferente para el tablero y por lo tanto un nuevo estudio de toda la estructura, incluida su cimentación.

El Viaducto nº 1, de 12 vanos en el Proyecto Original, pasa a tener 5 vanos, con luces de 39 y 48 m. de modo que se extiende desde el P.K. 703 + 343 al P.K. 703 + 565.

La sustitución de parte del Viaducto por terraplén, da lugar a la modificación en la actuación medioambiental de la zona. Se incluye Informe de la Dirección Medioambiental del G.I.F en el Anejo correspondiente.

El Viaducto nº 2, de 13 vanos en el Proyecto Original, pasa a tener 12 vanos, con luces de 39 y 48 m. de modo que se extiende desde el P.K. 711 + 257,30 al P.K. 711 + 815,30.

La modificación del perfil longitudinal en la zona del Viaducto 2, permite empujar el tablero desde el estribo lado Madrid, protegiéndose la zona del estribo lado Zaragoza de alto valor botánico y faunístico. Se incluye Informe de la Dirección Medioambiental del G.I.F. en el Anejo correspondiente.

A continuación se adjuntan los cálculos estructurales de ambos viaductos, en base a las mismas acciones del Proyecto Original y a los nuevos parámetros geotécnicos obtenidos por los nuevos ensayos realizados y que se incluyen en el Anejo correspondiente.

GIF
Gestor de Infraestructuras Ferroviarias

PROYECTO CONSTRUCTIVO DE LA LINEA DE ALTA VELOCIDAD: MADRID - BARCELONA - FRONTERA FRANCESA TRAMO: MADRID-ZARAGOZA. SUBTRAMO VII. PLATAFORMA

MODIFICACION Nº 2 DEL PROYECTO CONSTRUCTIVO. LINEA DE ALTA VELOCIDAD: MADRID-BARCELONA-FRONTERA FRANCESA TRAMO: MADRID-ZARAGOZA. SUBTRAMO VII. PLATAFORMA.

VIADUCTO Nº 1 DEL P.K. 703+343 AL 703+565

ferrovial AGROMAN *Dirección Técnica*

MARZO–2000

MODIFICACIÓN Nº 2 DEL PROYECTO CONSTRUCTIVO. VIADUCTO Nº 1

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- CÁLCULO DE DEFORMACIÓN DE PILAS EN FASE DE CONSTRUCCIÓN
- CÁLCULO DE ESTRIBOS
- CÁLCULO DE CIMENTACIÓN
- DIMENSIONAMIENTO GEOTÉCNICO DE LONGITUD DE PILOTES DE PILAS 1,2,3,4 Y DE ESTRIBO 1
- CÁLCULO DE PILOTES FRENTE A ESFUERZOS TRANSVERSALES
- CÁLCULO DEL PESCANTE

MEMORIA

MEMORIA

1 Introducción

En este proyecto se define el viaducto nº 1 del Subtramo VII del Ferrocarril de Alta Velocidad Madrid-Barcelona,

En este proyecto se incluyen las modificac iones aparecidas a raíz de nuevos datos. También se recogen algunas mejoras que se describen más abajo.

2 Antecedentes

Se cita como antecedente el proyecto redactado por el GIF y adjudicado a la UTE Ferrovial-Agromán.

También se cita como antecedente el Proyecto de construcción del viaducto nº 2 realizado por estes Oficina Técnica.

3 Descripción del viaducto

3.1 Cimentación

Con los parámetros del terreno especificados por el CEDEX, se han dimensionado las cimentaciones profundas para las pilas 1 a 4 y estribo nº 1 y cimentación directa para el estribo nº 2. Las cimentaciones profundas consisten en 9 pilotes de 1,5 metros de diámetro de longitudes comprendidas entre 26 y 31 metros. Para el calculo de estas longitudes no se ha tenido en cuenta la contribución del aluvial. Estos pilotes están recogidos por un encepado de dimensiones en planta de 10x10 metros.

3.2. Pilas

La forma de las pilas se ha respetado según el proyecto original manteniéndolas en sección cajón con su dimensión longitudinal variable y su dimensión transversal constante. En sentido transversal se ha pasado de 6,4 metros de ancho a 6 metros para adecuarlo al ancho del fondo del tablero. Además en las pilas más altas se ha colocado un diafragma intermedio de 0,50 metros que mejora el comportamiento de la pila frente a torsión.

3.3. Tablero

En el proyecto de este viaducto no se ha realizado un cálculo específico ni del pretensado del tablero ni de la armadura del mismo, debido a que la luz de los vanos de este viaducto es idéntica a los del viaducto nº2.

3.3.0. Cambio de distancia intereje de vía y ampliación de espesor de balasto.

Las nuevas prescripciones propuestas por el GIF, se recogen en este proyecto de la siguiente forma:

- El peso del balasto considerado se ha tomado de las bases de cálculo para el Proyecto de estructuras de puentes de ferrocarril del tramo -Zaragoza-Lleida. En estas bases el espesor considerado de balasto baja la traviesa de ferrocarril es de 35cm

- Con respecto al incremento de la distancia entre ejes de vías , esta pasa a ser de 4,70m en lugar de los 4,50, anteriormente fijados. Esta incremento en la excentricidad de las cargas se ha considerado que queda dentro de la hipótesis de que las cargas puedan sufrir un ripado de 30 cm respecto al eje primitivo de la via, quedando un resguardo en el calculo de 20 cm de eventual ripado de la misma.

3.3.1. Sistema de empuje de voladizo - dovela

La relación canto-luz en el proyecto original era de 1/14,5. Sin embargo, y teniendo en cuenta las recomendaciones de la UIC sobre rigideces de tablero y las relaciones canto-luz de otras realizaciones en España y Francia, se ha llegado a la conclusión que se podría mejorar el comportamiento del tablero con una relación canto-luz de 1/12, lo cual nos lleva a un canto de 4 metros. Por otro lado, en la sección del tablero, su cara superior tiene un bombeo del 2% para el drenaje de la plataforma. Se ha preferido añadir este bombeo a la forma de la sección para disminuir de esta manera el peso del tablero. El ancho del tablero es de 14 metros, sin embargo, en los 2 metros extremos a cada lado apenas hay carga ya que el balastro está situado en los 10 metros centrales de la plataforma y las sobrecargas del ferrocarril (que son las más significativas) se encuentran también en estos 10 metros centrales. Por tanto desde el punto de vista de cargas, éstas se encuentran concentradas en la zona central lo cual debe tenerse en cuenta para la distribución en la losa superior del tablero entre voladizos y losa entre almas. Por esta razón, se ha considerado adecuado colocar un voladizo de 4 metros de forma que la cara exterior del alma quede en la vertical del carril más extremo. Las almas se han considerado de 45 centímetros de espesor y la losa inferior de 25 centímetros aumentando hasta 50 centímetros en las zonas sobre apoyos.

Se han dispuesto también diafragmas en pilas con tacones en la parte superior para el anclaje del pretensado de segunda fase así como desviadores en diferentes zonas del vano también para el pretensado de segunda fase.

Para el sistema de empuje se han definido unas dovelas de una longitud mitad a la del vano intermedio, es decir, 24 metros.

3.3.2. Pretensado

En este puente existen tres tipos de pretensado: un pretensado recto de lanzamiento que está situado en la losa superior y en la parte inferior del alma. Los cables superiores son ocho de 14 cordones de 0,6 pulgadas, mientras que los inferiores son también ocho pero de 14 cordones de 0,6 pulgadas. La resultante de las fuerzas de este pretensado es un axil cuyo punto de aplicación coincide aproximadamente con el centro de gravedad de la sección. Esto es debido a que cada

una de las secciones del tablero es sometida tanto a máximos momentos positivos como negativos durante el proceso de empuje, por lo que una excentricidad de la resultante del pretensado favorecería la capacidad de resistir esfuerzos frente a uno de los momentos pero perjudicaría a los del otro.

Existe además en los dos primeros vanos un refuerzo de este pretensado ya que las secciones de esta zona del tablero son sometidas a flexiones mayores que el resto, ya que por ejemplo, justo antes de que el pescante delantero toque la siguiente pila hay una sección sometida a los máximos momentos negativos, alterando esto los esfuerzos en los siguientes vanos. Sin embargo, según nos alejamos de la zona delantera del tablero se asemejan más las leyes de esfuerzos a los que tiene una viga de infinitos vanos, no siendo necesario por tanto en las zonas alejadas de la parte delantera este refuerzo. Todo el pretensado recto es conectado mediante manguitos de conexión que son montados con un sistema de preclavado de cuñas y de muelles que garantizan que cuando se realice el tesado por el extremo activo del cable no deslicen las cuñas del anclaje pasivo al que en ese momento no se tiene acceso. Para disminuir el número de anclajes y de conectores en este pretensado se ha colocado un número par de cables de forma que en cada dovela de empuje se anclen la mitad de estos pasando los cordones de los que no se anclan a la siguiente dovela donde serán anclados.

Existe además un pretensado en segunda fase que se coloca cuando se ha terminado el empuje del tablero y se han colocado los apoyos definitivos con la operación que se indica más abajo. En ese momento se ha de introducir un pretensado que resista el resto de cargas permanentes que se colocará en el tablero (balastro, canaletas, carriles, traviesas,...) Y la sobrecarga, así como los efectos diferidos y los asientos a largo plazo.

Para este pretensado existen tres posibilidades. La primera consiste en diseñar un pretensado adherente, interior en las almas, con un trazado curvo de forma que pase por los puntos superiores del tablero en las secciones de pila, y por los puntos inferiores en los centros de vano. Este pretensado se tesa desde nervios colocados a tres quintos (3/5) de la luz en las almas donde se cruzan los cables. Sin embargo, este sistema tiene el inconveniente de dificultar y complicar el hormigonado y de tener que dejar los nervios de cruce de cables desde el primer momento, no pudiendose hacer en segunda fase ya que son atravesados por las vainas y los anclajes de pretensado.

Un segundo sistema evita gran parte de los problemas del sistema anterior, consistiría en colocar en el centro del vano un pretensado recto por la losa inferior hasta aproximadamente las secciones de quintos de luz y un pretensado recto en la zona de pila hasta la misma sección en la losa superior. Este sistema tiene la ventaja de dejar libres las almas y poder hacer los nervios incluso en segunda fase. Sin embargo, tiene dos importantes inconvenientes. Uno es que duplica el número de anclajes y otro que al no ser un pretensado con trazado no se ve reducido el cortante de las cargas por la componente vertical del pretensado, resultando una armadura para las almas muy densa que dificulta su correcto hormigonado pudiendo llegar a necesitar pretensado vertical.

Existe una tercera alternativa que no tiene las desventajas de las anteriores que es el diseño de un pretensado con trazado pero fuera de las almas., Esto se resuelve mediante la colocación de un pretensado exterior que se ubica dentro del cajón del tablero con un trazado poligonal anclandose en los diafragmas de pila y quebrándose su trazado en desviadores situados aproximadamente a quintos de la luz. Por este procedimiento se están construyendo en Francia y Alemania los viaductos de los trenes de alta velocidad de más reciente construcción. La técnica de pretensado exterior está suficientemente avalada desde el punto de vista de su durabilidad y de la construcción ya que existen realizaciones desde hace varias décadas de las cuales en España tenemos algunos ejemplos. En general este sistema tiene excelentes condiciones respecto a la durabilidad y mantenimiento ya que a lo largo de toda la vida del puente se puede comprobar el estado de los cables e incluso con métodos extraordinariamente sencillos se puede medir la tensión de estos cables en cualquier momento de la vida del puente, detectándose de esta manera cualquier anomalía. En un pretensado adherente los problemas de corrosión bajo tensión son imposibles de detectar y en caso de producirse no es posible su reparación. Sin embargo, en el caso de pretensado exterior, una simple inspección visual detecta inmediatamente cualquier problema de este tipo y las posibilidades de reparación son mayores que en el caso del pretensado

adherente. De hecho cuando se ha debido reparar alguna estructura con pretensado adherente se ha hecho en general colocando pretensado exterior. Por lo general este sistema es preferido por las administraciones que tienen que realizar la conservación de las estructuras debido a lo anteriormente expuesto, sin embargo, en muchos casos este procedimiento es algo más caro que el pretensado convencional, sin embargo, en este caso no es así ya que respecto a la segunda solución expuesta más arriba, tiene cuatro veces menos de cables, de anclajes y aunque la vaina y las bridas tienen un precio mayor así como las trompetas de anclaje sin embargo el computo total es favorable a la solución de pretensado exterior.

Esta ultima solución es la que ha sido adoptada para el presente proyecto anclando la mitad de los cables de pretensado exterior en cada uno de los diafragmas de pila. Se han colocado nervios de desvío que se realizarían en segunda fase aunque sin por comodidad de hormigonado se pueden realizar tacones en la parte inferior, también podrían ser modificados.

Tanto los nervios de desvío como los diafragmas de pila se realizarían en segunda fase colocando para ello durante el empuje manguitos de conexión para la armadura principal y en general para toda aquella armadura de calibres de 16 mm y superiores, pudiéndose resolver las armaduras de 12 mm e inferiores grifando barras.

3.3.3. Procedimiento constructivo

El procedimiento constructivo de este tablero es el de empuje acompasado desde el estribo nº 1. Para ello se ubicarán en este estribo un conjunto de gatos verticales y horizontales de forma que con la acción sincronizada de éstos se pueda avanzar la longitud de la dovela construida en el encofrado que se encuentra situado en el terreno posterior al estribo. La longitud de la dovela de empuje es de 24 metros. Este proceso de empuje consiste en el ferrallado y hormigonado en el encofrado de cada una de las dovelas, el tesado de esta dovela con los cables rectos descritos más arriba y el empuje de los 24 metros. Antes del primer empuje se montará el pescante metálico que llegará a apoyarse en los gatos, en este caso, la reacción sobre los gastos puede ser muy pequeña con lo cual deberían colocarse contrapesos o ayudarse de elementos auxiliares. Durante el empuje de una dovela cualquiera debe haber operarios en cada una de las pilas con instrucciones muy claras de la colocación de almohadillas de teflón. Estos operarios según vaya avanzando el tablero deberán ir introduciendo por la parte posterior del apoyo las almohadillas que irán saliendo por la parte delantera. Todos ellos irán conectados mediante radio y tendrán un pulsador de alarma de forma que en caso de error, de introducción de la almohadilla del revés, o de cualquier problema de acodalamiento, rotura, etc...detengan la operación. Junto a los apoyos, existirán además unas piezas metálicas que servirán de guía para el puente, teniendo el operario la obligación de controlar si existen acodalamientos o roturas en el hormigón debido a la presencia de estas piezas. Al llegar el pescante metálico a la pila se recuperará la flecha con el gato ubicado en este pescante poniéndose los patines a la cota de los apoyos situados en la pila. Se efectuará en este momento el avance para tomar apoyo del pescante en la pila y se seguirá con el procedimiento de empuje. Durante éste cada una de las pilas sufre una fuerza horizontal igual a la carga vertical del peso del tablero y multiplicado por el rozamiento real (no de cálculo) del teflón con el acero inoxidable. Todo esto produce un movimiento en la cabeza de la pila que debido a la gran altura de éstas y a la presencia de los pilotes pueden tener magnitudes muy importantes. Se deberán colocar elementos de control como conectores eléctricos o cualquier otros sistema que garantice que las deformaciones de las pilas no sobrepasan unas tolerancias admisibles fijadas en el proyecto y que en el momento que sobrepase esas deformaciones la central hidráulica que comanda todo el empuje se detenga automáticamente. Para el calculo de estas deformaciones se obtendrán datos lo más fiables posibles de los rozamientos de los apoyos ya que debido a la incertidumbre de los módulos de formación del hormigón dar valores muy estrictos para estas deformaciones podría ocasionar que el sistema se estuviese deteniendo con demasiada frecuencia, sin que esta detención fuese debida a causas que comprometiesen la seguridad de la estructura.

Una vez se haya completado el procedimiento de empuje y se haya desmontado la nariz y se hayan hormigonado los elementos de segunda fase como diafragmas y desviadores comentados más arriba, se procederá a la colocación de los elementos de apoyo definitivos y de los teflones con las pastillas encastradas que servirán de apoyo al puente durante su uso. Para esta operación es necesaria la colocación de gatos bajo el tablero que lo eleven lo suficiente para meter los

nuevos elementos. En esta operación se aprovechará para dejar el tablero en una cota que no suponga ningún descenso de apoyo debido a los asientos geotecnicos habidos durante el periodo de construcción y eliminando también los errores de colocación en cota de apoyo que pueden suponer diferentes reacciones en cada una de las pilas. Para ello el criterio para dejar cada uno de los tableros, debido a que éste tiene una gran rigidez será en vez de una determinada cota, se le aplicará a los gatos una determinada presión que suponga dar la reacción que debe tener cada una de las pilas debido a su peso propio. Debido a esta operación se ha calculado el tablero en servicio con los asientos residuales desde el momento en que se produzca esta operación hasta tiempo infinito añadiendo un error de 5 mm consecuencia de esta misma operación. Durante el procedimiento de lanzamiento se ha considerado un error en la colocación del apoyo de 1 cm que es lo que marca la Norma del Eurocódigo nº 2 en su parte 1-6 para este tipo de puentes y un error de 5mm en torsión que marca la misma norma.

3.4. Estribos

Se ha dispuesto el estribo de forma que sea en el que se reciben tanto la reacción de las fuerzas de empuje como la situación del punto fijo y por tanto el estribo que recibe los esfuerzos de frenado de la sobrecarga del puente.

Madrid, 12 de marzo de 1999

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ANEJO DE CALCULO

MEMORIA DE CALCULO

MEMORIA DE CALCULO VIADUCTO nº 1

SUBTRAMO VII

1.0 INTRODUCCIÓN

En la presente memoria se establecen los criterios de cálculo y de dimensionamiento que se han seguido en la elaboración de este proyecto de construcción.

El presente tablero está constituido por una sección cajón con almas verticales y dos voladizos de 4m de anchura. La estructura tiene una longitud total de 222 m, y se encuentra dividida en 2 vanos extremos de 39 m luz y 3 vanos centrales de 48m de luz. El canto total del tablero es de 4.00 m, con el que se obtiene una relacion canto/luz de un doceavo(1/12).

El pretensado del tablero se realiza en dos fases. La primera fase se produce durante el periodo de lanzamiento, en la que el peso del tablero es resistido mediante un pretensado recto adherente. La segunda fase de pretensado se dispone antes de disponer el resto de cargas permanentes y sirve para resistir tanto estas cargas como la sobrecarga de uso. Esta segunda fase se realiza mediante la disposición de pretensado exterior.

Las pilas sobre las que se apoya el tablero presentan una sección en cajón, con una anchura constante de 6.00 m y un canto variable con la altura de las pilas, aumentando desde 2.00 m de canto en la coronación, con un incremento lineal con la altura de 1/50. El espesor de las paredes de las mismas se mantiene constante en toda la altura en 35 cm.

El estribo nº 2 de la estructura es un estribo cerrado y tiene dos cometidos fundamentales, el primero durante la construcción del tablero, ya que sirve de apoyo para los gatos encargados del empuje del tablero. El segundo cometido de este estribo consiste en ser utilizado como punto fijo de todo el tablero. La unión de el tablero con este estribo se realiza mediante tendones de pretensado.

2.0 ACCIONES

Las acciones consideradas para el calculo del tablero han sido las siguientes:

- Peso Propio ..... 26.0 t/m

- Resto de carga permanente:
  - a) Balasto ..... 1.60 t/m^3
  - b) Traviesas y carriles ..... 0.64 t/m/vía
  - c) Conductos de cableado, cables y paseos ..... 0.3 t/m/lateral
  - d) Soportes de catenaria ..... 0.5 t/poste
  - e) Impostas y barandillas ..... 0.75 t/m
- Sobrecargas:
  - a) Se aplicara la envolvente de los esfuerzos producidos por los trenes de carga de la IAPF-75 y por los del EC 1.3

- Gradiente térmico lineal (vertical) ..... 5°

- Descenso de apoyos ..... 2 cm

3.0 MATERIALES

El cuadro de características de materiales es el siguiente:

CUADRO DE CARACTERÍSTICAS SEGÚN EHE

ELEMENTOS	LOCALIZACIÓN	ESPECIFICACIÓN DEL ELEMENTO	NIVEL DE CONTROL	COEFICIENTE			RECUB cm
				γ_a	γ_a	γ_c	
HORMIGÓN	ZAPATAS	H-250	NORMAL	1.50			3.5
	ALZADOS ESTRIBOS	H-250	NORMAL	1.50			3.0
	PILAS	H-300	NORMAL	1.50			3.0
	TABLERO	H-400	INTENSO	1.40			3.0
ACERO DE ARMADURAS	ZAPATAS	AEH-500	NORMAL		1.15		
	ALZADOS ESTRIBOS	AEH-500	NORMAL		1.15		
	PILAS	AEH-500	NORMAL		1.15		
	TABLERO	AEH-500	NORMAL		1.15		
EJECUCIÓN	ZAPATAS		NORMAL			IAP	
	ALZADOS ESTRIBOS		NORMAL			IAP	
	PILAS		NORMAL			IAP	
	TABLERO		NORMAL			IAP	
NOTA:							

Los alambres que constituyen los cordones de pretensado serán de acero superestabilizado con una tensión mínima de rotura garantizada de 18,985 kp/cm2, y un relajamiento menor del 2% para una tensión de 13.290 kp/cm2 aplicada durante 1000 horas (estos alambres formarán cordones NEN-3868(KOMO) de 0,6" de diámetro nominal Y 150mm2 de sección nominal.

Los valores utilizados para el cálculo de las perdidas por rozamiento para el pretensado de lanzamiento son:

μ=0.18

K=0.00108

Los valores utilizados para el cálculo de las perdidas por rozamiento para el pretensado exterior son:

μ=0.07

K=0.00

Estos valores son los que se especifica en la instrucción EHE.

4.0 CALCULO DEL TABLERO

El procedimiento de construcción del tablero será mediante el empuje de semivanos de 24 m., por lo que es necesario un cálculo de las distintas fases por las que pasa el tablero hasta su terminación. Todas estas fases se ven reflejadas en el siguiente anejo de calculo.

El método de cálculo seguido es el siguiente:

- Cálculo de los esfuerzos a los que se ve sometido el tablero bajo peso propio con el pescante en voladizo antes de llegar a la primera pila, posteriormente se calcula cuando apoya el pescante en la pila y por ultimo se calcula cuando el tablero de hormigón se apoya sobre la pila y todo el pescante se encuentra en voladizo.

- Repetición de la misma operación anterior para el apoyo sobre el resto de las pilas terminar el tablero

- Durante cada una de las fases se calculan los esfuerzos producidos por una sobrecarga de obra de 10 kp/m2 y por un gradiente de temperatura de 5°

El dimensionamiento del pretensado del tablero, se realiza teniendo en cuenta todos estos estados, de forma que con un pretensado centrado no se alcance la resistencia a tracción del hormigón durante la fase de empuje.

El calculo de pretensado exterior se realiza partiendo del pretensado centrado existente, suplementandolo para que bajo las acciones de resto de carga permanente y sobrecargas no se llegue a alcanzar en ninguna fibra del tablero la resistencia a tracción del hormigón.

5.0 PROCEDIMIENTO DE CALCULO

El cálculo del tablero se ha realizado utilizando varios programas informáticos. Entre ellos se encuentran los programas SAP2000 y SAP90 utilizados para la obtención de los esfuerzos longitudinales, así como para la comprobación del trazado de pretensado para las distintas fases.

Los resultados obtenidos con ambos programas se han elaborado mediante una hoja de cálculo, para obtener por un lado las tensiones de servicio.

El calculo de las pilas se realiza mediante el programa PYRUS, que realiza un calculo de las pilas en 2° orden, teniendo en cuenta las deformaciones que tiene la pila en cabeza debido a las deformaciones no lineales de las pilas.

La bibliografía consultada y la normativa aplicada ha sido:

- Directivas de la UIC
- IAPF-75
-EHE.
- IAP.
- HORMIGÓN ARMADO, Jiménez Montoya.

Todos los listados obtenidos mediante estos programas se adjuntan a continuación, en el anejo correspondiente.

BASES DE CALCULO

BASES DE CALCULO

ACCIONES

1. Peso propio:
2. Cargas muertas.

a) Balasto: $q_0 = A \times \delta$ { A: area de balasto; $\delta = 1{,}6\ t/m^3$

Valor característico { $1{,}20 \cdot q_0$; $1.00 \cdot q_0$ – E.L.U.

2.1 Estados transitorios de desbalastado

50% del balasto de 1 vía en toda la longitud

100% del balasto de 1 vía en 15m de longitud.

b) Traviesas y carriles.

q traviesas = 0,52 t/m/vía

q carriles = 0,12 t/m/vía

NOTA: El desbalastado se considera incompatible con la presencia de traviesas y carriles.

c) Conductos de cableado, cables y pasos.

$q_{cond+cables} = 0{,}3\ t/m$ / lateral.

d) Soportes de catenarias.

Postes + catenaria { Horizontal – 0,5 t; Vertical – 0,5 t; M base 9 m·t

Se dispone un poste en cada lateral D≤60m.

Estado accidental de rotura de 1 catenaria.

H = 2 t. } En la base del poste.
M = 2×7 = 14 t×m.

e) Impostas y barandillas.

P = 0,75 t/m (Igual a proyecto base)

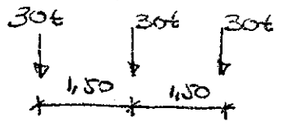
SOBRECARGAS

Sobrecarga de uso.

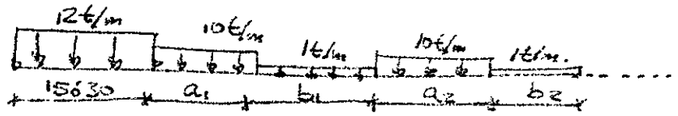
IPF-75

a) Trenes de carga para vía RENFE

TIPO A



TIPO B



ai, bi pésimos Σ = ilimitada.

Andenes : 0,5 t/m² en aceras.

Sólo el 50% de S. aceras es concomitante con sobrecarga ferroviaria.

Sobrecarga en andenes = 1,45 × 0,5 × 2 = 1,45 t/m.

b) Frenado y arranque.

-Frenado = 1/8 Tren tipo

TIPO A : $F_A = \frac{90}{8} = 11{,}25$ t

TIPO B : $F_B = \frac{1}{8}[30 \times 12 + (558-30) \times 10] = 70{,}5$ t.

-Arranque = 1/2 12×30 = 45 t.

c) Efecto de lazo

Fuerza de 5t transversal al eje de la vía en cota superior del carril.

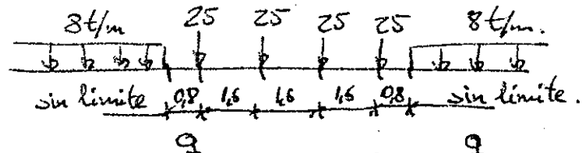
d) Ripado : 30 cm en el sentido más desfavorable.

e) Empuje sobre barandillas : 150 kp/m en elemento superior de la barandilla.

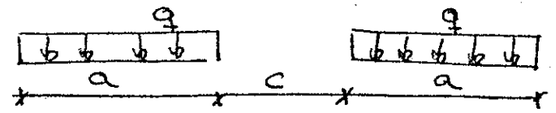
EC 1.3

a) Trenes de carga:

MODELO 71

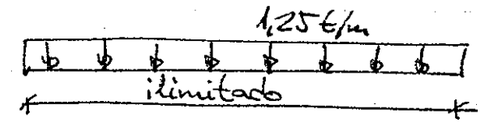


MODELOS SW



	q	a	c
SW/0	13,3	15	5,3
SW/2	15,0	25,0	7.0

TREN DESCARGADO



Oficina Técnica	PROYECTO:	
	ASUNTO:	
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA DE

COMPROBACION COEFICIENTE IMPACTO

$$\phi_1 = \frac{0,96}{\sqrt{L\phi} - 0,2} + 0,88 \rightarrow \text{Cortantes}$$

$$\phi_2 = \frac{1,44}{\sqrt{L\phi} - 0,2} + 0,92 \quad \text{Flectores.}$$

$$\phi_3 = \frac{2,16}{\sqrt{L\phi} - 92} + 0,73$$

Para $L = 48m$: $\begin{cases} \phi_1 = 1,022 \\ \phi_2 = 1,036 \\ \phi_3 = 1,028 \end{cases}$

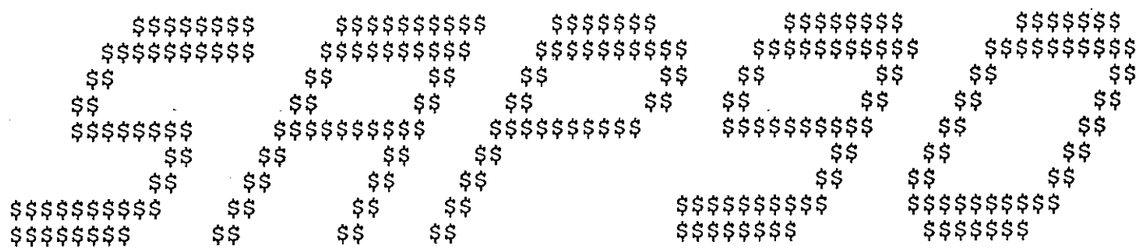
Oficina Técnica	PROYECTO: VIADUCTO Nº 1	
	ASUNTO:	
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA DE

CARGAS PERMANENTES

EVACUACION

- Balasto: $q = 1,6 \times 4,18 = 6,688$ t/m $\times 1,2 = 8,02$ t/m.
- Traviesas $0,52 \times 2 = 1,04$ t/m
- Carriles $0,12 \times 2 = 0,24$ t/m.
- Conductos y cableado $0,3 \times 2 = 0,6$ t/m.
- Impostas y barandillas $2 \times 0,75 = 1,5$ t/m
- Soporte de catenaria $\frac{2 \times 0,5}{60} = 0,02$ t/m

TOTAL 11,51 t/m.



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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CALCULO DE REACCIONES MAXIMAS

```
EVALUACION DE REACCIONES DE SOBRECARGAS
SYSTEM
L=3
)
JOINTS
1     X=0        Y=0.00
2     X=39       Y=0.00
3     X=87       Y=0.00
4     X=135      Y=0.00
5     X=183      Y=0.00
6     X=231      Y=0.00
7     X=279      Y=0.00
8     X=327      Y=0.00
9     X=375      Y=0.00
10    X=423      Y=0.00
11    X=471      Y=0.00
12    X=519      Y=0.00
13    X=558      Y=0.00
:
FRAMES
NM=1  NL=6
1  A=8.924        I=20.4489,89.6148          J=28.370      E=3800000
)  TRAP=0,-12,0,30,-12,0,30,-10,0,48,-10,0
2  WG=0,-10,0
3  TRAP=0,-8,0,44.8,-8,0  PLD=45.6,-25,0,47.2,-8,0
4  TRAP=3.2,-8,0,48.0,-8,0  PLD=0.8,-25,0,2.4,-8,0
5  TRAP=19.5,-15,0,44.5,-15,0
6  TRAP=3.5,-15,0,28.5,-15,0
1      1      2     M=1  LP=1,0
2      2      3     M=1  LP=1,0
3      3      4     M=1  LP=1,0
4      4      5     M=1  LP=1,0
5      5      6     M=1  LP=1,0
6      6      7     M=1  LP=1,0  NSL=1,3,5
7      7      8     M=1  LP=1,0  NSL=2,4,6
8      8      9     M=1  LP=1,0
9      9      10    M=1  LP=1,0
10     10     11    M=1  LP=1,0
11     11     12    M=1  LP=1,0
12     12     13    M=1  LP=1,0
:
)  TRAINTS
1   13   1  R=0,1,1,1,1,0
1          R=1,1,1,1,1,0
:
→
```


EVALUACION DE REACCIONES DE SOBRECARGAS

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXI TOR
1								
	1	.000			.000			
		.000	-.147	.000				
		39.000	-.147	-5.748				
		39.000			.000			
	2	.000			.000			
		.000	-.098	.000				
		39.000	-.098	-3.812				
		39.000			.000			
	3	.000			.000			
		.000	-.084	.000				
		39.000	-.084	-3.292				
		39.000			.000			
2								
	1	.000			.000			
		.000	.554	-5.748				
		48.000	.554	20.837				
		48.000			.000			
	2	.000			.000			
		.000	.367	-3.812				
		48.000	.367	13.819				
		48.000			.000			
	3	.000			.000			
		.000	.317	-3.292				
		48.000	.317	11.932				
		48.000			.000			
3								
	1	.000			.000			
		.000	-2.051	20.837				
		48.000	-2.051	-77.600				
		48.000			.000			
	2	.000			.000			
		.000	-1.360	13.819				
		48.000	-1.360	-51.462				
		48.000			.000			
	3	.000			.000			
		.000	-1.174	11.932				
		48.000	-1.174	-44.435				
		48.000			.000			
4								
	1	.000			.000			

EVALUACION DE REACCIONES DE SOBRECARGAS

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		.000	7.649	-77.600				
		48.000	7.649	289.564				
		48.000			.000			
	2	.000			.000			
		.000	5.073	-51.462				
		48.000	5.073	192.031				
		48.000			.000			
	3	.000			.000			
		.000	4.380	-44.435				
		48.000	4.380	165.810				
		48.000			.000			
5								
	1	.000			.000			
		.000	-28.546	289.564				
		48.000	-28.546	-1080.657				
		48.000			.000			
	2	.000			.000			
		.000	-18.931	192.031				
		48.000	-18.931	-716.662				
		48.000			.000			
	3	.000			.000			
		.000	-16.346	165.810				
		48.000	-16.346	-618.803				
		48.000			.000			
6								
	1	.000			.000			
		.000	250.061	-1080.657				
		20.839	-.001	1524.786				
		30.000	-109.939	1021.175				
		48.000	-289.939	-2577.718				
		48.000			.000			
	2	.000			.000			
		.000	166.653	-716.662				
		20.832	-.001	1019.163				
		44.800	-191.747	-1278.779				
		47.200	-224.747	-1778.995				
		48.000	-224.747	-1958.761				
		48.000			.000			
	3	.000			.000			
		.000	83.370	-618.803				
		19.500	83.370	1006.921				
		25.058	-.001	1238.604				
		44.500	-291.630	-1596.341				

EVALUACION DE REACCIONES DE SOBRECARGAS

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXI TO
		48.000	-291.630	-2617.031				
		48.000			.000			
7								
	1	.000			.000			
		.000	275.938	-2577.718				
		27.594	-.001	1229.373				
		48.000	-204.062	-852.691				
		48.000			.000			
	2	.000			.000			
		.000	225.465	-1958.761				
		2.400	192.465	-1457.617				
		3.200	192.465	-1303.663				
		27.258	-.001	1011.501				
		48.000	-165.935	-709.401				
		48.000			.000			
	3	.000			.000			
		.000	291.630	-2617.031				
		3.500	291.629	-1596.313				
		22.942	-.001	1238.604				
		28.500	-83.370	1006.913				
		48.000	-83.370	-618.803				
		48.000			.000			
8								
	1	.000			.000			
		.000	22.524	-852.691				
		48.000	22.524	228.480				
		48.000			.000			
	2	.000			.000			
		.000	18.739	-709.401				
		48.000	18.739	190.085				
		48.000			.000			
	3	.000			.000			
		.000	16.346	-618.803				
		48.000	16.346	165.810				
		48.000			.000			
9								
	1	.000			.000			
		.000	-6.036	228.480				
		48.000	-6.036	-61.230				
		48.000			.000			
	2	.000			.000			
		.000	-5.021	190.085				
		48.000	-5.021	-50.941				

EVALUACION DE REACCIONES DE SOBRECARGAS

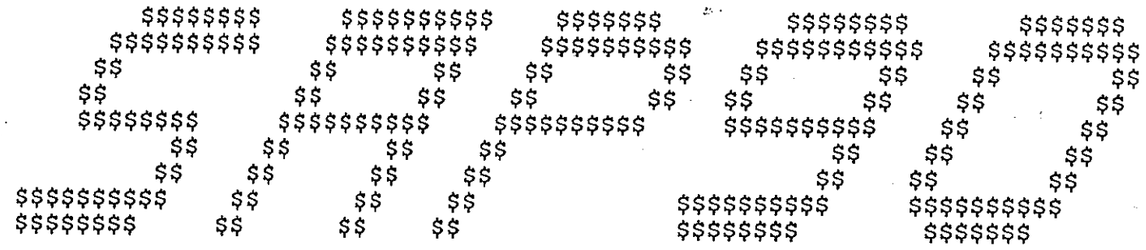
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		48.000			.000			
	3	.000			.000			
		.000	-4.380	165.810				
		48.000	-4.380	-44.435				
		48.000			.000			
10								
	1	.000			.000			
		.000	1.618	-61.230				
		48.000	1.618	16.442				
		48.000			.000			
	2	.000			.000			
		.000	1.346	-50.941				
		48.000	1.346	13.679				
		48.000			.000			
	3	.000			.000			
		.000	1.174	-44.435				
		48.000	1.174	11.932				
		48.000			.000			
11								
	1	.000			.000			
		.000	-.437	16.442				
		48.000	-.437	-4.536				
		48.000			.000			
	2	.000			.000			
		.000	-.364	13.679				
		48.000	-.364	-3.773				
		48.000			.000			
	3	.000			.000			
		.000	-.317	11.932				
		48.000	-.317	-3.292				
		48.000			.000			
12								
	1	.000			.000			
		.000	.116	-4.536				
		39.000	.116	.000				
		39.000			.000			
	2	.000			.000			
		.000	.097	-3.773				
		39.000	.097	.000				
		39.000			.000			
	3	.000			.000			

EVALUACION DE REACCIONES DE SOBRECARGAS

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COND	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
		.000	.084	-3.292				
		39.000	.084	.000				
		39.000			.000			



STRUCTURAL ANALYSIS PROGRAMS

VERSION 5.40

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EVALUACION DE REACCIONES DE SOBRECARGAS

J O I N T D I S P L A C E M E N T S

LOAD CONDITION 1 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	R(Z)
1	.0000E+00	.4808E-06
2	.0000E+00	-.9617E-06
3	.0000E+00	.3699E-05
4	.0000E+00	-.1383E-04
5	.0000E+00	.5163E-04
6	.0000E+00	-.1927E-03
7	.0000E+00	.2555E-04
8	.0000E+00	.1521E-03
9	.0000E+00	-.4074E-04
10	.0000E+00	.1091E-04
11	.0000E+00	-.2918E-05
12	.0000E+00	.7588E-06
13	.0000E+00	-.3794E-06

EVALUACION DE REACCIONES DE SOBRECARGAS

J O I N T D I S P L A C E M E N T S

LOAD CONDITION 2 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	R(Z)
1	.0000E+00	.3189E-06
2	.0000E+00	-.6377E-06
3	.0000E+00	.2453E-05
4	.0000E+00	-.9174E-05
5	.0000E+00	.3424E-04
6	.0000E+00	-.1278E-03
7	.0000E+00	.2152E-05
8	.0000E+00	.1265E-03
9	.0000E+00	-.3389E-04
10	.0000E+00	.9081E-05
11	.0000E+00	-.2428E-05
12	.0000E+00	.6313E-06
13	.0000E+00	-.3156E-06

EVALUACION DE REACCIONES DE SOBRECARGAS

J O I N T D I S P L A C E M E N T S

LOAD CONDITION 3 - DISPLACEMENTS "U" AND ROTATIONS "R"

JOINT	U(X)	R(Z)
1	.0000E+00	.2753E-06
2	.0000E+00	-.5507E-06
3	.0000E+00	.2118E-05
4	.0000E+00	-.7921E-05
5	.0000E+00	.2957E-04
6	.0000E+00	-.1103E-03
7	.000000	.000000
8	.0000E+00	.1103E-03
9	.0000E+00	-.2957E-04
10	.0000E+00	.7921E-05
11	.0000E+00	-.2118E-05
12	.0000E+00	.5507E-06
13	.0000E+00	-.2753E-06

EVALUACION DE REACCIONES DE SOBRECARGAS

R E A C T I O N S A N D A P P L I E D F O R C E S

LOAD CONDITION 1 - FORCES "F" AND MOMENTS "M"

JOINT	F(Y)	M(Z)
1	-.1474	.0000
2	.7012	.0000
3	-2.6046	.0000
4	9.7000	.0000
5	-36.1955	.0000
6	278.6075	.0000
7	565.8768	.0000
8	226.5863	.0000
9	-28.5600	.0000
10	7.6538	.0000
11	-2.0552	.0000
12	.5533	.0000
13	-.1163	.0000
TOTAL	.1020E+04	-.1480E-12

EVALUACION DE REACCIONES DE SOBRECARGAS

R E A C T I O N S A N D A P P L I E D F O R C E S

LOAD CONDITION 2 - FORCES "F" AND MOMENTS "M"

JOINT	F(Y)	M(Z)
1	-.0977	.0000
2	.4650	.0000
3	-1.7273	.0000
4	6.4328	.0000
5	-24.0039	.0000
6	185.5841	.0000
7	450.2121	.0000
8	184.6743	.0000
9	-23.7607	.0000
10	6.3676	.0000
11	-1.7098	.0000
12	.4603	.0000
13	-.0968	.0000
TOTAL	.7828E+03	-.3481E-12

EVALUACION DE REACCIONES DE SOBRECARGAS

R E A C T I O N S A N D A P P L I E D F O R C E S

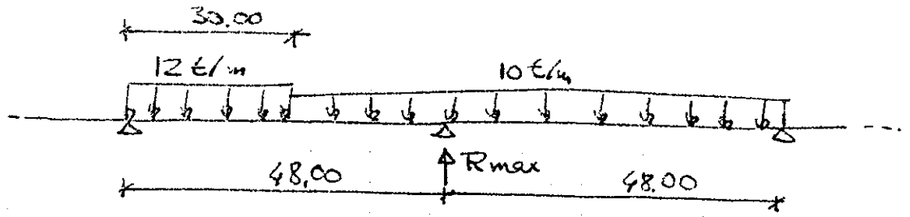
LOAD CONDITION 3 - FORCES "F" AND MOMENTS "M"

JOINT	F(Y)	M(Z)
1	-.0844	.0000
2	.4015	.0000
3	-1.4915	.0000
4	5.5544	.0000
5	-20.7262	.0000
6	99.7163	.0000
7	583.2595	.0000
8	99.7163	.0000
9	-20.7262	.0000
10	5.5544	.0000
11	-1.4915	.0000
12	.4015	.0000
13	-.0844	.0000
TOTAL	.7500E+03	-.1990E-12

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA	DE

EVALUACION REACCIONES DE SOBRECARGAS.

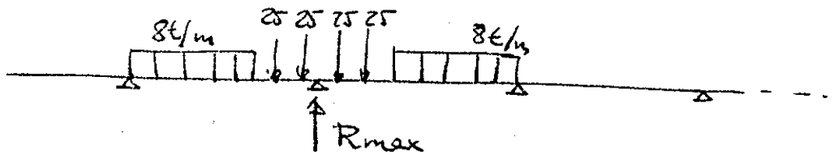
1) Tren de cargas IAPF-75



Rmax= 565,9 t.

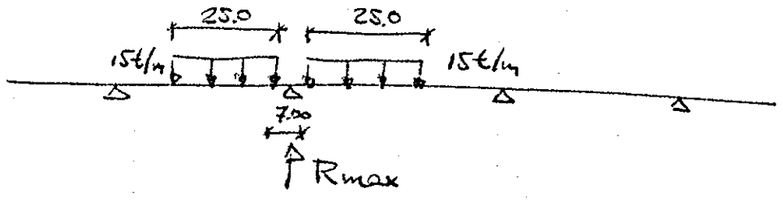
Reacción total por doble vía = 1131,8t

2) TREN DE CARGAS UIC-71



Rmax= 450.21 t

3) TREN PESADO SW-2



Rmax= 583.26 t

Combinación máxima (1 UIC-71 + 1 SW-2) = 583.26 + 450.21 = 1033.5 t.

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA	DE

ESFUERZOS TRANSVERSALES CONCOMITANTES CON CARGAS VERTICALES.

① BALASTO

Area balasto = 4.18 m² (Sección completa simétrica)

H conc. = 0

Estado transitorio

a) 50% de la vía en toda la longitud

$q_a = 1.6 \times 2,18 m^2 = 3.49$ t/m $\quad q_s = 1,2 \times 3,49 = 4.2$ t/m.

Momento concomitante = $4.2 \times 2,09 = 8.778$ t×m/m

② Traviesas y carriles (Por vía)

$q = 0,52 + 0,12 = 0,64$ t/m.

$M_{conc} = 0,64 \times 2,25 = 1,44$ t.m/m.

③ SOBRECARGAS

IAPF:75

Rmax = 1131,8 t

- Ripado de Vía : $M_{trans} = 1131,8 \times 0,3 = 339,6$ t×m.
- Efecto lazo : $H_{trans} = 5$ t

$M_{trans} = 5 \times (1,4732 + 0,8194) = 11.463$ t/m

- Empuje sobre barandillas

50% compatible con sc → $H_t = 0,15 \times 0,5 = 0,075$ t/m

$M_t = 0,075 \times (1,4732 + 0,874) = 0,176$ t...

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA	DE

③ SOBRECARGAS (CONTINUACION)

(EC-1)

$R_{max} = 1033,5$ €.

$M_{trans,concen} = (583,26 - 450,21) \times 2,25 = 299.36$ €.m.

-Ripado de vía:

$M_{trans} = (583,26 + 450.21) \times 0,3 = 310.09$ €.m.

-Efecto lazo:

$H_€ = 10$€.

$M_€ = 10€ \times (1,4732 + 0,819\%) = 22,926$ €xm

CARGAS DEBIDAS A 1 SOLO TREN

-1APF-75

$R_{max} = 565.9$ € $M_€ = 1273.3 + 169.77$ (Ripado) $= 1443.0$ €.m.

-EC-1

UIC-71 : $R = 583,26$ $M_€ = 1312.335 + 174.98$ (Ripado) $= 1487.3$ €.m

SW-2 : $R = 450.21$ $M_€ = 1012.97 + 135.06$ (Ripado) $= 1148.03$ €.m.

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA	DE

ESFUERZOS LONGITUDINALES EN CABEZA DE PILA

-RESUMEN DE REACCIONES

	PP	RCP	TOTAL	HL = 5% · Vmax
P-1	1250.2	558.3	1808.5	90.42 t
P-2	1252.4	559.3	1811.7	90.585 €
P-3	1247.4	557.0	1804.4	90.22 €
P-4	1249.2	557.8	1807.0	90.35 €

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA	DE

COMBINACION DE HIPÓTESIS

Para la combinación de Hipótesis se aplicará la Instrucción IAP vigente.

Para la cual se distinguirá entre sobrecargas principales y secundarias, e irán afectadas por el valor Ψ correspondiente.

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CALCULO DE CIMENTACION.

Para establecer los valores de dimensionamiento de la cimentación se establecen tres combinaciones básicas:

Nmax, M concomitante

N min, H concomitante

M max, N concomitante

Como las reacciones son parecidas en todas las pilas, se toma la pési

RESUMEN DE HIPOTESIS (En cabeza de pila)

PP: (Se utiliza un peso de 22,3 t/m + 4 t/m por macizados y riostras)

- N: 1253,1 Mconc = 0

RCP

- N: 559,5 Mconc: 0 He: 0,5 t (Soporte de catenarias)
- Desbalastado de vía

N = 559,5 - 201.6 = 357.9 Mconc: 421,3 t.m

N (Trav. y carriles) -30.72 Mconc = 69.12

327.18 490.42

CALCULO DE ACCION DE FUERZA CENTRIFUGA

Oficina Técnica | PROYECTO: VIADUCTO nº 1 | ASUNTO:

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Fuerza centrífuga IAPF-75

$$Fc = Q \times \frac{V^2}{127 \cdot R}$$

Suponiendo V= 200 km/h

$$Fc\ máquina = \frac{1{,}094 \times 12}{25{,}4} = 0{,}52\ t/m$$

$$Fc\ vagón\ pésimo: \frac{1{,}094 \times 10}{25{,}4} = 0{,}43\ t/m$$

Carga máxima por pila. $Fc = [0{,}52 \times 30 + 0{,}43 \times (48-30)] \times 2 = 46{,}68\ t.$

Fuerza debida a viento

$F_V = 1{,}527 \times 48 = 73{,}3\ t.$

- Efecto de lazo 5t
- Empuje sobre barandillas = 150 kp/m ⇒ total 48m: 7,2 t.

Combinaciones pésimas

- SC + 0,6 x viento

$H_{max} = 46{,}68 + 5^{\times 2} + 7{,}2 + 0{,}6 \times 73{,}3 = 107{,}86\ t.$

- 0,6 SC + viento

$H_{max} = 0{,}6 \times [46{,}68 + 5^{\times 2} + 7{,}2] + 73{,}3 = 111{,}6\ t.$

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FUERZA CENTRIFUGA EC 1.3

$$Q_{tk} = \frac{V^2}{127R} \times f \times Q_{vk}$$

- Modelo 71 con V= 120 km/h con ϕ_2 y f=1

$Q_t = 0{,}014\ Q_v$

- Modelo 71 reducido con $f = \left[1 - \frac{V-120}{1000}\left(\frac{814}{V} + 1{,}75\right)\left(-1 - \sqrt{\frac{2{,}88}{4}}\right)\right.$

f=0,3 → $Q_t = 0{,}036\ Q_v$ (Para V= 350 km/h)

RESUMEN DE CARGAS VERTICALES

2 Trenes UIC-75 900,42 t.

Fcentrifuga: 32,41 t.

COMPROBACION DE TENSIONES
FASE DE SERVICIO

X	HIPOTESIS 1 PP	HIPOTESIS 2 BALASTO	HIPOTESIS 3 RCP	HIPOTESIS 4 DESBALASTADO 50%	HIPOTESIS 5 DESBALASTADO 100% EN 15M	HIPOTESIS 6 PRETENSADO LANZAMIENTO	HIPOTESIS 7 PRETENSADO EXTERIOR	COEF. IMPACTO 1.12 HIPOTESIS 8 IAPF-75 SC Mmax VANO 6	COEF. IMPACTO 1.12 HIPOTESIS 9 IAPF-75 SC Mmax VANO 12	COEF. IMPACTO 1.12 HIPOTESIS 10 IAPF-75 SC Qmax PILA 6	COEF. IMPACTO 1.12 HIPOTESIS 11 IAPF-75 SC Mmin PILA 6	HIPOTESIS 12 EMPUJE BARANDILLA	COEF. IMPACTO 1.04 HIPOTESIS 13 UIC-71 SC Mmax VANO 6
0.00	-4413.15	-1562.26	-699.32	818.14	617.26	0.00	2.21	-1819.73	-1201.07	-1583.13	-1583.13	0.00	-1157.84
1.20	-3770.84	-1337.08	-598.52	700.22	598.53	0.00	1.92	-1364.87	-886.56	-1540.00	-1540.00	0.00	-893.89
2.40	-3164.28	-1123.45	-502.89	588.34	579.80	0.00	1.63	-934.19	-588.17	-1498.49	-1498.49	0.00	-641.92
3.60	-2592.42	-921.37	-412.43	482.51	561.06	0.00	1.34	-527.71	-305.91	-1458.58	-1458.58	0.00	-401.93
4.80	-2054.22	-730.83	-327.14	382.73	542.33	0.00	1.05	-145.42	-39.78	-1420.29	-1420.29	0.00	-173.93
4.80	-2054.22	-730.83	-327.14	382.73	542.33	0.00	1.05	-145.42	-39.78	-1420.29	-1420.29	0.00	-173.93
6.00	-1548.81	-551.85	-247.02	289.00	523.60	0.00	0.76	212.68	210.22	-1383.62	-1383.62	0.00	42.10
7.20	-1076.03	-384.41	-172.07	201.31	504.87	0.00	0.47	546.59	444.10	-1348.55	-1348.55	0.00	246.14
8.40	-635.88	-228.52	-102.29	119.67	486.14	0.00	0.18	856.30	661.84	-1315.10	-1315.10	0.00	438.21
9.60	-228.35	-84.18	-37.68	44.09	467.40	0.00	-0.11	1141.82	863.46	-1283.26	-1283.26	0.00	618.29
9.60	-228.35	-84.18	-37.68	44.09	467.40	0.00	-0.11	1141.82	863.46	-1283.26	-1283.26	0.00	618.29
10.80	146.56	48.61	21.76	-25.46	448.67	0.00	-0.40	1403.15	1048.95	-1253.04	-1253.04	0.00	786.39
12.00	488.85	169.85	76.03	-88.95	429.94	0.00	-0.69	1640.29	1218.31	-1224.42	-1224.42	0.00	942.52
13.20	798.51	279.54	125.13	-146.39	411.21	0.00	-0.69	1853.24	1371.55	-1197.42	-1197.42	0.00	1086.66
14.40	1075.56	377.69	169.06	-197.79	392.47	0.00	-0.69	2041.99	1508.65	-1172.03	-1172.03	0.00	1218.82
14.40	1075.56	377.69	169.06	-197.79	392.47	0.00	-0.69	2041.99	1508.65	-1172.03	-1172.03	0.00	1218.82
15.60	1319.97	464.28	207.83	-243.14	373.74	0.00	-0.69	2206.55	1629.63	-1148.26	-1148.26	0.00	1339.00
16.80	1531.77	539.33	241.42	-282.44	355.01	0.00	-0.69	2346.93	1734.48	-1126.10	-1126.10	0.00	1447.20
18.00	1710.94	602.83	269.84	-315.69	336.28	0.00	-0.69	2463.10	1823.21	-1105.55	-1105.55	0.00	1543.42
19.20	1857.48	654.77	293.10	-342.90	317.55	0.00	-0.69	2555.09	1895.80	-1086.61	-1086.61	0.00	1627.65
19.20	1857.48	654.77	293.10	-342.90	317.55	0.00	-0.69	2555.09	1895.80	-1086.61	-1086.61	0.00	1627.65
20.40	1971.41	695.17	311.18	-364.06	298.81	0.00	-0.69	2622.88	1952.27	-1069.29	-1069.29	0.00	1699.91
21.60	2052.71	724.03	324.10	-379.17	280.08	0.00	-0.69	2666.49	1992.61	-1053.58	-1053.58	0.00	1762.85
22.80	2101.39	741.33	331.84	-388.23	261.35	0.00	-0.69	2685.90	2016.82	-1039.48	-1039.48	0.00	1793.92
24.00	2117.44	747.08	334.42	-391.24	242.62	0.00	-0.69	2681.12	2024.90	-1026.99	-1026.99	0.00	1804.19
24.00	2117.44	747.08	334.42	-391.24	242.62	0.00	-0.69	2681.12	2024.90	-1026.99	-1026.99	0.00	1804.19
25.20	2100.87	741.29	331.82	-388.20	223.88	0.00	-0.69	2652.14	2016.85	-1016.12	-1016.12	0.00	1793.67
26.40	2051.68	723.94	324.06	-379.12	205.15	0.00	-0.69	2598.98	1992.68	-1006.86	-1006.86	0.00	1762.34
27.60	1969.86	695.05	311.13	-363.99	186.42	0.00	-0.69	2521.62	1952.38	-999.21	-999.21	0.00	1699.14
28.80	1855.43	654.61	293.02	-342.81	167.69	0.00	-0.69	2420.07	1895.95	-993.18	-993.18	0.00	1626.63
28.80	1855.43	654.61	293.02	-342.81	167.69	0.00	-0.69	2420.07	1895.95	-993.18	-993.18	0.00	1626.63
30.00	1708.36	602.62	269.75	-315.58	148.96	0.00	-0.69	2294.33	1823.39	-988.76	-988.76	0.00	1542.15
31.20	1528.68	539.08	241.31	-282.31	130.22	0.00	-0.69	2148.43	1734.71	-985.95	-985.95	0.00	1445.69
32.40	1316.37	463.99	207.70	-242.99	111.49	0.00	-0.69	1986.40	1629.89	-984.76	-984.76	0.00	1337.24
33.60	1071.44	377.35	168.91	-197.62	92.76	0.00	-0.69	1808.24	1508.95	-985.17	-985.17	0.00	1216.82
33.60	1071.44	377.35	168.91	-197.62	92.76	0.00	-0.69	1808.24	1508.95	-985.17	-985.17	0.00	1216.82
34.80	793.89	279.17	124.96	-146.20	74.03	0.00	-0.69	1613.97	1371.88	-987.20	-987.20	0.00	1084.41
36.00	483.71	169.43	75.84	-88.73	55.29	0.00	-0.69	1403.57	1218.69	-990.85	-990.85	0.00	940.03
37.20	140.91	48.15	21.55	-25.22	36.56	0.00	-0.40	1177.04	1049.36	-996.10	-996.10	0.00	783.66
38.40	-234.52	-84.68	-37.91	44.35	17.83	0.00	-0.11	934.38	863.91	-1002.97	-1002.97	0.00	615.31
38.40	-234.52	-84.68	-37.91	44.35	17.83	0.00	-0.11	934.38	863.91	-1002.97	-1002.97	0.00	615.31
39.60	-642.56	-229.06	-102.54	119.96	-0.90	0.00	0.18	675.60	662.32	-1011.45	-1011.45	0.00	434.98
40.80	-1083.23	-384.99	-172.34	201.62	-19.63	0.00	0.47	400.69	444.62	-1021.54	-1021.54	0.00	242.67
42.00	-1556.53	-552.47	-247.30	289.32	-38.37	0.00	0.76	109.65	210.78	-1033.25	-1033.25	0.00	38.38
43.20	-2062.44	-731.50	-327.44	383.08	-57.10	0.00	1.05	-197.52	-39.19	-1046.57	-1046.57	0.00	-177.89
43.20	-2062.44	-731.50	-327.44	383.08	-57.10	0.00	1.05	-197.52	-39.19	-1046.57	-1046.57	0.00	-177.89
44.40	-2601.16	-922.08	-412.75	482.88	-75.83	0.00	1.34	-520.82	-305.28	-1061.50	-1061.50	0.00	-406.14
45.60	-3173.53	-1124.20	-503.23	588.73	-94.56	0.00	1.63	-860.24	-587.50	-1078.05	-1078.05	0.00	-646.37
46.80	-3780.61	-1337.88	-598.87	700.63	-113.30	0.00	1.92	-1215.79	-885.85	-1096.21	-1096.21	0.00	-898.59
48.00	-4423.43	-1563.10	-699.69	818.58	-132.03	0.00	2.21	-1587.47	-1200.33	-1115.98	-1115.98	0.00	-1162.78

	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04	COEF. IMPACTO 1.04								
	HIPOTESIS 14 UIC-71 SC Mmax	HIPOTESIS 15 UIC-71 SC Qmax	HIPOTESIS 16 UIC-71 SC Mmin	HIPOTESIS 17 SW/2 SC Mmax	HIPOTESIS 18 SW/2 SC Mmax	HIPOTESIS 19 SW/2 SC Qmax	HIPOTESIS 20 SW/2 SC Mmin	HIPOTESIS 21	HIPOTESIS 22	HIPOTESIS 23	HIPOTESIS 24a DESCENSO 1.25 cm	HIPOTESIS 24b DESCENSO 1.25 cm	HIPOTESIS 24c DESCENSO 1.25 cm	HIPOTESIS 24d DESCENSO 1.25 cm	HIPOTESIS 25 DESCENSO 1.25 cm
X	VANO 12	PILA 6	PILA 6	VANO 6	VANO 12	PILA 6	PILA 6	VIENTO SIN SC	VIENTO CON SC	GRADIENTE 5°	PILA 6	PILA 6	PILA 6	PILA 6	PILA 11
0.00	-0.14	-1947.57	-1947.57	-1698.25	-0.16	-2599.45	-2599.45	0.00	0.00	970.53	410.33	-1720.61	2773.68	-1719.16	0.00
1.20	-0.12	-1660.23	-1660.23	-1319.40	-0.13	-2213.76	-2213.76	0.00	0.00	970.50	357.05	-1608.26	2661.36	-1665.99	0.00
2.40	-0.10	-1393.70	-1393.70	-963.01	-0.11	-1837.15	-1837.15	0.00	0.00	970.48	303.78	-1495.90	2549.04	-1612.81	0.00
3.60	-0.08	-1159.02	-1159.02	-629.09	-0.09	-1482.06	-1482.06	0.00	0.00	970.46	250.51	-1383.54	2436.72	-1559.64	0.00
4.80	-0.06	-933.67	-933.67	-317.63	-0.07	-1148.57	-1148.57	0.00	0.00	970.43	197.23	-1271.19	2324.40	-1506.46	0.00
4.80	-0.06	-933.67	-933.67	-317.63	-0.07	-1148.57	-1148.57	0.00	0.00	970.43	197.23	-1271.19	2324.40	-1506.46	0.00
6.00	-0.04	-720.28	-720.28	-28.63	-0.05	-836.66	-836.66	0.00	0.00	970.41	143.96	-1158.83	2212.08	-1453.29	0.00
7.20	-0.02	-518.88	-518.88	237.90	-0.03	-546.36	-546.36	0.00	0.00	970.38	90.68	-1046.47	2099.76	-1400.11	0.00
8.40	-0.01	-329.46	-329.46	481.97	-0.01	-277.65	-277.65	0.00	0.00	970.36	37.41	-934.11	1987.44	-1346.94	0.00
9.60	0.01	-152.02	-152.02	703.58	0.02	-30.54	-30.54	0.00	0.00	970.34	-15.86	-821.75	1875.11	-1293.76	0.00
9.60	0.01	-152.02	-152.02	703.58	0.02	-30.54	-30.54	0.00	0.00	970.34	-15.86	-821.75	1875.11	-1293.76	0.00
10.80	0.03	13.44	13.44	902.72	0.04	194.96	194.96	0.00	0.00	970.31	-69.14	-709.40	1762.79	-1240.59	0.00
12.00	0.05	166.92	166.92	1079.39	0.06	398.87	398.87	0.00	0.00	970.29	-122.41	-597.04	1650.47	-1187.42	0.00
13.20	0.07	308.42	308.42	1233.61	0.08	581.17	581.17	0.00	0.00	970.26	-175.68	-484.68	1538.15	-1134.24	0.00
14.40	0.09	437.94	437.94	1365.36	0.10	741.88	741.88	0.00	0.00	970.24	-228.96	-372.33	1425.83	-1081.07	0.00
14.40	0.09	437.94	437.94	1365.36	0.10	741.88	741.88	0.00	0.00	970.24	-228.96	-372.33	1425.83	-1081.07	0.00
15.60	0.11	555.48	555.48	1474.95	0.12	880.99	880.99	0.00	0.00	970.21	-282.23	-259.97	1313.51	-1027.89	0.00
16.80	0.12	661.03	661.03	1576.75	0.14	998.49	998.49	0.00	0.00	970.19	-335.50	-147.61	1201.19	-974.72	0.00
18.00	0.14	754.61	754.61	1678.55	0.17	1094.40	1094.40	0.00	0.00	970.17	-388.78	-35.25	1088.87	-921.54	0.00
19.20	0.16	836.21	836.21	1780.34	0.19	1168.71	1168.71	0.00	0.00	970.14	-442.05	77.10	976.55	-868.37	0.00
19.20	0.16	836.21	836.21	1780.34	0.19	1168.71	1168.71	0.00	0.00	970.14	-442.05	77.10	976.55	-868.37	0.00
20.40	0.18	905.82	905.82	1882.14	0.21	1221.41	1221.41	0.00	0.00	970.12	-495.32	189.46	864.22	-815.19	0.00
21.60	0.20	963.45	963.45	1978.94	0.23	1252.52	1252.52	0.00	0.00	970.09	-548.60	301.82	751.90	-762.02	0.00
22.80	0.22	1009.11	1009.11	2054.53	0.25	1262.03	1262.03	0.00	0.00	970.07	-601.87	414.18	639.58	-708.84	0.00
24.00	0.24	1042.78	1042.78	2107.66	0.27	1249.93	1249.93	0.00	0.00	970.04	-655.14	526.53	527.26	-655.67	0.00
24.00	0.24	1042.78	1042.78	2107.66	0.27	1249.93	1249.93	0.00	0.00	970.04	-655.14	526.53	527.26	-655.67	0.00
25.20	0.25	1064.47	1064.47	2138.34	0.29	1216.24	1216.24	0.00	0.00	970.02	-708.42	638.89	414.94	-602.50	0.00
26.40	0.27	1074.18	1074.18	2146.55	0.32	1160.94	1160.94	0.00	0.00	970.00	-761.69	751.25	302.62	-549.32	0.00
27.60	0.29	1071.91	1071.91	2132.30	0.34	1084.05	1084.05	0.00	0.00	969.97	-814.96	863.61	190.30	-496.15	0.00
28.80	0.31	1057.66	1057.66	2095.59	0.36	985.56	985.56	0.00	0.00	969.95	-868.24	975.96	77.98	-442.97	0.00
28.80	0.31	1057.66	1057.66	2095.59	0.36	985.56	985.56	0.00	0.00	969.95	-868.24	975.96	77.98	-442.97	0.00
30.00	0.33	1031.43	1031.43	2036.42	0.38	876.26	876.26	0.00	0.00	969.92	-921.51	1088.32	-34.34	-389.80	0.00
31.20	0.35	993.21	993.21	1954.78	0.40	766.97	766.97	0.00	0.00	969.90	-974.79	1200.68	-146.67	-336.62	0.00
32.40	0.37	943.02	943.02	1850.67	0.42	657.68	657.68	0.00	0.00	969.88	-1028.06	1313.04	-258.99	-283.45	0.00
33.60	0.38	880.84	880.84	1724.10	0.44	548.38	548.38	0.00	0.00	969.85	-1081.33	1425.39	-371.31	-230.27	0.00
33.60	0.38	880.84	880.84	1724.10	0.44	548.38	548.38	0.00	0.00	969.85	-1081.33	1425.39	-371.31	-230.27	0.00
34.80	0.40	806.69	806.69	1575.07	0.47	439.09	439.09	0.00	0.00	969.83	-1134.61	1537.75	-483.63	-177.10	0.00
36.00	0.42	720.55	720.55	1403.57	0.49	329.79	329.79	0.00	0.00	969.80	-1187.88	1650.11	-595.95	-123.93	0.00
37.20	0.44	622.44	622.44	1209.61	0.51	220.50	220.50	0.00	0.00	969.78	-1241.15	1762.47	-708.27	-70.75	0.00
38.40	0.46	512.34	512.34	993.19	0.53	111.21	111.21	0.00	0.00	969.75	-1294.43	1874.82	-820.59	-17.58	0.00
38.40	0.46	512.34	512.34	993.19	0.53	111.21	111.21	0.00	0.00	969.75	-1294.43	1874.82	-820.59	-17.58	0.00
39.60	0.48	390.26	390.26	754.30	0.55	1.91	1.91	0.00	0.00	969.73	-1347.70	1987.18	-932.91	35.60	0.00
40.80	0.50	256.20	256.20	492.95	0.57	-107.38	-107.38	0.00	0.00	969.71	-1400.97	2099.54	-1045.23	88.77	0.00
42.00	0.51	110.16	110.16	209.13	0.59	-216.67	-216.67	0.00	0.00	969.68	-1454.25	2211.90	-1157.56	141.95	0.00
43.20	0.53	-47.86	-47.86	-97.15	0.62	-325.97	-325.97	0.00	0.00	969.66	-1507.52	2324.25	-1269.88	195.12	0.00
43.20	0.53	-47.86	-47.86	-97.15	0.62	-325.97	-325.97	0.00	0.00	969.66	-1507.52	2324.25	-1269.88	195.12	0.00
44.40	0.55	-217.86	-217.86	-425.89	0.64	-435.26	-435.26	0.00	0.00	969.63	-1560.79	2436.61	-1382.20	248.30	0.00
45.60	0.57	-399.85	-399.85	-777.10	0.66	-544.56	-544.56	0.00	0.00	969.61	-1614.07	2548.97	-1494.52	301.47	0.00
46.80	0.59	-593.81	-593.81	-1150.78	0.68	-653.85	-653.85	0.00	0.00	969.58	-1667.34	2661.33	-1606.84	354.65	0.00
48.00	0.61	-799.75	-799.75	-1546.91	0.70	-763.14	-763.14	0.00	0.00	969.56	-1720.61	2773.68	-1719.16	407.82	0.00

RESUMEN DE TENSIONES

CARACTERISTICAS MECANICAS

A	9.062
I	20.008
ys	1.495
yi	2.505
Ws	13.385
Wi	7.987

PRETENSADO

Nº TENDONES	6	4
Nº CORDONES	25	0
CARGA ROTURA TENDON	28.39	95.00
% TESADO	80%	100%

	1	1	0.6	0.6	0.6
CARGAS PERMANENTES	POSITIVOS ENVOLVENTE SOBRECARGAS	NEGATIVOS ENVOLVENTE SOBRECARGAS	POSITIV ASIENTO 1.25 cm	NEGATIV ASIENTO 1.25 cm	GRADIENTE
-6674.72	-2315.68	-4547.02	1040.13	-645.23	582.32
-5706.44	-1787.78	-3873.99	998.01	-624.74	582.30
-4790.61	-1283.84	-3230.84	955.89	-604.80	582.29
-3926.21	-803.87	-2641.08	913.77	-584.86	582.27
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-2347.68	425.36	-1556.95	829.53	-544.98	582.24
-1632.52	1093.17	-1065.24	787.41	-525.04	582.23
-966.69	1712.60	-658.92	745.29	-505.10	582.22
-350.21	2283.64	-304.03	703.17	-485.16	582.20
-350.21	2283.64	-304.03	703.17	-485.16	582.20
216.93	2806.31	26.89	661.05	-465.22	582.19
734.73	3280.58	333.85	618.93	-445.28	582.17
1203.19	3706.47	616.84	576.81	-425.34	582.16
1622.31	4083.98	875.88	534.69	-405.40	582.14
1622.31	4083.98	875.88	534.69	-405.40	582.14
1992.08	4413.11	1110.96	492.57	-385.46	582.13
2312.51	4693.85	1322.07	450.45	-365.52	582.11
2583.60	4926.21	1509.22	408.33	-345.58	582.10
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2977.76	5245.77	1811.64	324.08	-305.70	582.07
3100.83	5332.97	1926.91	281.96	-285.76	582.06
3174.55	5371.79	2018.21	239.84	-265.82	582.04
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3173.98	5304.28	2128.94	239.58	-265.66	582.01
3099.68	5197.95	2148.36	281.72	-285.63	582.00
2976.04	5043.24	2143.82	323.85	-305.61	581.98
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2580.73	4588.66	1907.69	408.12	-345.57	581.95
2309.06	4296.85	1760.18	450.25	-365.54	581.94
1988.06	3972.79	1600.69	492.39	-385.52	581.93
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1198.02	3227.93	1245.78	576.66	-425.48	581.90
728.98	2807.13	1050.35	618.79	-445.45	581.88
210.61	2354.08	842.94	660.92	-465.43	581.87
-357.11	1868.76	623.54	703.06	-485.41	581.85
-357.11	1868.76	623.54	703.06	-485.41	581.85
-974.16	1351.20	392.17	745.19	-505.39	581.84
-1640.56	801.37	148.82	787.33	-525.36	581.82
-2356.30	247.51	-106.51	829.46	-545.34	581.81
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3935.98	-812.28	-1041.64	913.73	-585.30	581.78
-4800.96	-1292.75	-1720.49	955.86	-605.28	581.77
-5717.36	-1797.17	-2431.59	998.00	-625.25	581.75
-6686.22	-2325.56	-3174.95	1040.13	-645.23	581.74

MULTIPLICADOR 3066.43

MOMENTO PRETENSADO EXTERIOR	MOMENTO PRETENSADO CENTRADO	MOMENTO PRETENSADO BARRAS
6766.69	0.00	450.00
5877.48	0.00	450.00
4988.26	0.00	450.00
4099.05	0.00	450.00
3209.83	0.00	450.00
3209.83	0.00	450.00
2320.62	0.00	450.00
1431.40	0.00	450.00
542.19	0.00	450.00
-347.03	0.00	450.00
-347.03	0.00	450.00
-1236.24	0.00	450.00
-2125.46	0.00	-290.00
-2125.29	0.00	-290.00
-2125.11	0.00	-290.00
-2125.11	0.00	-290.00
-2124.94	0.00	-290.00
-2124.77	0.00	-290.00
-2124.60	0.00	-290.00
-2124.43	0.00	-290.00
-2124.43	0.00	-290.00
-2124.25	0.00	-290.00
-2124.08	0.00	-290.00
-2123.91	0.00	-290.00
-2123.74	0.00	-290.00
-2123.74	0.00	-290.00
-2123.57	0.00	-290.00
-2123.39	0.00	-290.00
-2123.22	0.00	-290.00
-2123.05	0.00	-290.00
-2123.05	0.00	-290.00
-2122.88	0.00	-290.00
-2122.71	0.00	-290.00
-2122.53	0.00	-290.00
-2122.36	0.00	-290.00
-2122.36	0.00	-290.00
-2122.19	0.00	-290.00
-2122.02	0.00	450.00
-1232.46	0.00	450.00
-342.90	0.00	450.00
-342.90	0.00	450.00
546.66	0.00	450.00
1436.22	0.00	450.00
2325.78	0.00	450.00
3215.33	0.00	450.00
3215.33	0.00	450.00
4104.89	0.00	450.00
4994.45	0.00	450.00
5884.01	0.00	450.00
6773.57	0.00	450.00

MULTIPLICADOR 2453.1429 3679.7143

AXIL EXTERIOR	AXIL CENTRADO	AXIL BARRAS
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	
2453.14	3679.71	0.00
2453.14	3679.71	0.00
2453.14	3679.71	0.00

RESUMEN DE TENSIONES

CARACTERISTICAS MECANICAS

A	9.062
I	20.008
ys	1.495
yi	2.505
Ws	13.385
Wi	7.987

PRETENSADO

Nº TENDONES	6	2
Nº CORDONES	25	1
CARGA ROTURA TENDON	28.39	95.00
% TESADO	80%	100%

	1	1	0.6	0.6	0.6
CARGAS PERMANENTES	POSITIVOS ENVOLVENTE SOBRECARGAS	NEGATIVOS ENVOLVENTE SOBRECARGAS	POSITIV ASIENTO 1.25 cm	NEGATIV ASIENTO 1.25 cm	GRADIENTE
-6674.72	-2315.68	-4547.02	1040.13	-645.23	582.32
-5706.44	-1787.78	-3873.99	998.01	-624.74	582.30
-4790.61	-1283.84	-3230.84	955.89	-604.80	582.29
-3926.21	-803.87	-2641.08	913.77	-584.86	582.27
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-2347.68	425.36	-1556.95	829.53	-544.98	582.24
-1632.52	1093.17	-1065.24	787.41	-525.04	582.23
-966.69	1712.60	-658.92	745.29	-505.10	582.22
-350.21	2283.64	-304.03	703.17	-485.16	582.20
-350.21	2283.64	-304.03	703.17	-485.16	582.20
216.93	2806.31	26.89	661.05	-465.22	582.19
734.73	3280.58	333.85	618.93	-445.28	582.17
1203.19	3706.47	616.84	576.81	-425.34	582.16
1622.31	4083.98	875.88	534.69	-405.40	582.14
1622.31	4083.98	875.88	534.69	-405.40	582.14
1992.08	4413.11	1110.96	492.57	-385.46	582.13
2312.51	4693.85	1322.07	450.45	-365.52	582.11
2583.60	4926.21	1509.22	408.33	-345.58	582.10
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2977.76	5245.77	1811.64	324.08	-305.70	582.07
3100.83	5332.97	1926.91	281.96	-285.76	582.06
3174.55	5371.79	2018.21	239.84	-265.82	582.04
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3173.98	5304.28	2128.94	239.58	-265.66	582.01
3099.68	5197.95	2148.36	281.72	-285.63	582.00
2976.04	5043.24	2143.82	323.85	-305.61	581.98
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2580.73	4588.66	1907.69	408.12	-345.57	581.95
2309.06	4296.85	1760.18	450.25	-365.54	581.94
1988.06	3972.79	1600.69	492.39	-385.52	581.93
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1198.02	3227.93	1245.78	576.66	-425.48	581.90
728.98	2807.13	1050.35	618.79	-445.45	581.88
210.61	2354.08	842.94	660.92	-465.43	581.87
-357.11	1868.76	623.54	703.06	-485.41	581.85
-357.11	1868.76	623.54	703.06	-485.41	581.85
-974.16	1351.20	392.17	745.19	-505.39	581.84
-1640.56	801.37	148.82	787.33	-525.36	581.82
-2356.30	247.51	-106.51	829.46	-545.34	581.81
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3935.98	-812.28	-1041.64	913.73	-585.30	581.78
-4800.96	-1292.75	-1720.49	955.86	-605.28	581.77
-5717.36	-1797.17	-2431.59	998.00	-625.25	581.75
-6686.22	-2325.56	-3174.95	1040.13	-645.23	581.74

MULTIPLICADOR		171.00	MULTIPLICADOR			MOMENTOS POSITIVOS		MOMENTOS NEGATIVOS	
3066.43			2453.1429	3679.7143					
MOMENTO PRETENSADO EXTERIOR	MOMENTO PRETENSADO CENTRADO	MOMENTO PRETENSADO BARRAS	AXIL EXTERIOR	AXIL CENTRADO	AXIL BARRAS	TENSION INF	TENSION SUP	TENSION INF	TENSION SUP
6766.69	0.00	450.00	2453.14	3679.71		405.75	838.45	1259.02	329.34
5877.48	0.00	450.00	2453.14	3679.71		401.12	841.21	1162.28	387.06
4988.26	0.00	450.00	2453.14	3679.71		403.06	840.05	1075.92	438.58
4099.05	0.00	450.00	2453.14	3679.71		411.45	835.05	1002.69	482.28
3209.83	0.00	450.00	2453.14	3679.71		426.14	826.28	939.63	519.90
3209.83	0.00	450.00	2453.14	3679.71		426.14	826.28	939.63	519.90
2320.62	0.00	450.00	2453.14	3679.71		393.77	845.60	886.98	551.32
1431.40	0.00	450.00	2453.14	3679.71		337.22	879.34	844.71	576.54
542.19	0.00	450.00	2453.14	3679.71		292.91	905.78	819.31	591.70
-347.03	0.00	450.00	2453.14	3679.71		260.83	924.92	806.52	599.32
-347.03	0.00	450.00	2453.14	3679.71		260.83	924.92	806.52	599.32
-1236.24	0.00	450.00	2453.14	3679.71		240.99	936.75	806.29	599.46
-2125.46	0.00	-290.00	2453.14	3679.71	171.00	344.91	904.88	961.82	536.79
-2125.29	0.00	-290.00	2453.14	3679.71	171.00	238.19	968.56	900.65	573.29
-2125.11	0.00	-290.00	2453.14	3679.71	171.00	143.69	1024.93	845.65	606.11
-2125.11	0.00	-290.00	2453.14	3679.71	171.00	143.69	1024.93	845.65	606.11
-2124.94	0.00	-290.00	2453.14	3679.71	171.00	61.44	1074.01	796.83	635.23
-2124.77	0.00	-290.00	2453.14	3679.71	171.00	-8.58	1115.79	754.19	660.68
-2124.60	0.00	-290.00	2453.14	3679.71	171.00	-66.36	1150.27	717.73	682.43
-2124.43	0.00	-290.00	2453.14	3679.71	171.00	-111.91	1177.44	687.45	700.50
-2124.43	0.00	-290.00	2453.14	3679.71	171.00	-111.91	1177.44	687.45	700.50
-2124.25	0.00	-290.00	2453.14	3679.71	171.00	-145.22	1197.32	663.34	714.88
-2124.08	0.00	-290.00	2453.14	3679.71	171.00	-166.29	1209.89	645.41	725.58
-2123.91	0.00	-290.00	2453.14	3679.71	171.00	-175.13	1215.16	633.66	732.59
-2123.74	0.00	-290.00	2453.14	3679.71	171.00	-171.73	1213.14	628.09	735.91
-2123.74	0.00	-290.00	2453.14	3679.71	171.00	-171.73	1213.14	628.09	735.91
-2123.57	0.00	-290.00	2453.14	3679.71	171.00	-166.61	1210.08	633.67	732.58
-2123.39	0.00	-290.00	2453.14	3679.71	171.00	-149.29	1199.75	645.46	725.55
-2123.22	0.00	-290.00	2453.14	3679.71	171.00	-119.73	1182.11	663.42	714.84
-2123.05	0.00	-290.00	2453.14	3679.71	171.00	-77.94	1157.17	687.56	700.43
-2123.05	0.00	-290.00	2453.14	3679.71	171.00	-77.94	1157.17	687.56	700.43
-2122.88	0.00	-290.00	2453.14	3679.71	171.00	-23.91	1124.94	717.87	682.35
-2122.71	0.00	-290.00	2453.14	3679.71	171.00	41.35	1086.00	754.37	660.57
-2122.53	0.00	-290.00	2453.14	3679.71	171.00	116.82	1040.97	797.04	635.11
-2122.36	0.00	-290.00	2453.14	3679.71	171.00	202.51	989.84	845.89	605.96
-2122.36	0.00	-290.00	2453.14	3679.71	171.00	202.51	989.84	845.89	605.96
-2122.19	0.00	-290.00	2453.14	3679.71	171.00	298.42	932.62	900.92	573.13
-2122.02	0.00	450.00	2453.14	3679.71		293.01	905.71	850.61	573.02
-1232.46	0.00	450.00	2453.14	3679.71		297.99	902.75	806.63	599.26
-342.90	0.00	450.00	2453.14	3679.71		313.18	893.68	768.83	621.81
-342.90	0.00	450.00	2453.14	3679.71		313.18	893.68	768.83	621.81
546.66	0.00	450.00	2453.14	3679.71		338.59	878.52	737.22	640.68
1436.22	0.00	450.00	2453.14	3679.71		374.22	857.26	711.77	655.86
2325.78	0.00	450.00	2453.14	3679.71		416.53	832.01	705.85	659.39
3215.33	0.00	450.00	2453.14	3679.71		426.67	825.97	728.89	645.64
3215.33	0.00	450.00	2453.14	3679.71		426.67	825.97	728.89	645.64
4104.89	0.00	450.00	2453.14	3679.71		412.01	834.72	802.97	601.44
4994.45	0.00	450.00	2453.14	3679.71		403.65	839.70	887.39	551.07
5884.01	0.00	450.00	2453.14	3679.71		401.74	840.84	982.29	494.45
6773.57	0.00	450.00	2453.14	3679.71		406.40	838.06	1087.80	431.50

RESUMEN DE TENSIONES

CARACTERISTICAS MECANICAS

A	9.062
I	20.008
ys	1.495
yi	2.505
Ws	13.385
Wi	7.987

PRETENSADO

Nº TENDONES	6	4
Nº CORDONES	25	1
CARGA ROTURA TENDON	28.39	95.00
% TESADO	80%	100%

	1	1	0.6	0.6	0.6
CARGAS PERMANENTES	POSITIVOS ENVOLVENTE SOBRECARGAS	NEGATIVOS ENVOLVENTE SOBRECARGAS	POSITIV ASIENTO 1.25 cm	NEGATIV ASIENTO 1.25 cm	GRADIENTE
-6674.72	-2315.68	-4547.02	1040.13	-645.23	582.32
-5706.44	-1787.78	-3873.99	998.01	-624.74	582.30
-4790.61	-1283.84	-3230.84	955.89	-604.80	582.29
-3926.21	-803.87	-2641.08	913.77	-584.86	582.27
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-3112.19	-290.84	-2082.24	871.65	-564.92	582.26
-2347.68	425.36	-1556.95	829.53	-544.98	582.24
-1632.52	1093.17	-1065.24	787.41	-525.04	582.23
-966.69	1712.60	-658.92	745.29	-505.10	582.22
-350.21	2283.64	-304.03	703.17	-485.16	582.20
-350.21	2283.64	-304.03	703.17	-485.16	582.20
216.93	2806.31	26.89	661.05	-465.22	582.19
734.73	3280.58	333.85	618.93	-445.28	582.17
1203.19	3706.47	616.84	576.81	-425.34	582.16
1622.31	4083.98	875.88	534.69	-405.40	582.14
1622.31	4083.98	875.88	534.69	-405.40	582.14
1992.08	4413.11	1110.96	492.57	-385.46	582.13
2312.51	4693.85	1322.07	450.45	-365.52	582.11
2583.60	4926.21	1509.22	408.33	-345.58	582.10
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2805.35	5110.18	1672.41	366.20	-325.64	582.08
2977.76	5245.77	1811.64	324.08	-305.70	582.07
3100.83	5332.97	1926.91	281.96	-285.76	582.06
3174.55	5371.79	2018.21	239.84	-265.82	582.04
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3198.94	5362.23	2085.56	197.72	-245.88	582.03
3173.98	5304.28	2128.94	239.58	-265.66	582.01
3099.68	5197.95	2148.36	281.72	-285.63	582.00
2976.04	5043.24	2143.82	323.85	-305.61	581.98
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2803.06	4840.14	2043.21	365.99	-325.59	581.97
2580.73	4588.66	1907.69	408.12	-345.57	581.95
2309.06	4296.85	1760.18	450.25	-365.54	581.94
1988.06	3972.79	1600.69	492.39	-385.52	581.93
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1617.71	3616.48	1429.23	534.52	-405.50	581.91
1198.02	3227.93	1245.78	576.66	-425.48	581.90
728.98	2807.13	1050.35	618.79	-445.45	581.88
210.61	2354.08	842.94	660.92	-465.43	581.87
-357.11	1868.76	623.54	703.06	-485.41	581.85
-357.11	1868.76	623.54	703.06	-485.41	581.85
-974.16	1351.20	392.17	745.19	-505.39	581.84
-1640.56	801.37	148.82	787.33	-525.36	581.82
-2356.30	247.51	-106.51	829.46	-545.34	581.81
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3121.39	-275.04	-395.04	871.59	-565.32	581.79
-3935.98	-812.28	-1041.64	913.73	-585.30	581.78
-4800.96	-1292.75	-1720.49	955.86	-605.28	581.77
-5717.36	-1797.17	-2431.59	998.00	-625.25	581.75
-6686.22	-2325.56	-3174.95	1040.13	-645.23	581.74

MULTIPLICADOR							MOMENTOS POSITIVOS		MOMENTOS NEGATIVOS	
3066.43		342.00	MULTIPLICADOR				TENSION	TENSION	TENSION	TENSION
MOMENTO PRETENSADO EXTERIOR	MOMENTO PRETENSADO CENTRADO	MOMENTO PRETENSADO BARRAS	2453.1429 AXIL EXTERIOR	3679.7143 AXIL CENTRADO	AXIL BARRAS		INF	SUP	INF	SUP
6766.69	0.00	450.00	2453.14	3679.71			405.75	838.45	1259.02	329.34
5877.48	0.00	450.00	2453.14	3679.71			401.12	841.21	1162.28	387.06
4988.26	0.00	450.00	2453.14	3679.71			403.06	840.05	1075.92	438.58
4099.05	0.00	450.00	2453.14	3679.71			411.45	835.05	1002.69	482.28
3209.83	0.00	450.00	2453.14	3679.71			426.14	826.28	939.63	519.90
3209.83	0.00	450.00	2453.14	3679.71			426.14	826.28	939.63	519.90
2320.62	0.00	450.00	2453.14	3679.71			393.77	845.60	886.98	551.32
1431.40	0.00	450.00	2453.14	3679.71			337.22	879.34	844.71	576.54
542.19	0.00	450.00	2453.14	3679.71			292.91	905.78	819.31	591.70
-347.03	0.00	450.00	2453.14	3679.71			260.83	924.92	806.52	599.32
-347.03	0.00	450.00	2453.14	3679.71			260.83	924.92	806.52	599.32
-1236.24	0.00	450.00	2453.14	3679.71			240.99	936.75	806.29	599.46
-2125.46	0.00	-290.00	2453.14	3679.71	342.00		363.78	923.74	980.69	555.66
-2125.29	0.00	-290.00	2453.14	3679.71	342.00		257.06	987.42	919.52	592.16
-2125.11	0.00	-290.00	2453.14	3679.71	342.00		162.56	1043.80	864.52	624.98
-2125.11	0.00	-290.00	2453.14	3679.71	342.00		162.56	1043.80	864.52	624.98
-2124.94	0.00	-290.00	2453.14	3679.71	342.00		80.31	1092.88	815.70	654.10
-2124.77	0.00	-290.00	2453.14	3679.71	342.00		10.29	1134.66	773.06	679.54
-2124.60	0.00	-290.00	2453.14	3679.71	342.00		-47.49	1169.14	736.60	701.30
-2124.43	0.00	-290.00	2453.14	3679.71	342.00		-93.04	1196.31	706.32	719.37
-2124.43	0.00	-290.00	2453.14	3679.71	342.00		-93.04	1196.31	706.32	719.37
-2124.25	0.00	-290.00	2453.14	3679.71	342.00		-126.35	1216.19	682.21	733.75
-2124.08	0.00	-290.00	2453.14	3679.71	342.00		-147.42	1228.76	664.28	744.45
-2123.91	0.00	-290.00	2453.14	3679.71	342.00		-156.26	1234.03	652.53	751.46
-2123.74	0.00	-290.00	2453.14	3679.71	342.00		-152.86	1232.01	646.96	754.78
-2123.74	0.00	-290.00	2453.14	3679.71	342.00		-152.86	1232.01	646.96	754.78
-2123.57	0.00	-290.00	2453.14	3679.71	342.00		-147.74	1228.95	652.54	751.45
-2123.39	0.00	-290.00	2453.14	3679.71	342.00		-130.42	1218.62	664.33	744.42
-2123.22	0.00	-290.00	2453.14	3679.71	342.00		-100.86	1200.98	682.29	733.71
-2123.05	0.00	-290.00	2453.14	3679.71	342.00		-59.07	1176.04	706.43	719.30
-2123.05	0.00	-290.00	2453.14	3679.71	342.00		-59.07	1176.04	706.43	719.30
-2122.88	0.00	-290.00	2453.14	3679.71	342.00		-5.04	1143.81	736.74	701.21
-2122.71	0.00	-290.00	2453.14	3679.71	342.00		60.22	1104.87	773.24	679.44
-2122.53	0.00	-290.00	2453.14	3679.71	342.00		135.69	1059.84	815.91	653.98
-2122.36	0.00	-290.00	2453.14	3679.71	342.00		221.38	1008.71	864.76	624.83
-2122.36	0.00	-290.00	2453.14	3679.71	342.00		221.38	1008.71	864.76	624.83
-2122.19	0.00	-290.00	2453.14	3679.71	342.00		317.29	951.49	919.79	592.00
-2122.02	0.00	450.00	2453.14	3679.71			293.01	905.71	850.61	573.02
-1232.46	0.00	450.00	2453.14	3679.71			297.99	902.75	806.63	599.26
-342.90	0.00	450.00	2453.14	3679.71			313.18	893.68	768.83	621.81
-342.90	0.00	450.00	2453.14	3679.71			313.18	893.68	768.83	621.81
546.66	0.00	450.00	2453.14	3679.71			338.59	878.52	737.22	640.68
1436.22	0.00	450.00	2453.14	3679.71			374.22	857.26	711.77	655.86
2325.78	0.00	450.00	2453.14	3679.71			416.53	832.01	705.85	659.39
3215.33	0.00	450.00	2453.14	3679.71			426.67	825.97	728.89	645.64
3215.33	0.00	450.00	2453.14	3679.71			426.67	825.97	728.89	645.64
4104.89	0.00	450.00	2453.14	3679.71			412.01	834.72	802.97	601.44
4994.45	0.00	450.00	2453.14	3679.71			403.65	839.70	887.39	551.07
5884.01	0.00	450.00	2453.14	3679.71			401.74	840.84	982.29	494.45
6773.57	0.00	450.00	2453.14	3679.71			406.40	838.06	1087.80	431.50

RESUMEN DE TENSIONES VANO 39 m JUNTO A ESTRIBO 2

CARACTERISTICAS MECANICAS

A	9.062
I	20.008
ys	1.495
yi	2.505
Ws	13.385
Wi	7.987

PRETENSADO

Nº TENDONES	4	0	2
Nº CORDONES	25	19	6
CARGA ROTURA TENDON	28.39	28.39	28.39
% TESADO	80%	80%	75%
Excentricidad	0	-0.31	-2.105

1	1	1	0.6	0.6	0.6
CARGAS PERMANENTES	POSITIVOS ENVOLVENTE SOBRECARGAS	NEGATIVOS ENVOLVENTE SOBRECARGAS	POSITIV ASIENTO 1.25 cm	NEGATIV ASIENTO 1.25 cm	GRADIENTE
-6615.30	-1711.78	-1902.67	1081.82	0.00	702.99
-5796.08	-1243.13	-1434.27	1054.77	0.00	685.41
-5009.42	-749.51	-987.73	1027.73	0.00	667.84
-4255.34	-277.18	-596.52	1000.68	0.00	650.26
-3533.83	173.85	-255.18	973.64	0.00	632.69
-3533.83	173.85	-255.18	973.64	0.00	632.69
-2844.90	603.59	70.94	946.59	0.00	615.11
-2188.54	1012.03	381.85	919.55	0.00	597.54
-1564.75	1399.18	677.56	892.50	0.00	579.96
-973.54	1765.04	958.05	865.45	0.00	562.39
-973.54	1765.04	958.05	865.45	0.00	562.39
-414.90	2109.60	1223.33	838.41	0.00	544.81
108.32	2429.72	1473.41	811.36	0.00	527.24
583.29	2718.18	1708.27	784.32	0.00	509.67
1025.69	2974.70	1927.92	757.27	0.00	492.09
1025.69	2974.70	1927.92	757.27	0.00	492.09
1435.51	3199.28	2132.37	730.23	0.00	474.52
1812.76	3391.91	2321.60	703.18	0.00	456.94
2157.44	3552.61	2495.62	676.14	0.00	439.37
2469.55	3681.36	2654.44	649.09	0.00	421.79
2469.55	3681.36	2654.44	649.09	0.00	421.79
2749.08	3794.15	2798.64	622.05	0.00	404.22
2996.04	3906.93	2916.43	595.00	0.00	386.64
3210.42	4019.72	3007.97	567.95	0.00	369.07
3392.23	4132.50	3059.51	540.91	0.00	351.49
3392.23	4132.50	3059.51	540.91	0.00	351.49
3541.47	4229.32	3093.55	513.86	0.00	333.92
3658.14	4294.19	3087.58	486.82	0.00	316.34
3742.23	4327.12	3055.37	459.77	0.00	298.77
3793.75	4328.11	2996.74	432.73	0.00	281.19
3793.75	4328.11	2996.74	432.73	0.00	281.19
3812.69	4297.16	2923.52	405.68	0.00	263.62
3799.07	4234.27	2835.09	378.64	0.00	246.05
3752.86	4139.44	2731.45	351.59	0.00	228.47
3674.09	4012.67	2606.85	324.55	0.00	210.90
3674.09	4012.67	2606.85	324.55	0.00	210.90
3562.74	3853.96	2456.24	297.50	0.00	193.32
3415.97	3663.30	2298.02	270.45	0.00	175.75
3220.96	3440.70	2132.21	243.41	0.00	158.17
2993.37	3186.17	1958.78	216.36	0.00	140.60
2993.37	3186.17	1958.78	216.36	0.00	140.60
2733.20	2899.69	1777.75	189.32	0.00	123.02
2440.46	2581.27	1580.08	162.27	0.00	105.45
2115.15	2230.91	1354.76	135.23	0.00	87.87
1757.27	1848.61	1114.23	108.18	0.00	70.30
1757.27	1848.61	1114.23	108.18	0.00	70.30
1366.81	1434.37	858.48	81.14	0.00	52.72
943.78	988.19	587.53	54.09	0.00	35.15
488.18	510.06	301.37	27.05	0.00	17.57
0.00	0.00	0.00	0.00	0.00	0.00

1746.024429	0	
MULTIPLICADOR		
1746.02		255.51
MOMENTO PRETENSADO EXTERIOR	MOMENTO PRETENSADO CENTRADO	MOMENTO PRETENSADO BARRAS
4486.41	80.69	0.00
3920.10	70.01	9.33
3353.78	59.32	18.66
2787.47	48.64	27.98
2221.15	37.96	37.31
2221.15	37.96	37.31
1654.84	27.28	46.64
1088.53	16.60	55.97
522.21	5.92	65.29
-44.10	-4.76	74.62
-44.10	-4.76	74.62
-610.42	-15.45	83.95
-1107.06	-26.13	-514.84
-1220.55	-36.81	-505.51
-1334.03	-47.49	-496.18
-1334.03	-47.49	-496.18
-1447.51	-58.17	-486.85
-1561.00	-68.85	-477.53
-1674.48	-79.53	-468.20
-1787.96	-90.22	-458.87
-1787.96	-90.22	-458.87
-1901.45	-100.90	-449.54
-2014.93	-111.58	-440.21
-2128.41	-122.26	-430.89
-2241.89	-132.94	-421.56
-2241.89	-132.94	-421.56
-2355.38	-143.62	-412.23
-2468.86	-154.30	-402.90
-2582.34	-164.99	-393.58
-2695.83	-175.67	-384.25
-2695.83	-175.67	-384.25
-2809.31	-186.35	-374.92
-2922.79	-197.03	-365.59
-3036.27	-207.71	-356.26
-3149.76	-218.39	-346.94
-3149.76	-218.39	-346.94
-3263.24	-229.07	-337.61
-3308.37	-239.76	279.83
-2977.53	-250.44	289.16
-2646.69	-261.12	298.49
-2646.69	-261.12	298.49
-2315.86	-271.80	307.82
-1985.02	-282.48	317.14
-1654.18	-293.16	326.47
-1323.35	-303.84	335.80
-1323.35	-303.84	335.80
-992.51	-314.53	345.13
-661.67	-325.21	354.45
-330.84	-335.89	363.78
0.00	0.00	373.11

MULTIPLICADOR		
1746.02	3923.5567	
AXIL EXTERIOR	AXIL CENTRADO	AXIL BARRAS
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	
1746.02	3923.56	255.51
1746.02	3923.56	255.51
1746.02	3923.56	255.51

RESUMEN DE TENSIONES VANO 39 m JUNTO A ESTRIBO 1

CARACTERISTICAS MECANICAS

A	9.062
I	20.008
ys	1.495
yi	2.505
Ws	13.385
Wi	7.987

PRETENSADO

Nº TENDONES	4	0	0
Nº CORDONES	25	19	6
CARGA ROTURA TENDON	28.39	28.39	28.39
% TESADO	80%	80%	75%
Excentricidad	0	-0.31	-2.105

	1	1	1	0.6	0.6	0.6
CARGAS PERMANENTES	POSITIVOS ENVOLVENTE SOBRECARGAS	NEGATIVOS ENVOLVENTE SOBRECARGAS	POSITIV ASIENTO 1.25 cm	NEGATIV ASIENTO 1.25 cm	GRADIENTE
-6615.30	-1711.78	-1902.67	1081.82	0.00	702.99
-5796.08	-1243.13	-1434.27	1054.77	0.00	685.41
-5009.42	-749.51	-987.73	1027.73	0.00	667.84
-4255.34	-277.18	-596.52	1000.68	0.00	650.26
-3533.83	173.85	-255.18	973.64	0.00	632.69
-3533.83	173.85	-255.18	973.64	0.00	632.69
-2844.90	603.59	70.94	946.59	0.00	615.11
-2188.54	1012.03	381.85	919.55	0.00	597.54
-1564.75	1399.18	677.56	892.50	0.00	579.96
-973.54	1765.04	958.05	865.45	0.00	562.39
-973.54	1765.04	958.05	865.45	0.00	562.39
-414.90	2109.60	1223.33	838.41	0.00	544.81
108.32	2429.72	1473.41	811.36	0.00	527.24
583.29	2718.18	1708.27	784.32	0.00	509.67
1025.69	2974.70	1927.92	757.27	0.00	492.09
1025.69	2974.70	1927.92	757.27	0.00	492.09
1435.51	3199.28	2132.37	730.23	0.00	474.52
1812.76	3391.91	2321.60	703.18	0.00	456.94
2157.44	3552.61	2495.62	676.14	0.00	439.37
2469.55	3681.36	2654.44	649.09	0.00	421.79
2469.55	3681.36	2654.44	649.09	0.00	421.79
2749.08	3794.15	2798.64	622.05	0.00	404.22
2996.04	3906.93	2916.43	595.00	0.00	386.64
3210.42	4019.72	3007.97	567.95	0.00	369.07
3392.23	4132.50	3059.51	540.91	0.00	351.49
3392.23	4132.50	3059.51	540.91	0.00	351.49
3541.47	4229.32	3093.55	513.86	0.00	333.92
3658.14	4294.19	3087.58	486.82	0.00	316.34
3742.23	4327.12	3055.37	459.77	0.00	298.77
3793.75	4328.11	2996.74	432.73	0.00	281.19
3793.75	4328.11	2996.74	432.73	0.00	281.19
3812.69	4297.16	2923.52	405.68	0.00	263.62
3799.07	4234.27	2835.09	378.64	0.00	246.05
3752.86	4139.44	2731.45	351.59	0.00	228.47
3674.09	4012.67	2606.85	324.55	0.00	210.90
3674.09	4012.67	2606.85	324.55	0.00	210.90
3562.74	3853.96	2456.24	297.50	0.00	193.32
3415.97	3663.30	2298.02	270.45	0.00	175.75
3220.96	3440.70	2132.21	243.41	0.00	158.17
2993.37	3186.17	1958.78	216.36	0.00	140.60
2993.37	3186.17	1958.78	216.36	0.00	140.60
2733.20	2899.69	1777.75	189.32	0.00	123.02
2440.46	2581.27	1580.08	162.27	0.00	105.45
2115.15	2230.91	1354.76	135.23	0.00	87.87
1757.27	1848.61	1114.23	108.18	0.00	70.30
1757.27	1848.61	1114.23	108.18	0.00	70.30
1366.81	1434.37	858.48	81.14	0.00	52.72
943.78	988.19	587.53	54.09	0.00	35.15
488.18	510.06	301.37	27.05	0.00	17.57
0.00	0.00	0.00	0.00	0.00	0.00

1746.024429 0

MULTIPLICADOR 1746.02 0.00

MOMENTO PRETENSADO EXTERIOR	MOMENTO PRETENSADO CENTRADO	MOMENTO PRETENSADO BARRAS
4486.41	80.69	0.00
3920.10	70.01	0.00
3353.78	59.32	0.00
2787.47	48.64	0.00
2221.15	37.96	0.00
2221.15	37.96	0.00
1654.84	27.28	0.00
1088.53	16.60	0.00
522.21	5.92	0.00
-44.10	-4.76	0.00
-44.10	-4.76	0.00
-610.42	-15.45	0.00
-1107.06	-26.13	0.00
-1220.55	-36.81	0.00
-1334.03	-47.49	0.00
-1334.03	-47.49	0.00
-1447.51	-58.17	0.00
-1561.00	-68.85	0.00
-1674.48	-79.53	0.00
-1787.96	-90.22	0.00
-1787.96	-90.22	0.00
-1901.45	-100.90	0.00
-2014.93	-111.58	0.00
-2128.41	-122.26	0.00
-2241.89	-132.94	0.00
-2241.89	-132.94	0.00
-2355.38	-143.62	0.00
-2468.86	-154.30	0.00
-2582.34	-164.99	0.00
-2695.83	-175.67	0.00
-2695.83	-175.67	0.00
-2809.31	-186.35	0.00
-2922.79	-197.03	0.00
-3036.27	-207.71	0.00
-3149.76	-218.39	0.00
-3149.76	-218.39	0.00
-3263.24	-229.07	0.00
-3308.37	-239.76	0.00
-2977.53	-250.44	0.00
-2646.69	-261.12	0.00
-2646.69	-261.12	0.00
-2315.86	-271.80	0.00
-1985.02	-282.48	0.00
-1654.18	-293.16	0.00
-1323.35	-303.84	0.00
-1323.35	-303.84	0.00
-992.51	-314.53	0.00
-661.67	-325.21	0.00
-330.84	-335.89	0.00
0.00	0.00	0.00

MULTIPLICADOR 1746.02 4904.4459

AXIL EXTERIOR	AXIL CENTRADO	AXIL BARRAS
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	
1746.02	4904.45	0.00
1746.02	4904.45	0.00
1746.02	4904.45	0.00

COMPROBACION DE TENSIONES DURANTE LANZAMIENTO

ENVOLVENTE DE MOMENTOS

NUDOS	X	FASE1	FASE2	FASE3	FASE4	FASE5	FASE6	FASE7	FASE8	FASE9	FASE10	FASE11	FASE12	FASE13	FASE14
1	0	-1060.98	-367.92	324.25	-1060.98	153.02	555.90	-1060.98	144.09	532.91	-1060.98	76.77	530.78	-1060.98	76.25
2	3	-1613.64	-855.20	1156.83	-1613.64	-285.12	1620.12	-1613.64	-294.88	1574.14	-1613.64	-368.55	1569.88	-1613.64	-369.12
3	6	-2370.20	-1546.37	1785.52	-2370.20	-927.14	2480.45	-2370.20	-937.75	2411.48	-2370.20	-1017.77	2405.09	-2370.20	-1018.39
4	9	-3330.65	-2441.44	2210.30	-3330.65	-1773.07	3136.88	-3330.65	-1784.51	3044.92	-3330.65	-1870.88	3036.41	-3330.65	-1871.56
5	12	-2200.69	-1422.63	2431.20	-4494.99	-2822.88	3589.42	-4494.99	-2835.17	3474.46	-4494.99	-2927.89	3463.83	-4494.99	-2928.61
6	15	-1274.62	-607.71	2448.19	-5863.23	-4076.59	3838.06	-5863.23	-4089.73	3700.12	-5863.23	-4188.80	3687.35	-5863.23	-4189.57
7	18	-552.44	3.31	2261.30	-7435.37	-5534.20	3882.81	-7435.37	-5548.17	3721.87	-7435.37	-5653.60	3706.98	-7435.37	-5654.42
8	21	-34.16	410.44	1870.51	-5704.96	-3994.53	3723.66	-5717.04	-3988.24	3539.73	-5648.46	-4007.62	3522.71	-5647.92	-4007.84
9	24	280.22	613.67	1275.82	-4178.44	-2658.76	3360.61	-4202.62	-2632.19	3153.70	-4065.44	-2565.55	3134.55	-4064.38	-2565.17
10	27	390.71	613.01	477.24	-2855.82	-1526.89	2793.68	-2892.08	-1480.04	2563.77	-2686.32	-1327.36	2542.50	-2684.72	-1326.39
11	30	297.30	408.45	-525.24	-1737.10	-598.91	2022.84	-1785.44	-531.79	1769.95	-1511.10	-293.08	1746.54	-1508.96	-291.50
12	33	0.00	0.00	-1731.61	-822.27	125.18	1048.12	-882.70	212.57	772.23	-539.77	537.32	746.70	-537.10	539.49
13	36			-3146.21	-115.66	641.04	-134.84	-188.18	748.70	-433.72	223.34	1159.48	-461.38	226.54	1162.26
14	39			-2035.51	369.72	935.67	-1539.02	285.11	1063.61	-1860.88	765.22	1560.42	-1890.67	768.95	1563.80
15	42			-1133.04	646.87	1022.08	-3151.42	550.18	1170.30	-3496.28	1098.87	1753.14	-3528.19	1103.14	1757.12
16	45			-434.46	720.13	904.60	-4967.72	611.35	1073.08	-5335.57	1228.63	1741.96	-5369.61	1233.43	1746.54
17	48			60.22	589.49	583.21	-3499.92	468.63	771.97	-3734.75	1154.49	1526.89	-3758.17	1159.83	1532.06
18	51			351.01	254.96	57.94	-2236.00	122.01	266.97	-2337.82	876.46	1107.92	-2350.62	882.33	1113.69
19	54			437.90	-283.47	-671.23	-1175.98	-428.51	-441.93	-1144.79	394.53	485.05	-1146.96	400.94	491.43
20	57			320.90	-1025.79	-1604.30	-319.86	-1182.91	-1354.72	-155.65	-291.29	-341.71	-147.20	-284.35	-334.74
21	60			0.00	-183.94	-690.13	332.37	-2141.22	-2471.41	629.59	-1181.01	-1372.36	648.66	-1173.54	-1364.79
22	63				454.03	20.15	780.70	-3303.42	-3791.99	1210.94	-2274.62	-2606.91	1240.63	-2266.62	-2598.74
23	66				888.09	526.53	1025.14	-1815.56	-2264.66	1588.39	-3572.12	-4045.36	1628.71	-3563.59	-4036.59
24	69				1118.26	829.01	1065.68	-531.61	-941.23	1761.94	-2088.06	-2523.85	1812.89	-2082.21	-2517.79
25	72				1144.54	927.60	902.33	548.46	178.31	1731.60	-807.89	-1206.25	1793.17	-804.72	-1202.89
26	75				966.92	822.30	535.08	1424.62	1093.96	1497.37	268.39	-92.53	1569.56	268.88	-91.88
27	78				585.41	513.10	-36.06	2096.90	1805.70	1059.24	1140.77	817.29	1142.06	1138.57	815.23
28	81				0.00	0.00	-811.10	2565.27	2313.56	417.22	1809.26	1523.21	510.66	1804.38	1518.45
29	84						-1794.36	2825.42	2613.19	-433.03	2269.52	2020.90	-328.97	2261.95	2013.44
30	87						-852.65	2864.35	2691.59	-1504.51	2508.56	2297.38	-1389.82	2498.30	2287.20
31	90						-119.15	2695.05	2561.77	-2784.21	2539.36	2365.62	-2658.90	2526.43	2352.74
32	93						410.44	2321.86	2228.05	-4267.80	2366.28	2229.97	-4131.87	2350.66	2214.39
33	96						736.14	1744.77	1690.43	-2711.24	1989.30	1890.43	-2615.60	1971.00	1872.14
34	99						857.95	963.78	948.93	-1358.57	1408.42	1346.99	-1303.22	1387.44	1325.99
35	102						775.86	-21.10	3.52	-209.80	623.65	599.66	-194.74	599.98	575.95
36	105						489.88	-1209.87	-1145.78	735.08	-365.01	-351.57	709.84	-391.37	-377.99
37	108						0.00	-2602.54	-2498.97	1476.07	-1557.57	-1506.70	1410.54	-1586.61	-1535.82
38	111							-4199.11	-4056.06	2013.16	-2954.03	-2865.72	1907.33	-2985.75	-2897.54
39	114							-2795.15	-2666.46	2346.35	-4554.38	-4428.63	2200.23	-4588.79	-4463.16
40	117							-1595.09	-1480.76	2475.65	-3002.92	-2887.13	2289.24	-3027.04	-2911.35
41	120							-598.92	-498.95	2401.05	-1655.35	-1549.53	2174.35	-1669.19	-1563.44
42	123							193.35	278.96	2122.56	-511.68	-415.82	1855.56	-515.23	-419.42
43	126							781.72	852.97	1640.18	428.10	514.00	1332.88	434.83	520.71
44	129							1166.20	1223.10	953.90	1163.98	1239.92	606.31	1181.00	1256.93
45	132							1342.46	1384.99	59.39	1691.63	1757.61	-328.50	1718.94	1784.94
46	135							1297.49	1325.66	-1056.35	1998.07	2054.08	-1484.52	2035.65	2091.72
47	138							1044.29	1058.11	-2380.30	2096.27	2142.32	-2848.77	2144.14	2190.27
48	141							587.20	586.66	-3908.16	1990.58	2026.67	-4416.92	2048.73	2084.93
49	144							-73.79	-88.69	-2547.74	1680.99	1707.12	-2889.05	1749.43	1775.69
50	147							-938.67	-967.93	-1391.23	1167.51	1183.68	-1565.08	1246.24	1262.56
51	150							-2007.44	-2051.07	-438.61	450.14	456.34	-445.00	539.15	545.53
52	153							-1042.88	-1081.05	310.12	-471.13	-474.89	471.18	-371.84	-375.39
53	156							-282.21	-314.93	854.95	-1596.30	-1610.02	1183.47	-1486.72	-1500.21

ENVOLVENTE DE MOMENTOS

NUDOS	X	FASE1	FASE2	FASE3	FASE4	FASE5	FASE6	FASE7	FASE8	FASE9	FASE10	FASE11	FASE12	FASE13	FASE14
54	159							274.56	247.30	1195.89	-2925.36	-2949.04	1691.86	-2805.50	-2828.92
55	162							627.44	605.63	1332.93	-4458.31	-4491.96	1996.36	-4328.17	-4361.53
56	165							776.42	760.06	1266.08	-2875.67	-2906.59	2096.96	-2784.29	-2815.02
57	168							721.51	710.60	995.33	-1496.92	-1525.12	1993.67	-1444.31	-1472.40
58	171							462.70	457.25	520.69	-322.06	-347.54	1686.48	-308.23	-333.67
59	174							0.00	0.00	-157.85	648.90	626.14	1175.40	623.97	601.16
60	177									-1040.28	1415.97	1395.92	460.42	1352.26	1332.09
61	180									-2130.94	1974.81	1957.48	-462.78	1872.33	1854.80
62	183									-1147.15	2312.43	2297.82	-1607.21	2171.17	2156.29
63	186									-371.59	2441.82	2429.93	-2959.86	2261.79	2249.54
64	189									200.08	2367.31	2358.14	-4516.41	2148.52	2138.91
65	192									567.86	2088.91	2082.46	-2939.68	1831.34	1824.37
66	195									731.73	1606.62	1602.88	-1566.84	1310.28	1305.95
67	198									691.72	920.42	919.41	-397.90	585.32	583.62
68	201									447.81	30.34	32.05	567.15	-343.54	-342.59
69	204									0.00	-1063.64	-1059.22	1328.30	-1476.29	-1472.71
70	207										-2361.52	-2354.37	1885.56	-2812.94	-2806.71
71	210										-3863.29	-3853.42	2238.92	-4353.48	-4344.62
72	213										-2491.26	-2482.39	2388.39	-2817.93	-2809.77
73	216										-1323.14	-1315.25	2333.96	-1486.28	-1478.82
74	219										-358.90	-352.01	2075.64	-358.53	-351.77
75	222										401.43	407.34	1613.42	565.33	571.39
76	225										957.88	962.79	947.31	1285.30	1290.65
77	228										1306.09	1310.02	72.97	1797.04	1801.69
78	231										1433.09	1436.02	-1022.60	2087.56	2091.50
79	234										1351.85	1353.80	-2326.39	2169.84	2173.09
80	237										1066.72	1067.68	-3834.07	2048.24	2050.78
81	240										577.70	577.67	-2481.17	1722.74	1724.58
82	243										-115.22	-116.24	-1332.16	1193.34	1194.48
83	246										-1012.04	-1014.05	-387.05	460.05	460.49
84	249										-2112.75	-2115.75	354.17	-477.14	-477.40
85	252										-1135.02	-1137.65	891.49	-1618.22	-1619.18
86	255										-361.19	-363.44	1224.92	-2963.19	-2964.86
87	258										208.75	206.87	1354.45	-4512.06	-4514.44
88	261										574.79	573.29	1280.09	-2925.07	-2927.25
89	264										736.93	735.81	1001.84	-1541.98	-1543.97
90	267										695.18	694.43	519.68	-362.78	-364.57
91	270										449.54	449.16	-166.36	612.53	610.93
92	273										0.00	0.00	-1056.31	1383.94	1382.53
93	276												-2154.48	1947.13	1945.90
94	279												-1167.74	2289.09	2288.06
95	282												-389.24	2422.82	2421.98
96	285												185.37	2352.66	2352.01
97	288												556.09	2078.60	2078.15
98	291												722.91	1600.65	1600.39
99	294												685.83	918.81	918.73
100	297												444.87	33.06	33.19
101	300												0.00	-1056.57	-1056.26
102	303													-2350.10	-2349.60
103	306													-3847.53	-3846.83
104	309													-2477.09	-2476.46
105	312													-1310.54	-1309.99
106	315													-347.89	-347.40

ENVOLVENTE DE MOMENTOS

NUDOS	X	FASE1	FASE2	FASE3	FASE4	FASE5	FASE6	FASE7	FASE8	FASE9	FASE10	FASE11	FASE12	FASE13	FASE14
107	318													410.87	411.28
108	321													965.73	966.08
109	324													1312.37	1312.64
110	327													1437.78	1437.98
111	330													1354.96	1355.10
112	333													1068.25	1068.32
113	336													577.65	577.64
114	339													-116.85	-116.93
115	342													-1015.25	-1015.39
116	345													-2117.54	-2117.75
117	348													-1139.22	-1139.40
118	351													-364.79	-364.94
119	354													205.75	205.62
120	357													572.39	572.28
121	360													735.14	735.06
122	363													693.99	693.93
123	366													448.94	448.91
124	369													0.00	0.00
125	372														
126	375														
127	378														
128	381														
129	384														
130	387														
131	390														
132	393														
133	396														

ENVOLVENTE D

NUDOS	X	FASE15	FASE41	FASE42	FASE43	FASE44	FASE45	FASE46	MAX	MIN
1	0	530.62	642.64	1230.43	1844.88	2380.24	2713.06	2742.36	2742.36	-1060.98
2	3	1569.57	279.27	964.20	1707.35	2401.12	2915.20	3140.53	3140.53	-1613.64
3	6	2404.63	-288.00	494.07	1365.92	2218.11	2913.46	3334.81	3334.81	-2370.20
4	9	3035.78	-1059.15	-179.95	820.59	1831.19	2707.82	3325.20	3325.20	-3330.65
5	12	3463.05	-2034.21	-1057.87	71.37	1240.39	2298.28	3111.69	3589.42	-4494.99
6	15	3686.42	-3213.16	-2139.68	-881.75	445.69	1684.85	2694.29	3838.06	-5863.23
7	18	3705.89	-4596.00	-3425.39	-2038.76	-552.91	867.52	2072.99	3882.81	-7435.37
8	21	3521.47	-6182.74	-4914.99	-3399.67	-1755.40	-153.70	1247.79	3723.66	-6182.74
9	24	3133.15	-4493.41	-6608.49	-4964.47	-3161.79	-1378.82	218.70	3360.61	-6608.49
10	27	2540.94	-3007.97	-4883.98	-6733.16	-4772.07	-2807.83	-1014.28	2793.68	-6733.16
11	30	1744.83	-1726.43	-3363.38	-4997.34	-6586.25	-4440.74	-2451.16	2022.84	-6586.25
12	33	744.83	-648.79	-2046.66	-3465.41	-4860.67	-6277.54	-4091.93	1048.12	-6277.54
13	36	-463.40	220.63	-938.18	-2141.70	-3343.33	-4579.48	-5940.94	2864.35	-5940.94
14	39	-1892.85	868.82	-50.91	-1039.22	-2047.20	-3102.64	-4285.58	2864.35	-5372.10
15	42	-3530.53	1308.79	628.12	-144.97	-959.30	-1834.03	-2838.44	2864.35	-5372.10
16	45	-5372.10	1544.86	1103.27	545.39	-75.30	-769.32	-1595.21	2864.35	-5372.10
17	48	-3759.88	1577.04	1374.51	1031.86	604.81	91.50	-555.86	2864.35	-4588.79
18	51	-2351.55	1405.32	1441.86	1314.43	1081.02	748.42	279.59	2864.35	-4588.79
19	54	-1147.12	1029.71	1305.32	1393.10	1353.34	1201.45	911.14	2864.35	-4588.79
20	57	-146.58	450.20	964.88	1267.88	1421.76	1450.59	1338.80	2864.35	-4588.79
21	60	650.06	-333.20	420.55	938.76	1286.29	1495.83	1562.56	2864.35	-4588.79
22	63	1242.81	-1320.50	-327.68	405.75	946.92	1337.17	1582.43	1816.62	-4045.36
23	66	1631.66	-2511.69	-1279.81	-331.15	403.66	974.62	1398.40	1631.66	-4045.36
24	69	1816.62	-3906.78	-2435.82	-1271.96	-343.50	408.18	1010.48	1816.62	-3906.78
25	72	1797.68	-2394.82	-3795.74	-2416.65	-1294.55	-362.16	418.66	1797.68	-3795.74
26	75	1574.85	-1086.75	-2291.24	-3765.24	-2449.50	-1336.40	-377.05	1574.85	-3765.24
27	78	1148.12	17.42	-990.63	-2261.92	-3808.34	-2514.53	-1376.66	2096.90	-3808.34
28	81	517.50	917.69	106.08	-962.49	-2300.45	-3896.56	-2580.16	2565.27	-3896.56
29	84	-321.35	1609.74	994.56	128.71	-1000.78	-2384.92	-3991.89	2825.42	-3991.89
30	87	-1381.42	2080.56	1661.83	998.69	77.66	-1094.51	-2488.76	2864.35	-2488.76
31	90	-2649.72	2343.16	2120.86	1660.45	947.88	-12.33	-1193.86	2695.05	-2784.21
32	93	-4121.92	2401.86	2376.00	2118.30	1614.20	865.96	-102.85	2401.86	-4267.80
33	96	-2608.60	2256.67	2427.24	2372.27	2076.62	1540.35	784.26	2427.24	-2711.24
34	99	-1299.17	1907.58	2274.59	2422.33	2335.15	2010.85	1467.48	2422.33	-1358.57
35	102	-193.64	1354.60	1918.05	2268.51	2389.79	2277.45	1946.80	2389.79	-209.80
36	105	708.00	597.72	1357.61	1910.78	2240.53	2340.16	2222.23	2340.16	-1209.87
37	108	1405.74	-363.05	593.27	1349.17	1887.38	2198.97	2293.76	2293.76	-2602.54
38	111	1899.58	-1527.72	-374.96	583.65	1330.33	1853.89	2161.40	2161.40	-4199.11
39	114	2189.54	-2896.28	-1547.09	-385.76	569.38	1304.91	1825.14	2346.35	-4588.79
40	117	2275.59	-4468.74	-2923.11	-1559.06	-395.46	552.04	1284.99	2475.65	-4468.74
41	120	2157.75	-2922.65	-4503.02	-2936.26	-1564.19	-404.73	540.94	2401.05	-4503.02
42	123	1836.02	-1580.45	-2952.89	-4517.35	-2936.82	-1565.39	-407.01	2122.56	-4517.35
43	126	1310.39	-442.15	-1606.64	-2964.81	-4513.35	-2929.95	-1558.84	1640.18	-4513.35
44	129	580.86	492.26	-464.29	-1616.16	-2959.92	-4498.40	-2914.58	1256.93	-4498.40
45	132	-356.89	1218.44	469.83	-475.75	-1614.73	-2949.36	-4478.54	1784.94	-4478.54
46	135	-1515.86	1723.39	1182.73	443.45	-490.75	-1621.54	-2947.15	2091.72	-2947.15
47	138	-2883.06	2020.12	1687.40	1154.42	424.99	-501.95	-1624.00	2190.27	-2883.06
48	141	-4454.16	2112.96	1988.18	1661.49	1136.85	413.75	-504.74	2112.96	-4454.16
49	144	-2915.29	2001.90	2085.06	1964.67	1644.80	1125.55	410.63	2085.06	-2915.29
50	147	-1580.32	1686.94	1978.05	2063.95	1948.86	1633.45	1122.10	2063.95	-1580.32
51	150	-449.24	1168.09	1667.14	1959.34	2049.03	1937.46	1629.68	2049.03	-2051.07
52	153	477.94	445.35	1152.34	1650.83	1945.30	2037.58	1933.36	2037.58	-1081.05
53	156	1201.23	-481.29	433.64	1138.43	1637.68	1933.80	2033.14	2033.14	-1610.02

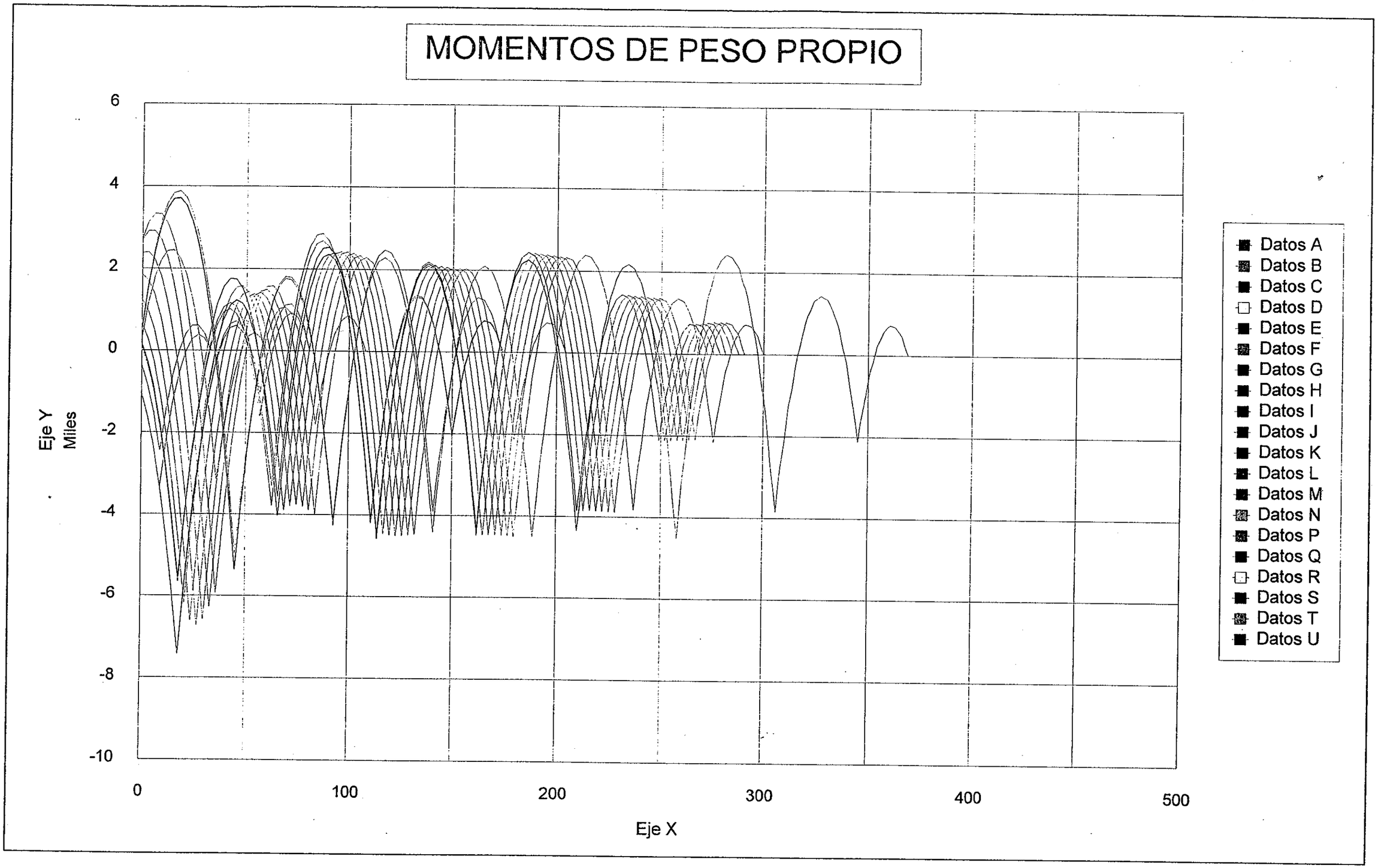
ENVOLVENTE D

NUDOS	X	FASE15	FASE41	FASE42	FASE43	FASE44	FASE45	FASE46	MAX	MIN
54	159	1720.62	-1611.83	-488.95	422.13	1126.16	1626.12	1929.03	1929.03	-2949.04
55	162	2036.12	-2946.26	-1615.44	-498.06	410.75	1114.56	1621.03	2036.12	-4491.96
56	165	2147.72	-4484.58	-2945.82	-1622.15	-508.56	399.09	1109.13	2147.72	-4484.58
57	168	2055.43	-2898.40	-4480.10	-2950.13	-1631.77	-520.27	393.33	2055.43	-4480.10
58	171	1759.24	-1516.10	-2892.93	-4482.01	-2958.87	-1643.52	-526.36	1759.24	-4482.01
59	174	1259.16	-337.71	-1509.66	-2893.49	-4489.86	-2970.67	-1649.94	1259.16	-4489.86
60	177	555.18	636.80	-330.28	-1508.87	-2899.67	-4501.72	-2977.42	1415.97	-4501.72
61	180	-357.03	1403.07	640.87	-332.47	-1517.72	-2914.03	-4513.13	1974.81	-4513.13
62	183	-1490.45	1948.12	1390.80	622.70	-356.98	-1547.58	-2940.66	2312.43	-2940.66
63	186	-2832.11	2284.95	1932.50	1369.65	595.53	-389.34	-1576.42	2441.82	-2959.86
64	189	-4377.66	2417.88	2270.30	1912.70	1344.14	564.99	-416.08	2417.88	-4516.41
65	192	-2841.90	2346.91	2404.21	2251.85	1888.86	1315.44	540.37	2404.21	-2939.68
66	195	-1510.04	2072.05	2334.22	2387.11	2229.69	1861.98	1292.92	2387.11	-1566.84
67	198	-382.07	1593.30	2060.34	2318.48	2366.61	2204.64	1841.58	2366.61	-397.90
68	201	542.01	910.65	1582.57	2045.95	2299.65	2343.39	2186.34	2343.39	-343.54
69	204	1262.19	24.10	900.90	1569.52	2028.79	2278.26	2327.21	2327.21	-1476.29
70	207	1778.47	-1066.34	15.33	889.20	1554.03	2009.22	2264.18	2264.18	-2812.94
71	210	2090.86	-2360.67	-1074.13	4.98	875.38	1536.29	1997.26	2238.92	-4353.48
72	213	2199.35	-3858.90	-2367.48	-1083.13	-7.17	859.47	1526.44	2388.39	-3858.90
73	216	2103.95	-2485.59	-3864.73	-2375.13	-1093.61	-21.25	851.73	2333.96	-3864.73
74	219	1804.66	-1316.18	-2489.15	-3871.03	-2383.95	-1105.86	-26.88	2075.64	-3871.03
75	222	1301.47	-350.65	-1317.47	-2492.86	-3878.18	-2394.37	-1109.39	1613.42	-3878.18
76	225	594.38	410.97	-349.68	-1318.59	-2497.04	-3886.77	-2395.78	1290.65	-3886.77
77	228	-320.93	964.37	409.89	-352.54	-1324.13	-2506.60	-3890.41	1801.69	-3890.41
78	231	-1457.47	1296.55	948.23	392.28	-372.44	-1347.66	-2525.08	2091.50	-2525.08
79	234	-2802.23	1420.49	1278.34	928.88	371.03	-396.94	-1367.99	2173.09	-2802.23
80	237	-4350.89	1340.55	1404.56	1261.58	910.59	349.89	-414.79	2050.78	-4350.89
81	240	-2828.27	1056.71	1326.88	1390.39	1246.27	892.82	334.52	1724.58	-2828.27
82	243	-1509.54	568.97	1045.31	1315.30	1378.04	1231.85	879.93	1378.04	-1509.54
83	246	-394.70	-122.66	559.84	1036.31	1305.92	1366.99	1221.45	1366.99	-1014.05
84	249	516.24	-1018.19	-129.52	553.44	1029.91	1298.24	1359.07	1359.07	-2115.75
85	252	1223.28	-2117.61	-1022.78	-133.34	550.00	1025.58	1292.79	1292.79	-2117.61
86	255	1726.43	-1138.73	-2119.93	-1024.01	-133.80	549.04	1022.62	1726.43	-2964.86
87	258	2025.68	-363.75	-1138.06	-2118.57	-1021.50	-131.40	548.56	2025.68	-4514.44
88	261	2121.04	207.33	-360.08	-1133.62	-2113.09	-1015.74	-129.40	2121.04	-2927.25
89	264	2012.51	574.52	214.01	-352.56	-1125.58	-2103.97	-1011.26	2012.51	-2103.97
90	267	1700.08	737.82	584.19	224.60	-341.95	-1114.35	-2097.00	1700.08	-2097.00
91	270	1183.75	697.22	750.49	597.87	237.77	-328.62	-1105.00	1183.75	-1105.00
92	273	463.53	452.72	712.88	767.24	613.60	253.22	-316.89	1383.94	-1056.31
93	276	-464.92	0.00	467.05	728.38	781.21	626.83	262.99	1947.13	-2154.48
94	279	-1614.59		0.00	468.31	727.59	779.21	621.65	2289.09	-1614.59
95	282	-2972.49			0.00	465.74	723.37	772.08	2422.82	-2972.49
96	285	-4534.28				0.00	463.63	718.61	2352.66	-4534.28
97	288	-2956.10					0.00	461.25	2078.60	-2956.10
98	291	-1581.81						0.00	1600.65	-7435.37
99	294	-411.42							918.81	-411.42
100	297	555.08							555.08	33.06
101	300	1317.68							1317.68	-1056.57
102	303	1876.39							1876.39	-2350.10
103	306	2231.20							2231.20	-3847.53
104	309	2382.12							2382.12	-2477.09
105	312	2329.14							2329.14	-1310.54
106	315	2072.26							2072.26	-347.89

ENVOLVENTE D

NUDOS	X	FASE15	FASE41	FASE42	FASE43	FASE44	FASE45	FASE46	MAX	MIN
107	318	1611.50							1611.50	410.87
108	321	946.83							966.08	946.83
109	324	73.94							1312.64	73.94
110	327	-1020.17							1437.98	-1020.17
111	330	-2322.51							1355.10	-2322.51
112	333	-3828.75							1068.32	-3828.75
113	336	-2476.38							577.65	-2476.38
114	339	-1327.91							-116.85	-1327.91
115	342	-383.34							-383.34	-1015.39
116	345	357.34							357.34	-2117.75
117	348	894.12							894.12	-1139.40
118	351	1227.01							1227.01	-364.94
119	354	1356.00							1356.00	205.62
120	357	1281.10							1281.10	572.28
121	360	1002.30							1002.30	735.06
122	363	519.61							693.99	519.61
123	366	-166.98							448.94	-166.98
124	369	-1057.46							0.00	-1057.46
125	372	-2156.17							-2156.17	-2156.17
126	375	-1169.22							-1169.22	-1169.22
127	378	-390.51							-390.51	-390.51
128	381	184.32							184.32	184.32
129	384	555.24							555.24	555.24
130	387	722.27							722.27	722.27
131	390	685.41							685.41	685.41
132	393	444.65							444.65	444.65
133	396	0.00							0.00	0.00

MOMENTOS DE PESO PROPIO



DIMENSIONAMIENTO DE PRETENSADO DE LANZAMIENTO

CARACTERISTICAS MECANICAS

A	9.06219
Wsup	13.385464
Winf	7.9865681

ESFUERZOS MAXIMOS EN ZONA DE REFUERZO

	Nº TEND	Nº CORD	EXCENTR
Nº CORD CARA SUP	10	18	1.27477
Nº CORD CARA INF	10	14	-2.00523

AXIL PRET	4579.2
M pret	-733.7252

		1
	PP	**GRAD**
Mpos	3882.805	1434.381
Mneg	-7435.367	-401.119

	Mpos	**Mneg**
Ten_sup	847.72908	-134.9542
Ten_inf	-68.58784	1578.3864

ESFUERZOS MAXIMOS EN ZONA GENERAL

	Nº TEND	Nº CORD	EXCENTR
Nº CORD CARA SUP	8	18	1.27477
Nº CORD CARA INF	8	14	-1.85523

AXIL PRET	3663.36
M pret	-346.5722

	PP	**GRAD**
Mpos	2695.052	1434.381
Mneg	-7435.367	-401.119

	Mpos	**Mneg**
	3782.8608	-8183.058
Ten_sup	686.85627	-207.0925
Ten_inf	-69.40621	1428.8492

CALCULO TRANSVERSAL DEL TABLERO

Oficina Técnica	PROYECTO: VIADUCTO nº 2
	ASUNTO: ESTADO DE SERVICIO

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE

ESTADO LIMITE DE AGOTAMIENTO FRENTE A CORTANTE

- Obtención de V_{u1}

$$V_{u1} = k \cdot f_{1cd} \cdot d \cdot \frac{\cot g\,\theta}{1 + \cot g^2 \theta}$$

$$f_{1cd} = 0{,}6 \times \frac{40}{1{,}5} = \frac{24}{1{,}5} = 16\ N/mm^2$$

Axil de Pretensado.

$$N_{p\,adherente} = (8\times 19 + 8\times 14)\times 26{,}5 \times 0{,}75 \times 0{,}75 \times 1{,}1 = \cancel{4108{,}46}\ 4328{,}8$$

$$N_{p\,exterior} = (6\times 25)\times 26{,}5 \times 0{,}75 \times 0{,}85 \times 1{,}1 = 2787{,}5$$

$$\sigma_{cd} = -\frac{(4328{,}8 + 2787{,}5)}{9{,}06} = -785{,}5\ T/m^2 = -7{,}85\ KN/mm^2$$

$$K = \frac{5}{3}\left(1 - \frac{7{,}85}{26{,}6}\right) = 1{,}17 \not< 1 \Rightarrow K = 1$$

$$V_{u1} = 1 \times 1600 \times 0{,}9 \times 0{,}9 \times 4{,}00 \times \frac{\cot g\,\theta}{1+\cot g^2\theta} = 5184 \times \frac{\cot g\,\theta}{1+\cot g^2\theta}$$

- Obtención de V_{u2}

$$V_{cu} = [0{,}10 \cdot \xi\,(100\,\rho_l \cdot f_{ck})^{1/3} - 0{,}15\,\sigma_{cd}] \cdot b_o \cdot d\beta$$

$$\xi = 1 + \sqrt{\frac{200}{0{,}9 \cdot 4000}} = 1{,}236$$

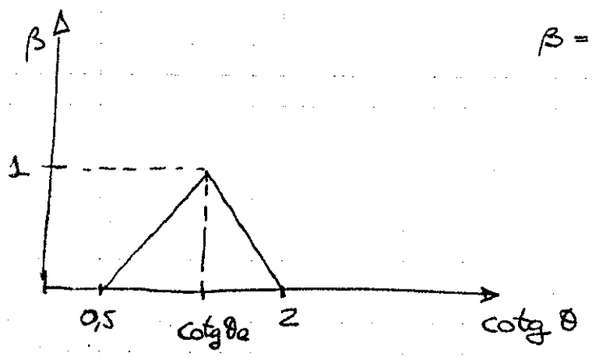
$$\rho_l = 4{,}52 \cdot 10^{-2} \not< 0{,}02 \Rightarrow \rho_l = 0{,}02$$

$$\cot g\,\theta_e = \sqrt{1 - \frac{-7{,}85}{f_{ctm}}} = \sqrt{1 + \frac{7{,}85}{3{,}5}} = 1{,}80$$

$$f_{ctm} = 0{,}3\sqrt[3]{40^2} = 3{,}5$$

Oficina Técnica	PROYECTO:
	ASUNTO:

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE



$\beta = max$ si $\cot g\,\theta = \cot g\,\theta_e$

$$V_{cu} = [0{,}10 \times 1{,}236 \times (100 \times 0{,}02 \times 40)^{1/3} + 0{,}15 \cdot 7{,}85] \times 100 \times 0{,}9 \times 0{,}9 \times 40$$

$V_{cu} = 554\ t.$

$$V_{su} = z \cdot \operatorname{sen}\alpha\,(\cot g\,\alpha + \cot g\,\theta) \cdot \Sigma A_\alpha \cdot f_{ya,d}$$

Oficina Técnica	PROYECTO: VIADUCTO nº2	
	ASUNTO: FASE DE LANZAMIENTO	
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA DE

- E.L.U. FRENTE A CORTANTE.

- Obtención de V_{u1}

$$V_{u1} = k \cdot f_{1cd} \cdot d \cdot \frac{\cot g\,\theta}{1+\cot g^2\theta}$$

$$f_{1cd} = 0{,}6 \times \frac{0{,}9}{1{,}5} = 16\ N/mm^2$$

Axil de Pretensado

$$N = (8\times19 + 8\times14)\times 26{,}5 \times 0{,}75 \times 0{,}82 \times 1{,}1 = 4732{,}8\ t$$

$$\sigma_{cd} = \frac{-4732{,}8}{9{,}06} = -522{,}4\ t/m^2 = -5{,}2\ N/mm^2$$

$$k = \frac{5}{3}\left(1 - \frac{5{,}2}{26{,}6}\right) = 1{,}34 \neq 1 \Rightarrow k = 1$$

$$V_{u1} = 1 \times 1600 \times 0{,}9 \times 0{,}9 \times 4{,}00 \times \frac{\cot g\,\theta}{1+\cot g^2\theta} = 5184 \cdot \frac{\cot g\,\theta}{1+\cot g^2\theta}$$

- Obtención de V_{u2}

$$V_{cu} = [0{,}10 \cdot \xi\,(100 \cdot \rho_l \cdot f_{ck})^{1/3} - 0{,}15\sigma_{cd}] \cdot b_o \cdot d \cdot \beta$$

$$\xi = 1 + \sqrt{\frac{200}{0.9 \cdot 4000}} = 1.236$$

$$\rho_l = 4{,}52 \cdot 10^{-2} \neq 0{,}02 \Rightarrow \rho_l = 0{,}02$$

$$\cot g\,\theta_e = \sqrt{1 - \frac{-5{,}2}{3{,}5}} = 1{,}57$$

Si se toma $\theta = \theta_e$

$$V_{cu} = [0{,}10 \times 1{,}236\,(100 \times 0{,}02 \times 40)^{1/3} + 0{,}15 \cdot 5{,}2] \times 100 \times 0{,}9 \times 0{,}9 \times 400 \times 1$$

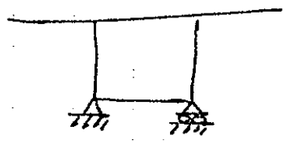
$$V_{cu} = 425{,}3\ t$$

Oficina Técnica	PROYECTO: VIADUCTO nº2
	ASUNTO:

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE

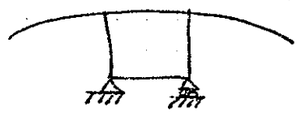
CALCULO DE COEFICIENTE DE IMPACTO PARA CALCULO DE ARMADURA TRANSVERSAL

Para la obtención de los coeficientes de impacto se toman los ~~modos~~ modos propios de vibración de la sección transversal



MODO 2

T= 0,0848 s



~~MODO~~

CALCULO DE COEF. DE IMPACTO DE VOLADIZO

$$I = 65 \cdot \frac{\mu}{1-\mu+\mu^2} \qquad \mu = \frac{V \cdot T}{2L}$$

- Voladizo: $L_{eq} = 8m \Rightarrow \mu = \frac{200 \cdot 0{,}0848}{2 \cdot 8} = 1{,}06$

$I = 64{,}8 \rightarrow$ coef = 1,65

- Losa interior $L_{eq} = 6$ $\mu = \frac{200 \cdot 0{,}0848}{2 \cdot 6} = 1{,}41$

$I = 57{,}8 \rightarrow$ coef = 1,6

Oficina Técnica	PROYECTO: VIADUCTO nº2
	ASUNTO:

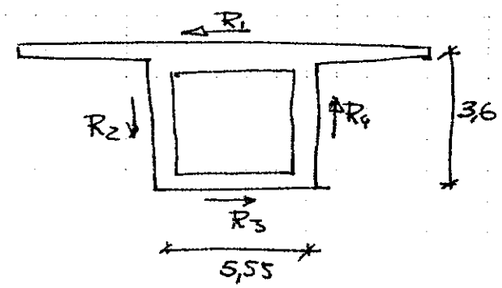
ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:.....	HOJA	DE

ESTUDIO DE DIAFRAGMA DE PILA.

- ESFUERZO TORSOR MAXIMO

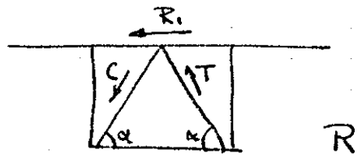
$T_d = 1127{,}4$ t·m

- ESTUDIO DE RASANTES



$$R_1 = R_T \cdot 5{,}55 = \frac{T}{2Ae} \times 6{,}55 = \frac{1127{,}4}{2 \cdot 20{,}12} \times 5{,}55 = 155{,}5\ t.$$

- Distribución de bielas y tirantes en diafragma



$\alpha = \text{arctg}(3{,}6/2{,}75) = 52{,}62°$

$R_1 = C\cos\alpha + T\cos\alpha \Rightarrow T$

$C = T$

$$\Rightarrow T = \frac{R_1}{2\cos\alpha} = 47{,}19\ t$$

Oficina Técnica.	PROYECTO: VIADUCTO nº 2
	ASUNTO:

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE

DIMENSIONAMIENTO PRETENSADO DE COSIDO.

- Esfuerzos a tener en cuenta:
  - Frenado : 1410 t
  - Retracción, Fluencia y T, suma de las fuerzas consideradas en cabeza de los pilas.

P-1	19 t.
P-2	10,6 t
P-3	9,1 t
P-4	10,5 t
P-5	12,0 t
P-6	15,8 t
P-7	18,5 t
P-8	21,0 t
P-9	25,0 t
P-10	56,5 t
P-11	93,0 t
E-2.	25,3 t
TOTAL:	316,3 t.

Frenado + RFT = 1726,3 t.

nº de cordones para 4 tendones

Carga por tendon = $\frac{1726,3}{4}$ = 431,6

t 25ϕ0,6" = 709,8 Carga rot.

% tesado = $\frac{431,6}{709,8}$ = 60%

CARACTERISTICAS DE LA SECCION

fck	400
fyk	5100
COEF. IMPACTO VOLADIZO	1.64
COEF. IMPACTO VANO INT	1.6

	BARRA	CANTO	PP	RCP	SCPASEO	SC 100	IAPF	2IAPF	UIC	2UIC	UIC_SW	DESCARR A	DESCARR B	DESCARR D	DESCARR C	ENVOLVENTES M+	Us1 +	ARMADURA +	M-	Us1 -	ARMADURA -
voladizo1	1	0.1500	-0.00	0.00	-0.00	0.00	-0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	ø10 a 20	0.00	0.00	ø10 a 20
voladizo1	1	0.1750	-0.06	-9.45	-0.06	0.00	-0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	0.00	-0.73	0.00	0.00	ø10 a 20	-12.93	-79.54	20 a 40+ø25 a 40
voladizo1	1	0.2000	-0.26	-10.15	-0.21	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	-7.47	0.00	0.00	ø10 a 20	-14.37	-76.88	20 a 40+ø25 a 40
voladizo1	1	0.2250	-0.62	-10.85	-0.52	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00	-0.00	0.00	-14.21	0.00	0.00	ø10 a 20	-16.27	-76.76	20 a 40+ø25 a 40
voladizo1	1	0.2500	-1.16	-11.81	-0.91	0.00	-0.00	0.00	0.00	-0.00	-0.00	-0.44	-1.47	0.00	-20.94	0.00	0.00	ø10 a 20	-21.07	-88.00	20 a 40+ø25 a 40
voladizo2	2	0.2500	-1.16	-11.77	-0.87	-0.00	0.00	-0.00	-0.00	-0.00	-0.00	-0.44	-1.47	-0.00	-20.94	0.00	0.00	ø10 a 20	-20.96	-87.59	20 a 40+ø25 a 40
voladizo2	2	0.3125	-1.79	-12.80	-1.22	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-1.19	-3.95	0.00	-26.88	0.00	0.00	ø10 a 20	-27.45	-90.74	ø25 a 20
voladizo2	2	0.3750	-2.62	-14.03	-1.56	0.00	-0.67	-0.00	-1.39	0.00	-0.00	-1.93	-6.42	0.00	-32.82	0.00	0.00	ø10 a 20	-34.46	-94.22	ø25 a 20
voladizo2	2	0.4375	-3.68	-15.47	-1.91	0.00	-2.44	-0.47	-5.05	-0.98	-0.58	-2.95	-9.83	0.00	-38.76	0.00	0.00	ø10 a 20	-43.48	-101.15	ø25 a 20
voladizo2	2	0.5000	-5.01	-17.16	-2.26	0.00	-5.90	-1.88	-12.21	-3.89	-2.33	-4.43	-14.78	0.00	-44.70	0.00	0.00	ø10 a 20	-55.49	-112.16	32 a 40+ø25 a 40
losa int	3	0.5000	-3.21	-9.19	-1.23	-0.02	-6.26	-11.07	-12.96	-16.68	-11.20	-2.41	-8.04	-5.50	-24.33	0.00	0.00	ø10 a 20	-43.61	-89.07	20 a 40+ø25 a 40
losa int	3	0.4560	-2.33	-7.66	-1.09	-0.02	-2.99	-6.18	-6.18	-7.78	-5.62	-2.14	-7.13	-4.10	-21.57	0.00	0.00	ø10 a 20	-26.79	-60.97	ø20 a 20
losa int	3	0.4120	-1.60	-6.26	-0.95	-0.02	-0.63	-2.19	-1.31	-0.78	-1.19	-1.86	-6.21	-2.69	-18.80	0.00	0.00	ø10 a 20	-21.35	-54.20	16 a 40+ø20 a 40
losa int	3	0.3680	-1.01	-4.99	-0.81	-0.02	0.81	0.87	1.68	4.32	2.11	-1.59	-5.30	-1.28	-16.04	0.49	1.44	ø10 a 20	-17.27	-49.49	16 a 40+ø20 a 40
losa int	3	0.3240	-0.54	-3.86	-0.67	-0.02	1.33	3.02	2.76	7.54	4.28	-1.32	-4.39	0.13	-13.28	6.90	23.90	ø12 a 20	-13.53	-44.54	ø16 a 20
losa int	4	0.3240	-0.54	-3.86	-0.67	-0.02	1.33	3.02	2.76	7.54	4.28	-1.32	-4.39	0.13	-13.28	6.90	23.90	ø12 a 20	-13.53	-44.54	ø16 a 20
losa int	4	0.3305	-0.23	-3.01	-0.55	-0.02	1.36	4.23	2.81	8.89	5.31	-1.09	-3.62	1.41	-10.95	10.10	34.47	12 a 40+ø16 a 40	-10.62	-34.47	12 a 40+ø16 a 40
losa int	4	0.3370	0.00	-2.23	-0.44	-0.02	1.17	4.72	2.42	8.76	5.45	-0.85	-2.85	2.69	-8.62	10.12	33.79	12 a 40+ø16 a 40	-7.16	-22.93	ø12 a 20
losa int	4	0.3435	0.14	-1.54	-0.32	-0.02	0.98	4.84	2.03	7.86	5.12	-0.62	-2.08	3.97	-6.29	9.89	32.29	12 a 40+ø16 a 40	-5.00	-15.76	ø10 a 20
losa int	4	0.3500	0.18	-0.93	-0.20	-0.02	0.79	4.83	1.63	6.69	4.64	-0.39	-1.31	4.01	-3.96	9.03	28.80	12 a 40+ø16 a 40	-3.01	-9.34	ø10 a 20
losa int	5	0.3500	0.18	-0.93	-0.20	-0.02	0.63	4.72	1.30	6.46	4.50	-0.39	-1.31	4.01	-3.96	8.68	27.66	12 a 40+ø16 a 40	-3.01	-9.34	ø10 a 20
losa int	5	0.3435	0.14	-0.41	-0.08	-0.02	0.44	4.73	0.91	5.32	4.04	-0.17	-0.55	3.67	-1.66	7.61	24.69	ø12 a 20	-1.23	-3.90	ø10 a 20
losa int	5	0.3370	0.00	0.02	0.03	-0.02	0.25	4.61	0.52	4.09	3.49	0.06	0.21	3.34	0.63	6.99	23.14	ø12 a 20	0.00	0.00	ø10 a 20
losa int	5	0.3305	-0.23	0.37	0.15	-0.02	0.06	4.12	0.13	2.62	2.70	0.29	0.97	3.00	2.93	6.54	22.14	ø12 a 20	0.00	0.00	ø10 a 20
losa int	5	0.3240	-0.54	0.64	0.26	-0.02	-0.12	2.91	-0.25	0.67	1.42	0.52	1.73	2.67	5.23	4.87	16.77	ø10 a 20	-0.24	-0.83	ø10 a 20
losa int	6	0.3240	-0.54	0.64	0.26	-0.02	-0.12	3.03	-0.25	0.75	1.50	0.52	1.73	2.67	5.23	5.04	17.36	ø10 a 20	-0.24	-0.83	ø10 a 20
losa int	6	0.3680	-1.00	0.78	0.39	-0.02	-0.33	0.88	-0.68	-1.93	-0.44	0.76	2.54	0.72	7.69	4.17	12.42	ø10 a 20	-3.20	-9.41	ø10 a 20
losa int	6	0.4120	-1.59	0.78	0.51	-0.02	-0.53	-2.19	-1.10	-5.22	-3.00	1.01	3.35	-1.45	10.15	4.99	13.16	ø10 a 20	-8.92	-23.05	ø12 a 20
losa int	6	0.4560	-2.32	0.65	0.64	-0.02	-0.74	-6.17	-1.52	-9.12	-6.17	1.25	4.17	-3.63	12.62	5.54	13.09	ø10 a 20	-15.93	-36.70	ø16 a 20
losa int	6	0.5000	-3.21	0.39	0.76	-0.02	-0.94	-11.06	-1.95	-13.63	-9.94	1.49	4.98	-5.81	15.08	5.80	12.41	ø10 a 20	-24.24	-50.39	16 a 40+ø20 a 40
voladizo2	7	0.5000	-5.01	-6.28	-0.00	-0.00	0.00	-1.50	0.00	-1.00	-1.00	-0.00	-0.00	0.00	-0.00	0.00	0.00	ø10 a 20	-17.49	-36.58	ø16 a 20
voladizo2	7	0.4375	-3.68	-4.85	-0.00	-0.00	0.00	-0.09	-0.00	-0.06	-0.06	-0.00	-0.00	0.00	-0.00	0.00	0.00	ø10 a 20	-11.65	-28.16	12 a 40+ø16 a 40
voladizo2	7	0.3750	-2.62	-3.65	-0.00	0.00	0.00	0.37	-0.00	0.25	0.25	-0.00	-0.00	0.00	-0.00	0.00	0.00	ø10 a 20	-8.47	-24.17	ø12 a 20
voladizo2	7	0.3125	-1.79	-2.67	-0.00	0.00	0.00	0.37	-0.00	0.25	0.25	-0.00	-0.00	-0.00	-0.00	0.00	0.00	ø10 a 20	-6.02	-20.97	ø12 a 20
voladizo2	7	0.2500	-1.16	-1.88	-0.00	0.00	0.00	0.37	-0.00	0.25	0.25	-0.00	-0.00	-0.00	-0.00	0.00	0.00	ø10 a 20	-4.10	-18.32	ø12 a 20
voladizo1	8	0.2500	-1.16	-1.89	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	ø10 a 20	-4.12	-18.37	ø12 a 20
voladizo1	8	0.2250	-0.62	-1.22	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00	ø10 a 20	-2.49	-12.58	ø10 a 20
voladizo1	8	0.2000	-0.26	-0.80	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	ø10 a 20	-1.44	-8.36	ø10 a 20
voladizo1	8	0.1750	-0.06	-0.38	0.00	-0.00	0.00	0.00	0.00	0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	ø10 a 20	-0.60	-4.10	ø10 a 20
voladizo1	8	0.1500	-0.00	0.04	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	-0.00	-0.00	0.00	0.04	0.33	ø10 a 20	0.00	0.00	ø10 a 20
alma1	9	0.4500	1.43	0.39	0.10	0.24	0.03	0.21	0.07	-0.01	0.08	0.20	0.68	0.36	2.03	3.63	8.68	ø10 a 20	0.00	0.00	ø10 a 20
alma1	9	0.4500	1.52	2.28	0.33	0.18	-0.12	-1.34	-0.24	-2.14	-1.40	0.66	2.19	-1.11	6.62	8.93	21.50	ø12 a 20	0.00	0.00	ø10 a 20
alma1	9	0.4500	1.62	4.17	0.57	0.11	-0.27	-2.89	-0.55	-4.27	-2.89	1.11	3.71	-2.57	11.20	14.23	34.50	12 a 40+ø16 a 40	-0.61	-1.46	ø10 a 20
alma1	9	0.4500	1.71	6.07	0.80	0.05	-0.42	-4.45	-0.86	-6.40	-4.37	1.57	5.23	-4.04	15.79	19.53	47.69	16 a 40+ø20 a 40	-1.82	-4.33	ø10 a 20
alma1	9	0.4500	1.80	7.96	1.03	-0.02	-0.57	-6.00	-1.17	-8.52	-5.86	2.02	6.74	-5.50	20.37	24.83	61.08	ø20 a 20	-3.03	-7.18	ø10 a 20
alma2	10	0.4500	-1.43	0.89	0.16	-0.24	-0.01	-0.21	-0.02	-0.60	-0.33	0.33	1.08	-0.05	3.26	1.34	3.19	ø10 a 20	-1.63	-3.87	ø10 a 20
alma2	10	0.4500	-1.52	-1.00	-0.07	-0.18	0.14	1.34	0.29	1.53	1.15	-0.13	-0.43	1.41	-1.32	0.00	0.00	ø10 a 20	-4.15	-9.84	ø10 a 20
alma2	10	0.4500	-1.62	-2.89	-0.30	-0.11	0.29	2.89	0.60	3.65	2.64	-0.58	-1.95	2.88	-5.91	0.97	2.32	ø10 a 20	-9.45	-22.25	ø12 a 20
alma2	10	0.4500	-1.71	-4.78	-0.53	-0.05	0.44	4.45	0.91	5.78	4.12	-1.04	-3.46	4.34	-10.49	2.18	5.21	ø10 a 20	-14.75	-34.50	12 a 40+ø16 a 40
alma2	10	0.4500	-1.80	-6.68	-0.76	0.02	0.59	6.00	1.22	7.91	5.60	-1.49	-4.98	5.81	-15.08	3.39	8.10	ø10 a 20	-20.05	-46.61	16 a 40+ø20 a 40
losainf1	11	0.2500	-1.43	-0.39	-0.10	-0.24	-0.03	-0.21	-0.07	0.01	-0.08	-0.20	-0.68	-0.36	-2.03	0.00	0.00	ø10 a 20	-3.63	-16.23	ø10 a 20
losainf1	11	0.2500	-0.38	-0.23	-0.07	-0.07	-0.03	-0.21	-0.06	-0.06	-0.11	-0.14	-0.46	-0.32	-1.37	0.00	0.00	ø10 a 20	-1.61	-7.26	ø10 a 20
losainf1	11	0.2500	0.37	-0.07	-0.04	0.05	-0.03	-0.21	-0.06	-0.14	-0.14	-0.07	-0.24	-0.28	-0.71	0.41	1.88	ø10 a 20	-0.17	-0.76	ø10 a 20
losainf1	11	0.2500	0.83	0.09	-0.00	0.12	-0.02	-0.21	-0.05	-0.22	-0.17	-0.01	-0.02	-0.24	-0.05	1.24	5.66	ø10 a 20	0.00	0.00	ø10 a 20
losainf1	11	0.2500	0.98	0.25	0.03	0.15	-0.02	-0.21	-0.04	-0.29	-0.20	0.06	0.20	-0.20	0.61	2.01	9.22	ø10 a 20	0.00	0.00	ø10 a 20
losainf2	12	0.2500	0.98	0.25	0.03	0.15	-0.02	-0.21	-0.04	-0.29	-0.20	0.06	0.20	-0.20	0.61	2.01	9.22	ø10 a 20	0.00	0.00	ø10 a 20
losainf2	12	0.2500	0.83	0.41	0.06	0.12	-0.02	-0.21	-0.04	-0.37	-0.24	0.13	0.42	-0.16	1.28	2.40	11.04	ø10 a 20	0.00	0.00	ø10 a 20
losainf2	12	0.2500	0.37	0.57	0.10	0.05	-0.02	-0.21	-0.03	-0.45	-0.27	0.19	0.64	-0.13	1.94	2.39	10.99	ø10 a 20	0.00	0.00	ø10 a 20
losainf2	12	0.2500	-0.38	0.73	0.13	-0.07	-0.01	-0.21	-0.03	-0.52	-0.30	0.26	0.86	-0.09	2.60	1.85	8.47	ø10 a 20	-0.31	-1.40	ø10 a 20
losainf2	12	0.2500	-1.43	0.89	0.16	-0.24	-0.01	-0.21	-0.02	-0.60	-0.33	0.33	1.08	-0.05	3.26	1.34	6.11	ø10 a 20	-1.63	-7.35	ø10 a 20

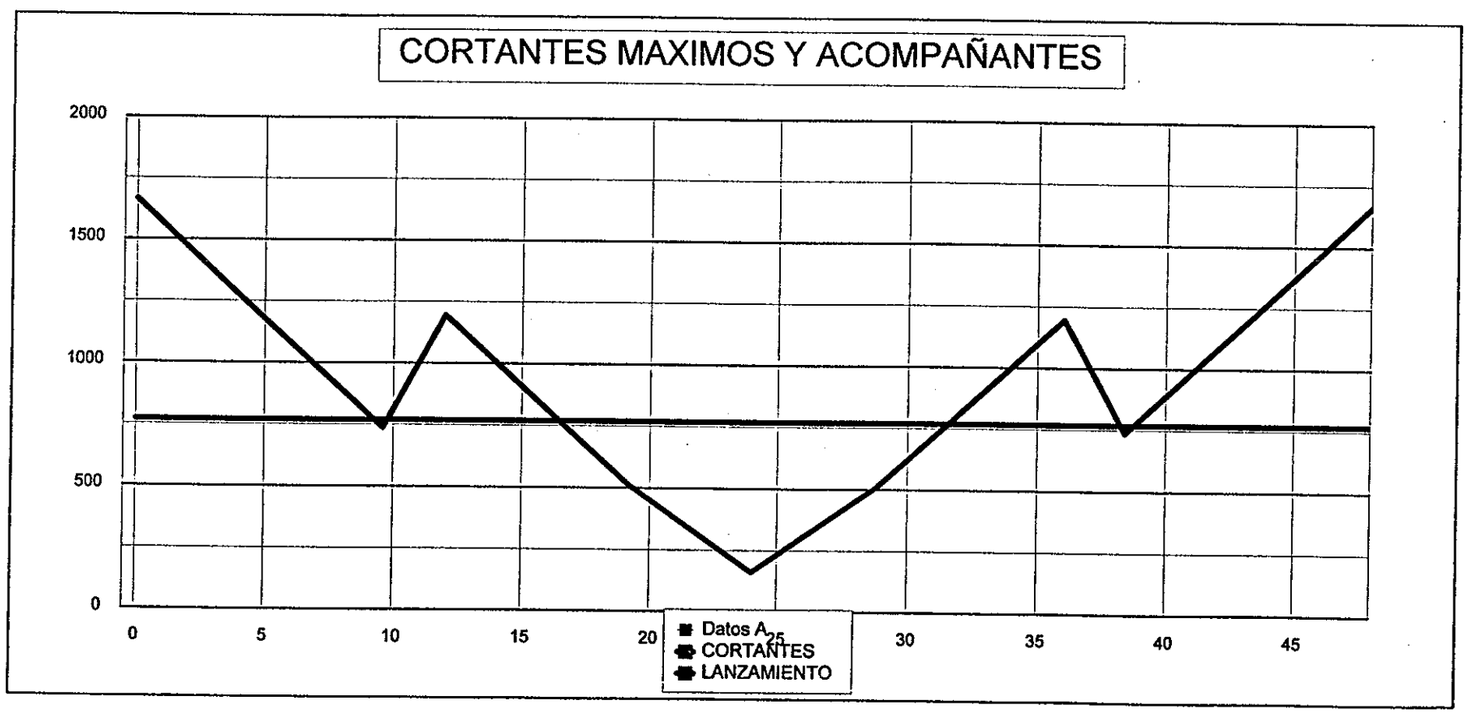
CALCULO DE CARACTERISTICAS MECANICAS

SECCION	X	CANTO	ESPESOR LOSA INFERIOR	AREA SECCION	CENTRO GRAVEDAD	INERCIA XX	INERCIA YY	AREA TORSION	PERIMETRO TORSION	INERCIA TORSION	CALCULO DE MOMENTOS ESTATICOS							COEF TORSION LONGITUD	COEF TORSION TRANS	Tu1	Vu1
											S1	S2	S3	S4	S5	S6	ST				
1	0.00	4.00	0.45	9.06	1.49	20.01	84.91	20.12	18.35	76005.70	0.57	1.38	1.84	2.48	1.41	1.41	3.06	0.456	0.025	4099.67	2200.75
2	2.40	4.00	0.40	9.06	1.49	20.01	84.91	20.26	18.40	79770.65	0.57	1.38	1.84	2.48	1.41	1.59	3.06	0.454	0.025	4127.94	2200.75
3	4.80	4.00	0.35	9.06	1.49	20.01	84.91	20.40	18.45	84350.37	0.57	1.38	1.84	2.48	1.41	1.59	3.06	0.452	0.025	4156.22	2200.75
4	7.20	4.00	0.30	9.06	1.49	20.01	84.91	20.54	18.50	90147.14	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.450	0.024	4184.49	2200.75
5	9.60	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
6	12.00	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
7	14.40	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
8	16.80	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
9	19.20	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
10	21.60	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
11	24.00	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
12	26.40	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
13	28.80	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
14	31.20	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
15	33.60	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
16	36.00	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
17	38.40	4.00	0.25	9.06	1.49	20.01	84.91	20.67	18.55	97885.00	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
18	40.80	4.00	0.30	9.06	1.49	20.01	84.91	20.54	18.50	90147.14	0.57	1.38	1.84	2.48	1.41	1.94	3.06	0.449	0.024	4212.76	2200.75
19	43.20	4.00	0.35	9.06	1.49	20.01	84.91	20.40	18.45	84350.37	0.57	1.38	1.84	2.48	1.41	1.59	3.06	0.450	0.024	4184.49	2200.75
20	45.60	4.00	0.40	9.06	1.49	20.01	84.91	20.26	18.40	79770.65	0.57	1.38	1.84	2.48	1.41	1.59	3.06	0.452	0.025	4156.22	2200.75
21	48.00	4.00	0.45	9.06	1.49	20.01	84.91	20.12	18.35	76005.70	0.57	1.38	1.84	2.48	1.41	1.41	3.06	0.454	0.025	4127.94	2200.75
																		0.456	0.025	4099.67	2200.75

CALCULO DE ARMADURA TRANSVERSAL EN SECCIONES CAJON

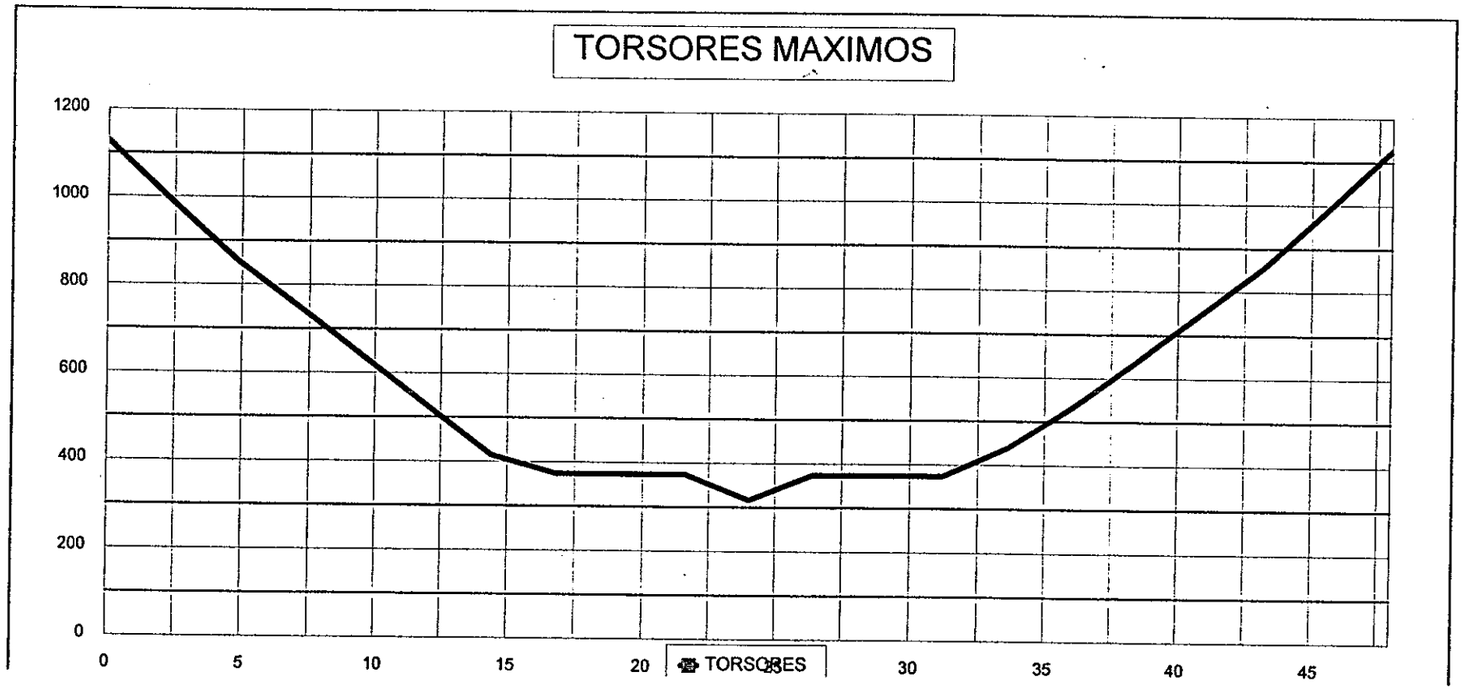
ESTRUCTURA **VIADUCTO Nº 2**

SECCIÓN		PESO PROPIO	RCP	PRETENSADO TOTAL INICIAL	FINAL	factor= 2683.13 PRETENSADO INICIAL	FINAL	SOB UNIFORME MAX	MIN	DESCENSO APOYOS MAX	MIN	MAYORADO ENVOLVENTE	
1	0.00	-569.44	-278.61	0.26	0.26	710.35	710.35	-763.40		-93.60		1663.87	1663.87
2	2.40	-509.87	-250.75	0.26	0.26	710.35	710.35	-684.30		-93.60		1427.18	1427.18
3	4.80	-453.76	-222.89	0.26	0.26	710.35	710.35	-605.20		-93.60		1195.17	1195.17
4	7.20	-399.39	-195.02	0.26	0.26	710.35	710.35	-526.10		-93.60		965.51	965.51
5	9.60	-345.02	-167.16	0.26	0.26	710.35	710.35	-447.00		-93.60		735.84	735.84
6	12.00	-271.65	-139.29	-0.00	-0.00	-3.37	-3.37	-367.90		-93.60		1194.23	1194.23
7	14.40	-217.27	-111.43	-0.00	-0.00	-3.37	-3.37	-288.81		-93.60		964.57	964.57
8	16.80	-162.90	-83.57	-0.00	-0.00	-3.37	-3.37	-209.71		-93.60		734.90	734.90
9	19.20	-108.53	-55.70	-0.00	-0.00	-3.37	-3.37	-133.11		-93.60		508.98	508.98
10	21.60	-54.16	-27.84	-0.00	-0.00	-3.37	-3.37	-90.92		-93.60		334.68	334.68
11	24.00	0.21	0.03	-0.00	-0.00	-3.37	-3.37	-48.74		-93.60		160.39	160.39
12	26.40	54.59	27.89	-0.00	-0.00	-3.37	-3.37	-6.55		-93.60		107.98	334.68
13	28.80	108.96	55.75	-0.00	-0.00	-3.37	-3.37	35.64		-93.60		218.99	508.98
14	31.20	163.33	83.62	-0.00	-0.00	-3.37	-3.37	77.82		-93.60		362.51	734.90
15	33.60	217.70	111.48	-0.00	-0.00	-3.37	-3.37	120.01		-93.60		536.81	964.57
16	36.00	291.07	139.35	-0.26	-0.26	-703.66	-703.66	162.20		-93.60		122.60	1194.23
17	38.40	345.45	167.21	-0.26	-0.26	-703.66	-703.66	202.25		-93.60		207.56	735.84
18	40.80	399.82	195.07	-0.26	-0.26	-703.66	-703.66	223.34		-93.60		350.22	965.51
19	43.20	454.19	222.94	-0.26	-0.26	-703.66	-703.66	244.44		-93.60		492.87	1195.17
20	45.60	510.30	250.80	-0.26	-0.26	-703.66	-703.66	265.53		-93.60		637.87	1427.18
21	48.00	569.87	278.67	-0.26	-0.26	-703.66	-703.66	286.62		-93.60		787.55	1663.87
LANZAMIENTO		569.87	0.00	0.00	0.00	0.00	0.00	0.00		0.00		769.32	769.32



TORSORES
=========

SECCIÓN		TORSOR MAXIMO	Td SOR MAYORADO
1	0.00	751.59	1127.38
2	2.40	659.79	989.68
3	4.80	570.31	855.46
4	7.20	496.87	745.30
5	9.60	423.43	635.14
6	12.00	349.99	524.98
7	14.40	276.55	414.82
8	16.80	249.02	373.54
9	19.20	249.02	373.54
10	21.60	249.02	373.54
11	24.00	210.77	316.16
12	26.40	249.02	373.54
13	28.80	249.02	373.54
14	31.20	249.02	373.54
15	33.60	292.61	438.92
16	36.00	353.81	530.72
17	38.40	423.43	635.14
18	40.80	496.87	745.30
19	43.20	570.31	855.46
20	45.60	659.79	989.68
21	48.00	751.59	1127.38



CALCULO DE ARMADURA DE TORSIÓN

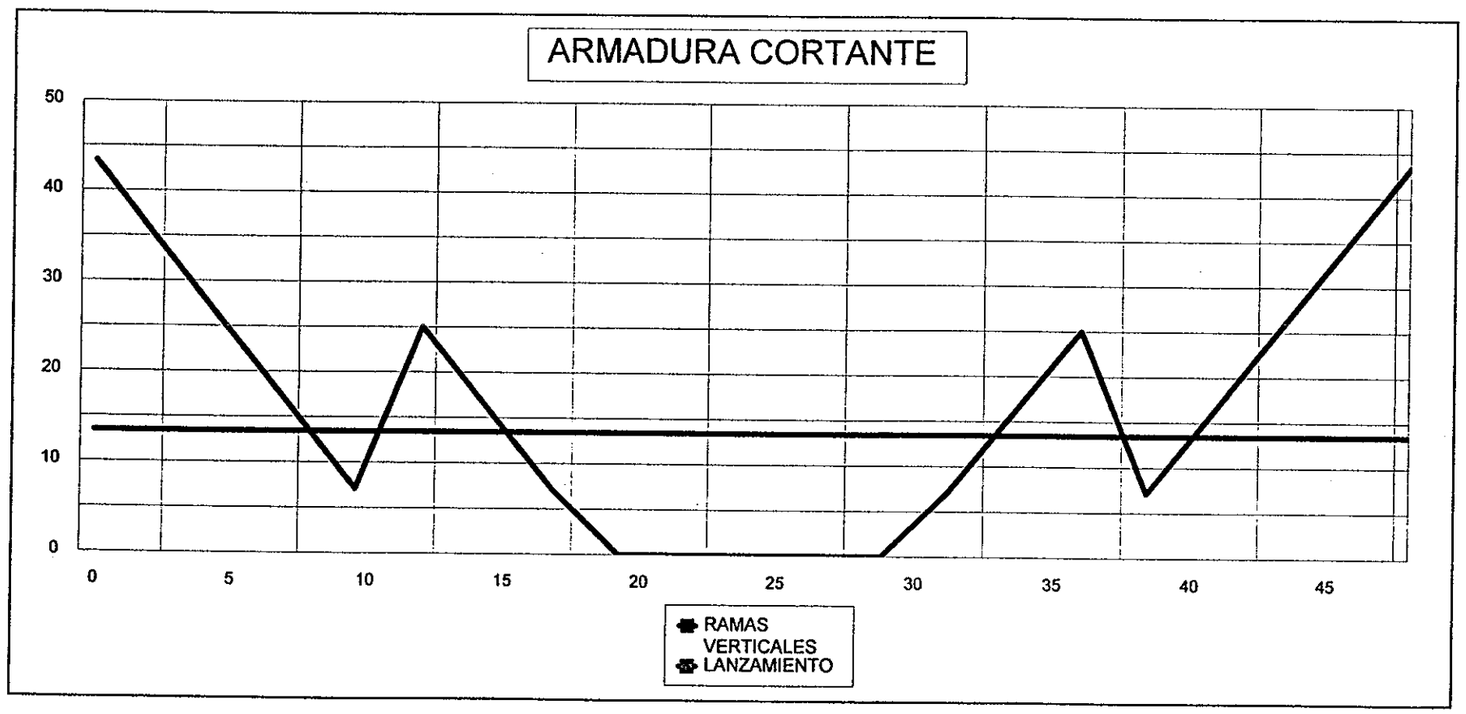
cotg(THETA) 1.80

SECCIÓN		Td T-60	T-60+SC/2	COEF. TORSION	ARMADURA LONG.	ARMADURA ACTIVA	ARMADURA PASIVA	num redon 70.00 diam min	COEF. TORSION	ARMADURA TRANSVERSAL T-60 (t/m)	COEF. TORSION	T-60+SC/2 (t/m)	ARM. POS LOSA INF	ARM. POS LOSA SUP
1	0.00	1127.38	1127.38	0.82088	925.44	1749.00	0.00	0.0	0.01381	15.57	0.01381	15.57	9.22	33.79
2	2.40	989.68	989.68	0.81748	812.40	1749.00	0.00	0.0	0.01371	13.66	0.01371	13.66	9.22	33.79
3	4.80	855.46	855.46	0.81412	702.23	1749.00	0.00	0.0	0.01362	11.81	0.01362	11.81	9.22	33.79
4	7.20	745.30	745.30	0.81081	611.80	1749.00	0.00	0.0	0.01353	10.29	0.01353	10.29	9.22	33.79
5	9.60	635.14	635.14	0.80755	521.37	1749.00	0.00	0.0	0.01344	8.77	0.01344	8.77	9.22	33.79
6	12.00	524.98	524.98	0.80755	430.94	1749.00	0.00	0.0	0.01344	7.25	0.01344	7.25	9.22	33.79
7	14.40	414.82	414.82	0.80755	340.52	1749.00	0.00	0.0	0.01344	5.73	0.01344	5.73	9.22	33.79
8	16.80	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
9	19.20	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
10	21.60	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
11	24.00	316.16	316.16	0.80755	259.53	1749.00	0.00	0.0	0.01344	4.37	0.01344	4.37	9.22	33.79
12	26.40	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
13	28.80	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
14	31.20	373.54	373.54	0.80755	306.63	1749.00	0.00	0.0	0.01344	5.16	0.01344	5.16	9.22	33.79
15	33.60	438.92	438.92	0.80755	360.30	1749.00	0.00	0.0	0.01344	6.06	0.01344	6.06	9.22	33.79
16	36.00	530.72	530.72	0.80755	435.65	1749.00	0.00	0.0	0.01344	7.33	0.01344	7.33	9.22	33.79
17	38.40	635.14	635.14	0.80755	521.37	1749.00	0.00	0.0	0.01344	8.77	0.01344	8.77	9.22	33.79
18	40.80	745.30	745.30	0.81081	611.80	1749.00	0.00	0.0	0.01353	10.29	0.01353	10.29	9.22	33.79
19	43.20	855.46	855.46	0.81412	702.23	1749.00	0.00	0.0	0.01362	11.81	0.01362	11.81	9.22	33.79
20	45.60	989.68	989.68	0.81748	812.40	1749.00	0.00	0.0	0.01371	13.66	0.01371	13.66	9.22	33.79
21	48.00	1127.38	1127.38	0.82088	925.44	1749.00	0.00	0.0	0.01381	15.57	0.01381	15.57	9.22	33.79

CALCULO DE ARMADURA DE CORTANTE

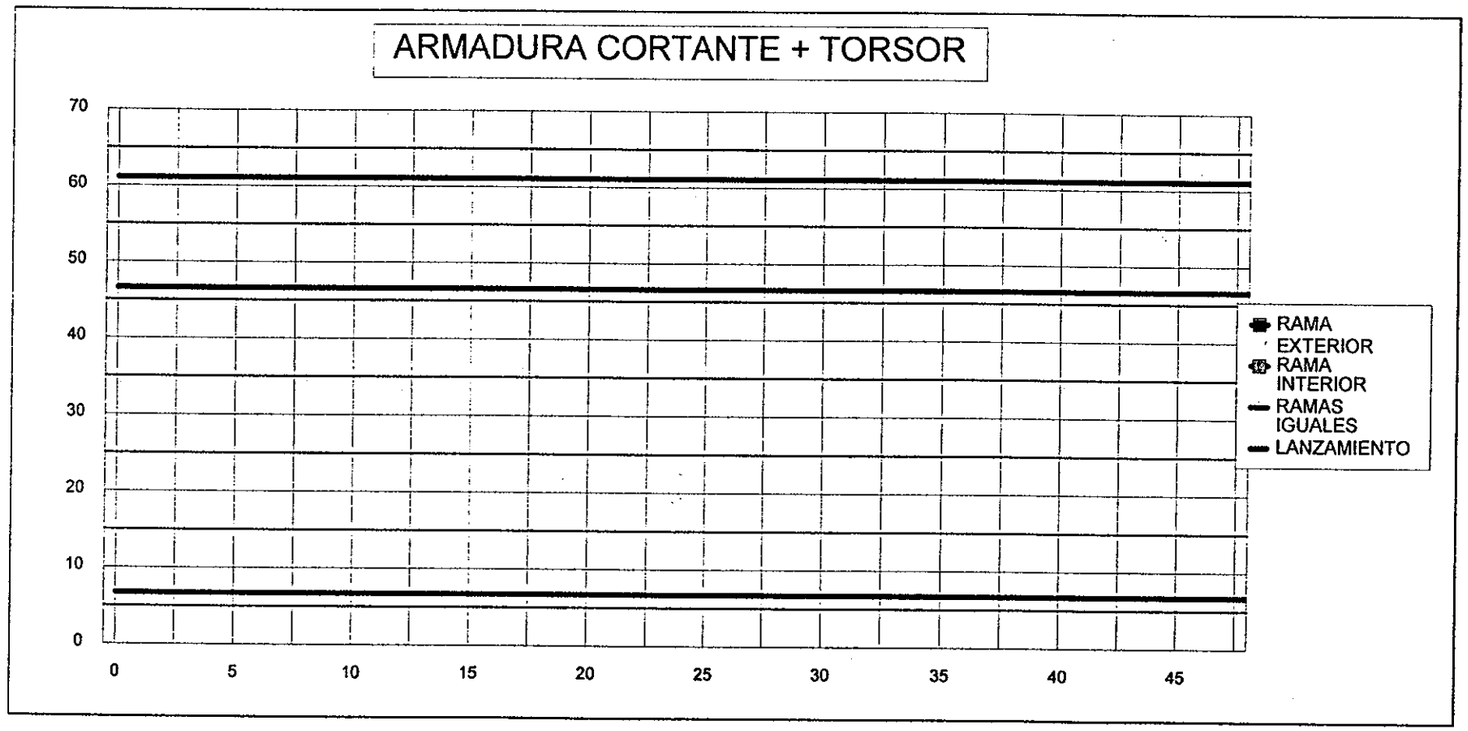
cotg(THETA) 1.80 num ramas= 4.00

SECCIÓN		Vrd CON SC	Vrd CON SC/2	Vcu	------total------ Vsu CON SC	Vsu CON SC/2		-----por rama---- U90/ramas CON SC	U90/ramas CON SC/2
1	0.00	1663.87	1663.87	554.00	1109.87	1109.87	0.28	43.36	43.36
2	2.40	1427.18	1427.18	554.00	873.18	873.18	0.28	34.11	34.11
3	4.80	1195.17	1195.17	554.00	641.17	641.17	0.28	25.05	25.05
4	7.20	965.51	965.51	554.00	411.51	411.51	0.28	16.08	16.08
5	9.60	735.84	735.84	554.00	181.84	181.84	0.28	7.10	7.10
6	12.00	1194.23	1194.23	554.00	640.23	640.23	0.28	25.01	25.01
7	14.40	964.57	964.57	554.00	410.57	410.57	0.28	16.04	16.04
8	16.80	734.90	734.90	554.00	180.90	180.90	0.28	7.07	7.07
9	19.20	508.98	508.98	554.00	0.00	0.00	0.28	0.00	0.00
10	21.60	334.68	334.68	554.00	0.00	0.00	0.28	0.00	0.00
11	24.00	160.39	160.39	554.00	0.00	0.00	0.28	0.00	0.00
12	26.40	334.68	334.68	554.00	0.00	0.00	0.28	0.00	0.00
13	28.80	508.98	508.98	554.00	0.00	0.00	0.28	0.00	0.00
14	31.20	734.90	734.90	554.00	180.90	180.90	0.28	7.07	7.07
15	33.60	964.57	964.57	554.00	410.57	410.57	0.28	16.04	16.04
16	36.00	1194.23	1194.23	554.00	640.23	640.23	0.28	25.01	25.01
17	38.40	735.84	735.84	554.00	181.84	181.84	0.28	7.10	7.10
18	40.80	965.51	965.51	554.00	411.51	411.51	0.28	16.08	16.08
19	43.20	1195.17	1195.17	554.00	641.17	641.17	0.28	25.05	25.05
20	45.60	1427.18	1427.18	554.00	873.18	873.18	0.28	34.11	34.11
21	48.00	1663.87	1663.87	554.00	1109.87	1109.87	0.28	43.36	43.36
LANZAMIENTO		769.32	769.32	425.00	344.32	344.32	0.28	13.45	13.45



CALCULO DE ARMADURA DE CORTANTE y/o TORSOR

SECCIÓN		Usu(Td)+Usu(Vsu/4) T. MAX C. ACOM	C. MAX T. ACOM	Usu/4 C. MAX	Usu min/4	INCREMENTO FLEXION CARA EXTERIOR	INCREMENTO FLEXION CARA INTERIOR	RAMAS EXTER	RAMAS INTERIOR	RAMAS IGUALES
1	0.00	58.93	58.93	43.36	12.00	61.08	46.61	61.08	46.61	61.08
2	2.40	47.78	47.78	34.11	12.00	61.08	46.61	61.08	46.61	61.08
3	4.80	36.86	36.86	25.05	12.00	61.08	46.61	61.08	46.61	61.08
4	7.20	26.37	26.37	16.08	12.00	61.08	46.61	61.08	46.61	61.08
5	9.60	15.87	15.87	7.10	12.00	61.08	46.61	61.08	46.61	61.08
6	12.00	32.26	32.26	25.01	12.00	61.08	46.61	61.08	46.61	61.08
7	14.40	21.77	21.77	16.04	12.00	61.08	46.61	61.08	46.61	61.08
8	16.80	12.22	12.22	7.07	12.00	61.08	46.61	61.08	46.61	61.08
9	19.20	5.16	5.16	0.00	12.00	61.08	46.61	61.08	46.61	61.08
10	21.60	5.16	5.16	0.00	12.00	61.08	46.61	61.08	46.61	61.08
11	24.00	4.37	4.37	0.00	12.00	61.08	46.61	61.08	46.61	61.08
12	26.40	5.16	5.16	0.00	12.00	61.08	46.61	61.08	46.61	61.08
13	28.80	5.16	5.16	0.00	12.00	61.08	46.61	61.08	46.61	61.08
14	31.20	12.22	12.22	7.07	12.00	61.08	46.61	61.08	46.61	61.08
15	33.60	22.10	22.10	16.04	12.00	61.08	46.61	61.08	46.61	61.08
16	36.00	32.34	32.34	25.01	12.00	61.08	46.61	61.08	46.61	61.08
17	38.40	15.87	15.87	7.10	12.00	61.08	46.61	61.08	46.61	61.08
18	40.80	26.37	26.37	16.08	12.00	61.08	46.61	61.08	46.61	61.08
19	43.20	36.86	36.86	25.05	12.00	61.08	46.61	61.08	46.61	61.08
20	45.60	47.78	47.78	34.11	12.00	61.08	46.61	61.08	46.61	61.08
21	48.00	58.93	58.93	43.36	12.00	61.08	46.61	61.08	46.61	61.08
LANZAMIENTO		0.00	0.00	13.45	12.00	0.00	0.00	0.00	13.45	6.73



CONDICION DE AGOTAMIENTO DEL HORMIGÓN

Td/Tu1 + Vrd/Vu1 < 1

beta 1.44

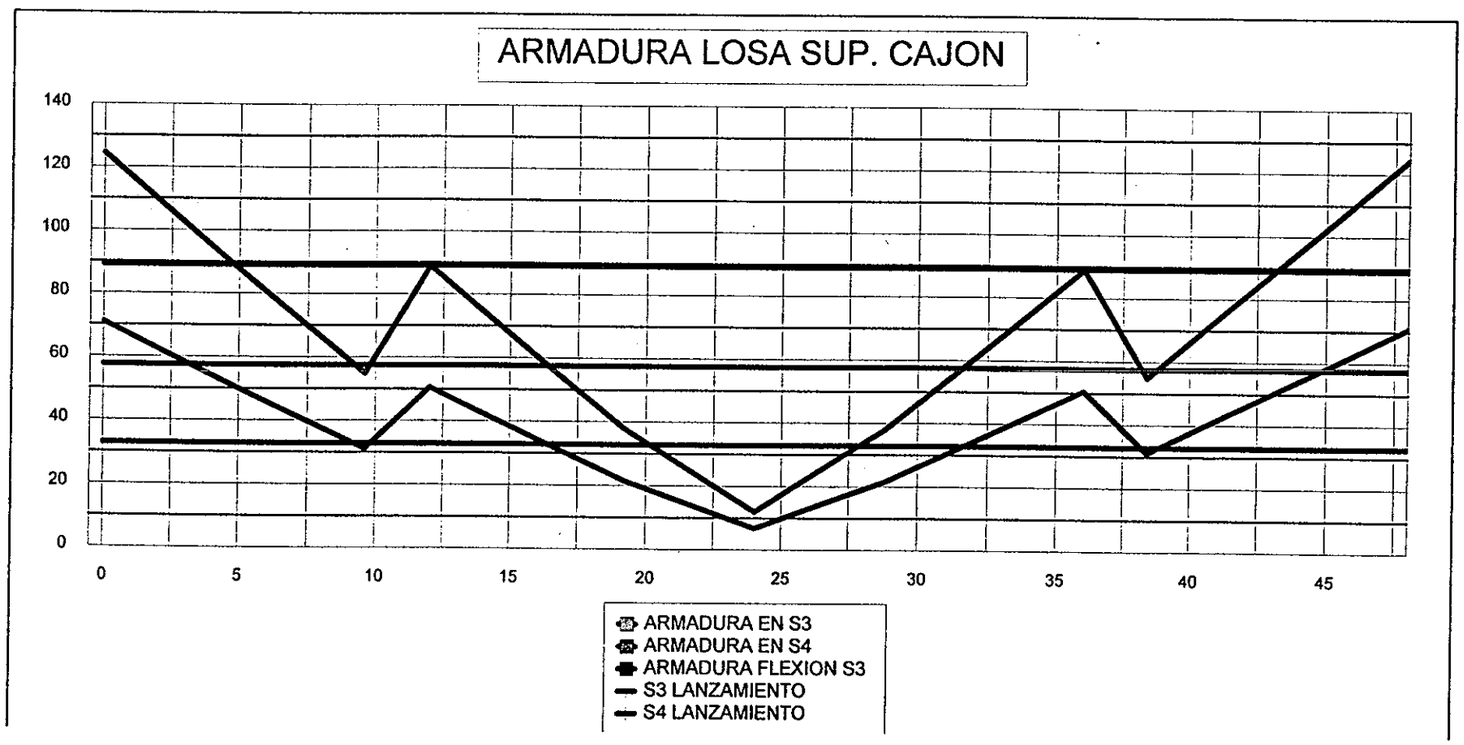
SECCIÓN		T. MAX	C. MAX	Tu1	Vu1	CONDIC.	C. ACOM	T. ACOM	Tu1	Vu1	CONDIC.
1	0.00	1127.38	1663.87	4099.67	2200.75	0.82	1127.38	1663.87	4099.67	2200.75	0.82
2	2.40	989.68	1427.18	4127.94	2200.75	0.66	989.68	1427.18	4127.94	2200.75	0.66
3	4.80	855.46	1195.17	4156.22	2200.75	0.52	855.46	1195.17	4156.22	2200.75	0.52
4	7.20	745.30	965.51	4184.49	2200.75	0.39	745.30	965.51	4184.49	2200.75	0.39
5	9.60	635.14	735.84	4212.76	2200.75	0.27	635.14	735.84	4212.76	2200.75	0.27
6	12.00	524.98	1194.23	4212.76	2200.75	0.46	524.98	1194.23	4212.76	2200.75	0.46
7	14.40	414.82	964.57	4212.76	2200.75	0.34	414.82	964.57	4212.76	2200.75	0.34
8	16.80	373.54	734.90	4212.76	2200.75	0.24	373.54	734.90	4212.76	2200.75	0.24
9	19.20	373.54	508.98	4212.76	2200.75	0.15	373.54	508.98	4212.76	2200.75	0.15
10	21.60	373.54	334.68	4212.76	2200.75	0.10	373.54	334.68	4212.76	2200.75	0.10
11	24.00	316.16	160.39	4212.76	2200.75	0.05	316.16	160.39	4212.76	2200.75	0.05
12	26.40	373.54	334.68	4212.76	2200.75	0.10	373.54	334.68	4212.76	2200.75	0.10
13	28.80	373.54	508.98	4212.76	2200.75	0.15	373.54	508.98	4212.76	2200.75	0.15
14	31.20	373.54	734.90	4212.76	2200.75	0.24	373.54	734.90	4212.76	2200.75	0.24
15	33.60	438.92	964.57	4212.76	2200.75	0.34	438.92	964.57	4212.76	2200.75	0.34
16	36.00	530.72	1194.23	4212.76	2200.75	0.46	530.72	1194.23	4212.76	2200.75	0.46
17	38.40	635.14	735.84	4212.76	2200.75	0.27	635.14	735.84	4212.76	2200.75	0.27
18	40.80	745.30	965.51	4184.49	2200.75	0.39	745.30	965.51	4184.49	2200.75	0.39
19	43.20	855.46	1195.17	4156.22	2200.75	0.52	855.46	1195.17	4156.22	2200.75	0.52
20	45.60	989.68	1427.18	4127.94	2200.75	0.66	989.68	1427.18	4127.94	2200.75	0.66
21	48.00	1127.38	1663.87	4099.67	2200.75	0.82	1127.38	1663.87	4099.67	2200.75	0.82

CALCULO DE ARMADURA LOSA SUP. CAJON S3

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	COEF=	ARMAD.TORSION U2 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1+U2)	ARMADURA FLEXION	restando arm flexion ARMADURA RESULTANTE
1	0.00	1663.87	1663.87	0.06096	101.43	101.43	0.01381	22.97	22.97	124.41	89.07	35.33
2	2.40	1427.18	1427.18	0.06096	87.00	87.00	0.01371	19.57	19.57	106.57	89.07	17.50
3	4.80	1195.17	1195.17	0.06096	72.86	72.86	0.01362	16.28	16.28	89.14	89.07	0.06
4	7.20	965.51	965.51	0.06096	58.86	58.86	0.01353	13.06	13.06	71.92	89.07	0.00
5	9.60	735.84	735.84	0.06096	44.86	44.86	0.01344	9.89	9.89	54.75	89.07	0.00
6	12.00	1194.23	1194.23	0.06096	72.80	72.80	0.01344	16.05	16.05	88.85	89.07	0.00
7	14.40	964.57	964.57	0.06096	58.80	58.80	0.01344	12.96	12.96	71.76	89.07	0.00
8	16.80	734.90	734.90	0.06096	44.80	44.80	0.01344	9.87	9.87	54.68	89.07	0.00
9	19.20	508.98	508.98	0.06096	31.03	31.03	0.01344	6.84	6.84	37.87	89.07	0.00
10	21.60	334.68	334.68	0.06096	20.40	20.40	0.01344	4.50	4.50	24.90	89.07	0.00
11	24.00	160.39	160.39	0.06096	9.78	9.78	0.01344	2.15	2.15	11.93	89.07	0.00
12	26.40	334.68	334.68	0.06096	20.40	20.40	0.01344	4.50	4.50	24.90	89.07	0.00
13	28.80	508.98	508.98	0.06096	31.03	31.03	0.01344	6.84	6.84	37.87	89.07	0.00
14	31.20	734.90	734.90	0.06096	44.80	44.80	0.01344	9.87	9.87	54.68	89.07	0.00
15	33.60	964.57	964.57	0.06096	58.80	58.80	0.01344	12.96	12.96	71.76	89.07	0.00
16	36.00	1194.23	1194.23	0.06096	72.80	72.80	0.01344	16.05	16.05	88.85	89.07	0.00
17	38.40	735.84	735.84	0.06096	44.86	44.86	0.01344	9.89	9.89	54.75	89.07	0.00
18	40.80	965.51	965.51	0.06096	58.86	58.86	0.01353	13.06	13.06	71.92	89.07	0.00
19	43.20	1195.17	1195.17	0.06096	72.86	72.86	0.01362	16.28	16.28	89.14	89.07	0.06
20	45.60	1427.18	1427.18	0.06096	87.00	87.00	0.01371	19.57	19.57	106.57	89.07	17.50
21	48.00	1663.87	1663.87	0.06096	101.43	101.43	0.01381	22.97	22.97	124.41	89.07	35.33
LANZAMIENTO		769.32	769.32	0.06096	46.90	46.90	0.01381	10.62	10.62	57.52	0.00	57.52

CALCULO DE ARMADURA LOSA SUP. CAJON S4

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	COEF=	ARMAD.TORSION U2 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1+U2)	ARMADURA FLEXION	restando arm flexion ARMADURA RESULTANTE
1	0.00	1663.87	1663.87	0.02883	47.97	47.97	0.01381	22.97	22.97	70.94	44.54	26.40
2	2.40	1427.18	1427.18	0.02883	41.14	41.14	0.01371	19.57	19.57	60.71	44.54	16.18
3	4.80	1195.17	1195.17	0.02883	34.46	34.46	0.01362	16.28	16.28	50.73	44.54	6.20
4	7.20	965.51	965.51	0.02883	27.83	27.83	0.01353	13.06	13.06	40.89	44.54	0.00
5	9.60	735.84	735.84	0.02883	21.21	21.21	0.01344	9.89	9.89	31.10	44.54	0.00
6	12.00	1194.23	1194.23	0.02883	34.43	34.43	0.01344	16.05	16.05	50.47	44.54	5.94
7	14.40	964.57	964.57	0.02883	27.81	27.81	0.01344	12.96	12.96	40.77	44.54	0.00
8	16.80	734.90	734.90	0.02883	21.19	21.19	0.01344	9.87	9.87	31.06	44.54	0.00
9	19.20	508.98	508.98	0.02883	14.67	14.67	0.01344	6.84	6.84	21.51	44.54	0.00
10	21.60	334.68	334.68	0.02883	9.65	9.65	0.01344	4.50	4.50	14.15	44.54	0.00
11	24.00	160.39	160.39	0.02883	4.62	4.62	0.01344	2.15	2.15	6.78	44.54	0.00
12	26.40	334.68	334.68	0.02883	9.65	9.65	0.01344	4.50	4.50	14.15	44.54	0.00
13	28.80	508.98	508.98	0.02883	14.67	14.67	0.01344	6.84	6.84	21.51	44.54	0.00
14	31.20	734.90	734.90	0.02883	21.19	21.19	0.01344	9.87	9.87	31.06	44.54	0.00
15	33.60	964.57	964.57	0.02883	27.81	27.81	0.01344	12.96	12.96	40.77	44.54	0.00
16	36.00	1194.23	1194.23	0.02883	34.43	34.43	0.01344	16.05	16.05	50.47	44.54	5.94
17	38.40	735.84	735.84	0.02883	21.21	21.21	0.01344	9.89	9.89	31.10	44.54	0.00
18	40.80	965.51	965.51	0.02883	27.83	27.83	0.01353	13.06	13.06	40.89	44.54	0.00
19	43.20	1195.17	1195.17	0.02883	34.46	34.46	0.01362	16.28	16.28	50.73	44.54	6.20
20	45.60	1427.18	1427.18	0.02883	41.14	41.14	0.01371	19.57	19.57	60.71	44.54	16.18
21	48.00	1663.87	1663.87	0.02883	47.97	47.97	0.01381	22.97	22.97	70.94	44.54	26.40
LANZAMIENTO		769.32	769.32	0.02883	22.18	22.18	0.01381	10.62	10.62	32.80	0.00	32.80

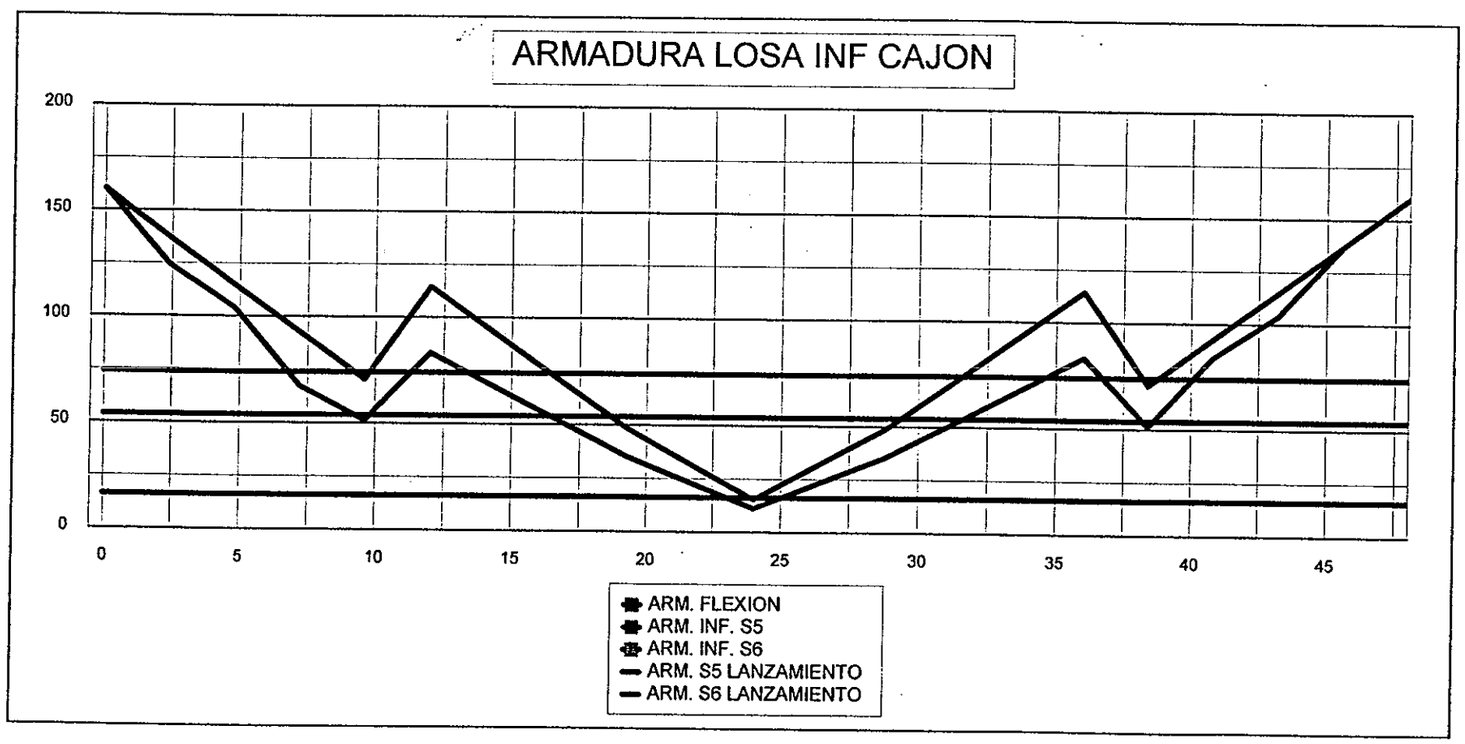


CALCULO DE ARMADURA LOSA INF. CAJON S5

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	COEF=	ARMAD. TORSION U2 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1+U2)	ARMADURA FLEXION	restando arm flexion ARMADURA RESULTANTE
1	0.00	1663.87	1663.87	0.08240	137.11	137.11	0.01381	22.97	22.97	160.08	16.23	143.85
2	2.40	1427.18	1427.18	0.08240	117.60	117.60	0.01371	19.57	19.57	137.17	16.23	120.95
3	4.80	1195.17	1195.17	0.08240	98.49	98.49	0.01362	16.28	16.28	114.76	16.23	98.54
4	7.20	965.51	965.51	0.08240	79.56	79.56	0.01353	13.06	13.06	92.62	16.23	76.39
5	9.60	735.84	735.84	0.08240	60.64	60.64	0.01344	9.89	9.89	70.52	16.23	54.29
6	12.00	1194.23	1194.23	0.08240	98.41	98.41	0.01344	16.05	16.05	114.45	16.23	98.23
7	14.40	964.57	964.57	0.08240	79.48	79.48	0.01344	12.96	12.96	92.44	16.23	76.22
8	16.80	734.90	734.90	0.08240	60.56	60.56	0.01344	9.87	9.87	70.43	16.23	54.20
9	19.20	508.98	508.98	0.08240	41.94	41.94	0.01344	6.84	6.84	48.78	16.23	32.55
10	21.60	334.68	334.68	0.08240	27.58	27.58	0.01344	4.50	4.50	32.08	16.23	15.85
11	24.00	160.39	160.39	0.08240	13.22	13.22	0.01344	2.15	2.15	15.37	16.23	0.00
12	26.40	334.68	334.68	0.08240	27.58	27.58	0.01344	4.50	4.50	32.08	16.23	15.85
13	28.80	508.98	508.98	0.08240	41.94	41.94	0.01344	6.84	6.84	48.78	16.23	32.55
14	31.20	734.90	734.90	0.08240	60.56	60.56	0.01344	9.87	9.87	70.43	16.23	54.20
15	33.60	964.57	964.57	0.08240	79.48	79.48	0.01344	12.96	12.96	92.44	16.23	76.22
16	36.00	1194.23	1194.23	0.08240	98.41	98.41	0.01344	16.05	16.05	114.45	16.23	98.23
17	38.40	735.84	735.84	0.08240	60.64	60.64	0.01344	9.89	9.89	70.52	16.23	54.29
18	40.80	965.51	965.51	0.08240	79.56	79.56	0.01353	13.06	13.06	92.62	16.23	76.39
19	43.20	1195.17	1195.17	0.08240	98.49	98.49	0.01362	16.28	16.28	114.76	16.23	98.54
20	45.60	1427.18	1427.18	0.08240	117.60	117.60	0.01371	19.57	19.57	137.17	16.23	120.95
21	48.00	1663.87	1663.87	0.08240	137.11	137.11	0.01381	22.97	22.97	160.08	16.23	143.85
LANZAMIENTO		769.32	769.32	0.08240	63.39	63.39	0.01381	10.62	10.62	74.02	0.00	74.02

CALCULO DE ARMADURA LOSA INF. CAJON S6

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	COEF=	ARMAD. TORSION U2 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1+U2)	ARMADURA FLEXION	restando arm flexion ARMADURA RESULTANTE
1	0.00	1663.87	1663.87	0.08240	137.11	137.11	0.01381	22.97	22.97	160.08	11.04	149.04
2	2.40	1427.18	1427.18	0.07334	104.67	104.67	0.01371	19.57	19.57	124.24	11.04	113.20
3	4.80	1195.17	1195.17	0.07334	87.66	87.66	0.01362	16.28	16.28	103.93	11.04	92.89
4	7.20	965.51	965.51	0.05624	54.30	54.30	0.01353	13.06	13.06	67.36	11.04	56.31
5	9.60	735.84	735.84	0.05624	41.38	41.38	0.01344	9.89	9.89	51.27	11.04	40.22
6	12.00	1194.23	1194.23	0.05624	67.16	67.16	0.01344	16.05	16.05	83.21	11.04	72.16
7	14.40	964.57	964.57	0.05624	54.24	54.24	0.01344	12.96	12.96	67.20	11.04	56.16
8	16.80	734.90	734.90	0.05624	41.33	41.33	0.01344	9.87	9.87	51.20	11.04	40.16
9	19.20	508.98	508.98	0.05624	28.62	28.62	0.01344	6.84	6.84	35.46	11.04	24.42
10	21.60	334.68	334.68	0.05624	18.82	18.82	0.01344	4.50	4.50	23.32	11.04	12.28
11	24.00	160.39	160.39	0.05624	9.02	9.02	0.01344	2.15	2.15	11.17	11.04	0.13
12	26.40	334.68	334.68	0.05624	18.82	18.82	0.01344	4.50	4.50	23.32	11.04	12.28
13	28.80	508.98	508.98	0.05624	28.62	28.62	0.01344	6.84	6.84	35.46	11.04	24.42
14	31.20	734.90	734.90	0.05624	41.33	41.33	0.01344	9.87	9.87	51.20	11.04	40.16
15	33.60	964.57	964.57	0.05624	54.24	54.24	0.01344	12.96	12.96	67.20	11.04	56.16
16	36.00	1194.23	1194.23	0.05624	67.16	67.16	0.01344	16.05	16.05	83.21	11.04	72.16
17	38.40	735.84	735.84	0.05624	41.38	41.38	0.01344	9.89	9.89	51.27	11.04	40.22
18	40.80	965.51	965.51	0.07334	70.81	70.81	0.01353	13.06	13.06	83.87	11.04	72.83
19	43.20	1195.17	1195.17	0.07334	87.66	87.66	0.01362	16.28	16.28	103.93	11.04	92.89
20	45.60	1427.18	1427.18	0.08240	117.60	117.60	0.01371	19.57	19.57	137.17	11.04	126.13
21	48.00	1663.87	1663.87	0.08240	137.11	137.11	0.01381	22.97	22.97	160.08	11.04	149.04
LANZAMIENTO		769.32	769.32	0.05624	43.26	43.26	0.01381	10.62	10.62	53.89	0.00	53.89

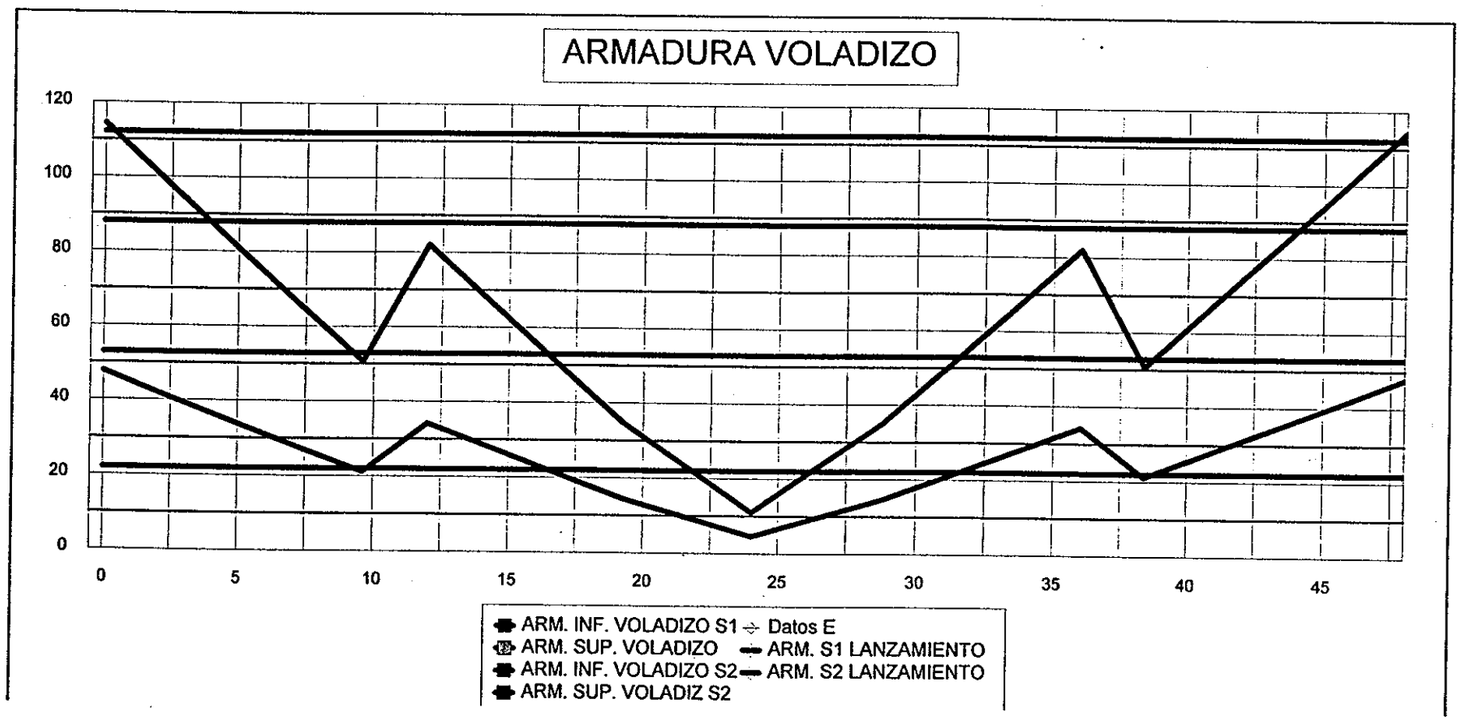


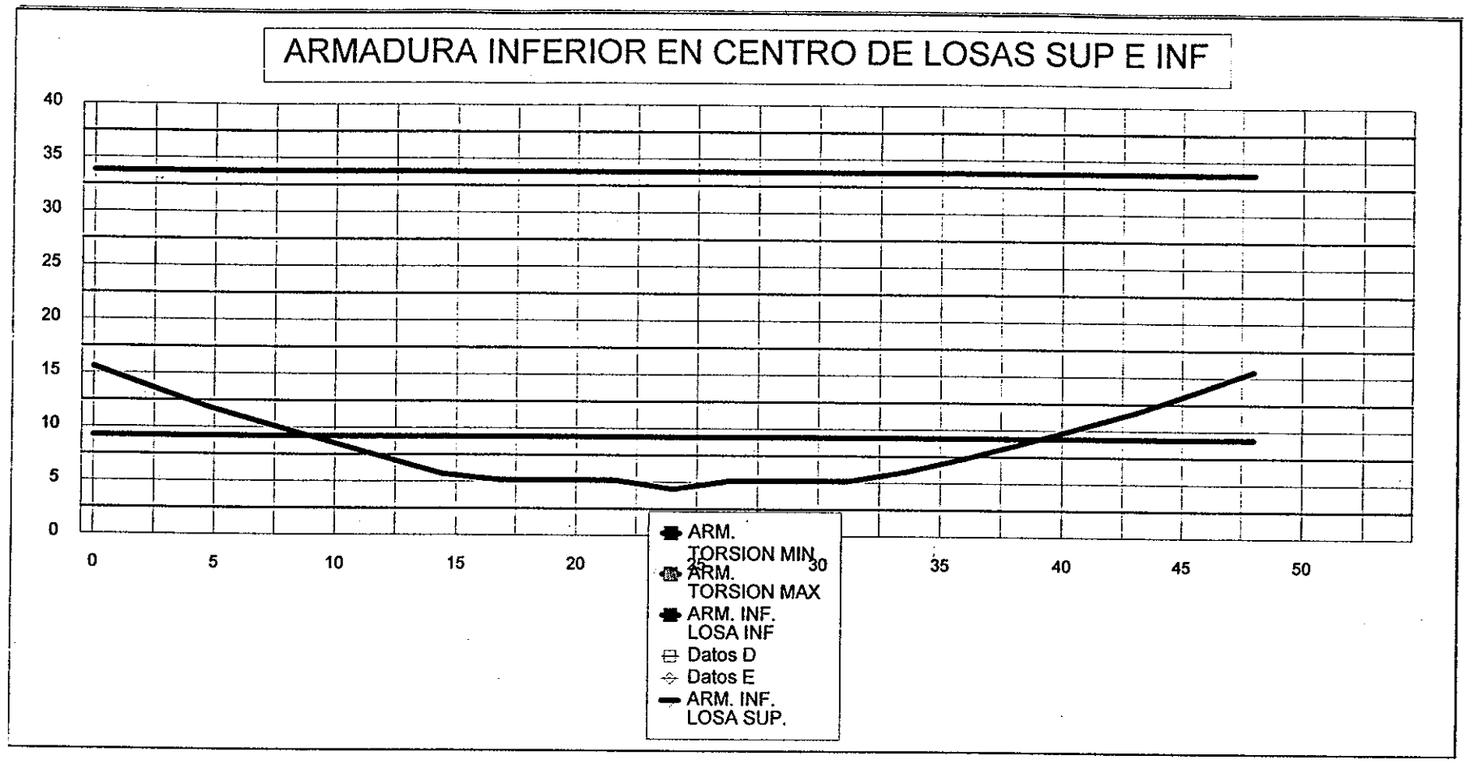
CALCULO DE ARMADURA DE VOLADIZO S1

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1)	ARMADURA FLEXION CARA SUPERIOR	ARMADURA DIFERENCIA CARA INFERIOR
1	0.00	1663.87	1663.87	0.02866	47.69	47.69	47.69	88.00	0.00
2	2.40	1427.18	1427.18	0.02866	40.91	40.91	40.91	88.00	0.00
3	4.80	1195.17	1195.17	0.02866	34.26	34.26	34.26	88.00	0.00
4	7.20	965.51	965.51	0.02866	27.67	27.67	27.67	88.00	0.00
5	9.60	735.84	735.84	0.02866	21.09	21.09	21.09	88.00	0.00
6	12.00	1194.23	1194.23	0.02866	34.23	34.23	34.23	88.00	0.00
7	14.40	964.57	964.57	0.02866	27.65	27.65	27.65	88.00	0.00
8	16.80	734.90	734.90	0.02866	21.06	21.06	21.06	88.00	0.00
9	19.20	508.98	508.98	0.02866	14.59	14.59	14.59	88.00	0.00
10	21.60	334.68	334.68	0.02866	9.59	9.59	9.59	88.00	0.00
11	24.00	160.39	160.39	0.02866	4.60	4.60	4.60	88.00	0.00
12	26.40	334.68	334.68	0.02866	9.59	9.59	9.59	88.00	0.00
13	28.80	508.98	508.98	0.02866	14.59	14.59	14.59	88.00	0.00
14	31.20	734.90	734.90	0.02866	21.06	21.06	21.06	88.00	0.00
15	33.60	964.57	964.57	0.02866	27.65	27.65	27.65	88.00	0.00
16	36.00	1194.23	1194.23	0.02866	34.23	34.23	34.23	88.00	0.00
17	38.40	735.84	735.84	0.02866	21.09	21.09	21.09	88.00	0.00
18	40.80	965.51	965.51	0.02866	27.67	27.67	27.67	88.00	0.00
19	43.20	1195.17	1195.17	0.02866	34.26	34.26	34.26	88.00	0.00
20	45.60	1427.18	1427.18	0.02866	40.91	40.91	40.91	88.00	0.00
21	48.00	1663.87	1663.87	0.02866	47.69	47.69	47.69	88.00	0.00
LANZAMIENTO		769.32	769.32	0.02866	22.05	22.05	22.05	0.00	22.05

CALCULO DE ARMADURA DE VOLADIZO S2

SECCION		Vrd CON SC	CON SC/2	COEF=	ARMAD.RASANTE U1 CON SC	CON SC/2	ARMADURA TANGENCIAL MAX(U1)	ARMADURA FLEXION CARA SUPERIOR	ARMADURA DIFERENCIA CARA INFERIOR
1	0.00	1663.87	1663.87	0.06872	114.35	114.35	114.35	112.16	2.19
2	2.40	1427.18	1427.18	0.06872	98.08	98.08	98.08	112.16	0.00
3	4.80	1195.17	1195.17	0.06872	82.14	82.14	82.14	112.16	0.00
4	7.20	965.51	965.51	0.06872	66.35	66.35	66.35	112.16	0.00
5	9.60	735.84	735.84	0.06872	50.57	50.57	50.57	112.16	0.00
6	12.00	1194.23	1194.23	0.06872	82.07	82.07	82.07	112.16	0.00
7	14.40	964.57	964.57	0.06872	66.29	66.29	66.29	112.16	0.00
8	16.80	734.90	734.90	0.06872	50.51	50.51	50.51	112.16	0.00
9	19.20	508.98	508.98	0.06872	34.98	34.98	34.98	112.16	0.00
10	21.60	334.68	334.68	0.06872	23.00	23.00	23.00	112.16	0.00
11	24.00	160.39	160.39	0.06872	11.02	11.02	11.02	112.16	0.00
12	26.40	334.68	334.68	0.06872	23.00	23.00	23.00	112.16	0.00
13	28.80	508.98	508.98	0.06872	34.98	34.98	34.98	112.16	0.00
14	31.20	734.90	734.90	0.06872	50.51	50.51	50.51	112.16	0.00
15	33.60	964.57	964.57	0.06872	66.29	66.29	66.29	112.16	0.00
16	36.00	1194.23	1194.23	0.06872	82.07	82.07	82.07	112.16	0.00
17	38.40	735.84	735.84	0.06872	50.57	50.57	50.57	112.16	0.00
18	40.80	965.51	965.51	0.06872	66.35	66.35	66.35	112.16	0.00
19	43.20	1195.17	1195.17	0.06872	82.14	82.14	82.14	112.16	0.00
20	45.60	1427.18	1427.18	0.06872	98.08	98.08	98.08	112.16	0.00
21	48.00	1663.87	1663.87	0.06872	114.35	114.35	114.35	112.16	2.19
LANZAMIENTO		769.32	769.32	0.06872	52.87	52.87	52.87	0.00	52.87




ARMADURA INFERIOR EN CENTRO DE LOSAS SUP E INF
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35
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ARM. TORSION MIN.
ARM. TORSION MAX
ARM. INF. LOSA INF
Datos D
Datos E
ARM. INF. LOSA SUP.

CALCULO DE ZONA DE DESVIADORES

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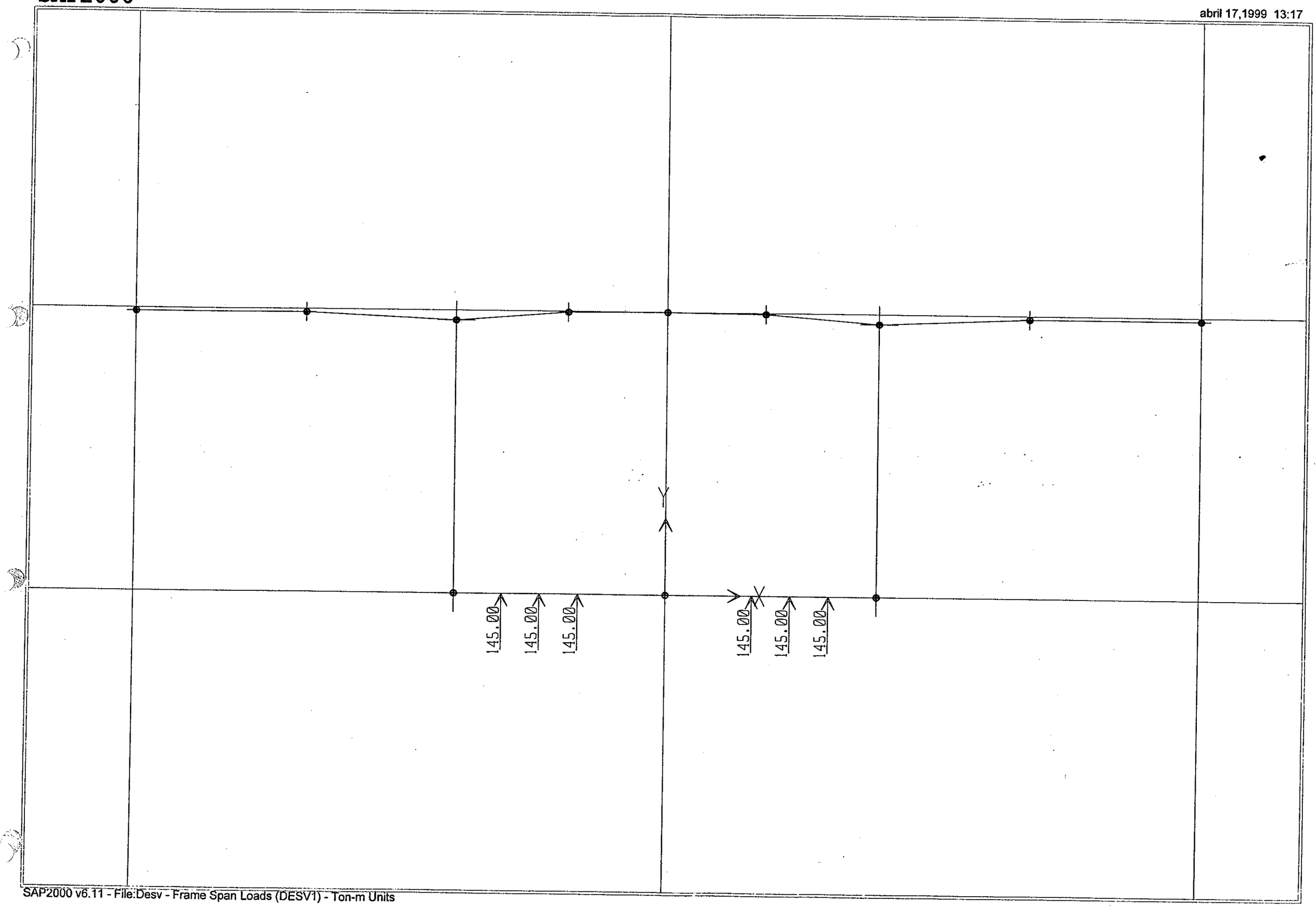

SAP2000 v6.11 - File:Desv - Frame Span Loads (DESV1) - Ton-m Units

CALCULO TRANSVERSAL VIADUCTO N§ 2 AVE

S T A T I C L O A D C A S E S

STATIC CASE	CASE TYPE	SELF WT FACTOR
DESV	DEAD	0.0000
DESV1	DEAD	0.0000

CALCULO TRANSVERSAL VIADUCTO N$ 2 AVE

J O I N T D A T A

JOINT	GLOBAL-X	GLOBAL-Y	GLOBAL-Z	RESTRAINTS	ANGLE-A	ANGLE-B	ANGLE-C
1	-7.00000	3.65500	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
2	-4.75500	3.65500	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
3	-2.77500	3.57000	0.00000	1 1 1 0 0 0	0.000	0.000	0.000
4	-1.30300	3.68700	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
5	0.00000	3.70000	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
6	1.30300	3.68700	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
7	2.77500	3.57000	0.00000	0 1 1 0 0 0	0.000	0.000	0.000
8	4.75300	3.65500	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
9	6.99800	3.65500	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
10	-2.77500	0.00000	0.00000	1 0 1 0 0 0	0.000	0.000	0.000
11	0.00000	0.00000	0.00000	0 0 1 1 1 0	0.000	0.000	0.000
12	2.77500	0.00000	0.00000	1 0 1 0 0 0	0.000	0.000	0.000

CALCULO TRANSVERSAL VIADUCTO N$ 2 AVE

F R A M E E L E M E N T D A T A

FRAME	JNT-1	JNT-2	SECTION	ANGLE	RELEASES	SEGMENTS	R1	R2	FACTOR	LENGTH
1	1	2	DESV	-90.000	000000	4	0.000	0.000	0.000	2.245
2	2	3	9	-90.000	000000	4	0.000	0.000	0.000	1.982
3	3	4	10	-90.000	000000	4	0.000	0.000	0.000	1.477
4	4	5	11	-90.000	000000	4	0.000	0.000	0.000	1.303
5	5	6	12	-90.000	000000	4	0.000	0.000	0.000	1.303
6	6	7	13	-90.000	000000	4	0.000	0.000	0.000	1.477
7	7	8	14	-90.000	000000	4	0.000	0.000	0.000	1.980
8	8	9	15	-90.000	000000	4	0.000	0.000	0.000	2.245
9	10	3	6	-90.000	000000	4	0.000	0.000	0.000	3.570
10	12	7	6	-90.000	000000	4	0.000	0.000	0.000	3.570
11	10	11	DESV	90.000	000000	4	0.000	0.000	0.000	2.775
12	11	12	DESV	90.000	000000	4	0.000	0.000	0.000	2.775

CALCULO TRANSVERSAL VIADUCTO N$ 2 AVE

F R A M E S P A N P O I N T L O A D S Load Case DESV1

FRAME	TYPE	DIRECTION	DISTANCE	VALUE
11	FORCE	GLOBAL-Y	0.2252	145.0000
11	FORCE	GLOBAL-Y	0.4054	145.0000
11	FORCE	GLOBAL-Y	0.5856	145.0000
12	FORCE	GLOBAL-Y	0.4144	145.0000
12	FORCE	GLOBAL-Y	0.5946	145.0000
12	FORCE	GLOBAL-Y	0.7748	145.0000

CALCULO TRANSVERSAL VIADUCTO N§ 2 AVE

J O I N T D I S P L A C E M E N T S

JOINT	LOAD	UX	UY	UZ	RX	RY	RZ
1	DESV1	1.094E-04	5.439E-03	0.0000	0.0000	0.0000	-1.287E-03
2	DESV1	1.094E-04	2.549E-03	0.0000	0.0000	0.0000	-1.287E-03
3	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	-1.287E-03
4	DESV1	1.510E-04	-1.639E-03	0.0000	0.0000	0.0000	-8.141E-04
5	DESV1	1.780E-04	-2.128E-03	0.0000	0.0000	0.0000	2.763E-05
6	DESV1	2.054E-04	-1.585E-03	0.0000	0.0000	0.0000	8.213E-04
7	DESV1	3.521E-04	0.0000	0.0000	0.0000	0.0000	1.211E-03
8	DESV1	2.492E-04	2.396E-03	0.0000	0.0000	0.0000	1.211E-03
9	DESV1	2.492E-04	5.116E-03	0.0000	0.0000	0.0000	1.211E-03
10	DESV1	0.0000	4.758E-04	0.0000	0.0000	0.0000	3.052E-03
11	DESV1	0.0000	6.490E-03	0.0000	0.0000	0.0000	4.436E-06
12	DESV1	0.0000	4.738E-04	0.0000	0.0000	0.0000	-3.077E-03

CALCULO TRANSVERSAL VIADUCTO N§ 2 AVE

J O I N T R E A C T I O N S

JOINT	LOAD	F1	F2	F3	M1	M2	M3
1	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	DESV1	2.4098	-436.5501	0.0000	0.0000	0.0000	0.0000
4	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	DESV1	0.0000	-433.4499	0.0000	0.0000	0.0000	0.0000
8	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	DESV1	-43.8582	0.0000	0.0000	0.0000	0.0000	0.0000
11	DESV1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	DESV1	41.4484	0.0000	0.0000	0.0000	0.0000	0.0000

CALCULO TRANSVERSAL VIADUCTO N$ 2 AVE

F R A M E E L E M E N T F O R C E S

FRAME	LOAD	LOC	P	V2	V3	T	M2	M3
1	DESV1							
		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		5.6E-01	0.00	0.00	0.00	0.00	0.00	0.00
		1.12	0.00	0.00	0.00	0.00	0.00	0.00
		1.68	0.00	0.00	0.00	0.00	0.00	0.00
		2.24	0.00	0.00	0.00	0.00	0.00	0.00
2	DESV1							
		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		5.0E-01	0.00	0.00	0.00	0.00	0.00	0.00
		9.9E-01	0.00	0.00	0.00	0.00	0.00	0.00
		1.49	0.00	0.00	0.00	0.00	0.00	0.00
		1.98	0.00	0.00	0.00	0.00	0.00	0.00
3	DESV1							
		0.00	41.37	-2.65	0.00	0.00	0.00	11.19
		3.7E-01	41.37	-2.65	0.00	0.00	0.00	12.17
		7.4E-01	41.37	-2.65	0.00	0.00	0.00	13.15
		1.11	41.37	-2.65	0.00	0.00	0.00	14.13
		1.48	41.37	-2.65	0.00	0.00	0.00	15.11
4	DESV1							
		0.00	41.45	2.184E-01	0.00	0.00	0.00	15.11
		3.3E-01	41.45	2.184E-01	0.00	0.00	0.00	15.04
		6.5E-01	41.45	2.184E-01	0.00	0.00	0.00	14.97
		9.8E-01	41.45	2.184E-01	0.00	0.00	0.00	14.90
		1.30	41.45	2.184E-01	0.00	0.00	0.00	14.83
5	DESV1							
		0.00	41.44	1.05	0.00	0.00	0.00	14.83
		3.3E-01	41.44	1.05	0.00	0.00	0.00	14.49
		6.5E-01	41.44	1.05	0.00	0.00	0.00	14.15
		9.8E-01	41.44	1.05	0.00	0.00	0.00	13.81
		1.30	41.44	1.05	0.00	0.00	0.00	13.47
6	DESV1							
		0.00	41.27	3.91	0.00	0.00	0.00	13.47
		3.7E-01	41.27	3.91	0.00	0.00	0.00	12.02
		7.4E-01	41.27	3.91	0.00	0.00	0.00	10.58
		1.11	41.27	3.91	0.00	0.00	0.00	9.13
		1.48	41.27	3.91	0.00	0.00	0.00	7.69
7	DESV1							

CALCULO TRANSVERSAL VIADUCTO NS 2 AVE

F R A M E E L E M E N T F O R C E S

FRAME	LOAD	LOC	P	V2	V3	T	M2	M3
		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		4.9E-01	0.00	0.00	0.00	0.00	0.00	0.00
		9.9E-01	0.00	0.00	0.00	0.00	0.00	0.00
		1.48	0.00	0.00	0.00	0.00	0.00	0.00
		1.98	0.00	0.00	0.00	0.00	0.00	0.00
8	DESV1							
		0.00	0.00	0.00	0.00	0.00	0.00	0.00
		5.6E-01	0.00	0.00	0.00	0.00	0.00	0.00
		1.12	0.00	0.00	0.00	0.00	0.00	0.00
		1.68	0.00	0.00	0.00	0.00	0.00	0.00
		2.25	0.00	0.00	0.00	0.00	0.00	0.00
9	DESV1							
		0.00	-435.92	-43.86	0.00	0.00	0.00	-145.38
		8.9E-01	-435.92	-43.86	0.00	0.00	0.00	-106.24
		1.78	-435.92	-43.86	0.00	0.00	0.00	-67.09
		2.68	-435.92	-43.86	0.00	0.00	0.00	-27.95
		3.57	-435.92	-43.86	0.00	0.00	0.00	11.19
10	DESV1							
		0.00	-434.08	41.45	0.00	0.00	0.00	140.28
		8.9E-01	-434.08	41.45	0.00	0.00	0.00	103.29
		1.78	-434.08	41.45	0.00	0.00	0.00	66.30
		2.68	-434.08	41.45	0.00	0.00	0.00	29.31
		3.57	-434.08	41.45	0.00	0.00	0.00	-7.69
11	DESV1							
		0.00	0.00	-435.92	0.00	0.00	0.00	-145.38
		6.9E-01	0.00	-290.92	0.00	0.00	0.00	147.07
		1.39	0.00	-145.92	0.00	0.00	0.00	310.83
		2.08	0.00	-9.182E-01	0.00	0.00	0.00	345.91
		2.78	0.00	-9.182E-01	0.00	0.00	0.00	346.54
12	DESV1							
		0.00	0.00	-9.182E-01	0.00	0.00	0.00	346.54
		6.9E-01	0.00	-9.182E-01	0.00	0.00	0.00	347.18
		1.39	0.00	144.08	0.00	0.00	0.00	313.38
		2.08	0.00	289.08	0.00	0.00	0.00	150.89
		2.78	0.00	434.08	0.00	0.00	0.00	-140.28

CALCULO EN ROTURA DEL TABLERO

Oficina Técnica	PROYECTO: VIADUCTO Nº 1		
	ASUNTO:		
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA DE	

CRITERIO DE COMPROBACION EN ROTURA.

Para la comprobación del E.L.U. del tablero se han utilizado las siguientes hipótesis.

ESFUERZOS ACTUANTES:

- CARGAS PERMANENTES (Flectores)
- SOBRECARGAS (Flectores)
- Hipótesis de Frenado (Axil correspondiente)
- Pretensado exterior y barras dywidag. (Flectores y axil). En este caso no se ha utilizado el incremento de 70 Kp/cm² que establece el manual H.P. 10-96 de la ATEP.

```
L 'cm'  Q T
A
T  /
-100.000 0.000  /
100.000 0.000  /
100.000 25.000  /
50.000 25.000  /
50.000 85.000  /
-50.000 85.000  /
-50.000 25.000  /
-100.000 25.000 M 'H400'

* B 'B1'
L -45.000 81.5 45.000 81.5 11 d 32 M 'AEH500'
L -45. 40. -45. 60. 2 d 25 M 'AEH500'
L 45. 40. 45. 60. 2 d 25 M 'AEH500'
L -95.000 3. 95.000 3. 10 d 20 M 'AEH500'
L -95.000 22. 95.000 22. 10 d 20 M 'AEH500'
* S 'm' 't'  /
0.000 -346.000 0.000 0.000  /
0.000 140.800 0.000 0.000
*
```


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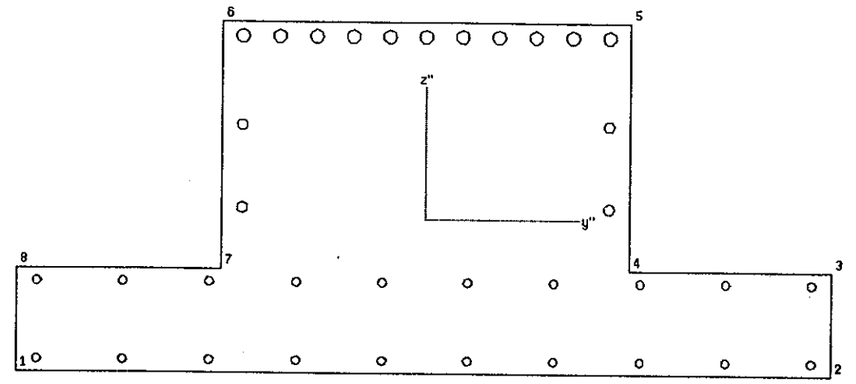

Sección :"DESVIAD" Armadura :"B1"
Tipo : tipo viga/ Genérico Unidades :[cm]

Sección parcial 1: Hormigón = H400 Coef. homogeneización= 1.00

Pto	Coord-Y	Coord-Z	Pto	Coord-Y	Coord-Z
1	-100.00	0.00	2	100.00	0.00
3	100.00	25.00	4	50.00	25.00
5	50.00	85.00	6	-50.00	85.00
7	-50.00	25.00	8	-100.00	25.00

Características mecánicas de la sección:
Area : Ax= 1.220 [m2]
Momentos de inercia : Iy= 0.085621 [m4] Iz= 0.236861 [m4]
Inercia a torsión : Ix= 0.236751 [m4] (de un círculo del mismo área)

Posición del centro de gravedad: ys= 0.000 [m] zs= 0.373336 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-1.000	-0.236861	0.194
dch.	Iz	1.000	0.236861	-0.194
abajo	Iy	-0.373	-0.229341	0.147
arriba	Iy	0.477	0.179626	-0.188

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	AEH500	(2)	88.47	-45.00	81.50	45.00	81.50	7.00
2	AEH500	(2)	9.82	-45.00	40.00	-45.00	60.00	7.00
3	AEH500	(2)	9.82	45.00	40.00	45.00	60.00	7.00
4	AEH500	(2)	31.42	-95.00	3.00	95.00	3.00	7.00
5	AEH500	(2)	31.42	-95.00	22.00	95.00	22.00	7.00
Total:			170.93	Cuantía de armadura: 1.401 [o/o]				

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionad

Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

¡No se han definido valores para el cálculo a cortante!

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H400"	380000.0	-226.600	-2.000	0.0	8.170	400.000
"AEH500"	2.10E+06	4434.700				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Cálculo Resistencia Ultima: Viga "DESVIAD"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
				-346.000	

Coeficiente de seguridad 1.019

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	100.00	0.00	-2.125	-226.600	"H400"
Armadura-Min	95.00	3.00	-1.679	-3526.073	"AEH500"
Hormigón-Max	-50.00	85.00	10.521	0.000	"H400"
Armadura-Max	-45.00	81.50	10.000	4434.700	"AEH500"

Fibra neutra zn 14.29 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 14.29 cm Zona comprimida/Canto útil 0.21

Esfuerzos (Rotura) :	Rigideces secantes:	Deformaciones:
N = 0.000 [t]	*EAx= 436561.6 [t]	3.429005E-03
My= -352.561 [tm]	EIy= 23697.1 [tm2]	-1.487781E-02 [1/m]
Mz= 0.000 [tm]	*EIz= 141232.2 [tm2]	1.222786E-13 [1/m]

(*) Rigidez tangencial !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-100.00	0.00	-2.125		-226.600	-444.357	31.92
100.00	0.00	-2.125		-226.600		
100.00	25.00	1.594		0.000		
50.00	25.00	1.594		0.000		
50.00	85.00	10.521		0.000		
-50.00	85.00	10.521		0.000		
-50.00	25.00	1.594		0.000		
-100.00	25.00	1.594		0.000		

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
1	-45.000	81.500	10.000	4434.70
	45.000	81.500	10.000	4434.70
2	-45.000	40.000	3.826	4434.70
	-45.000	60.000	6.801	4434.70
3	45.000	40.000	3.826	4434.70
	45.000	60.000	6.801	4434.70
4	-95.000	3.000	-1.679	-3526.07

	95.000	3.000	-1.679	-3526.07
5	-95.000	22.000	1.148	2410.17
	95.000	22.000	1.148	2410.17

Cálculo Resistencia Ultima: Viga "DESVIAD"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
				140.800	

Coeficiente de seguridad 1.552

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-50.00	85.00	-1.631	-218.877	"H400"
Armadura-Min	-45.00	81.50	-1.134	-2382.095	"AEH500"
Hormigón-Max	100.00	0.00	10.426	0.000	"H400"
Armadura-Max	95.00	3.00	10.000	4434.700	"AEH500"

Fibra neutra zn 73.50 cm yn -0.00 cm Angulo 0.0
Ancho zona comprim. 11.50 cm Zona comprimida/Canto útil 0.18

Esfuerzos (Rotura)		Rigideces secantes:		Deformaciones:	
N =	0.000 [t]	*EAx=	342952.2 [t]		5.130171E-03
My=	218.561 [tm]	EIy=	15409.1 [tm2]		1.418386E-02 [1/m]
Mz=	0.000 [tm]	*EIz=	25978.3 [tm2]		-4.795109E-12 [1/m]

(*) Rigidez tangencial !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-100.00	0.00	10.426		0.000	-154.694	43.48
100.00	0.00	10.426		0.000		
100.00	25.00	6.880		0.000		
50.00	25.00	6.880		0.000		
50.00	85.00	-1.631		-218.877		
-50.00	85.00	-1.631		-218.877		
-50.00	25.00	6.880		0.000		
-100.00	25.00	6.880		0.000		

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
1	-45.000	81.500	-1.134	-2382.09
	45.000	81.500	-1.134	-2382.09
2	-45.000	40.000	4.752	4434.70
	-45.000	60.000	1.915	4021.92

3	45.000	40.000	4.752	4434.70
	45.000	60.000	1.915	4021.92
4	-95.000	3.000	10.000	4434.70
	95.000	3.000	10.000	4434.70
5	-95.000	22.000	7.305	4434.70
	95.000	22.000	7.305	4434.70

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

```
L 'cm'  Q T
R 200.000 45.000 M 'H400'
* B 'B1'
L -95.000 5.000 95.000 5.000 20 d 25 M 'AEH500'
L -95.000 40.000 95.000 40.000 20 d 16 M 'AEH500'
* S 'm' 't'  /
-435.800 140.28 0.000 0.000  /
-217.500 70.14 0.000 0.000
*
```


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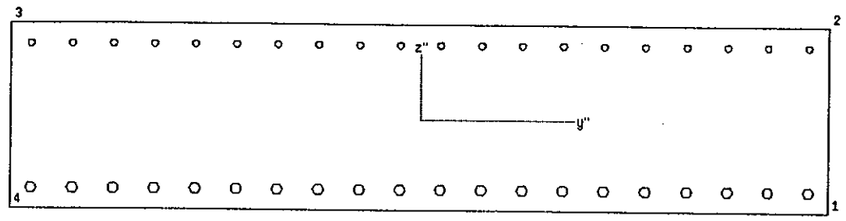


Sección :"ALMA_DES" Armadura :"B1"
Tipo : tipo viga/ Rectángulo Unidades :[cm]
Material :"H400" Coef. homogeneización: 1.00

Ancho = 200.00 cm Canto = 45.00 cm

Características mecánicas de la sección:
Area : Ax= 0.996871 [m2]
Momentos de inercia : Iy= 0.018104 [m4] Iz= 0.329142 [m4]
Inercia a torsión : Ix= 0.057753 [m4]

Posición del centro de gravedad: ys= 0.000 [m] zs= 0.217877 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-1.000	-0.329142	0.330
dch.	Iz	1.000	0.329142	-0.330
abajo	Iy	-0.218	-0.083091	0.078
arriba	Iy	0.232	0.077991	-0.083

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	AEH500	(2)	98.17	-95.00	5.00	95.00	5.00	7.00
2	AEH500	(2)	40.21	-95.00	40.00	95.00	40.00	7.00
	Total:		138.39	Cuantía de armadura: 1.388 [o/o]				

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Dimens. a cortante (valores por defecto): (Acero"AEH500"/Hormigón"H400")

Cortante	Area mín.cercos	Ancho alma ideal	Canto útil	Incl.bielas
Vz	0.00 [cm2/m]	200.00 [cm]	41.00 [cm]	0.00
Vy	0.00 [cm2/m]	45.00 [cm]	196.00 [cm]	0.00

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H400"	380000.0	-226.600	-2.000	0.0	8.170	400.000
"AEH500"	2.10E+06	4434.700				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Dimensionamiento : Viga "ALMA_DES"/"B1"

Esfuerzos (Rotura) Unidades : [tm]

N	Vy	Vz	Mx	My	Mz	Alpha
-435.800				140.280		45.0

La armadura mínima entrada es suficiente !
Armadura mínima definida con las áreas entradas ..
Factor actual de minoración de la resistencia de la sección 1.57
Factor necesario de minoración de la resistencia de la sección .. 1.00

Armadura Longitudinal:	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	dado (As-min)	dimens. [cm2]	As-nuevo [cm2]
1 "AEH500"	-95.0	5.0	95.0	5.0	98.17	-	98.17
2 "AEH500"	-95.0	40.0	95.0	40.0	40.21	-	40.21

Cuantía arm. 1.39 [o/o] Suma 138.39

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-100.00	45.00	-3.500	-226.600	"H400"
Armadura-Min	-95.00	40.00	-2.808	-4434.700	"AEH500"
Hormigón-Max	100.00	0.00	2.729	0.000	"H400"
Armadura-Max	95.00	5.00	2.037	4277.962	"AEH500"

Fibra neutra zn 19.72 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 25.28 cm Zona comprimida/Canto útil 0.63

Esfuerzos (Rotura)	: Rigideces secantes:		Deformaciones:	
N =	-685.808 [t]	EAx=	2.39150E+06 [t]	-2.867694E-04
My=	220.755 [tm]	EIy=	15947.3 [tm2]	1.384281E-02 [1/m]
Mz=	0.000 [tm]	*EIz=	171151.9 [tm2]	-1.341711E-12 [1/m]

(*) Rigidez tangencial !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
100.00	0.00	2.729		0.000	-927.605	12.70
100.00	45.00	-3.500		-226.600		
-100.00	45.00	-3.500		-226.600		
-100.00	0.00	2.729		0.000		

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
1	-95.000	5.000	2.037	4277.96
	95.000	5.000	2.037	4277.96
2	-95.000	40.000	-2.808	-4434.70
	95.000	40.000	-2.808	-4434.70

Dimensionamiento : Viga "ALMA_DES"/"B1"

Esfuerzos (Rotura) Unidades : [tm]

N	Vy	Vz	Mx	My	Mz	Alpha
-217.500				70.140		45.0

La armadura mínima entrada es suficiente !
Armadura mínima definida con las áreas entradas ..
Factor actual de minoración de la resistencia de la sección 3.15
Factor necesario de minoración de la resistencia de la sección .. 1.00

Armadura Longitudinal:	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	dado (As-min)	dimens. [cm2]	As-nuevo [cm2]
1 "AEH500"	-95.0	5.0	95.0	5.0	98.17	-	98.17
2 "AEH500"	-95.0	40.0	95.0	40.0	40.21	-	40.21
				Cuantía arm. 1.39 [o/o]	Suma		138.39

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-100.00	45.00	-3.500	-226.600	"H400"
Armadura-Min	-95.00	40.00	-2.808	-4434.700	"AEH500"
Hormigón-Max	100.00	0.00	2.732	0.000	"H400"
Armadura-Max	95.00	5.00	2.040	4283.590	"AEH500"

Fibra neutra zn 19.73 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 25.27 cm Zona comprimida/Canto útil 0.63

Esfuerzos (Rotura) :	Rigideces secantes:	Deformaciones:
N = -684.807 [t]	EAx= 2.40103E+06 [t]	-2.852142E-04
My= 220.838 [tm]	EIy= 15945.6 [tm2]	1.384951E-02 [1/m]
Mz= 0.000 [tm]	*EIz= 171099.1 [tm2]	-8.316336E-13 [1/m]

(*) Rigidez tangencial !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
100.00	0.00	2.732		0.000	-927.157	12.70
100.00	45.00	-3.500		-226.600		
-100.00	45.00	-3.500		-226.600		
-100.00	0.00	2.732		0.000		

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
1	-95.000	5.000	2.040	4283.59
	95.000	5.000	2.040	4283.59
2	-95.000	40.000	-2.808	-4434.70
	95.000	40.000	-2.808	-4434.70

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

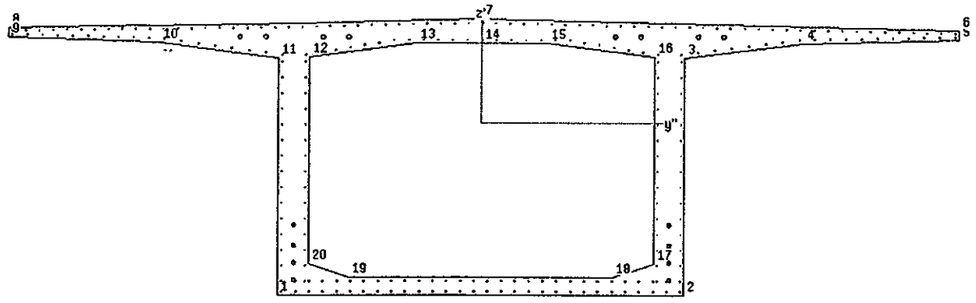
```
L 'cm'  Q T
A
T  /
-300.000 0.000  /
300.000 0.000  /
300.000 344.000  /
475.300 366.000  /
700.000 371.000  /
700.000 386.000  /
0.000 400.000  /
-700.000 386.000  /
-700.000 371.000  /
-475.300 366.000  /
-300.000 344.000 M 'H400'

W  /
-255.000 45.000  /
-195.000 25.000  /
195.000 25.000  /
255.000 45.000  /
255.000 345.000  /
97.000 365.000  /
0.000 365.000  /
-97.000 365.000  /
-255.000 345.000
* B 'B1'
P -277.500 22.000 21.000 M 'A1900' V 0.005320
P 277.500 22.000 21.000 M 'A1900' V 0.005320
P -277.500 47.000 21.000 M 'A1900' V 0.005320
P 277.500 47.000 21.000 M 'A1900' V 0.005320
P -277.500 72.000 21.000 M 'A1900' V 0.005320
P 277.500 72.000 21.000 M 'A1900' V 0.005320
P -277.500 102.000 21.000 M 'A1900' V 0.005320
P 277.500 102.000 21.000 M 'A1900' V 0.005320
P -358.000 375.000 27.000 M 'A1900' V 0.005320
P 358.000 375.000 27.000 M 'A1900' V 0.005320
P -320.000 375.000 27.000 M 'A1900' V 0.005320
P 320.000 375.000 27.000 M 'A1900' V 0.005320
P -235.000 375.000 27.000 M 'A1900' V 0.005320
P 235.000 375.000 27.000 M 'A1900' V 0.005320
P -197.000 375.000 27.000 M 'A1900' V 0.005320
P 197.000 375.000 27.000 M 'A1900' V 0.005320
L -295.000 5.000 295.000 5.000 30 d 16 M 'AEH500'
L -295.000 20.000 295.000 20.000 30 d 16 M 'AEH500'
L -695.000 381.000 0.000 395.000 35 d 12 M 'AEH500'
L 0.000 395.000 695.000 381.000 35 d 12 M 'AEH500'
L -695.000 376.000 -469.000 371.000 11 d 12 M 'AEH500'
L 469.000 371.000 695.000 376.000 11 d 12 M 'AEH500'
L -469.000 371.000 -295.000 349.000 8 d 12 M 'AEH500'
L 295.000 349.000 469.000 371.000 8 d 12 M 'AEH500'
L -260.000 349.000 -130.000 370.000 7 d 12 M 'AEH500'
L 130.000 370.000 260.000 349.000 7 d 12 M 'AEH500'
L -130.000 370.000 130.000 370.000 13 d 12 M 'AEH500'
L -295.000 20.000 -295.000 339.000 15 d 10 M 'AEH500'
L 295.000 20.000 295.000 339.000 15 d 10 M 'AEH500'
L -260.000 20.000 -260.000 339.000 15 d 10 M 'AEH500'
L 260.000 20.000 260.000 339.000 15 d 10 M 'AEH500'
* S 'm' 't'  /
```



```
-2697.020 11247.2 0.000 0.000  /
-1197.000 11247.2 0.000 0.000  /
-855.000 11247.2 0.000 0.000
*
```

Mstb. 1 : 90.0



Sección :"TAB_CEN" Armadura :"B1"
Tipo : tipo viga/ Genérico Unidades :[cm]

Sección parcial 1: Hormigón = H400 Coef. homogeneización= 1.00

Pto	Coord-Y	Coord-Z	Pto	Coord-Y	Coord-Z
1	-300.00	0.00	2	300.00	0.00
3	300.00	344.00	4	475.30	366.00
5	700.00	371.00	6	700.00	386.00
7	0.00	400.00	8	-700.00	386.00
9	-700.00	371.00	10	-475.30	366.00
11	-300.00	344.00			
Puntos aligeramiento:	12	-255.00	345.00		
13	-97.00	365.00	14	0.00	365.00
15	97.00	365.00	16	255.00	345.00
17	255.00	45.00	18	195.00	25.00
19	-195.00	25.00	20	-255.00	45.00

Características mecánicas de la sección:
Area : Ax= 9.602 [m2]
Momentos de inercia : Iy= 21.426 [m4] Iz= 88.994 [m4]
Inercia a torsión : Ix= 14.675 [m4] (de un círculo del mismo área)

Posición del centro de gravedad: ys= 0.000 [m] zs= 2.498 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-7.000	-12.713	1.324
dch.	Iz	7.000	12.713	-1.324
abajo	Iy	-2.498	-8.579	1.485
arriba	Iy	1.502	14.261	-0.893

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	A1900	(0)	21.00	-277.50	22.00			7.00
2	A1900	(0)	21.00	277.50	22.00			7.00
3	A1900	(0)	21.00	-277.50	47.00			7.00
4	A1900	(0)	21.00	277.50	47.00			7.00
5	A1900	(0)	21.00	-277.50	72.00			7.00
6	A1900	(0)	21.00	277.50	72.00			7.00

7	A1900	(0)	21.00	-277.50	102.00			7.00
8	A1900	(0)	21.00	277.50	102.00			7.00
9	A1900	(0)	27.00	-358.00	375.00			7.00
10	A1900	(0)	27.00	358.00	375.00			7.00
11	A1900	(0)	27.00	-320.00	375.00			7.00
12	A1900	(0)	27.00	320.00	375.00			7.00
13	A1900	(0)	27.00	-235.00	375.00			7.00
14	A1900	(0)	27.00	235.00	375.00			7.00
15	A1900	(0)	27.00	-197.00	375.00			7.00
16	A1900	(0)	27.00	197.00	375.00			7.00
17	AEH500	(2)	60.32	-295.00	5.00	295.00	5.00	7.00
18	AEH500	(2)	60.32	-295.00	20.00	295.00	20.00	7.00
19	AEH500	(2)	39.58	-695.00	381.00	0.00	395.00	7.00
20	AEH500	(2)	39.58	0.00	395.00	695.00	381.00	7.00
21	AEH500	(2)	12.44	-695.00	376.00	-469.00	371.00	7.00
22	AEH500	(2)	12.44	469.00	371.00	695.00	376.00	7.00
23	AEH500	(2)	9.05	-469.00	371.00	-295.00	349.00	7.00
24	AEH500	(2)	9.05	295.00	349.00	469.00	371.00	7.00
25	AEH500	(2)	7.92	-260.00	349.00	-130.00	370.00	7.00
26	AEH500	(2)	7.92	130.00	370.00	260.00	349.00	7.00
27	AEH500	(2)	14.70	-130.00	370.00	130.00	370.00	7.00
28	AEH500	(2)	11.78	-295.00	20.00	-295.00	339.00	7.00
29	AEH500	(2)	11.78	295.00	20.00	295.00	339.00	7.00
30	AEH500	(2)	11.78	-260.00	20.00	-260.00	339.00	7.00
31	AEH500	(2)	11.78	260.00	20.00	260.00	339.00	7.00

Total: 704.44 Cuantía de armadura: 0.734 [o/o]

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionad
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Armaduras pretensadas :

N°	Def.Impuesta	N°	Def.Impuesta	N°	Def.Impuesta
1	5.320E-0003	2	5.320E-0003	3	5.320E-0003
4	5.320E-0003	5	5.320E-0003	6	5.320E-0003
7	5.320E-0003	8	5.320E-0003	9	5.320E-0003
10	5.320E-0003	11	5.320E-0003	12	5.320E-0003
13	5.320E-0003	14	5.320E-0003	15	5.320E-0003
16	5.320E-0003				

¡No se han definido valores para el cálculo a cortante!

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H400"	380000.0	-226.600	-2.000	0.0	8.170	400.000
"AEH500"	2.10E+06	4434.700				
"A1900"	2.00E+06	15540.0				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Cálculo Resistencia Ultima: Viga "TAB_CEN"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
-2697.020				11247.2	

Coeficiente de seguridad 1.373

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-0.00	400.00	-1.922	-226.260	"H400"
Armadura-Min	-0.00	395.00	-1.772	-3720.271	"AEH500"
Hormigón-Max	300.00	0.00	10.151	0.000	"H400"
Armadura-Max	295.00	5.00	10.000	4434.700	"AEH500"

Fibra neutra zn 336.31 cm yn -0.00 cm Angulo 0.0
Ancho zona comprim. 63.69 cm Zona comprimida/Canto útil 0.28

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N =	-3702.148 [t]	EAx=	--1-- [t]	2.612407E-03	
My=	15438.8 [tm]	EIy=	--1-- [tm2]	3.018348E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	-1.414832E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-300.00	0.00	10.151		0.000	-8424.677	128.09
300.00	0.00	10.151		0.000		
300.00	344.00	-0.232		-49.562		
475.30	366.00	-0.896		-157.584		
700.00	371.00	-1.047		-175.167		
700.00	386.00	-1.500		-212.432		
0.00	400.00	-1.922		-226.260		
-700.00	386.00	-1.500		-212.432		
-700.00	371.00	-1.047		-175.167		
-475.30	366.00	-0.896		-157.584		
-300.00	344.00	-0.232		-49.562		
-300.00	0.00	10.151		0.000		
-255.00	345.00	-0.262		-55.556		
-97.00	365.00	-0.866		-153.757		
0.00	365.00	-0.866		-153.757		
97.00	365.00	-0.866		-153.757		
255.00	345.00	-0.262		-55.556		
255.00	45.00	8.793		0.000		
195.00	25.00	9.396		0.000		
-195.00	25.00	9.396		0.000		
-255.00	45.00	8.793		0.000		

-255.00 345.00 -0.262 -55.556

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
17	-295.000	5.000	10.000	4434.70
	295.000	5.000	10.000	4434.70
18	-295.000	20.000	9.547	4434.70
	295.000	20.000	9.547	4434.70
19	-695.000	381.000	-1.349	-2832.88
	0.000	395.000	-1.772	-3720.27
20	0.000	395.000	-1.772	-3720.27
	695.000	381.000	-1.349	-2832.88
21	-695.000	376.000	-1.198	-2515.95
	-469.000	371.000	-1.047	-2199.02
22	469.000	371.000	-1.047	-2199.02
	695.000	376.000	-1.198	-2515.95
23	-469.000	371.000	-1.047	-2199.02
	-295.000	349.000	-0.383	-804.55
24	295.000	349.000	-0.383	-804.55
	469.000	371.000	-1.047	-2199.02
25	-260.000	349.000	-0.383	-804.55
	-130.000	370.000	-1.017	-2135.64
26	130.000	370.000	-1.017	-2135.64
	260.000	349.000	-0.383	-804.55
27	-130.000	370.000	-1.017	-2135.64
	130.000	370.000	-1.017	-2135.64
28	-295.000	20.000	9.547	4434.70
	-295.000	339.000	-0.081	-170.69
29	295.000	20.000	9.547	4434.70
	295.000	339.000	-0.081	-170.69
30	-260.000	20.000	9.547	4434.70
	-260.000	339.000	-0.081	-170.69
31	260.000	20.000	9.547	4434.70
	260.000	339.000	-0.081	-170.69

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-277.500	22.000	5.320	9.487	14.807	4900.000	15540.0
2	277.500	22.000	5.320	9.487	14.807	4900.000	15540.0
3	-277.500	47.000	5.320	8.732	14.052	4900.000	15540.0
4	277.500	47.000	5.320	8.732	14.052	4900.000	15540.0
5	-277.500	72.000	5.320	7.978	13.298	4900.000	15540.0
6	277.500	72.000	5.320	7.978	13.298	4900.000	15540.0
7	-277.500	102.000	5.320	7.072	12.392	4900.000	15540.0
8	277.500	102.000	5.320	7.072	12.392	4900.000	15540.0
9	-358.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
10	358.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
11	-320.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
12	320.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
13	-235.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
14	235.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
15	-197.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224
16	197.000	375.000	5.320	-1.168	4.152	-2335.776	8304.224

Cálculo Resistencia Ultima: Viga "TAB_CEN"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
-1197.000				11247.2	

Coeficiente de seguridad 1.115

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-0.00	400.00	-1.503	-212.626	"H400"
Armadura-Min	-0.00	395.00	-1.358	-2851.214	"AEH500"
Hormigón-Max	300.00	0.00	10.146	0.000	"H400"
Armadura-Max	295.00	5.00	10.000	4434.700	"AEH500"

Fibra neutra zn 348.38 cm yn -0.00 cm Angulo 0.0
Ancho zona comprim. 51.62 cm Zona comprimida/Canto útil 0.23

Esfuerzos (Rotura) :		Rigideces secantes:		Deformaciones:	
N =	-1334.655 [t]	EAx=	--1-- [t]	2.872122E-03	
My=	12540.6 [tm]	EIy=	--1-- [tm2]	2.912236E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	-3.137229E-12	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-300.00	0.00	10.146		0.000	-6360.719	130.06
300.00	0.00	10.146		0.000		
300.00	344.00	0.128		0.000		
475.30	366.00	-0.513		-101.366		
700.00	371.00	-0.659		-124.695		
700.00	386.00	-1.096		-180.266		
0.00	400.00	-1.503		-212.626		
-700.00	386.00	-1.096		-180.266		
-700.00	371.00	-0.659		-124.695		
-475.30	366.00	-0.513		-101.366		
-300.00	344.00	0.128		0.000		
-300.00	0.00	10.146		0.000		
-255.00	345.00	0.098		0.000		
-97.00	365.00	-0.484		-96.412		
0.00	365.00	-0.484		-96.412		
97.00	365.00	-0.484		-96.412		
255.00	345.00	0.098		0.000		
255.00	45.00	8.835		0.000		
195.00	25.00	9.418		0.000		
-195.00	25.00	9.418		0.000		

-255.00	45.00	8.835		0.000
-255.00	345.00	0.098		0.000

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
17	-295.000	5.000	10.000	4434.70
	295.000	5.000	10.000	4434.70
18	-295.000	20.000	9.563	4434.70
	295.000	20.000	9.563	4434.70
19	-695.000	381.000	-0.950	-1995.02
	0.000	395.000	-1.358	-2851.21
20	0.000	395.000	-1.358	-2851.21
	695.000	381.000	-0.950	-1995.02
21	-695.000	376.000	-0.804	-1689.23
	-469.000	371.000	-0.659	-1383.45
22	469.000	371.000	-0.659	-1383.45
	695.000	376.000	-0.804	-1689.23
23	-469.000	371.000	-0.659	-1383.45
	-295.000	349.000	-0.018	-37.99
24	295.000	349.000	-0.018	-37.99
	469.000	371.000	-0.659	-1383.45
25	-260.000	349.000	-0.018	-37.99
	-130.000	370.000	-0.630	-1322.29
26	130.000	370.000	-0.630	-1322.29
	260.000	349.000	-0.018	-37.99
27	-130.000	370.000	-0.630	-1322.29
	130.000	370.000	-0.630	-1322.29
28	-295.000	20.000	9.563	4434.70
	-295.000	339.000	0.273	573.58
29	295.000	20.000	9.563	4434.70
	295.000	339.000	0.273	573.58
30	-260.000	20.000	9.563	4434.70
	-260.000	339.000	0.273	573.58
31	260.000	20.000	9.563	4434.70
	260.000	339.000	0.273	573.58

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-277.500	22.000	5.320	9.505	14.825	4900.000	15540.0
2	277.500	22.000	5.320	9.505	14.825	4900.000	15540.0
3	-277.500	47.000	5.320	8.777	14.097	4900.000	15540.0
4	277.500	47.000	5.320	8.777	14.097	4900.000	15540.0
5	-277.500	72.000	5.320	8.049	13.369	4900.000	15540.0
6	277.500	72.000	5.320	8.049	13.369	4900.000	15540.0
7	-277.500	102.000	5.320	7.175	12.495	4900.000	15540.0
8	277.500	102.000	5.320	7.175	12.495	4900.000	15540.0
9	-358.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
10	358.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
11	-320.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
12	320.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
13	-235.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
14	235.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452
15	-197.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452

16	197.000	375.000	5.320	-0.775	4.545	-1550.548	9089.452

Cálculo Resistencia Ultima: Viga "TAB_CEN"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
-855.000				11247.2	

Coeficiente de seguridad 1.069

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-0.00	400.00	-1.439	-208.787	"H400"
Armadura-Min	-0.00	395.00	-1.294	-2718.338	"AEH500"
Hormigón-Max	-300.00	0.00	10.145	0.000	"H400"
Armadura-Max	-295.00	5.00	10.000	4434.700	"AEH500"

Fibra neutra zn 350.30 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 49.70 cm Zona comprimida/Canto útil 0.22

Esfuerzos (Rotura) :	Rigideces secantes:		Deformaciones:	
N = -913.671 [t]	EAx=	--1-- [t]	2.911832E-03	
My= 12019.0 [tm]	EIy=	--1-- [tm2]	2.896012E-03	[1/m]
Mz= 0.000 [tm]	*EIz=	--1-- [tm2]	1.952557E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-300.00	0.00	10.145		0.000	-5986.380	130.45
300.00	0.00	10.145		0.000		
300.00	344.00	0.183		0.000		
475.30	366.00	-0.455		-91.306		
700.00	371.00	-0.599		-115.471		
700.00	386.00	-1.034		-173.715		
0.00	400.00	-1.439		-208.787		
-700.00	386.00	-1.034		-173.715		
-700.00	371.00	-0.599		-115.471		
-475.30	366.00	-0.455		-91.306		
-300.00	344.00	0.183		0.000		
-300.00	0.00	10.145		0.000		
-255.00	345.00	0.154		0.000		
-97.00	365.00	-0.426		-86.187		
0.00	365.00	-0.426		-86.187		
97.00	365.00	-0.426		-86.187		
255.00	345.00	0.154		0.000		
255.00	45.00	8.842		0.000		
195.00	25.00	9.421		0.000		

-195.00	25.00	9.421		0.000
-255.00	45.00	8.842		0.000
-255.00	345.00	0.154		0.000

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
17	-295.000	5.000	10.000	4434.70
	295.000	5.000	10.000	4434.70
18	-295.000	20.000	9.566	4434.70
	295.000	20.000	9.566	4434.70
19	-695.000	381.000	-0.889	-1866.91
	0.000	395.000	-1.294	-2718.34
20	0.000	395.000	-1.294	-2718.34
	695.000	381.000	-0.889	-1866.91
21	-695.000	376.000	-0.744	-1562.83
	-469.000	371.000	-0.599	-1258.75
22	469.000	371.000	-0.599	-1258.75
	695.000	376.000	-0.744	-1562.83
23	-469.000	371.000	-0.599	-1258.75
	-295.000	349.000	0.038	79.21
24	295.000	349.000	0.038	79.21
	469.000	371.000	-0.599	-1258.75
25	-260.000	349.000	0.038	79.21
	-130.000	370.000	-0.570	-1197.93
26	130.000	370.000	-0.570	-1197.93
	260.000	349.000	0.038	79.21
27	-130.000	370.000	-0.570	-1197.93
	130.000	370.000	-0.570	-1197.93
28	-295.000	20.000	9.566	4434.70
	-295.000	339.000	0.327	687.37
29	295.000	20.000	9.566	4434.70
	295.000	339.000	0.327	687.37
30	-260.000	20.000	9.566	4434.70
	-260.000	339.000	0.327	687.37
31	260.000	20.000	9.566	4434.70
	260.000	339.000	0.327	687.37

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-277.500	22.000	5.320	9.508	14.828	4900.000	15540.0
2	277.500	22.000	5.320	9.508	14.828	4900.000	15540.0
3	-277.500	47.000	5.320	8.784	14.104	4900.000	15540.0
4	277.500	47.000	5.320	8.784	14.104	4900.000	15540.0
5	-277.500	72.000	5.320	8.060	13.380	4900.000	15540.0
6	277.500	72.000	5.320	8.060	13.380	4900.000	15540.0
7	-277.500	102.000	5.320	7.191	12.511	4900.000	15540.0
8	277.500	102.000	5.320	7.191	12.511	4900.000	15540.0
9	-358.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
10	358.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
11	-320.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
12	320.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
13	-235.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
14	235.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512

15	-197.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512
16	197.000	375.000	5.320	-0.715	4.605	-1430.488	9209.512

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

```
L 'cm'  Q T
A
T  /
-300.000 0.000  /
300.000 0.000  /
300.000 344.000  /
475.300 366.000  /
700.000 371.000  /
700.000 386.000  /
0.000 400.000  /
-700.000 386.000  /
-700.000 371.000  /
-475.300 366.000  /
-300.000 344.000 M 'H400'

W  /
-255.000 75.  /
-195.000 50.  /
195.000 50.  /
255.000 75.  /
255.000 345.000  /
97.000 365.000  /
0.000 365.000  /
-97.000 365.000  /
-255.000 345.000
* B 'B1'
P -277.500 22.000 21.000 M 'A1900' V 0.005320
P 277.500 22.000 21.000 M 'A1900' V 0.005320
P -277.500 47.000 21.000 M 'A1900' V 0.005320
P 277.500 47.000 21.000 M 'A1900' V 0.005320
P -277.500 72.000 21.000 M 'A1900' V 0.005320
P 277.500 72.000 21.000 M 'A1900' V 0.005320
P -277.500 102.000 21.000 M 'A1900' V 0.005320
P 277.500 102.000 21.000 M 'A1900' V 0.005320
P -358.000 375.000 27.000 M 'A1900' V 0.005320
P 358.000 375.000 27.000 M 'A1900' V 0.005320
P -320.000 375.000 27.000 M 'A1900' V 0.005320
P 320.000 375.000 27.000 M 'A1900' V 0.005320
P -235.000 375.000 27.000 M 'A1900' V 0.005320
P 235.000 375.000 27.000 M 'A1900' V 0.005320
P -197.000 375.000 27.000 M 'A1900' V 0.005320
P 197.000 375.000 27.000 M 'A1900' V 0.005320
L -295.000 5.000 295.000 5.000 30 d 16 M 'AEH500'
L -295.000 45. 295.000 45. 30 d 16 M 'AEH500'
L -695.000 381.000 0.000 395.000 35 d 12 M 'AEH500'
L 0.000 395.000 695.000 381.000 35 d 12 M 'AEH500'
L -695.000 376.000 -469.000 371.000 11 d 12 M 'AEH500'
L 469.000 371.000 695.000 376.000 11 d 12 M 'AEH500'
L -469.000 371.000 -295.000 349.000 8 d 12 M 'AEH500'
L 295.000 349.000 469.000 371.000 8 d 12 M 'AEH500'
L -260.000 349.000 -130.000 370.000 7 d 12 M 'AEH500'
L 130.000 370.000 260.000 349.000 7 d 12 M 'AEH500'
L -130.000 370.000 130.000 370.000 13 d 12 M 'AEH500'
L -295.000 20.000 -295.000 339.000 15 d 10 M 'AEH500'
L 295.000 20.000 295.000 339.000 15 d 10 M 'AEH500'
L -260.000 20.000 -260.000 339.000 15 d 10 M 'AEH500'
L 260.000 20.000 260.000 339.000 15 d 10 M 'AEH500'
* S 'm' 't'  /
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-1197.000 -7579.7 0.000 0.000
*
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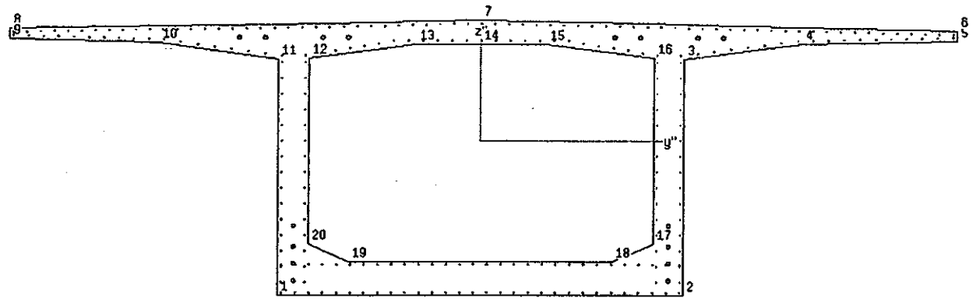


Sección :"TAB_PIL" Armadura :"B1"
Tipo : tipo viga/ Genérico Unidades :[cm]

Sección parcial 1: Hormigón = H400 Coef. homogeneización= 1.00

Pto	Coord-Y	Coord-Z	Pto	Coord-Y	Coord-Z
1	-300.00	0.00	2	300.00	0.00
3	300.00	344.00	4	475.30	366.00
5	700.00	371.00	6	700.00	386.00
7	0.00	400.00	8	-700.00	386.00
9	-700.00	371.00	10	-475.30	366.00
11	-300.00	344.00			
Puntos aligeramiento: 12			-255.00	345.00	
13	-97.00	365.00	14	0.00	365.00
15	97.00	365.00	16	255.00	345.00
17	255.00	75.00	18	195.00	50.00
19	-195.00	50.00	20	-255.00	75.00

Características mecánicas de la sección:
Area : Ax= 10.907 [m2]
Momentos de inercia : Iy= 26.432 [m4] Iz= 91.923 [m4]
Inercia a torsión : Ix= 18.935 [m4] (de un círculo del mismo área)

Posición del centro de gravedad: ys= 0.000 [m] zs= 2.248 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-7.000	-13.132	1.204
dch.	Iz	7.000	13.132	-1.204
abajo	Iy	-2.248	-11.757	1.383
arriba	Iy	1.752	15.087	-1.078

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	A1900	(0)	21.00	-277.50	22.00			7.00
2	A1900	(0)	21.00	277.50	22.00			7.00
3	A1900	(0)	21.00	-277.50	47.00			7.00
4	A1900	(0)	21.00	277.50	47.00			7.00
5	A1900	(0)	21.00	-277.50	72.00			7.00
6	A1900	(0)	21.00	277.50	72.00			7.00

7	A1900	(0)	21.00	-277.50	102.00			7.00
8	A1900	(0)	21.00	277.50	102.00			7.00
9	A1900	(0)	27.00	-358.00	375.00			7.00
10	A1900	(0)	27.00	358.00	375.00			7.00
11	A1900	(0)	27.00	-320.00	375.00			7.00
12	A1900	(0)	27.00	320.00	375.00			7.00
13	A1900	(0)	27.00	-235.00	375.00			7.00
14	A1900	(0)	27.00	235.00	375.00			7.00
15	A1900	(0)	27.00	-197.00	375.00			7.00
16	A1900	(0)	27.00	197.00	375.00			7.00
17	AEH500	(2)	60.32	-295.00	5.00	295.00	5.00	7.00
18	AEH500	(2)	60.32	-295.00	45.00	295.00	45.00	7.00
19	AEH500	(2)	39.58	-695.00	381.00	0.00	395.00	7.00
20	AEH500	(2)	39.58	0.00	395.00	695.00	381.00	7.00
21	AEH500	(2)	12.44	-695.00	376.00	-469.00	371.00	7.00
22	AEH500	(2)	12.44	469.00	371.00	695.00	376.00	7.00
23	AEH500	(2)	9.05	-469.00	371.00	-295.00	349.00	7.00
24	AEH500	(2)	9.05	295.00	349.00	469.00	371.00	7.00
25	AEH500	(2)	7.92	-260.00	349.00	-130.00	370.00	7.00
26	AEH500	(2)	7.92	130.00	370.00	260.00	349.00	7.00
27	AEH500	(2)	14.70	-130.00	370.00	130.00	370.00	7.00
28	AEH500	(2)	11.78	-295.00	20.00	-295.00	339.00	7.00
29	AEH500	(2)	11.78	295.00	20.00	295.00	339.00	7.00
30	AEH500	(2)	11.78	-260.00	20.00	-260.00	339.00	7.00
31	AEH500	(2)	11.78	260.00	20.00	260.00	339.00	7.00

Total: 704.44 Cuantía de armadura: 0.646 [o/o]

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionad
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Armaduras pretensadas :

N°	Def.Impuesta	N°	Def.Impuesta	N°	Def.Impuesta
1	5.320E-0003	2	5.320E-0003	3	5.320E-0003
4	5.320E-0003	5	5.320E-0003	6	5.320E-0003
7	5.320E-0003	8	5.320E-0003	9	5.320E-0003
10	5.320E-0003	11	5.320E-0003	12	5.320E-0003
13	5.320E-0003	14	5.320E-0003	15	5.320E-0003
16	5.320E-0003				

¡No se han definido valores para el cálculo a cortante!

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H400"	380000.0	-226.600	-2.000	0.0	8.170	400.000
"AEH500"	2.10E+06	4434.700				
"A1900"	2.00E+06	15540.0				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Cálculo Resistencia Ultima: Viga "TAB_PIL"/"B1"

Solicitación Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
-2697.020				-7579.700	

Coeficiente de seguridad 2.842

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	300.00	0.00	-3.500	-226.600	"H400"
Armadura-Min	295.00	5.00	-3.440	-4434.700	"AEH500"
Hormigón-Max	-0.00	400.00	1.301	0.000	"H400"
Armadura-Max	0.00	395.00	1.241	2605.671	"AEH500"

Fibra neutra zn 291.62 cm yn -0.00 cm Angulo 0.0
Ancho zona comprim. 291.62 cm Zona comprimida/Canto útil 0.95

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N =	-7664.297 [t]	EAx=	--1-- [t]	-8.018441E-04	
My=	-21539.7 [tm]	EIy=	--1-- [tm2]	-1.200201E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	8.702866E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-300.00	0.00	-3.500		-226.600	-10932.6	156.36
300.00	0.00	-3.500		-226.600		
300.00	344.00	0.629		0.000		
475.30	366.00	0.893		0.000		
700.00	371.00	0.953		0.000		
700.00	386.00	1.133		0.000		
0.00	400.00	1.301		0.000		
-700.00	386.00	1.133		0.000		
-700.00	371.00	0.953		0.000		
-475.30	366.00	0.893		0.000		
-300.00	344.00	0.629		0.000		
-300.00	0.00	-3.500		-226.600		
-255.00	345.00	0.641		0.000		
-97.00	365.00	0.881		0.000		
0.00	365.00	0.881		0.000		
97.00	365.00	0.881		0.000		
255.00	345.00	0.641		0.000		
255.00	75.00	-2.600		-226.600		
195.00	50.00	-2.900		-226.600		
-195.00	50.00	-2.900		-226.600		
-255.00	75.00	-2.600		-226.600		

-255.00	345.00	0.641		0.000

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
17	-295.000	5.000	-3.440	-4434.70
	295.000	5.000	-3.440	-4434.70
18	-295.000	45.000	-2.960	-4434.70
	295.000	45.000	-2.960	-4434.70
19	-695.000	381.000	1.073	2252.81
	0.000	395.000	1.241	2605.67
20	0.000	395.000	1.241	2605.67
	695.000	381.000	1.073	2252.81
21	-695.000	376.000	1.013	2126.79
	-469.000	371.000	0.953	2000.77
22	469.000	371.000	0.953	2000.77
	695.000	376.000	1.013	2126.79
23	-469.000	371.000	0.953	2000.77
	-295.000	349.000	0.689	1446.28
24	295.000	349.000	0.689	1446.28
	469.000	371.000	0.953	2000.77
25	-260.000	349.000	0.689	1446.28
	-130.000	370.000	0.941	1975.57
26	130.000	370.000	0.941	1975.57
	260.000	349.000	0.689	1446.28
27	-130.000	370.000	0.941	1975.57
	130.000	370.000	0.941	1975.57
28	-295.000	20.000	-3.260	-4434.70
	-295.000	339.000	0.569	1194.23
29	295.000	20.000	-3.260	-4434.70
	295.000	339.000	0.569	1194.23
30	-260.000	20.000	-3.260	-4434.70
	-260.000	339.000	0.569	1194.23
31	260.000	20.000	-3.260	-4434.70
	260.000	339.000	0.569	1194.23

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-277.500	22.000	5.320	-3.236	2.084	-6471.911	4168.089
2	277.500	22.000	5.320	-3.236	2.084	-6471.911	4168.089
3	-277.500	47.000	5.320	-2.936	2.384	-5871.811	4768.189
4	277.500	47.000	5.320	-2.936	2.384	-5871.811	4768.189
5	-277.500	72.000	5.320	-2.636	2.684	-5271.710	5368.290
6	277.500	72.000	5.320	-2.636	2.684	-5271.710	5368.290
7	-277.500	102.000	5.320	-2.276	3.044	-4551.589	6088.411
8	277.500	102.000	5.320	-2.276	3.044	-4551.589	6088.411
9	-358.000	375.000	5.320	1.001	6.321	2001.511	12641.5
10	358.000	375.000	5.320	1.001	6.321	2001.511	12641.5
11	-320.000	375.000	5.320	1.001	6.321	2001.511	12641.5
12	320.000	375.000	5.320	1.001	6.321	2001.511	12641.5
13	-235.000	375.000	5.320	1.001	6.321	2001.511	12641.5
14	235.000	375.000	5.320	1.001	6.321	2001.511	12641.5
15	-197.000	375.000	5.320	1.001	6.321	2001.511	12641.5
16	197.000	375.000	5.320	1.001	6.321	2001.511	12641.5

Cálculo Resistencia Ultima: Viga "TAB_PIL"/"B1"

Solicitación (Unidades : [tm])

N	Vy	Vz	Mx	My	Mz
-1197.000				-7579.700	

Coeficiente de seguridad 2.758

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	300.00	0.00	-3.500	-226.600	"H400"
Armadura-Min	295.00	5.00	-3.354	-4434.700	"AEH500"
Hormigón-Max	-0.00	400.00	8.197	0.000	"H400"
Armadura-Max	-0.00	395.00	8.051	4434.700	"AEH500"

Fibra neutra zn 119.69 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 119.69 cm Zona comprimida/Canto útil 0.39

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N = -3301.578 [t]	EAx= --1--	[t]	3.074008E-03	
My= -20906.4 [tm]	EIy= --1--	[tm2]	-2.924269E-03	[1/m]
Mz= 0.000 [tm]	*EIz= --1--	[tm2]	2.513787E-12	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
-300.00	0.00	-3.500		-226.600	-8088.063	192.38
300.00	0.00	-3.500		-226.600		
300.00	344.00	6.559		0.000		
475.30	366.00	7.203		0.000		
700.00	371.00	7.349		0.000		
700.00	386.00	7.788		0.000		
0.00	400.00	8.197		0.000		
-700.00	386.00	7.788		0.000		
-700.00	371.00	7.349		0.000		
-475.30	366.00	7.203		0.000		
-300.00	344.00	6.559		0.000		
-300.00	0.00	-3.500		-226.600		
-255.00	345.00	6.589		0.000		
-97.00	365.00	7.174		0.000		
0.00	365.00	7.174		0.000		
97.00	365.00	7.174		0.000		
255.00	345.00	6.589		0.000		
255.00	75.00	-1.307		-199.378		
195.00	50.00	-2.038		-226.600		
-195.00	50.00	-2.038		-226.600		

-255.00	75.00	-1.307	-199.378
-255.00	345.00	6.589	0.000

Deformaciones y tensiones de la armadura pasiva (Estado II):

N°	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Sigma-s [kp/cm2]
17	-295.000	5.000	-3.354	-4434.70
	295.000	5.000	-3.354	-4434.70
18	-295.000	45.000	-2.184	-4434.70
	295.000	45.000	-2.184	-4434.70
19	-695.000	381.000	7.641	4434.70
	0.000	395.000	8.051	4434.70
20	0.000	395.000	8.051	4434.70
	695.000	381.000	7.641	4434.70
21	-695.000	376.000	7.495	4434.70
	-469.000	371.000	7.349	4434.70
22	469.000	371.000	7.349	4434.70
	695.000	376.000	7.495	4434.70
23	-469.000	371.000	7.349	4434.70
	-295.000	349.000	6.706	4434.70
24	295.000	349.000	6.706	4434.70
	469.000	371.000	7.349	4434.70
25	-260.000	349.000	6.706	4434.70
	-130.000	370.000	7.320	4434.70
26	130.000	370.000	7.320	4434.70
	260.000	349.000	6.706	4434.70
27	-130.000	370.000	7.320	4434.70
	130.000	370.000	7.320	4434.70
28	-295.000	20.000	-2.915	-4434.70
	-295.000	339.000	6.413	4434.70
29	295.000	20.000	-2.915	-4434.70
	295.000	339.000	6.413	4434.70
30	-260.000	20.000	-2.915	-4434.70
	-260.000	339.000	6.413	4434.70
31	260.000	20.000	-2.915	-4434.70
	260.000	339.000	6.413	4434.70

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-277.500	22.000	5.320	-2.857	2.463	-5713.322	4926.678
2	277.500	22.000	5.320	-2.857	2.463	-5713.322	4926.678
3	-277.500	47.000	5.320	-2.126	3.194	-4251.187	6388.813
4	277.500	47.000	5.320	-2.126	3.194	-4251.187	6388.813
5	-277.500	72.000	5.320	-1.395	3.925	-2789.053	7850.947
6	277.500	72.000	5.320	-1.395	3.925	-2789.053	7850.947
7	-277.500	102.000	5.320	-0.517	4.803	-1034.491	9605.509
8	277.500	102.000	5.320	-0.517	4.803	-1034.491	9605.509
9	-358.000	375.000	5.320	7.466	12.786	4900.000	15540.0
10	358.000	375.000	5.320	7.466	12.786	4900.000	15540.0
11	-320.000	375.000	5.320	7.466	12.786	4900.000	15540.0
12	320.000	375.000	5.320	7.466	12.786	4900.000	15540.0
13	-235.000	375.000	5.320	7.466	12.786	4900.000	15540.0
14	235.000	375.000	5.320	7.466	12.786	4900.000	15540.0
15	-197.000	375.000	5.320	7.466	12.786	4900.000	15540.0

16	197.000	375.000	5.320	7.466	12.786	4900.000	15540.0

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

CALCULO DE PILAS

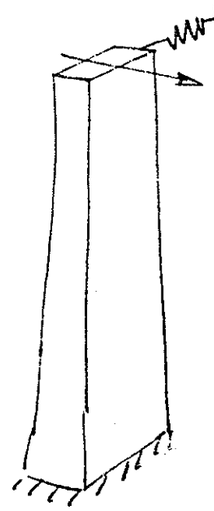
Oficina Técnica	PROYECTO: VIADUCTO nº2
	ASUNTO:

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE

DIMENSIONAMIENTO DE LAS PILAS.

- CRITERIOS:

El esquema de calculo utilizado en el calculo consiste en una pila, empotrada en su base, y articulada longitudinalmente en cabeza, teniendo un muelle horizontal en sentido transversal.



En lugar de establecer una fuerza en cabeza, igual al 5% de las cargas permanentes verticales, (Rozamiento del apoyo de teflón), se obtiene una fuerza horizontal que produzca el movimiento esperado del tablero debido a la retracción, fluencia y temperatura.

Este calculo se realiza con el programa PYRUS, que realiza el calculo en 2º orden.

Si la fuerza obtenida es menor del 5% de las cargas permanentes verticales, esta se mayora por los

Oficina Técnica	PROYECTO:
	ASUNTO:

ESCRITO POR:	FECHA:	REVISADO POR:	FECHA:	HOJA	DE

coeficientes correspondientes para obtener el dimensionamiento en E.L.U. de las pilas.

En caso de que la fuerza obtenida fuese mayor del 5% de las cargas verticales permanentes, nos estaria diciendo que el tablero desliza sobre el neopreno y por tanto la fuerza que debe ser aplicada es el 5% C.P.

- Como coef. de seguridad adicional, no se ha considerado la flexibilidad del conjunto de pilotes, Por lo tanto el esquema utilizado es más rigido que el esquema real.

El significado del muelle horizontal en cabeza, es la rigidez que le confiere todo el tablero, a dicha pila, ya que éste se encuentra casido a la pila transversalmente mediante un apoyo tipo POT.

PILA Nº 1

Pila ''PILA1'
****

Título : 'PILA 1 VIADUCTO N° 1'
Altura de la pila : 17.217 [m]
Long. max. de barra: Altura pila / 10

NUDOS Nu	x [m]	Apoyo d-xyz	r-xyz
12	17.217		
11	15.217		
10	13.695		
9	12.174		
8	10.652		
7	9.130		
6	7.609		
5	6.087		
4	4.565		
3	3.043		
2	1.522		
1	0.000	BBB	BBB

Apoyo: B=bloqueado, E=elástico

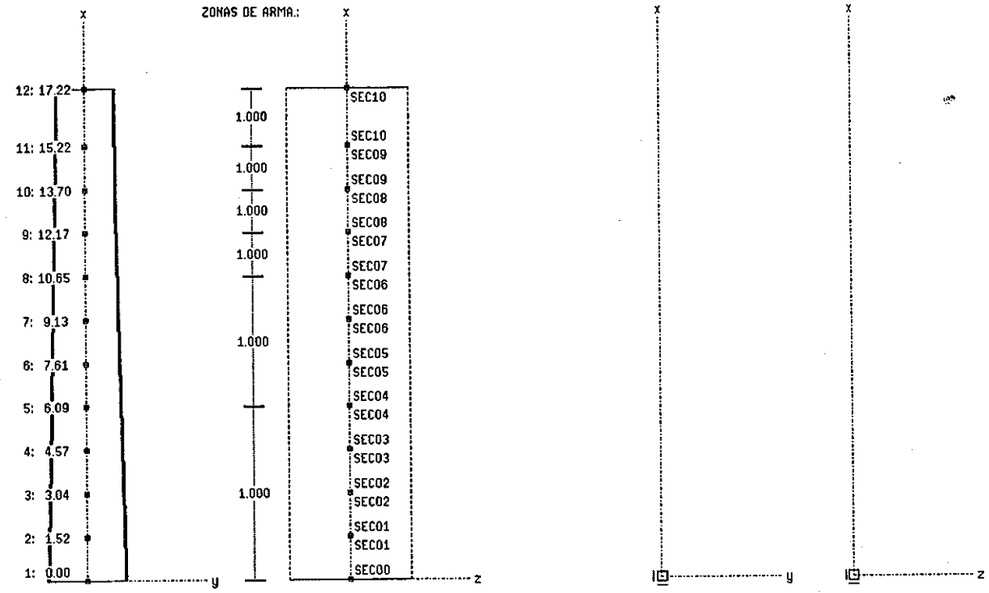
BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

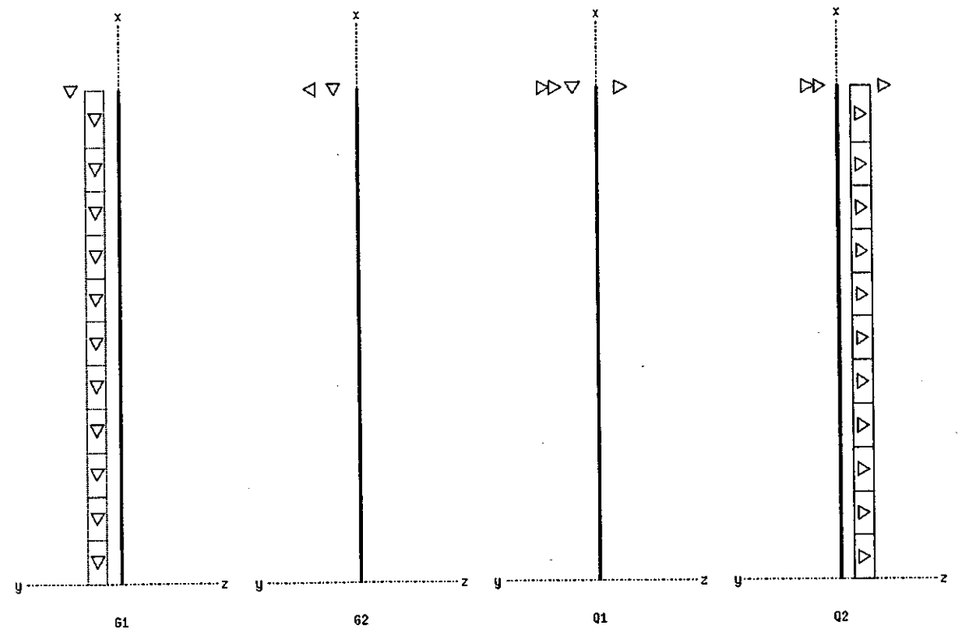
Ba	Nu	Sección	Tipo	Exc: ey [m]	ez [m]	Arm: Zona	fac
11	12-11	'SEC10'	SecFAGUS			1	1.000
10	11-10	'SEC09'	SecFAGUS			2	1.000
9	10-9	'SEC08'	SecFAGUS			3	1.000
8	9-8	'SEC07'	SecFAGUS			4	1.000
7	8-7	'SEC06'	SecFAGUS			5	1.000
6	7-6	'SEC06'	SecFAGUS			5	1.000
		'SEC05'	SecFAGUS				
5	6-5	'SEC05'	SecFAGUS			5	1.000
		'SEC04'	SecFAGUS				
4	5-4	'SEC04'	SecFAGUS			6	1.000
		'SEC03'	SecFAGUS				
3	4-3	'SEC03'	SecFAGUS			6	1.000
		'SEC02'	SecFAGUS				
2	3-2	'SEC02'	SecFAGUS			6	1.000
		'SEC01'	SecFAGUS				
1	2-1	'SEC01'	SecFAGUS			6	1.000
		'SEC00'	SecFAGUS				

CARGAS :

Nu/Ba		Tipo Car.	Dim.		Valor Val.arriba	ey[m] Val.abajo	ez[m]
Comp. Carga G1 :							
Nudo	12	Fuerza	x	[kN]	-12530.000		
Barra	11	Peso propio	x	[kN/m3]	-25.000		
Barra	10	Peso propio	x	[kN/m3]	-25.000		
Barra	9	Peso propio	x	[kN/m3]	-25.000		
Barra	8	Peso propio	x	[kN/m3]	-25.000		
Barra	7	Peso propio	x	[kN/m3]	-25.000		
Barra	6	Peso propio	x	[kN/m3]	-25.000		
Barra	5	Peso propio	x	[kN/m3]	-25.000		
Barra	4	Peso propio	x	[kN/m3]	-25.000		
Barra	3	Peso propio	x	[kN/m3]	-25.000		
Barra	2	Peso propio	x	[kN/m3]	-25.000		
Barra	1	Peso propio	x	[kN/m3]	-25.000		
Comp. Carga G2 :							
Nudo	12	Fuerza	x	[kN]	-5595.000		
		Fuerza	y	[kN]	900.000		
Comp. Carga Q1 :							
Nudo	12	Fuerza	x	[kN]	-11640.000		
		Fuerza	z	[kN]	557.800		
		Momento	y	[kNm]	-6862.000		
Comp. Carga Q2 :							
Nudo	12	Fuerza	z	[kN]	733.000		
		Momento	y	[kNm]	-3115.000		
Barra	11	Fuerza	z	[kN/m]	4.000		
Barra	10	Fuerza	z	[kN/m]	4.000		
Barra	9	Fuerza	z	[kN/m]	4.000		
Barra	8	Fuerza	z	[kN/m]	4.000		
Barra	7	Fuerza	z	[kN/m]	4.000		
Barra	6	Fuerza	z	[kN/m]	4.000		
Barra	5	Fuerza	z	[kN/m]	4.000		
Barra	4	Fuerza	z	[kN/m]	4.000		
Barra	3	Fuerza	z	[kN/m]	4.000		
Barra	2	Fuerza	z	[kN/m]	4.000		
Barra	1	Fuerza	z	[kN/m]	4.000		

Escala 1 : 215.1
Modelo, Deformación accidental y cargas de la pila PILA1





C A R G A F I J A <F.PILA1.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.323 [kN]
Tolerancia desequi. momentos	0.263 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 1.000 * Carga variable Q1 * ß
	+ 0.600 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.689	6.000	H300	AEH500	B1	0.000	11E+2
SEC01	2.620	6.000	H300	AEH500	B1	0.000	11E+2
SEC02	2.551	6.000	H300	AEH500	B1	0.000	11E+2
SEC03	2.482	6.000	H300	AEH500	B1	0.000	11E+2
SEC04	2.413	6.000	H300	AEH500	B1	0.000	389.6
SEC05	2.344	6.000	H300	AEH500	B1	0.000	389.6
SEC06	2.275	6.000	H300	AEH500	B1	0.000	389.6
SEC07	2.207	6.000	H300	AEH500	B1	0.000	383.3
SEC08	2.138	6.000	H300	AEH500	B1	0.000	383.3
SEC09	2.069	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	383.3	383.3
8	SEC07	SEC07	1.000	383.3	383.3
7	SEC06	SEC06	1.000	389.6	389.6
6	SEC06	SEC05	1.000	389.6	389.6

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC05	SEC04	1.000	389.6	389.6
4	SEC04	SEC03	1.000	389.6	11E+2
3	SEC03	SEC02	1.000	11E+2	11E+2
2	SEC02	SEC01	1.000	11E+2	11E+2
1	SEC01	SEC00	1.000	11E+2	11E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-15.50	0.00	0.00	-0.022	-1.293	0.000
Máxima	0.00	66.50	12.63	0.011	0.000	6.574

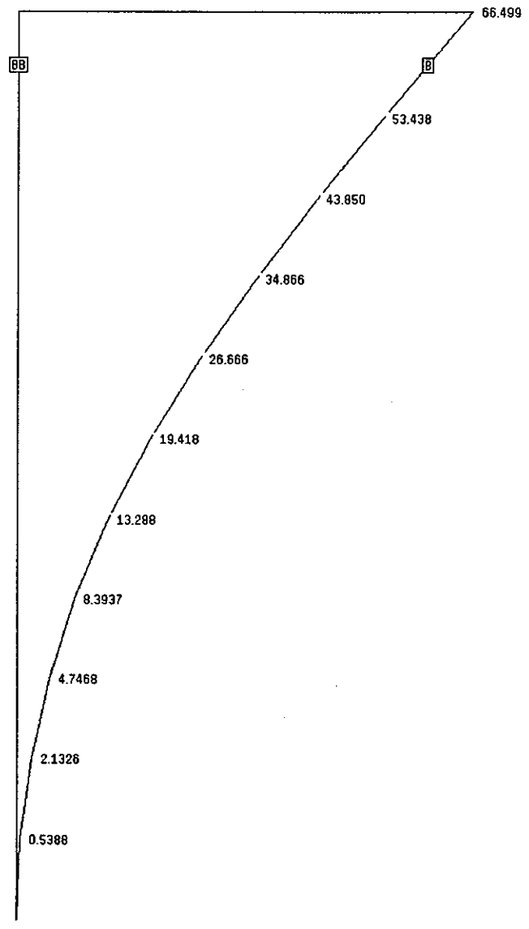
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-32298.25	-900.02	-1037.10	0.00	8730.16	-0.01
Máxima	-30065.00	-900.00	-1000.04	55.97	26651.71	17548.40

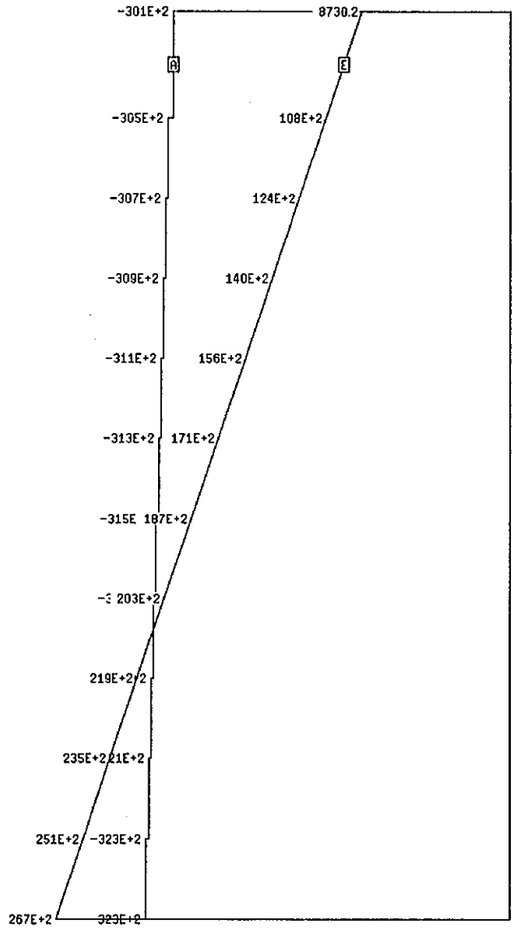
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-13.2	-421.9	-1.059	-2.009	1.945E+8	1.427E+7
Máxima	0.0	25.3	0.156	0.120	3.858E+8	3.734E+7

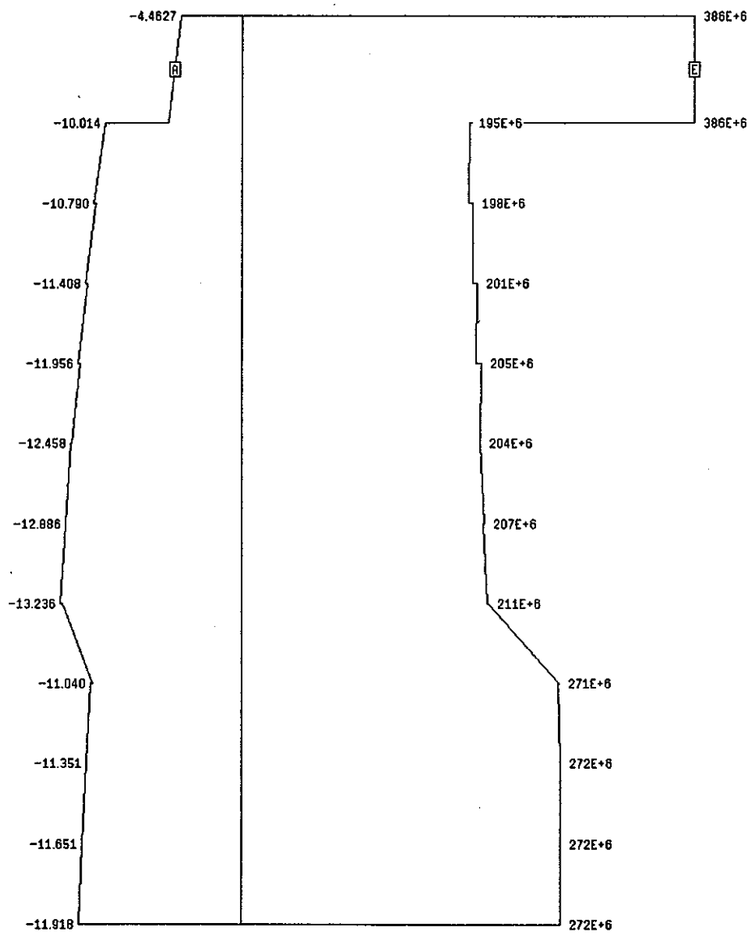
Escala 1 : 116.4
<F.PILA1.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 116.4
<F.PILA1.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 116.4
<F.PILA1.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.PILA1.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.276 [kN]
Tolerancia desequi. momentos	0.262 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 0.600 * Carga variable Q1 * ß
	+ 1.000 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.689	6.000	H300	AEH500	B1	0.000	11E+2
SEC01	2.620	6.000	H300	AEH500	B1	0.000	11E+2
SEC02	2.551	6.000	H300	AEH500	B1	0.000	11E+2
SEC03	2.482	6.000	H300	AEH500	B1	0.000	11E+2
SEC04	2.413	6.000	H300	AEH500	B1	0.000	389.6
SEC05	2.344	6.000	H300	AEH500	B1	0.000	389.6
SEC06	2.275	6.000	H300	AEH500	B1	0.000	389.6
SEC07	2.207	6.000	H300	AEH500	B1	0.000	383.3
SEC08	2.138	6.000	H300	AEH500	B1	0.000	383.3
SEC09	2.069	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	383.3	383.3
8	SEC07	SEC07	1.000	383.3	383.3
7	SEC06	SEC06	1.000	389.6	389.6
6	SEC06	SEC05	1.000	389.6	389.6

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC05	SEC04	1.000	389.6	389.6
4	SEC04	SEC03	1.000	389.6	11E+2
3	SEC03	SEC02	1.000	11E+2	11E+2
2	SEC02	SEC01	1.000	11E+2	11E+2
1	SEC01	SEC00	1.000	11E+2	11E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-14.10	0.00	0.00	-0.010	-1.198	0.000
Máxima	0.00	65.29	12.05	0.014	0.000	6.428

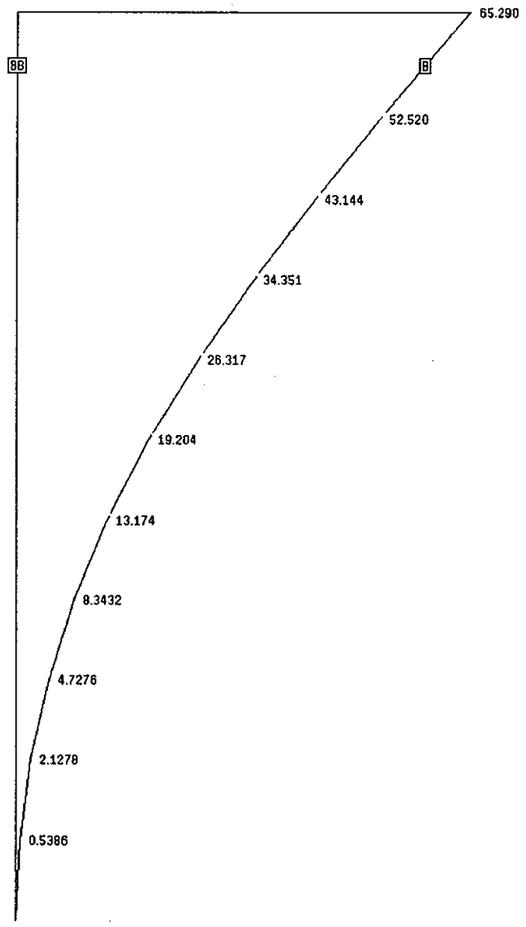
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-27642.25	-900.00	-1133.50	0.00	7230.86	-0.00
Máxima	-25409.00	-900.00	-1071.68	60.47	26522.40	17206.86

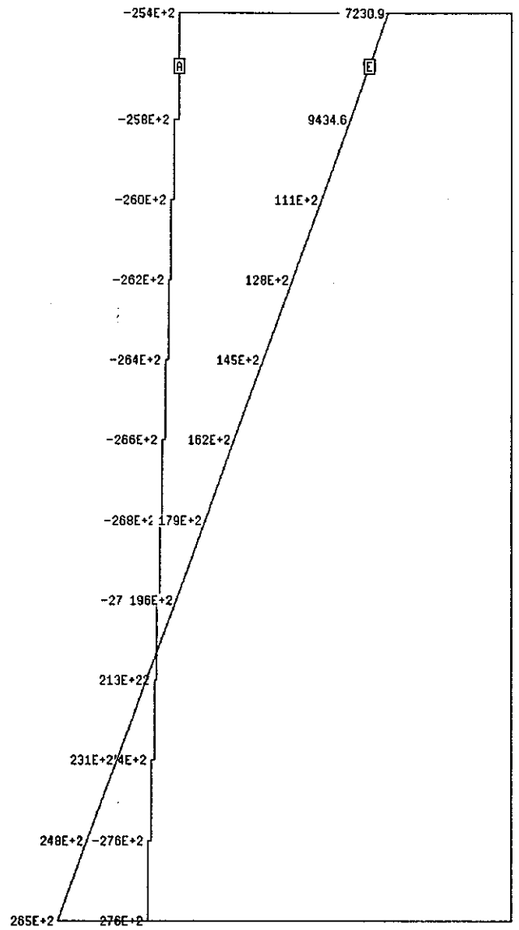
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-12.1	-394.2	-0.926	-1.877	2.052E+8	1.430E+7
Máxima	0.0	44.3	0.247	0.211	3.932E+8	3.656E+7

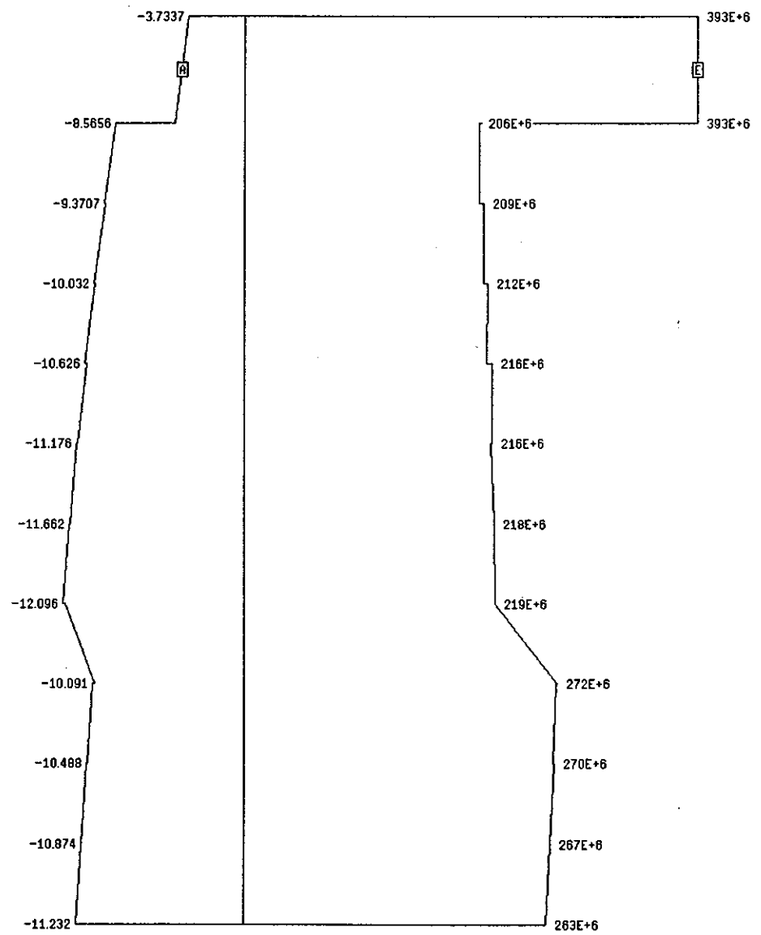
Escala 1 : 116.4
<F.PILA1.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 116.4
<F.PILA1.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 116.4
<F.PILA1.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA1.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.384 [kN]
Tolerancia desequi. momentos	0.393 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 0.900 * Carga variable Q1
	+ 1.500 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.00%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.689	6.000	H300	AEH500	B1	0.000
SEC01	2.620	6.000	H300	AEH500	B1	0.000
SEC02	2.551	6.000	H300	AEH500	B1	0.000
SEC03	2.482	6.000	H300	AEH500	B1	0.000
SEC04	2.413	6.000	H300	AEH500	B1	0.000
SEC05	2.344	6.000	H300	AEH500	B1	0.000
SEC06	2.275	6.000	H300	AEH500	B1	0.000
SEC07	2.207	6.000	H300	AEH500	B1	0.000
SEC08	2.138	6.000	H300	AEH500	B1	0.000
SEC09	2.069	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	383.3	383.3
8	SEC07	SEC07	1.000	383.3	383.3
7	SEC06	SEC06	1.000	389.6	389.6
6	SEC06	SEC05	1.000	389.6	389.6
5	SEC05	SEC04	1.000	389.6	389.6

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
4	SEC04	SEC03	1.000	389.6	11E+2
3	SEC03	SEC02	1.000	11E+2	11E+2
2	SEC02	SEC01	1.000	11E+2	11E+2
1	SEC01	SEC00	1.000	11E+2	11E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-20.31	0.00	0.00	-0.023	-2.077	0.000
Máxima	0.00	100.16	20.95	0.040	0.000	9.901

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-38364.63	-1215.03	-1700.26	0.00	10846.24	-0.01
Máxima	-35349.75	-1215.00	-1607.58	138.69	40073.05	24569.09

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-16.4	-443.5	-1.612	-2.971	1.720E+8	1.364E+7
Máxima	0.0	95.1	0.487	0.453	3.780E+8	3.459E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

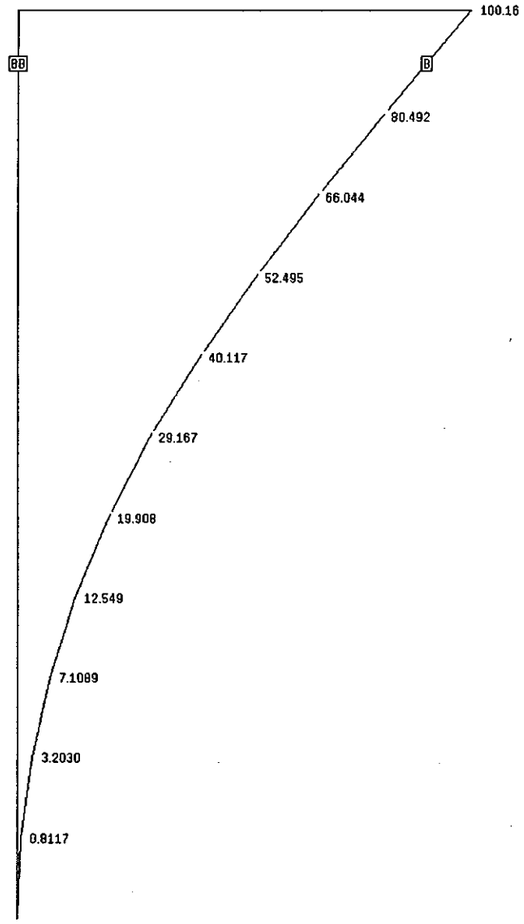
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
6	17.22	SEC10	383.3	0.32	27
	15.22	SEC10	383.3	0.32	29
5	15.22	SEC09	383.3	0.74	61
	13.70	SEC09	383.3	0.74	65
4	13.70	SEC08	383.3	0.74	64
	12.17	SEC08	383.3	0.74	68
3	12.17	SEC07	383.3	0.73	68
	10.65	SEC07	383.3	0.73	72
2	10.65	SEC06	389.6	0.73	71
	9.130	SEC06	389.6	0.73	76
	7.609	SEC05	389.6	0.73	79
	6.087	SEC04	389.6	0.72	82
1	6.087	SEC04	389.6	0.72	83
	4.565	SEC03	1061.6	1.95	68
	3.043	SEC02	1061.6	1.93	70

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

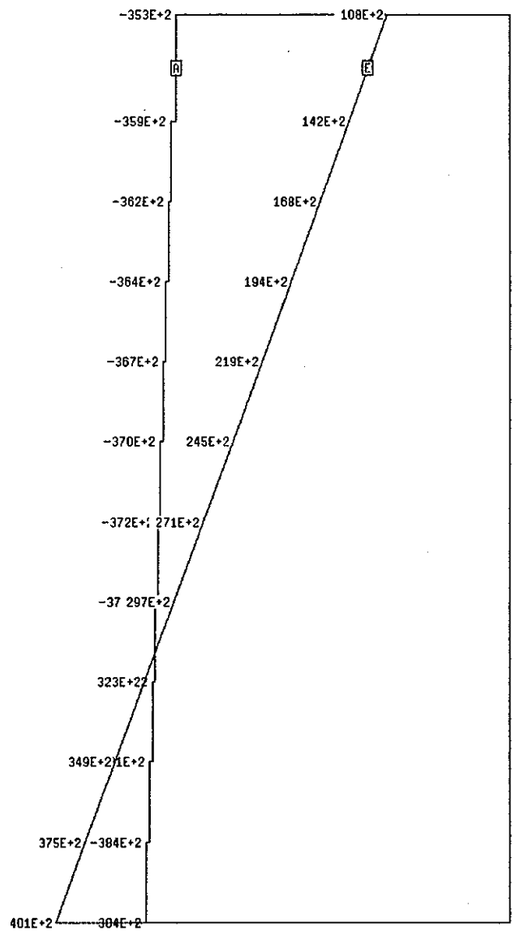
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
	1.522	SEC01	1061.6	1.91	73
	0.000	SEC00	1061.6	1.90	75

(≤) : Armadura ≤ μ_min = 0.00%
(≥) : Armadura ≥ μ_max = 8.00%

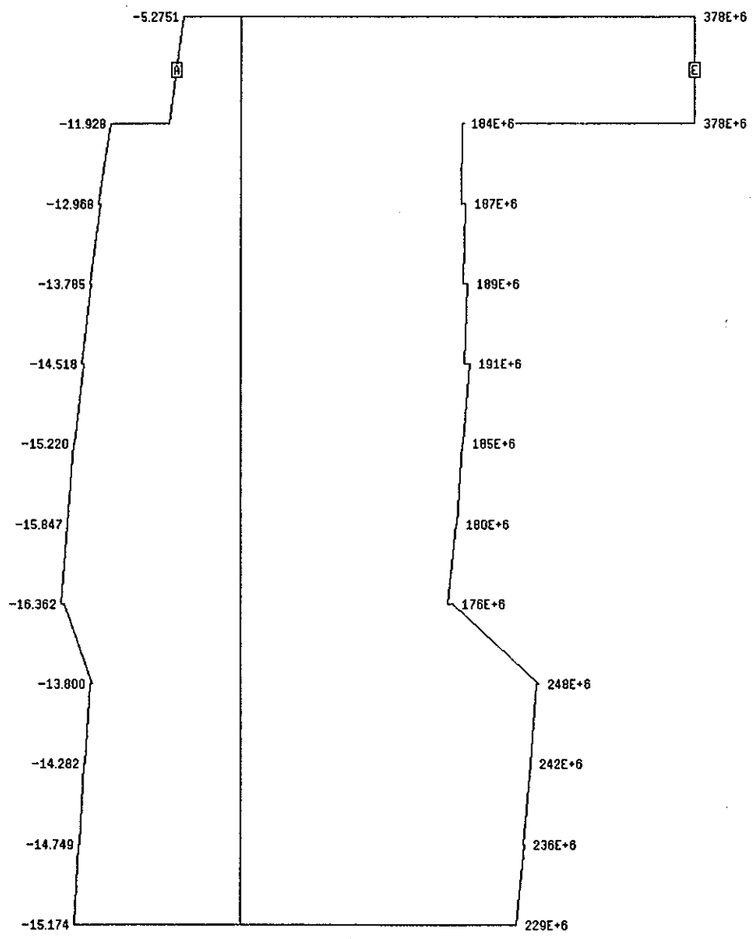
Escala 1 : 116.4
<B.PILA1.1> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 116.4
<B.PILA1.1> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 116.4
<B.PILA1.1> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA1.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.453 [kN]
Tolerancia desequi. momentos	0.394 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 1.500 * Carga variable Q1
	+ 0.900 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.00%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.689	6.000	H300	AEH500	B1	0.000
SEC01	2.620	6.000	H300	AEH500	B1	0.000
SEC02	2.551	6.000	H300	AEH500	B1	0.000
SEC03	2.482	6.000	H300	AEH500	B1	0.000
SEC04	2.413	6.000	H300	AEH500	B1	0.000
SEC05	2.344	6.000	H300	AEH500	B1	0.000
SEC06	2.275	6.000	H300	AEH500	B1	0.000
SEC07	2.207	6.000	H300	AEH500	B1	0.000
SEC08	2.138	6.000	H300	AEH500	B1	0.000
SEC09	2.069	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC10	1.000	383.3	383.3
9	SEC08	SEC08	1.000	383.3	383.3
8	SEC07	SEC07	1.000	383.3	383.3
7	SEC06	SEC06	1.000	389.6	389.6
6	SEC06	SEC05	1.000	389.6	389.6
5	SEC05	SEC04	1.000	389.6	389.6

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
4	SEC04	SEC03	1.000	389.6	11E+2
3	SEC03	SEC02	1.000	11E+2	11E+2
2	SEC02	SEC01	1.000	11E+2	11E+2
1	SEC01	SEC00	1.000	11E+2	11E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-23.09	0.00	0.00	-0.061	-2.407	0.000
Máxima	0.00	106.84	23.50	0.036	0.000	10.641

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-45348.63	-1215.00	-1555.64	0.00	13095.30	-0.00
Máxima	-42333.75	-1215.00	-1500.00	133.76	40413.12	25559.19

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-17.0	-443.5	-2.091	-3.442	1.458E+8	1.344E+7
Máxima	0.0	71.6	0.376	0.341	3.662E+8	3.498E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

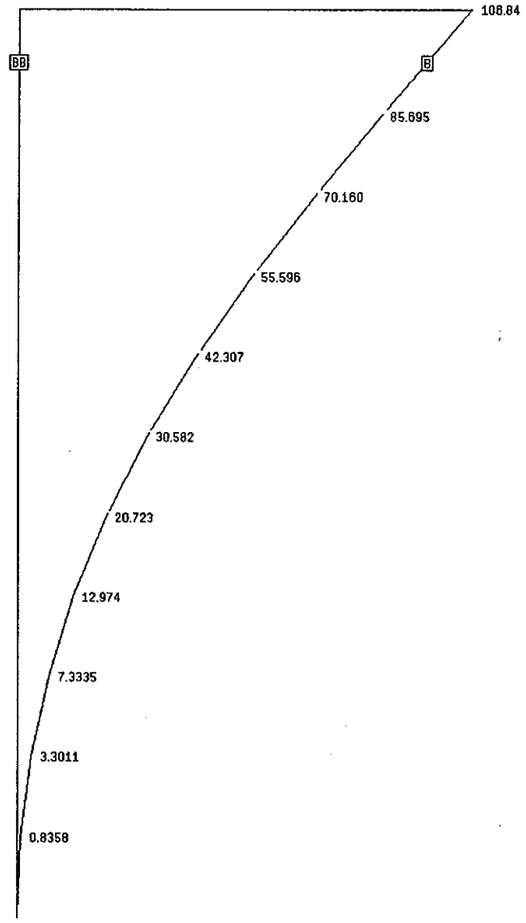
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
6	17.22	SEC10	383.3	0.32	33
	15.22	SEC10	383.3	0.32	35
5	15.22	SEC09	383.3	0.74	73
	13.70	SEC09	383.3	0.74	76
4	13.70	SEC08	383.3	0.74	75
	12.17	SEC08	383.3	0.74	79
3	12.17	SEC07	383.3	0.73	78
	10.65	SEC07	383.3	0.73	83
2	10.65	SEC06	389.6	0.73	82
	9.130	SEC06	389.6	0.73	86
	7.609	SEC05	389.6	0.73	89
	6.087	SEC04	389.6	0.72	92
1	6.087	SEC04	389.6	0.72	92
	4.565	SEC03	1061.6	1.95	75
	3.043	SEC02	1061.6	1.93	77

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

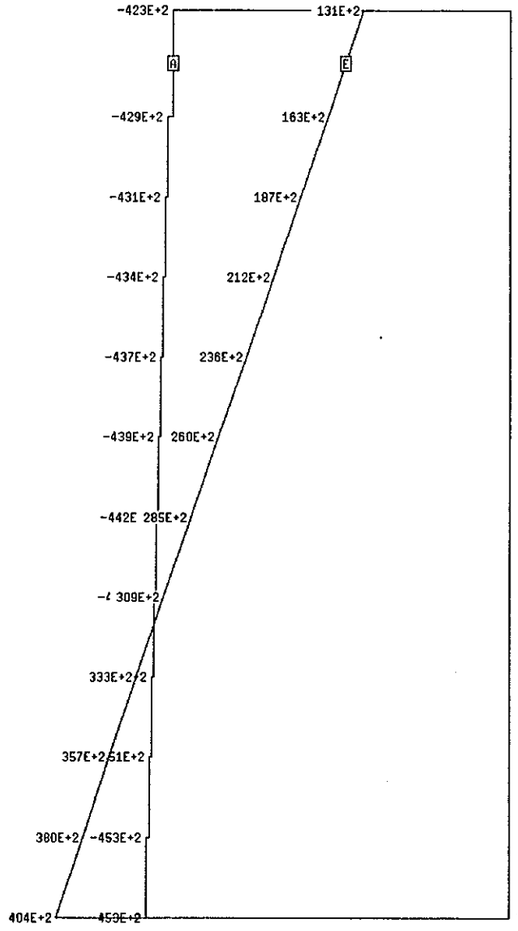
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
	1.522	SEC01	1061.6	1.91	80
	0.000	SEC00	1061.6	1.90	81

(≤) : Armadura ≤ μ_min = 0.00%
(≥) : Armadura ≥ μ_max = 8.00%

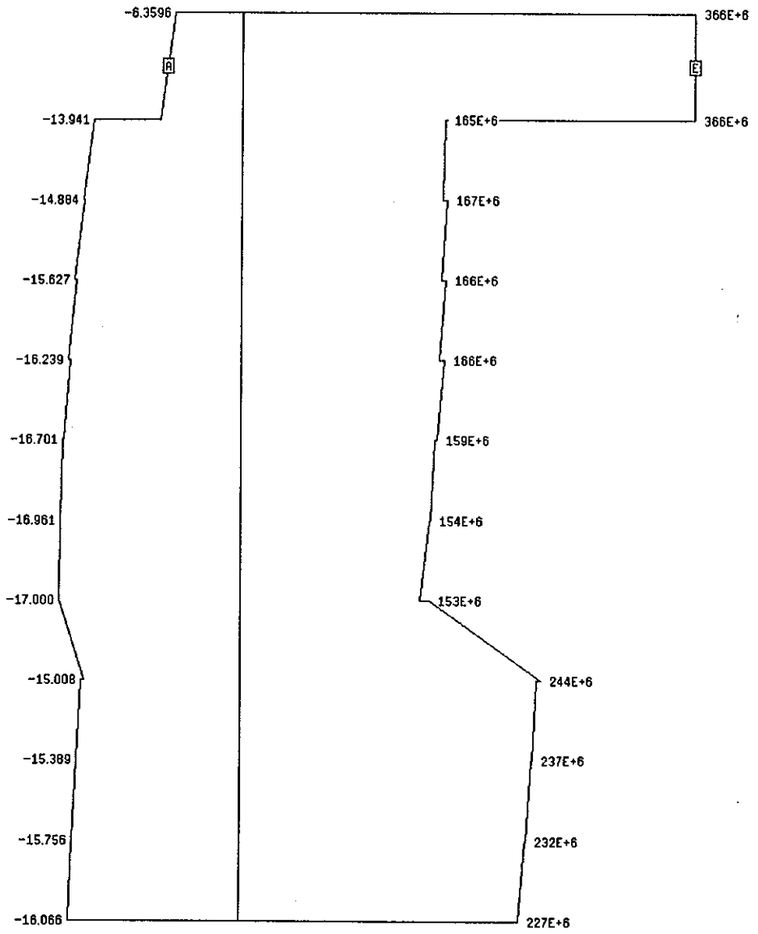
Escala 1 : 116.4
<B.PILA1.2> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 116.4
<B.PILA1.2> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 116.4
<B.PILA1.2> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



PILA Nº 2

Pila ''PILA2'
****

Título : 'PILA 2 VIADUCTO N° 1'
Altura de la pila : 18.040 [m]
Long. max. de barra: Altura pila / 10

NUDOS Nu	x [m]	Apoyo d-xyz	r-xyz
12	18.040		
11	16.040		
10	14.436		
9	12.834		
8	11.232		
7	9.624		
6	8.020		
5	6.416		
4	4.812		
3	3.208		
2	1.604		
1	0.000	BBB	BBB

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

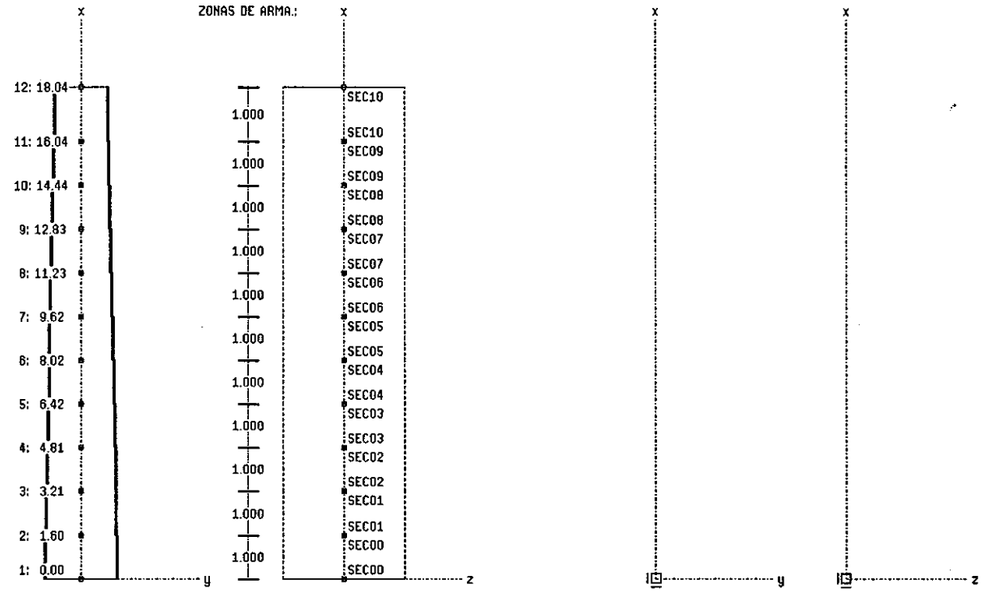
Ba	Nu	Sección	Tipo	Exc: ey [m]	ez [m]	Arm: Zona	fac
11	12-11	'SEC10'	SecFAGUS			1	1.000
10	11-10	'SEC09'	SecFAGUS			2	1.000
9	10-9	'SEC08'	SecFAGUS			3	1.000
8	9-8	'SEC07'	SecFAGUS			4	1.000
7	8-7	'SEC06'	SecFAGUS			5	1.000
6	7-6	'SEC05'	SecFAGUS			6	1.000
5	6-5	'SEC04'	SecFAGUS			7	1.000
4	5-4	'SEC03'	SecFAGUS			8	1.000
3	4-3	'SEC02'	SecFAGUS			9	1.000
2	3-2	'SEC01'	SecFAGUS			10	1.000
1	2-1	'SEC00'	SecFAGUS			11	1.000

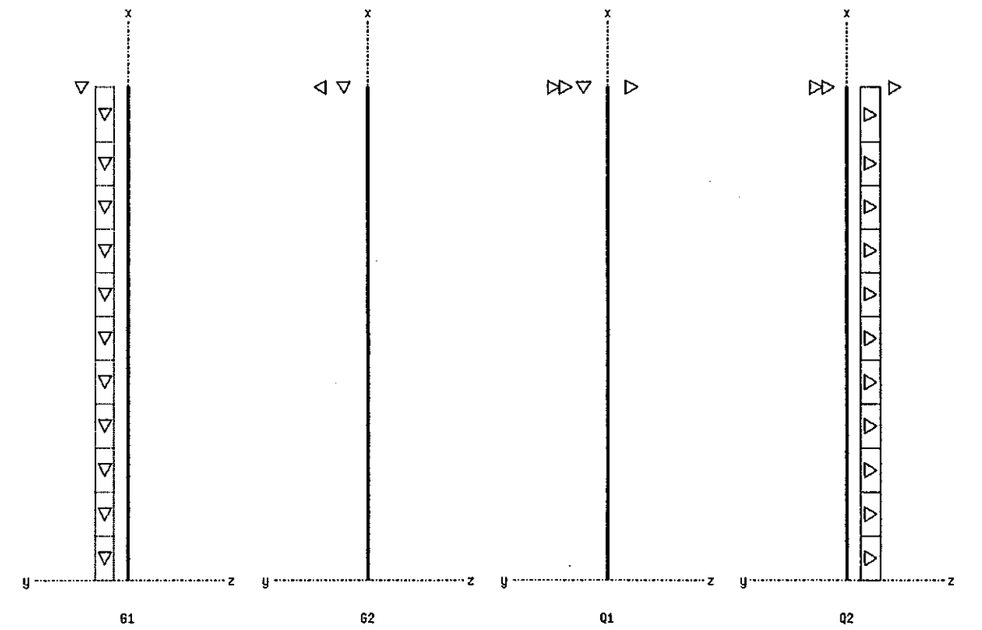
CARGAS :

Nu/Ba	Tipo Car.	Dim.		Valor Val.arriba	ey[m] Val.abajo	ez[m]
Comp. Carga G1 :						
Nudo 12	Fuerza	x	[kN]	-12530.000		
Barra 11	Peso propio	x	[kN/m3]	-25.000		
Barra 10	Peso propio	x	[kN/m3]	-25.000		
Barra 9	Peso propio	x	[kN/m3]	-25.000		
Barra 8	Peso propio	x	[kN/m3]	-25.000		
Barra 7	Peso propio	x	[kN/m3]	-25.000		
Barra 6	Peso propio	x	[kN/m3]	-25.000		
Barra 5	Peso propio	x	[kN/m3]	-25.000		

Nu/Ba	Tipo Car.	Dim.		Valor Val.arriba	ey[m] Val.abajo	ez[m]
Barra 4	Peso propio	x	[kN/m3]	-25.000		
Barra 3	Peso propio	x	[kN/m3]	-25.000		
Barra 2	Peso propio	x	[kN/m3]	-25.000		
Barra 1	Peso propio	x	[kN/m3]	-25.000		
Comp. Carga G2 :						
Nudo 12	Fuerza	x	[kN]	-5595.000		
	Fuerza	y	[kN]	903.500		
Comp. Carga Q1 :						
Nudo 12	Fuerza	x	[kN]	-11640.000		
	Fuerza	z	[kN]	557.800		
	Momento	y	[kNm]	-6862.000		
Comp. Carga Q2 :						
Nudo 12	Fuerza	z	[kN]	733.000		
	Momento	y	[kNm]	-3115.000		
Barra 11	Fuerza	z	[kN/m]	4.000		
Barra 10	Fuerza	z	[kN/m]	4.000		
Barra 9	Fuerza	z	[kN/m]	4.000		
Barra 8	Fuerza	z	[kN/m]	4.000		
Barra 7	Fuerza	z	[kN/m]	4.000		
Barra 6	Fuerza	z	[kN/m]	4.000		
Barra 5	Fuerza	z	[kN/m]	4.000		
Barra 4	Fuerza	z	[kN/m]	4.000		
Barra 3	Fuerza	z	[kN/m]	4.000		
Barra 2	Fuerza	z	[kN/m]	4.000		
Barra 1	Fuerza	z	[kN/m]	4.000		

Escala 1 : 225.4
Modelo, Deformación accidental y cargas de la pila PILA2





C A R G A F I J A <F.PILA2.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.321 [kN]
Tolerancia desequi. momentos	0.271 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 1.000 * Carga variable Q1 * ß
	+ 0.600 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm.	/ Acero	Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba	/ abajo	factor S de la armadura	Armadura variable arriba[cm²]	/abajo[cm²]
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba	/ abajo	factor S de la armadura	Armadura variable arriba[cm²]	/abajo[cm²]
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-14.90	0.00	0.00	-0.025	-1.299	0.000
Máxima	0.00	62.34	13.12	0.009	0.000	5.726

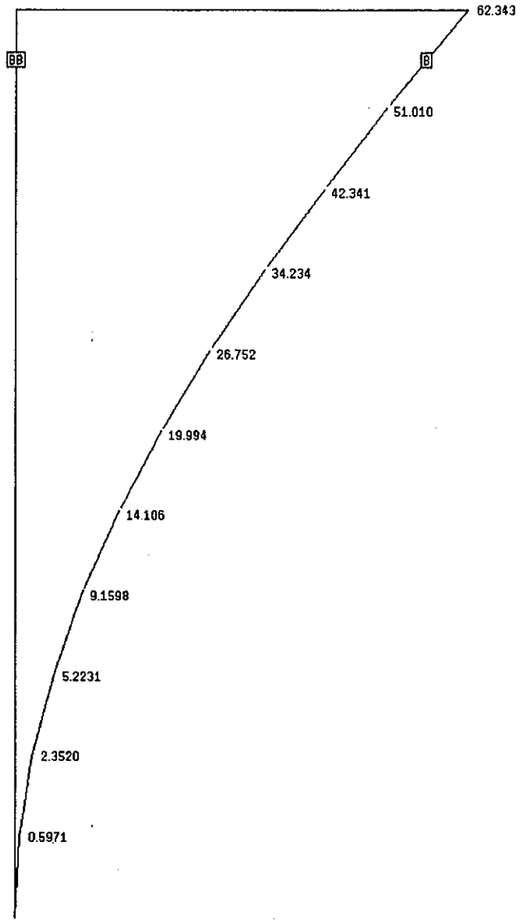
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-32068.41	-903.50	-1038.97	0.00	8730.20	0.00
Máxima	-29892.75	-903.50	-1000.00	51.35	27519.42	18208.80

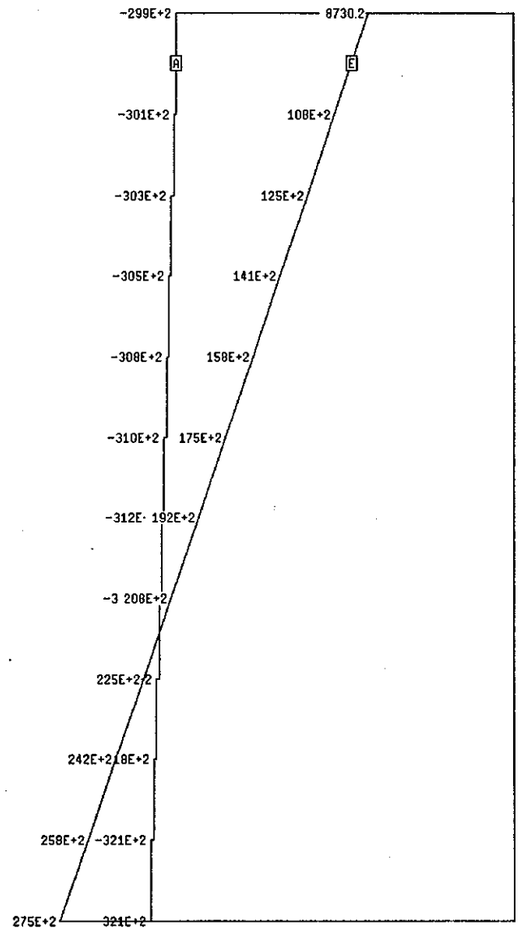
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-12.1	-358.7	-0.929	-1.708	1.921E+8	1.311E+7
Máxima	0.0	32.3	0.178	0.154	2.736E+8	3.839E+7

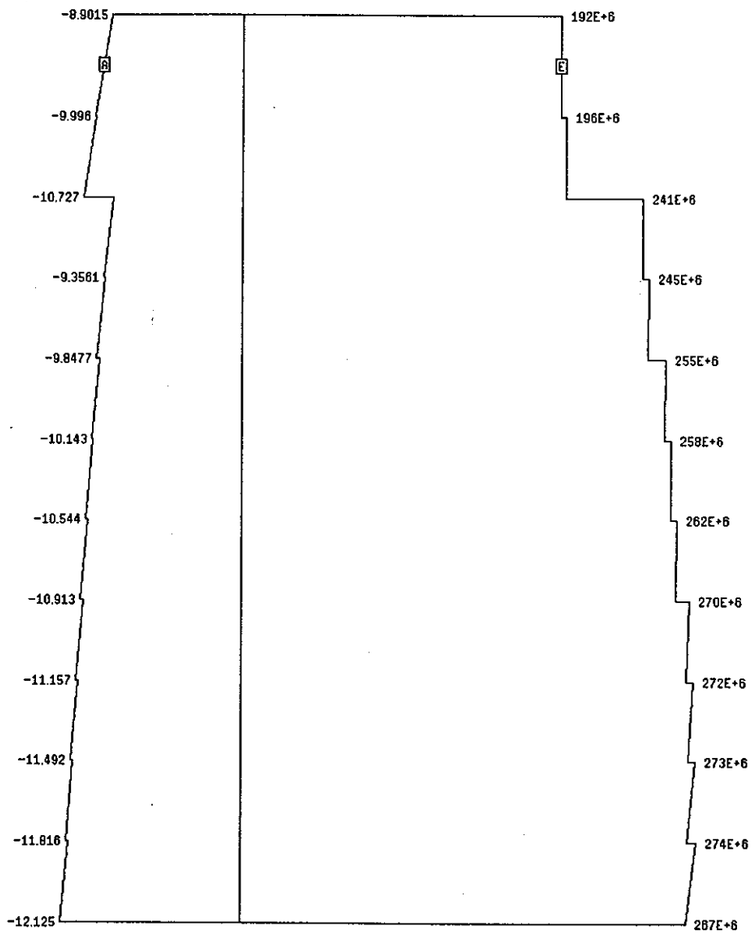
Escala 1 : 121.9
<F.PILA2.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 121.9
<F.PILA2.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 121.9
<F.PILA2.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.PILA2.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.274 [kN]
Tolerancia desequi. momentos	0.271 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 0.600 * Carga variable Q1 * ß
	+ 1.000 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-13.46	0.00	0.00	-1.367E-2	-1.218	0.000
Máxima	0.00	61.66	12.76	1.179E-2	0.000	5.638

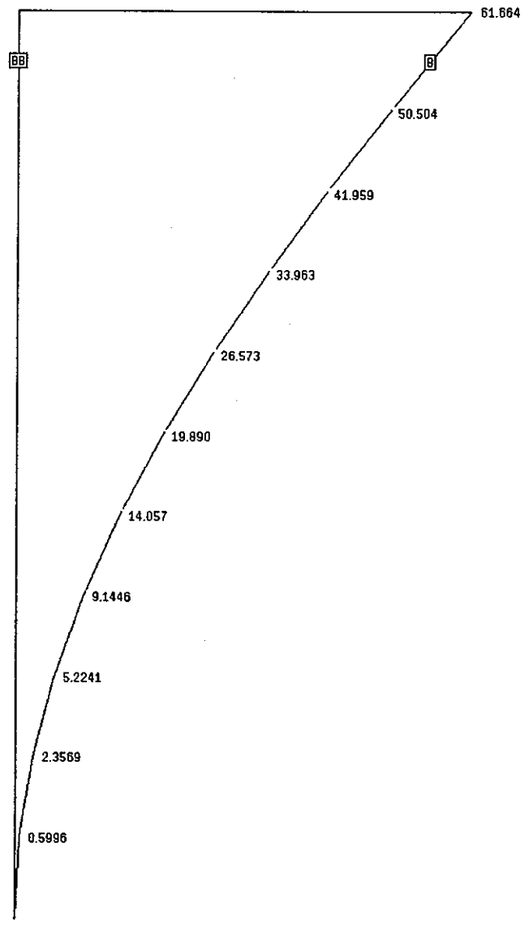
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-27412.41	-903.50	-1136.63	0.00	7230.87	0.00
Máxima	-25236.75	-903.50	-1071.68	55.95	27474.37	17900.70

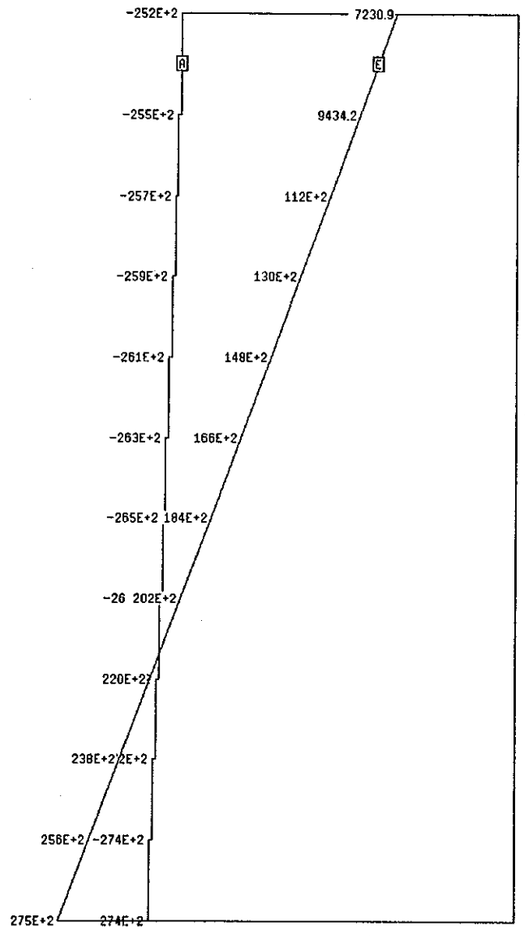
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-11.5	-344.6	-0.862	-1.641	2.026E+8	1.317E+7
Máxima	0.0	53.4	0.279	0.254	2.748E+8	3.772E+7

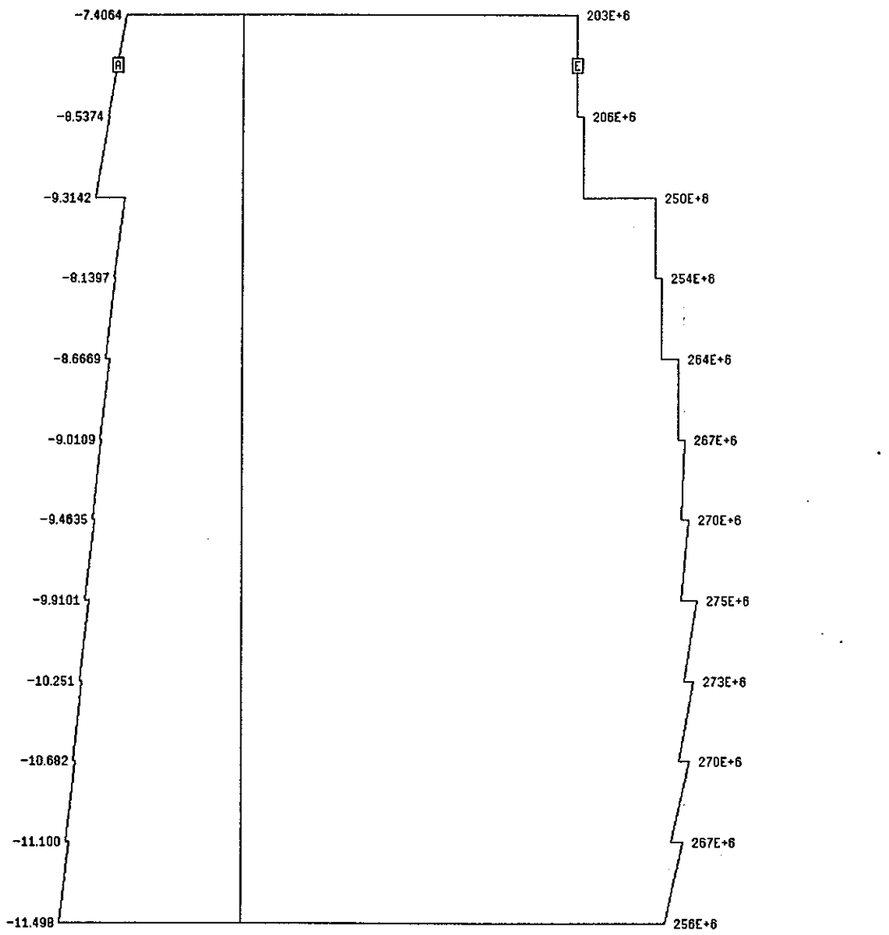
Escala 1 : 121.9
<F.PILA2.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 121.9
<F.PILA2.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 121.9
<F.PILA2.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA2.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.381 [kN]
Tolerancia desequi. momentos	0.407 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 0.900 * Carga variable Q1
	+ 1.500 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-19.11	0.00	0.00	-0.032	-2.030	0.000
Máxima	0.00	91.64	21.40	0.030	0.000	8.380

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-38054.35	-1219.73	-1704.95	0.00	10846.30	-0.00
Máxima	-35117.21	-1219.73	-1607.52	124.37	41487.45	25314.18

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

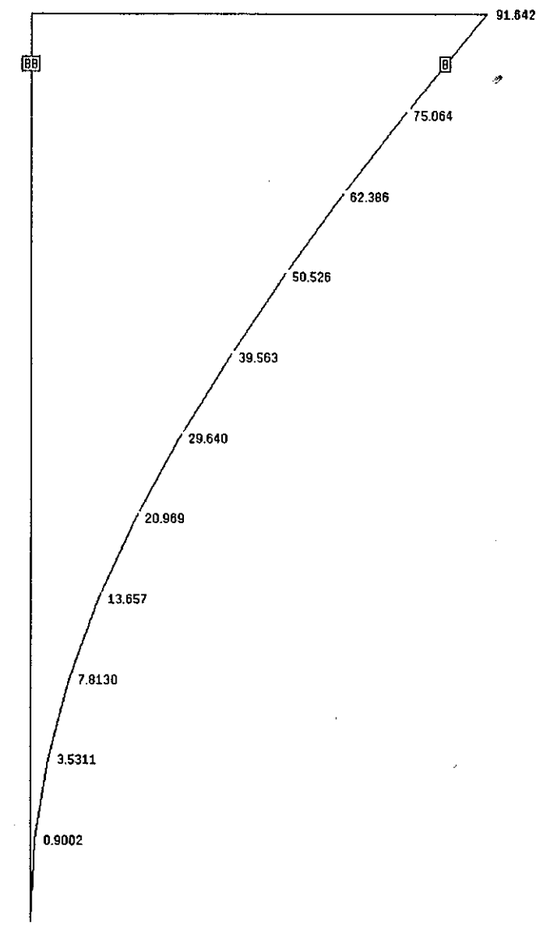
	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-15.5	-443.5	-1.398	-2.484	1.819E+8	1.254E+7
Máxima	0.0	109.9	0.545	0.523	2.516E+8	3.588E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

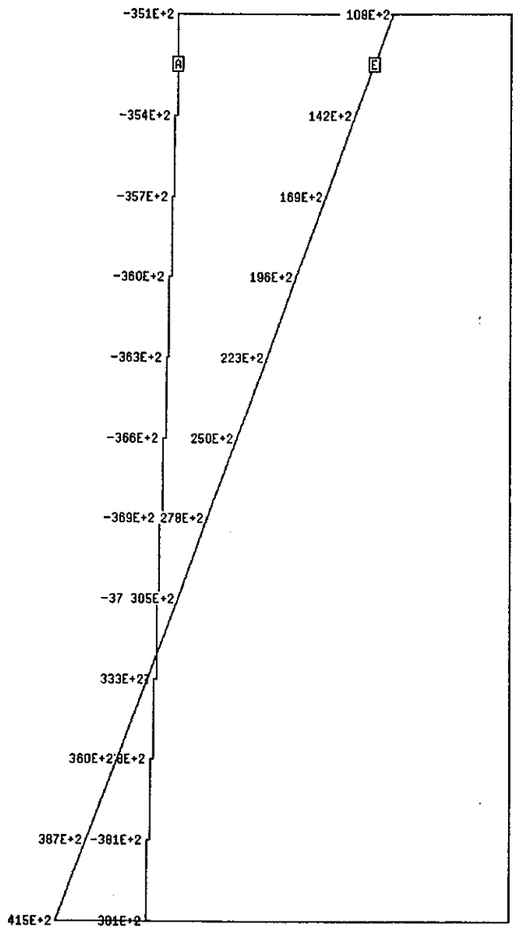
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	18.04	SEC10	383.3	0.75	58
	16.04	SEC10	383.3	0.75	61
10	16.04	SEC09	383.3	0.74	61
	14.44	SEC09	383.3	0.74	64
9	14.44	SEC08	949.0	1.82	52
	12.83	SEC08	949.0	1.82	55
8	12.83	SEC07	949.0	1.80	55
	11.23	SEC07	949.0	1.80	58
7	11.23	SEC06	997.3	1.88	57
	9.624	SEC06	997.3	1.88	60
6	9.624	SEC05	997.3	1.86	60
	8.020	SEC05	997.3	1.86	63
5	8.020	SEC04	997.3	1.84	63
	6.416	SEC04	997.3	1.84	66
4	6.416	SEC03	1029.4	1.88	65
	4.812	SEC03	1029.4	1.88	68
3	4.812	SEC02	1029.4	1.87	67
	3.208	SEC02	1029.4	1.87	71
2	3.208	SEC01	1029.4	1.85	70
	1.604	SEC01	1029.4	1.85	74
1	1.604	SEC00	1029.4	1.83	73
	0.000	SEC00	1029.4	1.83	76

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

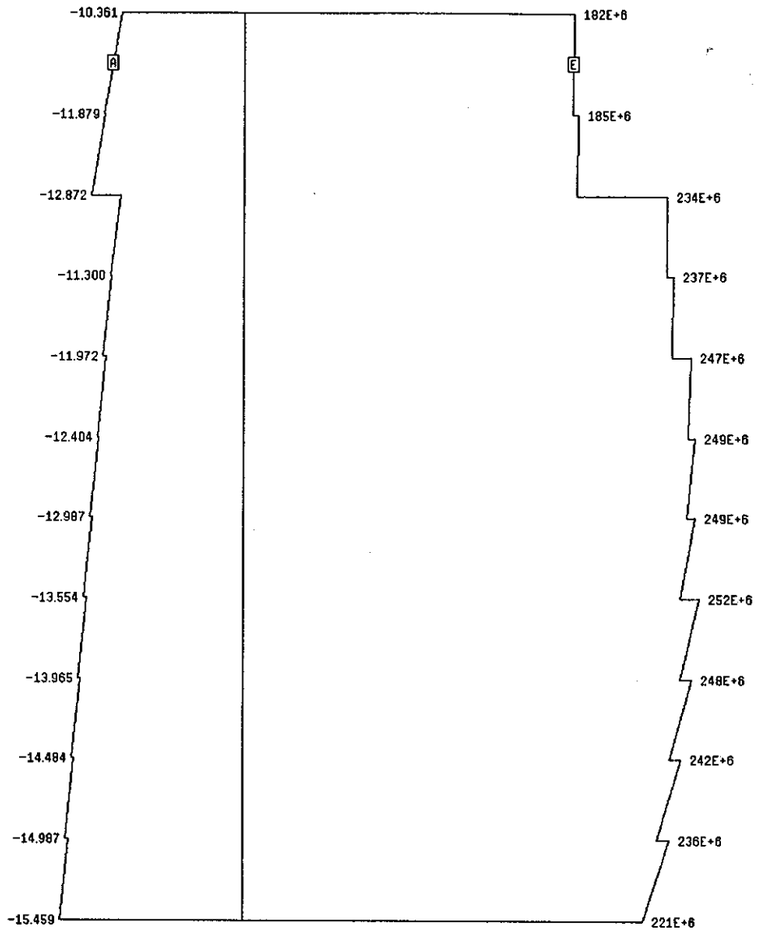
Escala 1 : 121.9
<B.PILA2.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 121.9
<B.PILA2.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 121.9
<B.PILA2.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



PILA Nº 3

Pila ''PILA3'
****

Título : 'PILA 3 VIADUCTO N° 1'
Altura de la pila : 17.431 [m]
Long. max. de barra: Altura pila / 10

NUDOS Nu	x [m]	Apoyo d-xyz	r-xyz
12	17.431		
11	15.431		
10	13.888		
9	12.345		
8	10.802		
7	9.257		
6	7.715		
5	6.172		
4	4.630		
3	3.086		
2	1.543		
1	0.000	BBB	BBB

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

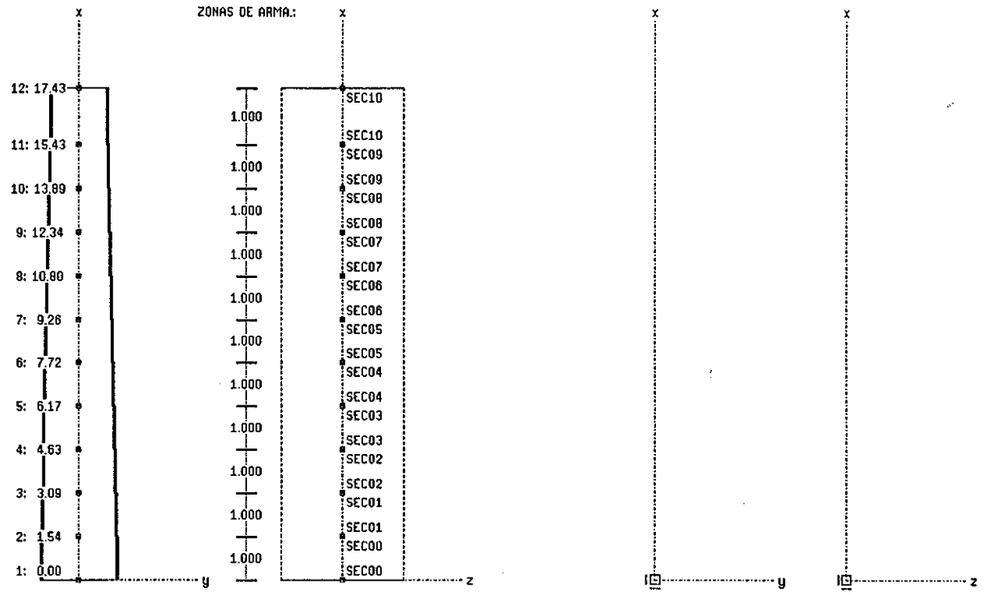
Ba	Nu	Sección	Tipo	Exc: ey [m]	ez [m]	Arm: Zona	fac
11	12-11	'SEC10'	SecFAGUS			1	1.000
10	11-10	'SEC09'	SecFAGUS			2	1.000
9	10-9	'SEC08'	SecFAGUS			3	1.000
8	9-8	'SEC07'	SecFAGUS			4	1.000
7	8-7	'SEC06'	SecFAGUS			5	1.000
6	7-6	'SEC05'	SecFAGUS			6	1.000
5	6-5	'SEC04'	SecFAGUS			7	1.000
4	5-4	'SEC03'	SecFAGUS			8	1.000
3	4-3	'SEC02'	SecFAGUS			9	1.000
2	3-2	'SEC01'	SecFAGUS			10	1.000
1	2-1	'SEC00'	SecFAGUS			11	1.000

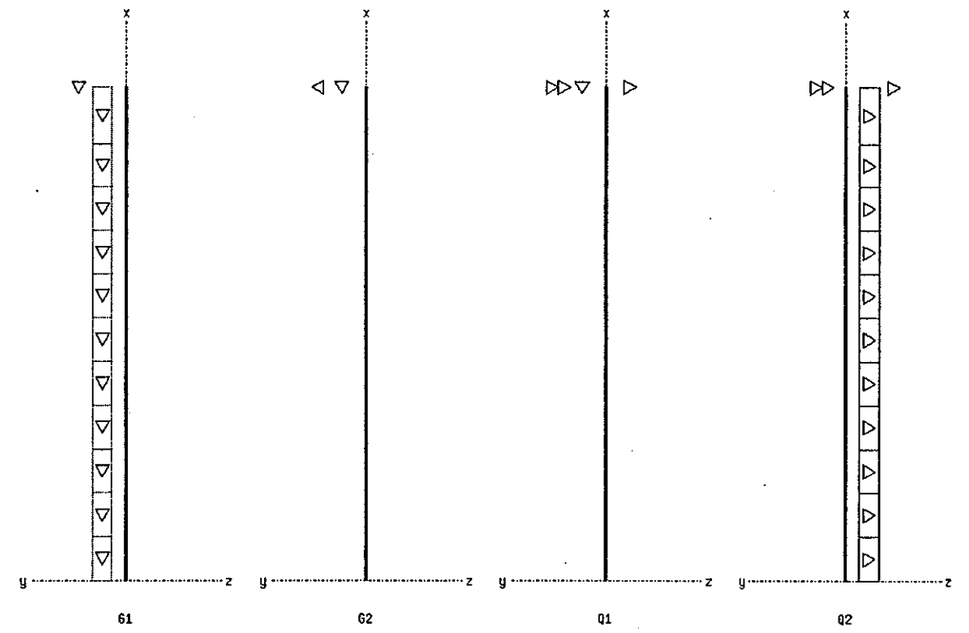
CARGAS :

Nu/Ba		Tipo Car.		Dim.	Valor Val.arriba	ey[m] Val.abajo	ez[m]
Comp. Carga G1 :							
Nudo	12	Fuerza	x	[kN]	-12530.000		
Barra	11	Peso propio	x	[kN/m3]	-25.000		
Barra	10	Peso propio	x	[kN/m3]	-25.000		
Barra	9	Peso propio	x	[kN/m3]	-25.000		
Barra	8	Peso propio	x	[kN/m3]	-25.000		
Barra	7	Peso propio	x	[kN/m3]	-25.000		
Barra	6	Peso propio	x	[kN/m3]	-25.000		
Barra	5	Peso propio	x	[kN/m3]	-25.000		

Nu/Ba		Tipo Car.		Dim.	Valor Val.arriba	ey[m] Val.abajo	ez[m]
Barra	4	Peso propio	x	[kN/m3]	-25.000		
Barra	3	Peso propio	x	[kN/m3]	-25.000		
Barra	2	Peso propio	x	[kN/m3]	-25.000		
Barra	1	Peso propio	x	[kN/m3]	-25.000		
Comp. Carga G2 :							
Nudo	12	Fuerza	x	[kN]	-5595.000		
		Fuerza	y	[kN]	903.500		
Comp. Carga Q1 :							
Nudo	12	Fuerza	x	[kN]	-11640.000		
		Fuerza	z	[kN]	557.800		
		Momento	y	[kNm]	-6862.000		
Comp. Carga Q2 :							
Nudo	12	Fuerza	z	[kN]	733.000		
		Momento	y	[kNm]	-3115.000		
Barra	11	Fuerza	z	[kN/m]	4.000		
Barra	10	Fuerza	z	[kN/m]	4.000		
Barra	9	Fuerza	z	[kN/m]	4.000		
Barra	8	Fuerza	z	[kN/m]	4.000		
Barra	7	Fuerza	z	[kN/m]	4.000		
Barra	6	Fuerza	z	[kN/m]	4.000		
Barra	5	Fuerza	z	[kN/m]	4.000		
Barra	4	Fuerza	z	[kN/m]	4.000		
Barra	3	Fuerza	z	[kN/m]	4.000		
Barra	2	Fuerza	z	[kN/m]	4.000		
Barra	1	Fuerza	z	[kN/m]	4.000		

Escala 1 : 217.7
Modelo, Deformación accidental y cargas de la pila PILA3





C A R G A F I J A <F.PILA3.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.320 [kN]
Tolerancia desequi. momentos	0.265 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 1.000 * Carga variable Q1 * ß
	+ 0.600 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-14.36	0.00	0.00	-2.284E-2	-1.230	0.000
Máxima	0.00	55.80	11.95	7.603E-3	0.000	5.311

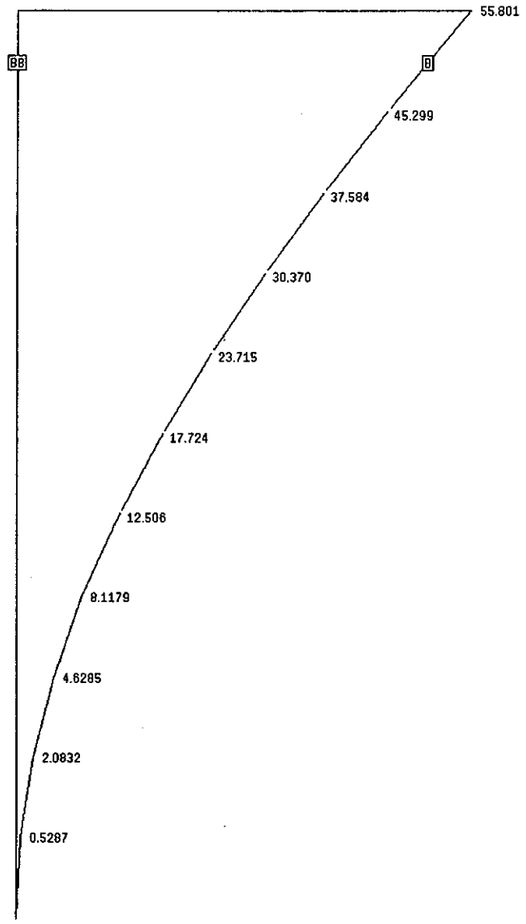
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-31990.65	-903.50	-1037.58	0.00	8730.20	0.00
Máxima	-29892.75	-903.50	-1000.00	45.75	26849.72	17456.57

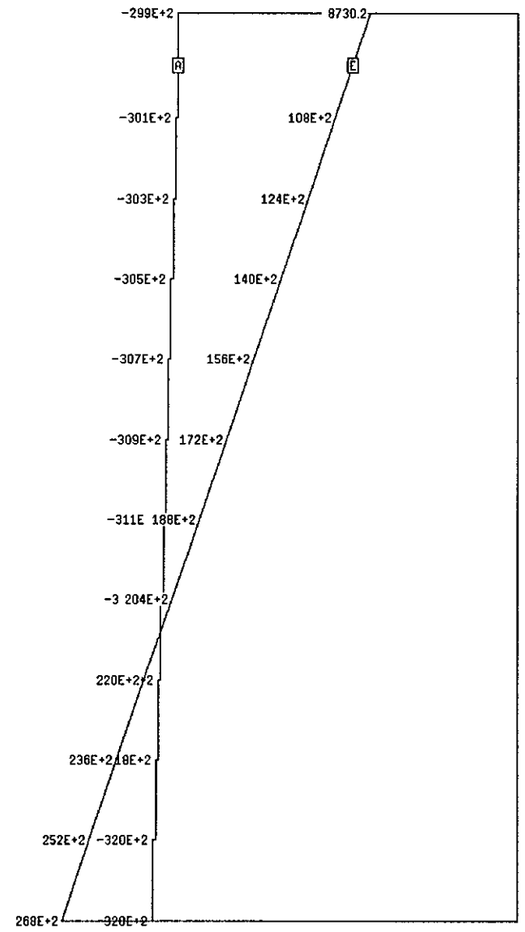
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-11.9	-350.2	-0.905	-1.668	1.921E+8	1.308E+7
Máxima	0.0	24.8	0.155	0.118	2.758E+8	3.843E+7

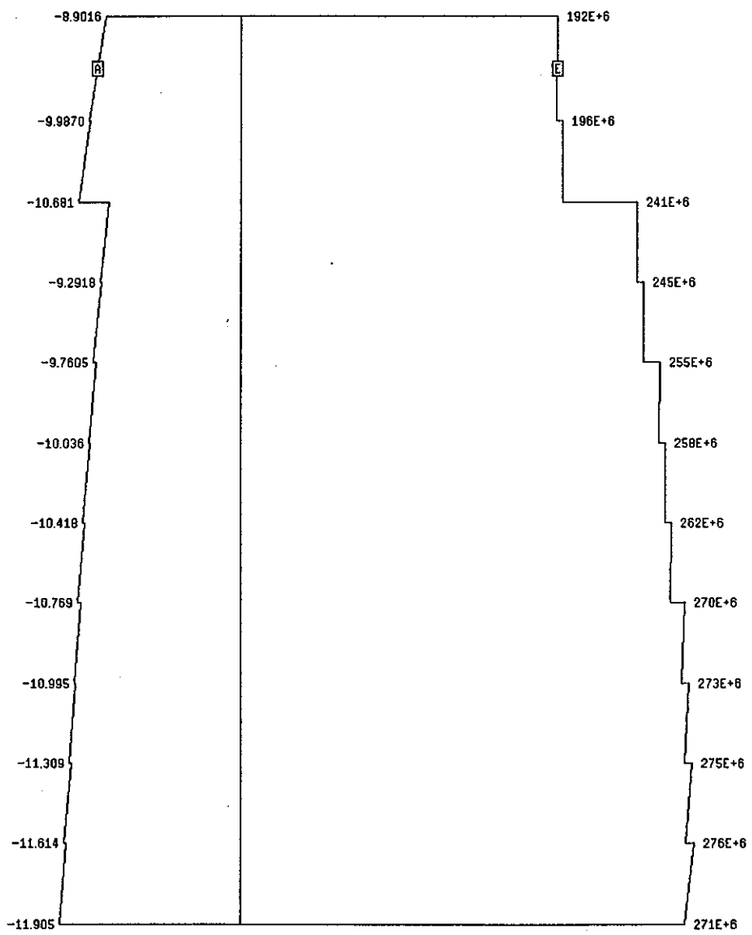
Escala 1 : 117.8
<F.PILA3.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 117.8
<F.PILA3.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 117.8
<F.PILA3.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA2.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.450 [kN]
Tolerancia desequi. momentos	0.407 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 1.500 * Carga variable Q1
	+ 0.900 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-21.60	0.00	0.00	-0.062	-2.234	0.000
Máxima	0.00	94.48	22.67	0.025	0.000	8.689

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-45038.35	-1219.75	-1558.47	0.00	13095.26	-0.01
Máxima	-42101.21	-1219.73	-1500.04	116.06	41653.57	26077.65

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

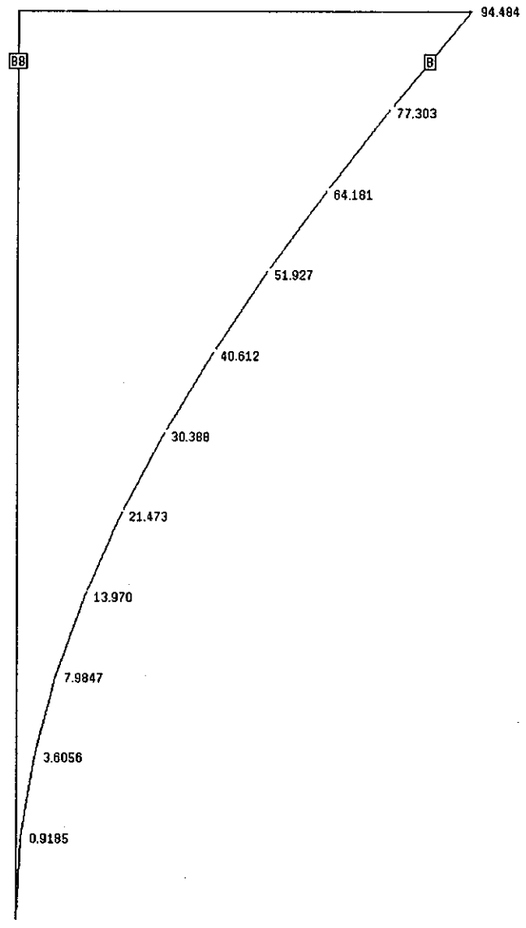
	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-16.2	-443.5	-1.576	-2.662	1.635E+8	1.231E+7
Máxima	0.0	82.4	0.415	0.392	2.435E+8	3.625E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

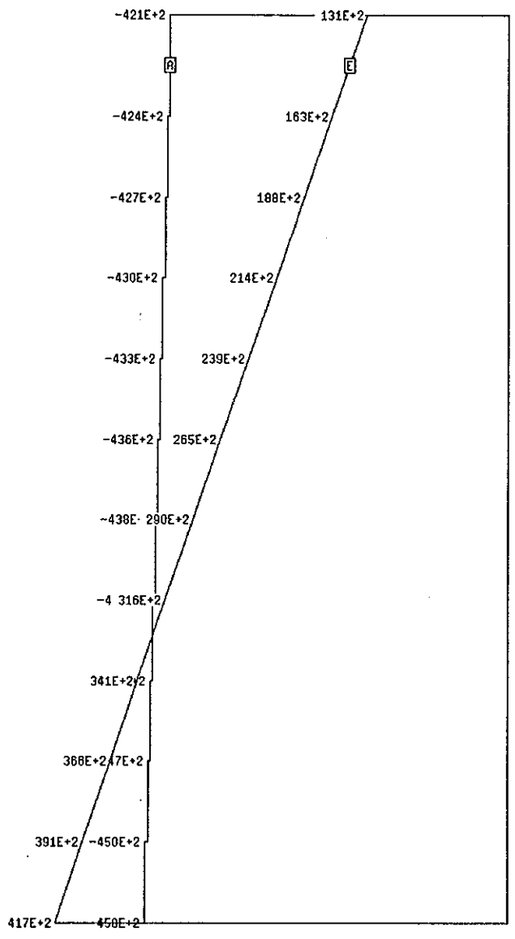
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	18.04	SEC10	383.3	0.75	69
	16.04	SEC10	383.3	0.75	72
10	16.04	SEC09	383.3	0.74	72
	14.44	SEC09	383.3	0.74	75
9	14.44	SEC08	949.0	1.82	61
	12.83	SEC08	949.0	1.82	64
8	12.83	SEC07	949.0	1.80	63
	11.23	SEC07	949.0	1.80	67
7	11.23	SEC06	997.3	1.88	65
	9.624	SEC06	997.3	1.88	68
6	9.624	SEC05	997.3	1.86	68
	8.020	SEC05	997.3	1.86	71
5	8.020	SEC04	997.3	1.84	70
	6.416	SEC04	997.3	1.84	74
4	6.416	SEC03	1029.4	1.88	72
	4.812	SEC03	1029.4	1.88	76
3	4.812	SEC02	1029.4	1.87	75
	3.208	SEC02	1029.4	1.87	78
2	3.208	SEC01	1029.4	1.85	77
	1.604	SEC01	1029.4	1.85	80
1	1.604	SEC00	1029.4	1.83	79
	0.000	SEC00	1029.4	1.83	82

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

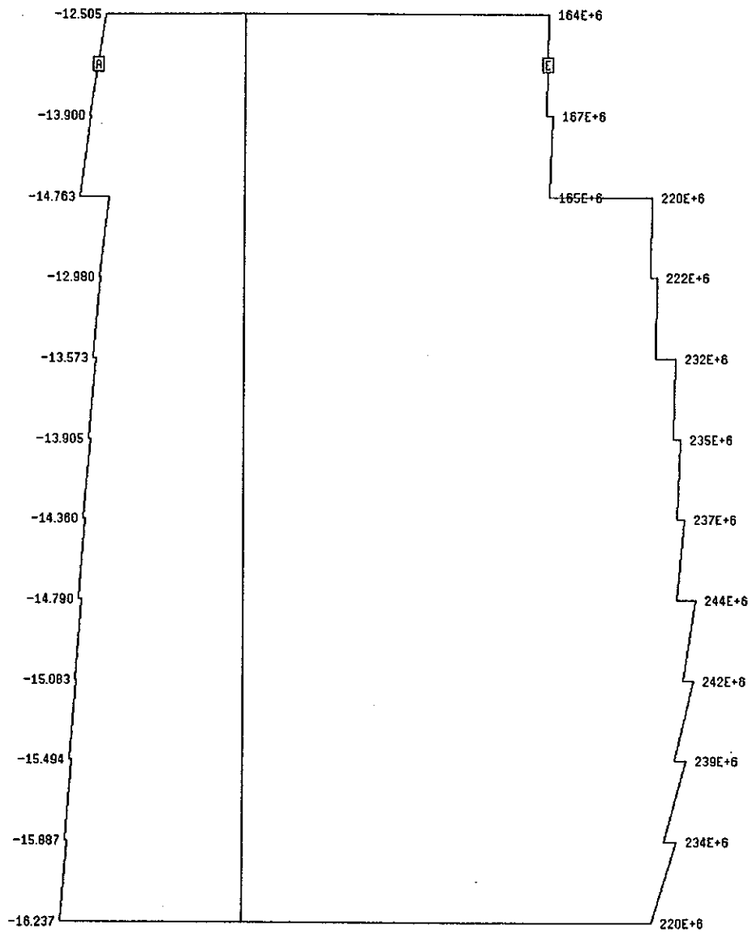
Escala 1 : 121.9
<B.PILA2.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 121.9
<B.PILA2.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 121.9
<B.PILA2.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.PILA3.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.273 [kN]
Tolerancia desequi. momentos	0.264 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 0.600 * Carga variable Q1 * ß
	+ 1.000 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm.	/ Acero	Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-12.99	0.00	0.00	-0.013	-1.147	0.000
Máxima	0.00	55.14	11.53	0.010	0.000	5.226

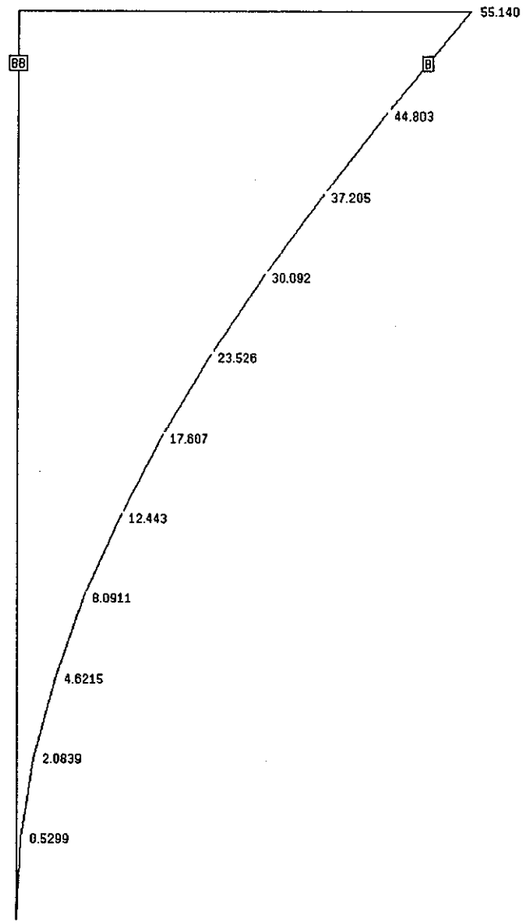
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-27334.65	-903.51	-1134.32	0.00	7230.85	-0.00
Máxima	-25236.75	-903.50	-1071.70	49.87	26748.77	17179.41

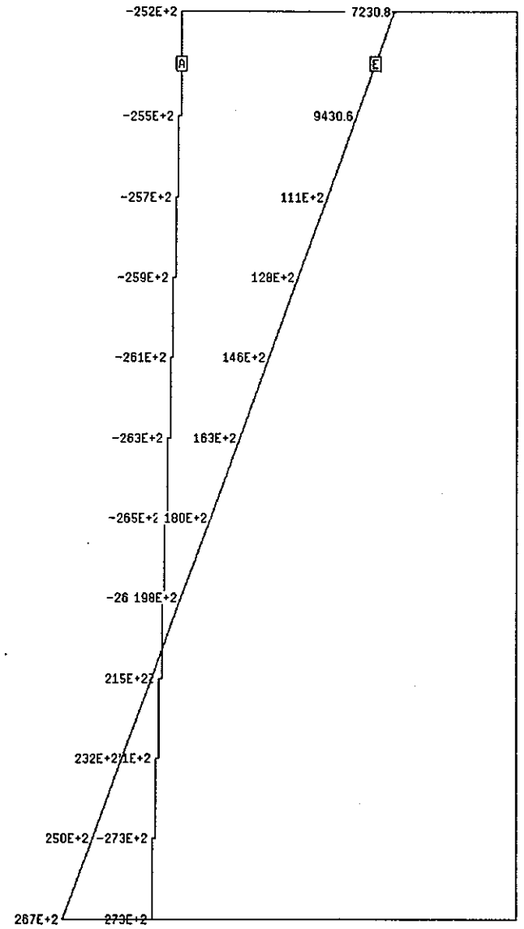
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-11.2	-335.6	-0.836	-1.598	2.026E+8	1.315E+7
Máxima	0.0	44.6	0.249	0.212	2.763E+8	3.787E+7

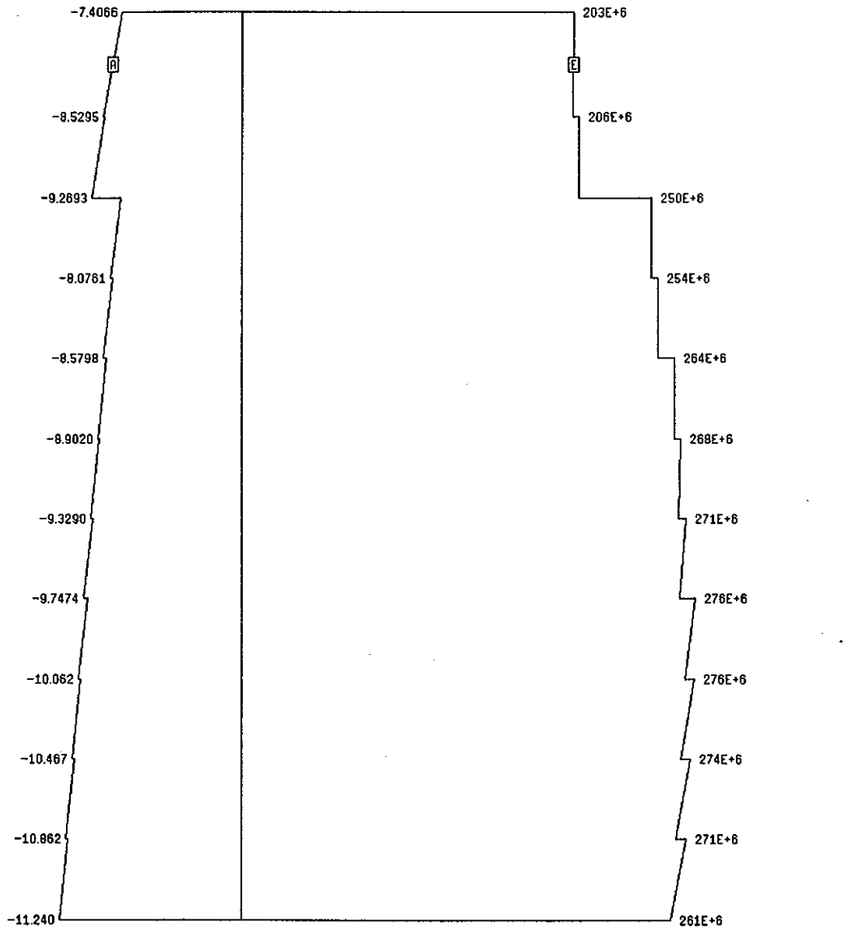
Escala 1 : 117.8
<F.PILA3.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 117.8
<F.PILA3.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 117.8
<F.PILA3.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA3.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.449 [kN]
Tolerancia desequi. momentos	0.397 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 1.500 * Carga variable Q1
	+ 0.900 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-20.79	0.00	0.00	-0.057	-2.100	0.000
Máxima	0.00	83.82	20.42	0.021	0.000	7.996

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-44933.37	-1219.74	-1556.38	0.00	13095.28	-0.00
Máxima	-42101.21	-1219.73	-1500.02	102.53	40605.38	24871.70

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

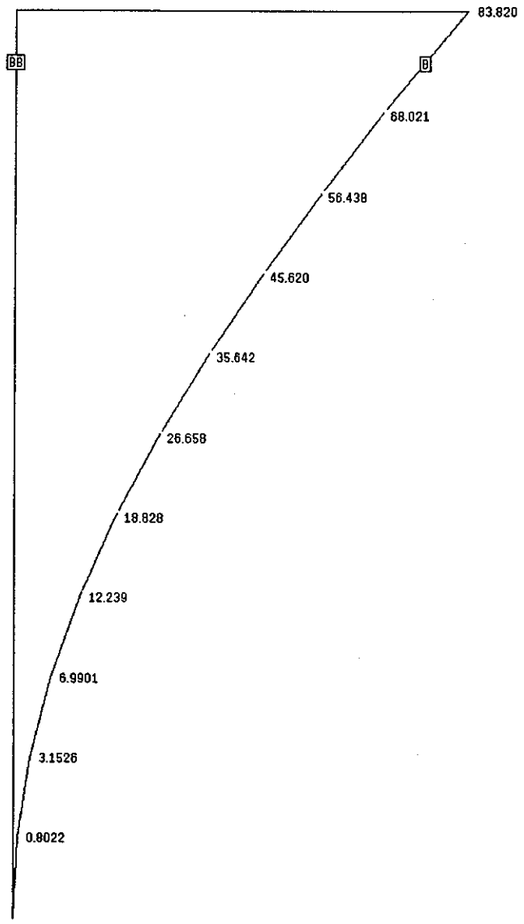
	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-16.0	-443.5	-1.505	-2.566	1.635E+8	1.226E+7
Máxima	0.0	65.6	0.353	0.312	2.449E+8	3.650E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

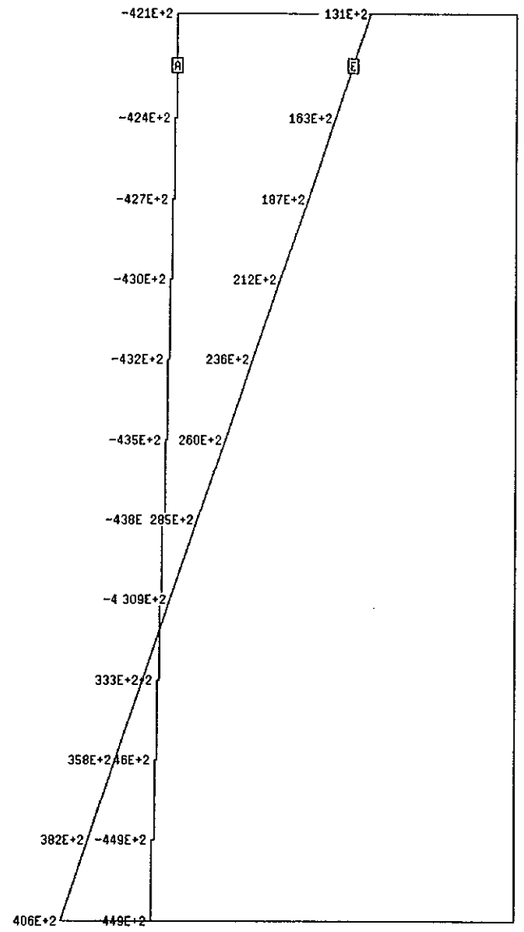
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	17.43	SEC10	383.3	0.75	69
	15.43	SEC10	383.3	0.75	72
10	15.43	SEC09	383.3	0.74	72
	13.89	SEC09	383.3	0.74	75
9	13.89	SEC08	949.0	1.82	61
	12.34	SEC08	949.0	1.82	63
8	12.34	SEC07	949.0	1.80	63
	10.80	SEC07	949.0	1.80	66
7	10.80	SEC06	997.3	1.88	65
	9.257	SEC06	997.3	1.88	68
6	9.257	SEC05	997.3	1.86	67
	7.715	SEC05	997.3	1.86	70
5	7.715	SEC04	997.3	1.84	70
	6.172	SEC04	997.3	1.84	73
4	6.172	SEC03	1029.4	1.88	71
	4.630	SEC03	1029.4	1.88	74
3	4.630	SEC02	1029.4	1.87	73
	3.086	SEC02	1029.4	1.87	76
2	3.086	SEC01	1029.4	1.85	76
	1.543	SEC01	1029.4	1.85	79
1	1.543	SEC00	1029.4	1.83	78
	0.000	SEC00	1029.4	1.83	81

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

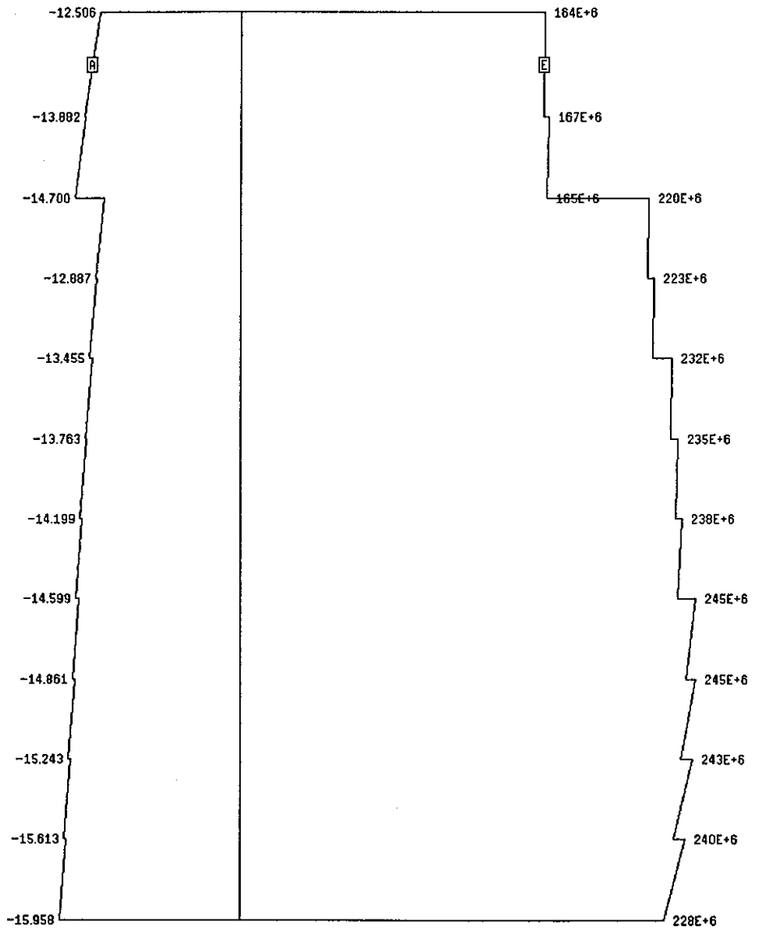
Escala 1 : 117.8
<B.PILA3.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 117.8
<B.PILA3.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 117.8
<B.PILA3.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA3.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.379 [kN]
Tolerancia desequi. momentos	0.397 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 0.900 * Carga variable Q1
	+ 1.500 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-18.41	0.00	0.00	-0.031	-1.899	0.000
Máxima	0.00	81.40	19.18	0.025	0.000	7.721

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-37949.37	-1219.73	-1701.48	0.00	10846.30	-0.00
Máxima	-35117.21	-1219.73	-1607.52	110.14	40366.74	24198.24

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

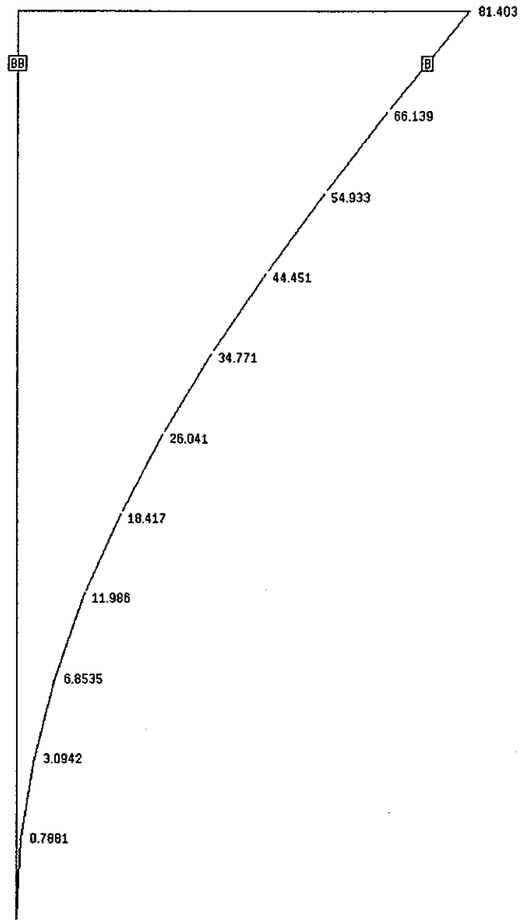
	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-15.1	-443.5	-1.336	-2.398	1.819E+8	1.251E+7
Máxima	0.0	92.5	0.480	0.440	2.541E+8	3.615E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

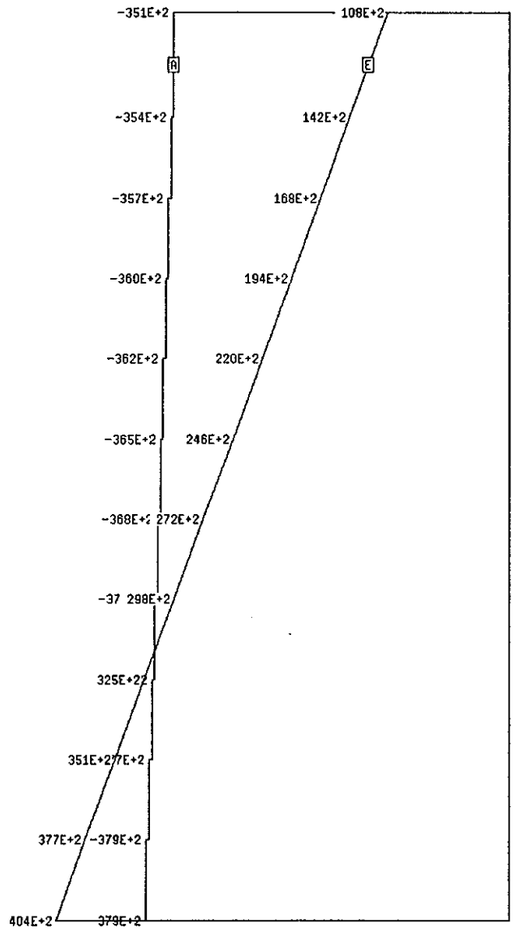
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	17.43	SEC10	383.3	0.75	58
	15.43	SEC10	383.3	0.75	61
10	15.43	SEC09	383.3	0.74	61
	13.89	SEC09	383.3	0.74	64
9	13.89	SEC08	949.0	1.82	52
	12.34	SEC08	949.0	1.82	55
8	12.34	SEC07	949.0	1.80	54
	10.80	SEC07	949.0	1.80	58
7	10.80	SEC06	997.3	1.88	56
	9.257	SEC06	997.3	1.88	59
6	9.257	SEC05	997.3	1.86	59
	7.715	SEC05	997.3	1.86	62
5	7.715	SEC04	997.3	1.84	62
	6.172	SEC04	997.3	1.84	65
4	6.172	SEC03	1029.4	1.88	64
	4.630	SEC03	1029.4	1.88	67
3	4.630	SEC02	1029.4	1.87	66
	3.086	SEC02	1029.4	1.87	69
2	3.086	SEC01	1029.4	1.85	69
	1.543	SEC01	1029.4	1.85	72
1	1.543	SEC00	1029.4	1.83	71
	0.000	SEC00	1029.4	1.83	74

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

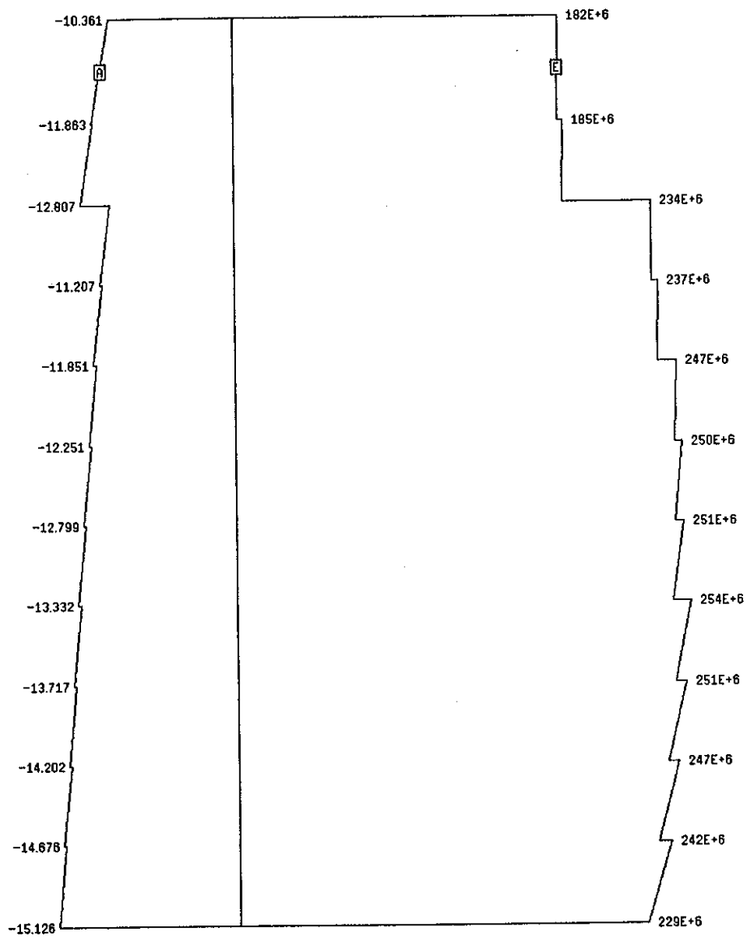
Escala 1 : 117.8
<B.PILA3.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 117.8
<B.PILA3.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 117.8
<B.PILA3.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



PILA Nº 4

Pila ''PILA4'
****

Título : 'PILA 4 VIADUCTO N° 1'
Altura de la pila : 17.846 [m]
Long. max. de barra: Altura pila / 10

NUDOS Nu	x [m]	Apoyo d-xyz	r-xyz
12	17.846		
11	15.846		
10	14.261		
9	12.677		
8	11.092		
7	9.508		
6	7.923		
5	6.338		
4	4.754		
3	3.163		
2	1.522		
1	0.000	BBB	BBB

Apoyo: B=bloqueado, E=elástico

BARRAS (1.línea: barra arriba, 2.línea: barra abajo)

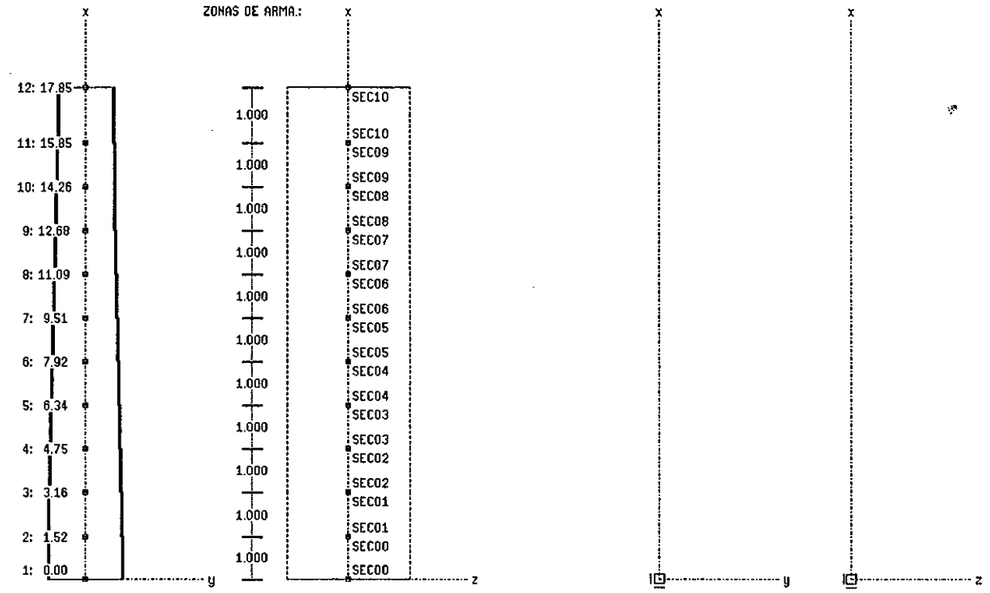
Ba	Nu	Sección	Tipo	Exc: ey [m]	ez [m]	Arm: Zona	fac
11	12-11	'SEC10'	SecFAGUS			1	1.000
10	11-10	'SEC09'	SecFAGUS			2	1.000
9	10-9	'SEC08'	SecFAGUS			3	1.000
8	9-8	'SEC07'	SecFAGUS			4	1.000
7	8-7	'SEC06'	SecFAGUS			5	1.000
6	7-6	'SEC05'	SecFAGUS			6	1.000
5	6-5	'SEC04'	SecFAGUS			7	1.000
4	5-4	'SEC03'	SecFAGUS			8	1.000
3	4-3	'SEC02'	SecFAGUS			9	1.000
2	3-2	'SEC01'	SecFAGUS			10	1.000
1	2-1	'SEC00'	SecFAGUS			11	1.000

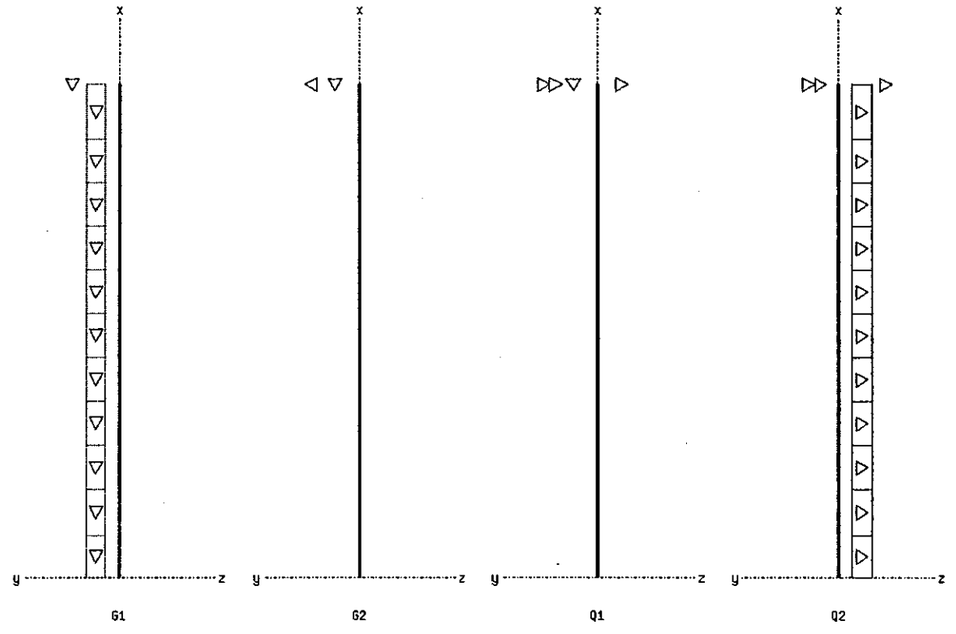
CARGAS :

Nu/Ba		Tipo Car.		Dim.	Valor Val.arriba	ey[m] Val.abajo	ez[m]
Comp. Carga G1 :							
Nudo	12	Fuerza	x	[kN]	-12530.000		
Barra	11	Peso propio	x	[kN/m3]	-25.000		
Barra	10	Peso propio	x	[kN/m3]	-25.000		
Barra	9	Peso propio	x	[kN/m3]	-25.000		
Barra	8	Peso propio	x	[kN/m3]	-25.000		
Barra	7	Peso propio	x	[kN/m3]	-25.000		
Barra	6	Peso propio	x	[kN/m3]	-25.000		
Barra	5	Peso propio	x	[kN/m3]	-25.000		

Nu/Ba		Tipo Car.		Dim.	Valor Val.arriba	ey[m] Val.abajo	ez[m]
Barra	4	Peso propio	x	[kN/m3]	-25.000		
Barra	3	Peso propio	x	[kN/m3]	-25.000		
Barra	2	Peso propio	x	[kN/m3]	-25.000		
Barra	1	Peso propio	x	[kN/m3]	-25.000		
Comp. Carga G2 :							
Nudo	12	Fuerza	x	[kN]	-5595.000		
		Fuerza	y	[kN]	630.000		
Comp. Carga Q1 :							
Nudo	12	Fuerza	x	[kN]	-11640.000		
		Fuerza	z	[kN]	557.800		
		Momento	y	[kNm]	-6862.000		
Comp. Carga Q2 :							
Nudo	12	Fuerza	z	[kN]	733.000		
		Momento	y	[kNm]	-3115.000		
Barra	11	Fuerza	z	[kN/m]	4.000		
Barra	10	Fuerza	z	[kN/m]	4.000		
Barra	9	Fuerza	z	[kN/m]	4.000		
Barra	8	Fuerza	z	[kN/m]	4.000		
Barra	7	Fuerza	z	[kN/m]	4.000		
Barra	6	Fuerza	z	[kN/m]	4.000		
Barra	5	Fuerza	z	[kN/m]	4.000		
Barra	4	Fuerza	z	[kN/m]	4.000		
Barra	3	Fuerza	z	[kN/m]	4.000		
Barra	2	Fuerza	z	[kN/m]	4.000		
Barra	1	Fuerza	z	[kN/m]	4.000		

Escala 1 : 222.9
Modelo, Deformación accidental y cargas de la pila PILA4





C A R G A F I J A <F.PILA4.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.320 [kN]
Tolerancia desequi. momentos	0.269 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 1.000 * Carga variable Q1 * ß
	+ 0.600 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-14.62	0.00	0.00	-1.707E-2	-1.267	0.000
Máxima	0.00	41.82	12.59	5.594E-3	0.000	3.889

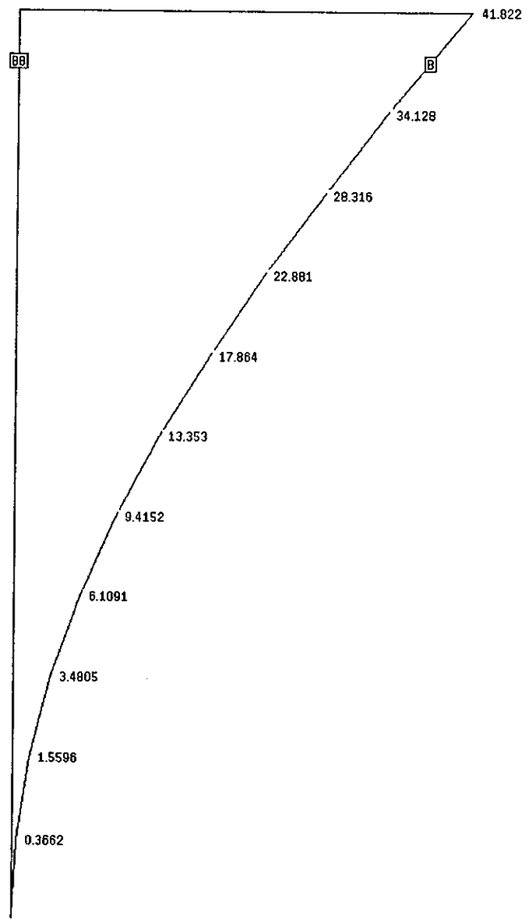
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-32047.94	-630.00	-1038.60	0.00	8730.20	0.00
Máxima	-29892.75	-630.00	-1000.00	34.46	27301.30	12523.68

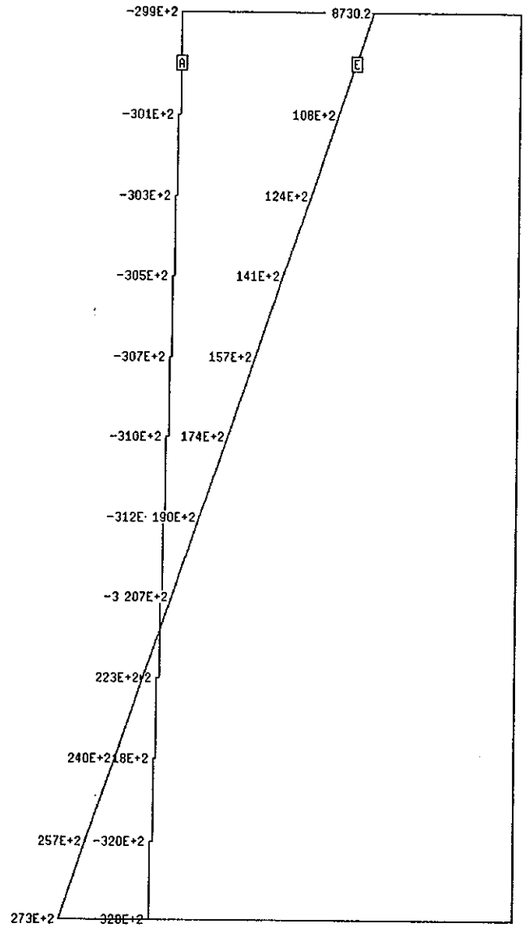
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-11.2	-312.8	-0.834	-1.490	1.921E+8	1.310E+7
Máxima	0.0	-12.3	0.080	-0.058	2.802E+8	3.867E+7

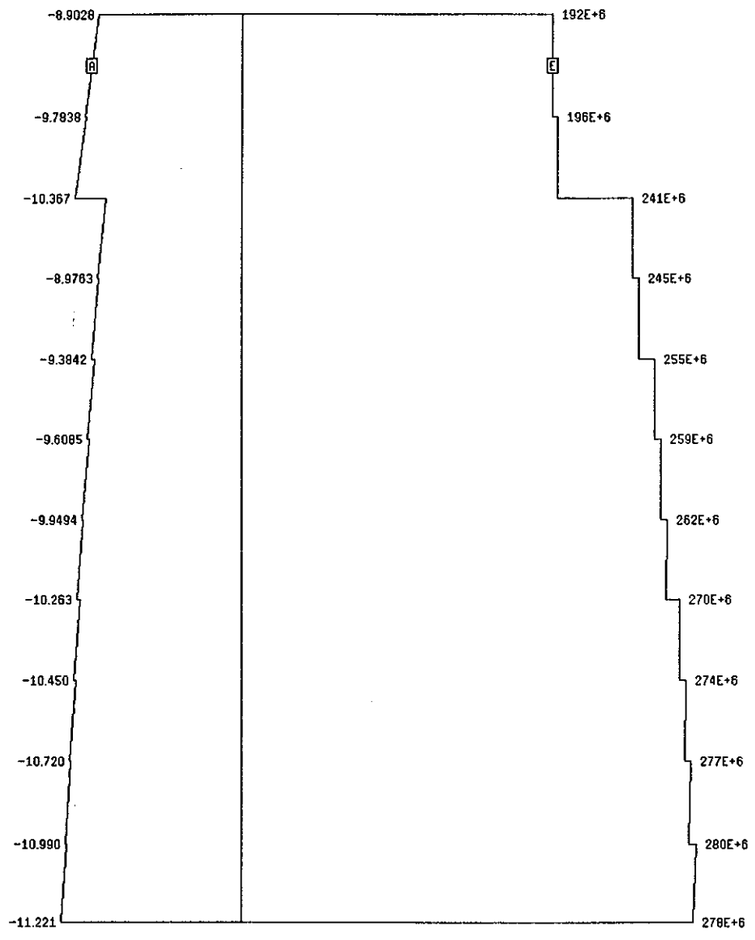
Escala 1 : 120.6
<F.PILA4.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 120.6
<F.PILA4.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 120.6
<F.PILA4.1> Carga: 1.00*G1 1.00*G2 1.00*Q1*ß 0.60*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.PILA4.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia.	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.274 [kN]
Tolerancia desequi. momentos	0.269 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1
	+ 1.000 * Carga permanente G2
	+ 0.600 * Carga variable Q1 * ß
	+ 1.000 * Carga variable Q2 * ß

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar. (ß=1.00).
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-13.23	0.00	0.00	-0.010	-1.169	0.000
Máxima	0.00	41.11	11.95	0.007	0.000	3.811

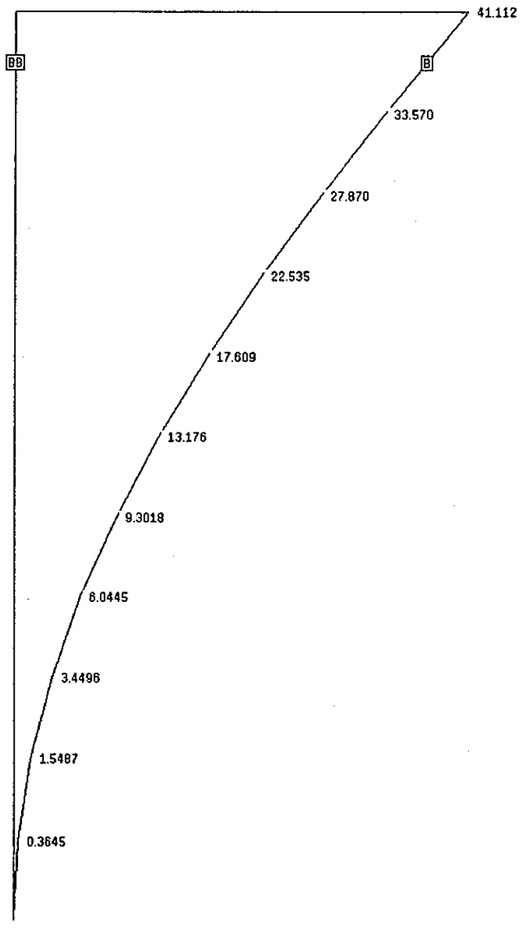
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-27391.94	-630.00	-1136.02	0.00	7230.87	0.00
Máxima	-25236.75	-630.00	-1071.68	37.44	27232.43	12310.34

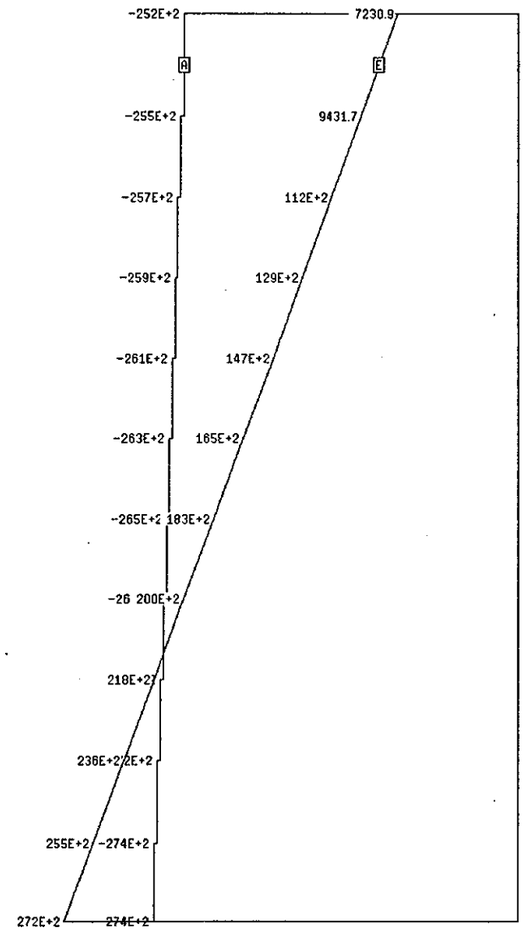
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-10.4	-296.9	-0.758	-1.414	2.026E+8	1.316E+7
Máxima	0.0	3.7	0.156	0.018	2.828E+8	3.834E+7

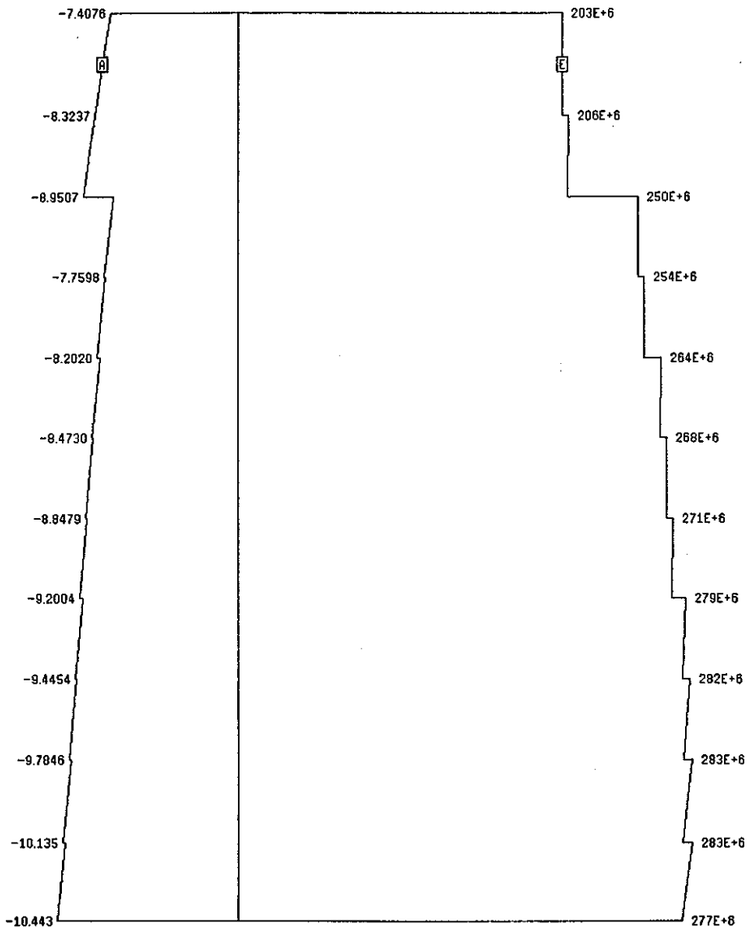
Escala 1 : 120.6
<F.PILA4.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 120.6
<F.PILA4.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 120.6
<F.PILA4.2> Carga: 1.00*G1 1.00*G2 0.60*Q1*ß 1.00*Q2*ß ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA4.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.450 [kN]
Tolerancia desequi. momentos	0.404 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 1.500 * Carga variable Q1
	+ 0.900 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-21.06	0.00	0.00	-0.043	-2.136	0.000
Máxima	0.00	62.44	21.10	0.015	0.000	5.833

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-45010.72	-850.50	-1557.91	0.00	13095.30	0.00
Máxima	-42101.21	-850.50	-1500.00	77.01	41282.82	17869.26

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-15.1	-443.5	-1.335	-2.244	1.636E+8	1.228E+7
Máxima	0.0	2.9	0.194	0.014	2.517E+8	3.723E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2° ORDEN

Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	17.85	SEC10	383.3	0.75	69
	15.85	SEC10	383.3	0.75	72
10	15.85	SEC09	383.3	0.74	71
	14.26	SEC09	383.3	0.74	74
9	14.26	SEC08	949.0	1.82	60
	12.68	SEC08	949.0	1.82	62
8	12.68	SEC07	949.0	1.80	61
	11.09	SEC07	949.0	1.80	64
7	11.09	SEC06	997.3	1.88	62
	9.508	SEC06	997.3	1.88	65
6	9.508	SEC05	997.3	1.86	64
	7.923	SEC05	997.3	1.86	67
5	7.923	SEC04	997.3	1.84	66
	6.338	SEC04	997.3	1.84	69
4	6.338	SEC03	1029.4	1.88	67
	4.754	SEC03	1029.4	1.88	70
3	4.754	SEC02	1029.4	1.87	69
	3.163	SEC02	1029.4	1.87	71
2	3.163	SEC01	1029.4	1.85	71
	1.522	SEC01	1029.4	1.85	73
1	1.522	SEC00	1029.4	1.83	73
	0.000	SEC00	1029.4	1.83	75

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

CALCULO DE DEFORMACION DE PILAS EN FASE DE CONSTRUCCION

C A R G A F I J A <F.P1-M.1>

PARAMETROS DE CALCULO:

Norma	EH	
Criterio de rotura	Agotamiento de secciones o del sistema	
Rotura de secciones	Limitación de deformaciones según FAGUS	
- Hormigón (def. centrada)	-2.000	[o/oo]
- Hormigón (flexión)	-3.500	[o/oo]
- Acero	10.00	[o/oo]
Coef. min. resist. (gamma_r)	1.500	
Coeficiente de fluencia	1.000	
Carga contribuyente a fluencia	1.000	* Carga permanente G1
Factor armadura (global)	1.000	
No de elementos	11	
Tolerancia desequi. fuerzas	0.151	[kN]
Tolerancia desequi. momentos	0.113	[kNm]
Mayoración de cargas	1.000	* Carga permanente G1

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar..
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm.	/ Acero	Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.689	6.000	H300	AEH500	B1	0.000	11E+2
SEC01	2.620	6.000	H300	AEH500	B1	0.000	11E+2
SEC02	2.551	6.000	H300	AEH500	B1	0.000	11E+2
SEC03	2.482	6.000	H300	AEH500	B1	0.000	11E+2
SEC04	2.413	6.000	H300	AEH500	B1	0.000	389.6
SEC05	2.344	6.000	H300	AEH500	B1	0.000	389.6
SEC06	2.275	6.000	H300	AEH500	B1	0.000	389.6
SEC07	2.207	6.000	H300	AEH500	B1	0.000	383.3
SEC08	2.138	6.000	H300	AEH500	B1	0.000	383.3
SEC09	2.069	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	383.3	383.3
8	SEC07	SEC07	1.000	383.3	383.3
7	SEC06	SEC06	1.000	389.6	389.6
6	SEC06	SEC05	1.000	389.6	389.6
5	SEC05	SEC04	1.000	389.6	389.6
4	SEC04	SEC03	1.000	389.6	11E+2
3	SEC03	SEC02	1.000	11E+2	11E+2
2	SEC02	SEC01	1.000	11E+2	11E+2

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
1	SEC01	SEC00	1.000	11E+2	11E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-6.24	0.00	0.00	0.000	0.000	0.000
Máxima	0.00	31.98	0.00	0.000	0.000	3.098

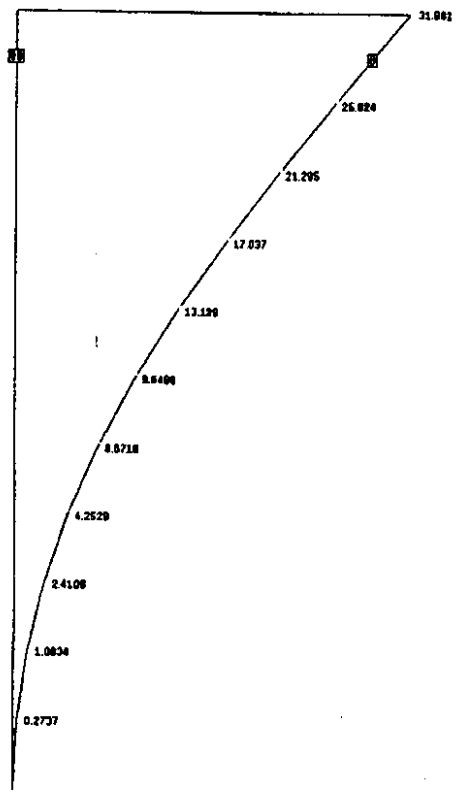
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-15063.25	-655.00	0.00	0.00	0.00	0.00
Máxima	-12830.00	-655.00	0.00	0.00	0.00	11713.05

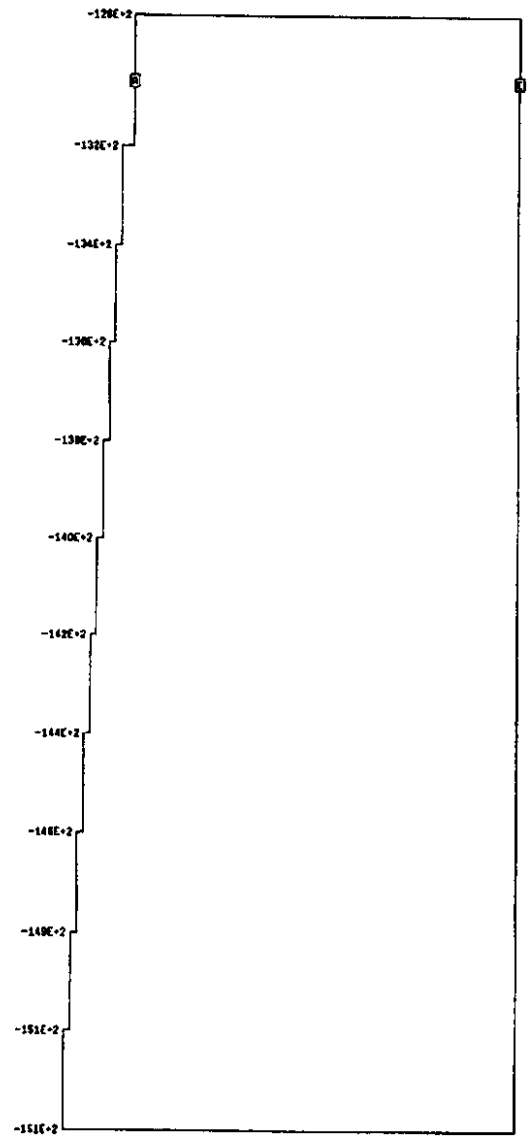
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-5.7	-151.7	-0.368	-0.722	6.08E+07	2.02E+07
Máxima	-0.2	-6.3	-0.009	-0.030	1.00E+09	4.90E+07

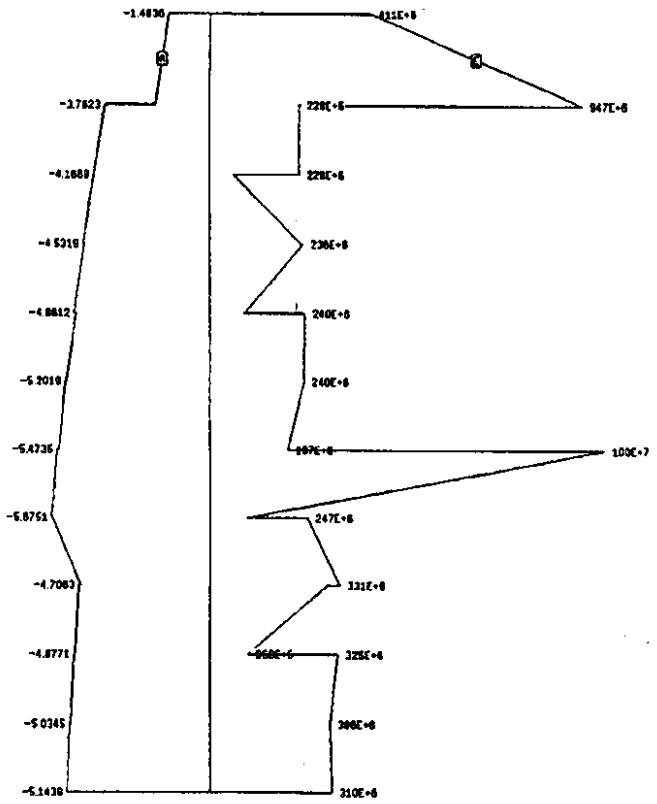
Escala 1 : 116.4
<F.P1-M.1> Carga: 1.00*G1 ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 81.4
<F.P1-M.1> Carga: 1.00*G1 ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 116.4
<F.P1-M.1> Carga: 1.00*G1 ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.P2-M.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	1.000
Carga contribuyente a fluencia	1.000 * Carga permanente G1
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.148 [kN]
Tolerancia desequi. momentos	0.118 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar..

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba / abajo		factor S de la armadura	Armadura variable arriba[cm²]/abajo[cm²]	
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-6.11	0.00	0.00	0.000	0.000	0.000
Máxima	0.00	31.54	0.00	0.000	0.000	2.869

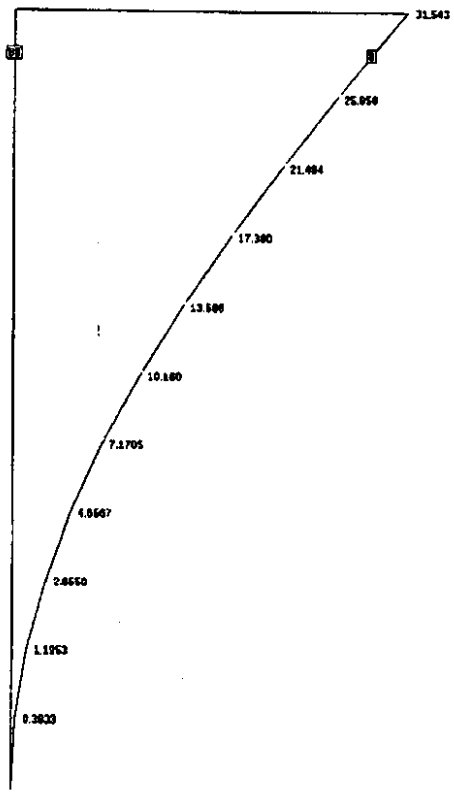
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-14833.41	-655.00	0.00	0.00	0.00	0.00
Máxima	-12657.75	-655.00	0.00	0.00	0.00	12238.21

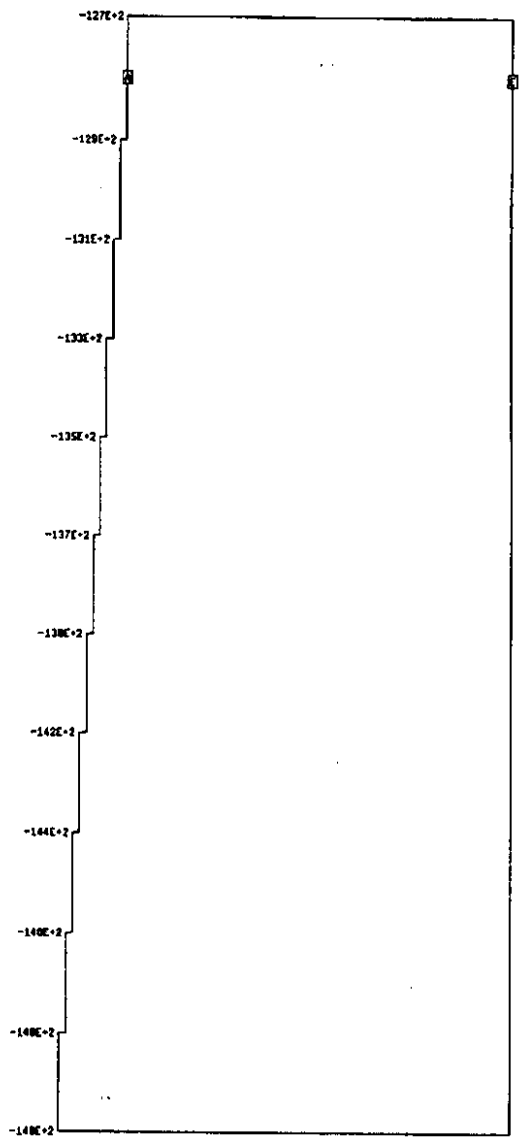
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-5.2	-137.5	-0.333	-0.655	1.30E+06	1.86E+07
Máxima	-0.0	-3.8	-0.003	-0.018	3.18E+09	5.04E+07

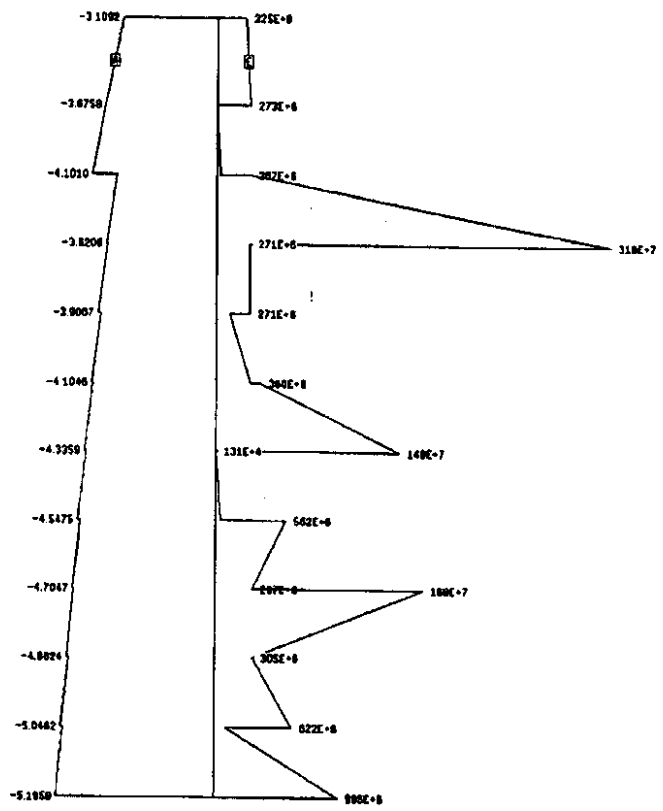
Escala 1 : 121.9
<F.P2-M.1> Carga: 1.00*G1 ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 85.2
<F.P2-M.1> Carga: 1.00*G1 ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 121.9
<F.P2-M.1> Carga: 1.00*G1 ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.P3-M.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	1.000
Carga contribuyente a fluencia	1.000 * Carga permanente G1
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.148 [kN]
Tolerancia desequi. momentos	0.114 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar..

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba	Sección abajo	factor S de la armadura	Armadura variable arriba[cm²]	Armadura variable abajo[cm²]
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-5.88	0.00	0.00	0.000	0.000	0.000
Máxima	0.00	28.40	0.00	0.000	0.000	2.675

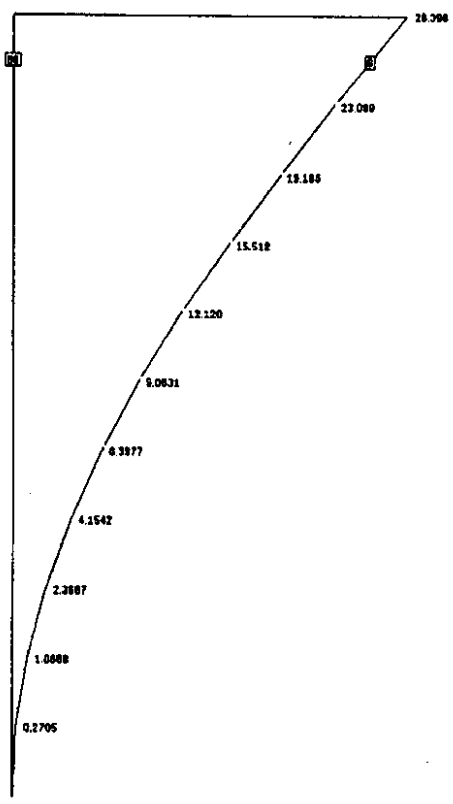
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-14755.65	-655.00	0.00	0.00	0.00	0.00
Máxima	-12657.75	-655.00	0.00	0.00	0.00	11796.42

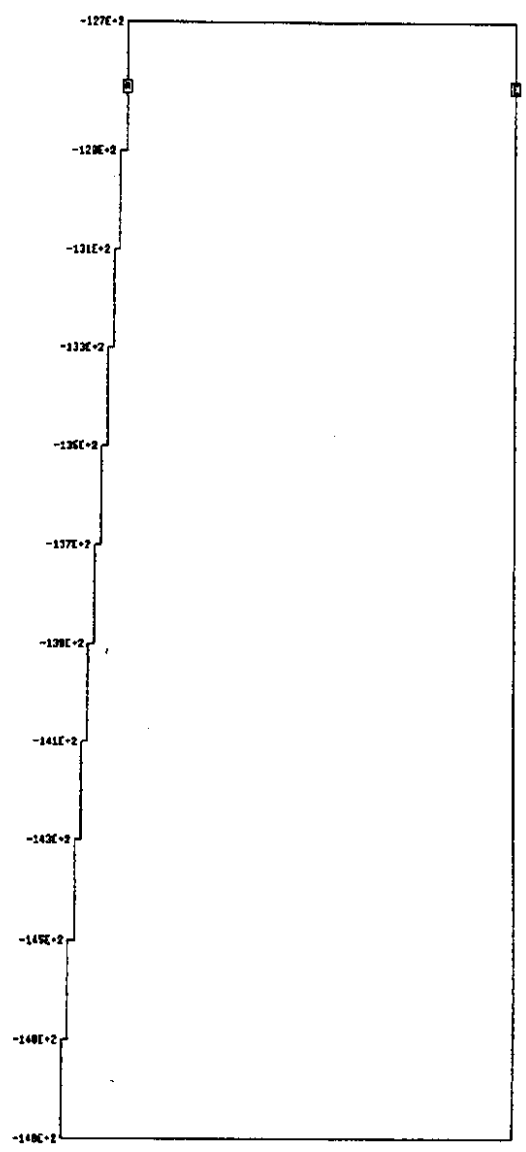
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-5.1	-134.6	-0.326	-0.641	1.79E+07	1.86E+07
Máxima	-0.1	-5.8	-0.008	-0.027	9.07E+09	5.04E+07

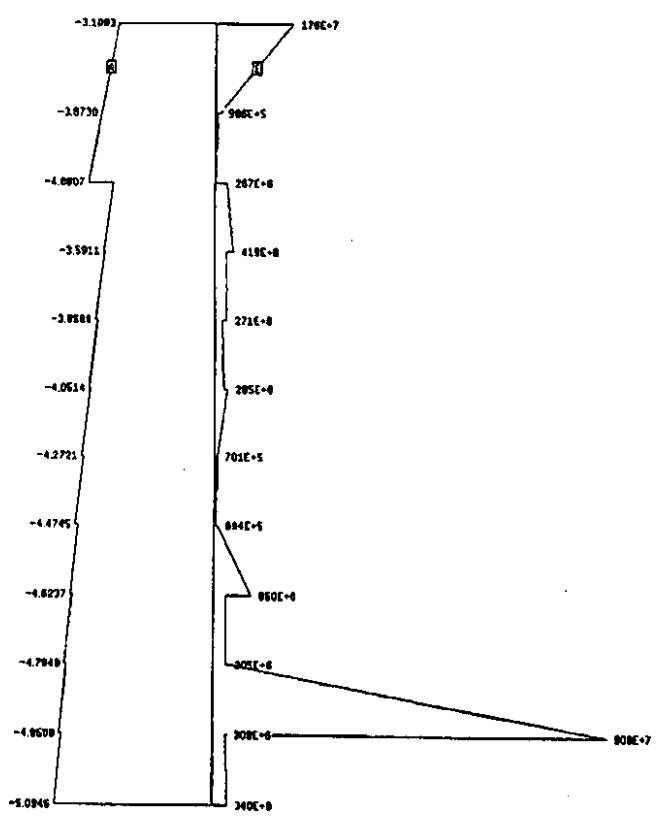
Escala 1 : 117.8
<F.P3-M.1> Carga: 1.00*G1 ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



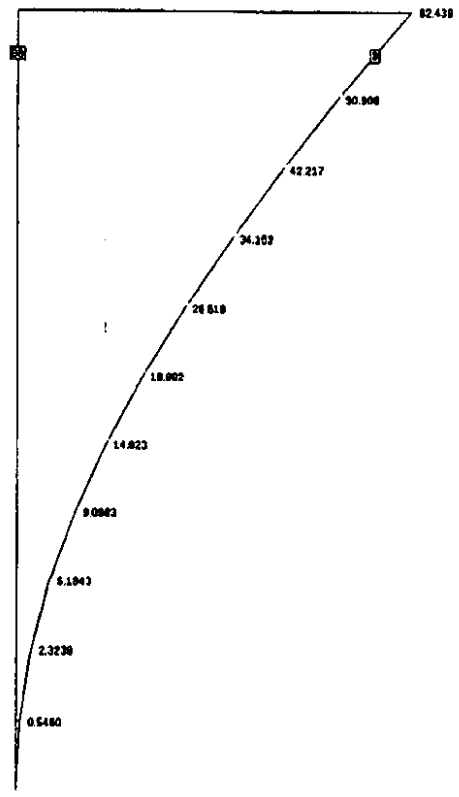
Escala 1 : 82.4
<F.P3-M.1> Carga: 1.00*G1 ß=1.0000
- A: Esfuerzo axil [kN]
- B: Momento flector por el eje y [kNm]



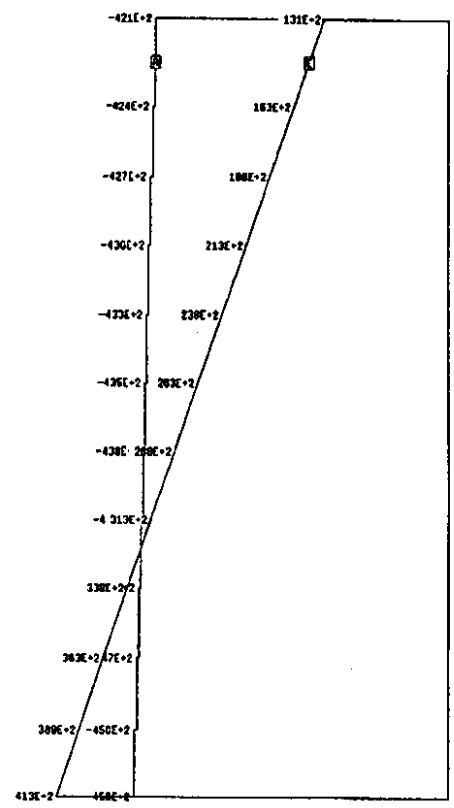
Escala 1 : 117.8
<F.P3-M.1> Carga: 1.00*G1 ß=1.0000
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



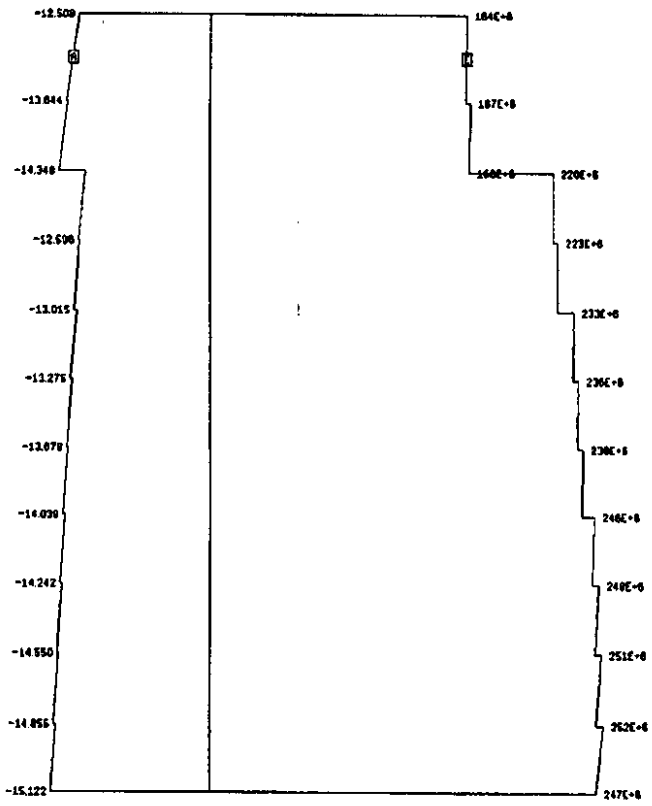
Escala 1 : 120.6
<B.PILA4.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 120.6
<B.PILA4.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 120.6
<B.PILA4.1> Carga: 1.35*G1 1.35*G2 1.50*Q1 0.90*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



D I M E N S I O N A M I E N T O (por zonas) <B.PILA4.2>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	2.000
Carga contribuyente a fluencia	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
No de elementos	11
Tolerancia desequi. fuerzas	0.380 [kN]
Tolerancia desequi. momentos	0.404 [kNm]
Mayoración de cargas	1.350 * Carga permanente G1
	+ 1.350 * Carga permanente G2
	+ 0.900 * Carga variable Q1
	+ 1.500 * Carga variable Q2

RESULTADOS DEL CALCULO NO LINEAL:
La armadura mímnima (μ_min= 0.40%) es suficiente.
Fuerza en la armadura comprimida > 50% fuerza de comp. del hormigón.

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm.	/ Acero	Distrib. de la armadura	Armadura fija[cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000
SEC01	2.649	6.000	H300	AEH500	B1	0.000
SEC02	2.577	6.000	H300	AEH500	B1	0.000
SEC03	2.505	6.000	H300	AEH500	B1	0.000
SEC04	2.433	6.000	H300	AEH500	B1	0.000
SEC05	2.361	6.000	H300	AEH500	B1	0.000
SEC06	2.289	6.000	H300	AEH500	B1	0.000
SEC07	2.216	6.000	H300	AEH500	B1	0.000
SEC08	2.144	6.000	H300	AEH500	B1	0.000
SEC09	2.072	6.000	H300	AEH500	B1	0.000
SEC10	2.000	6.000	H300	AEH500	B1	0.000

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-18.70	0.00	0.00	-0.023	-1.917	0.000
Máxima	0.00	60.53	19.63	0.018	0.000	5.622

ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-38026.72	-850.50	-1704.03	0.00	10846.30	0.00
Máxima	-35117.21	-850.50	-1607.52	82.66	41091.81	17363.62

TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

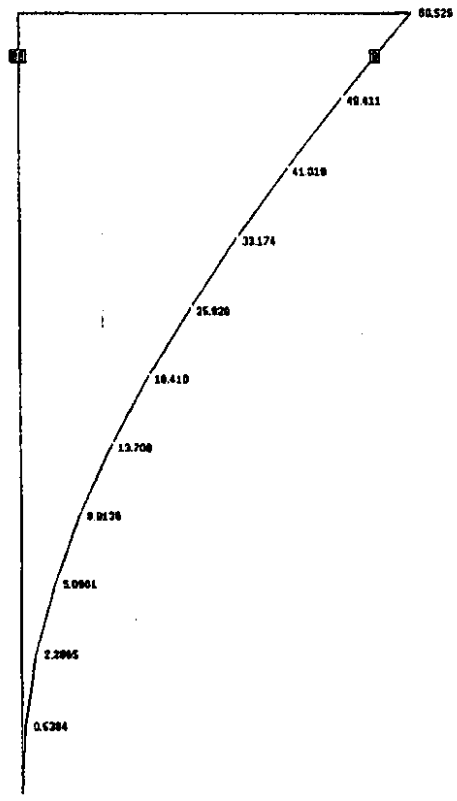
	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-14.2	-440.8	-1.190	-2.099	1.819E+8	1.252E+7
Máxima	0.0	27.9	0.313	0.133	2.601E+8	3.677E+7

DIMENSIONAMIENTO SEGUN TEORIA DE 2º ORDEN

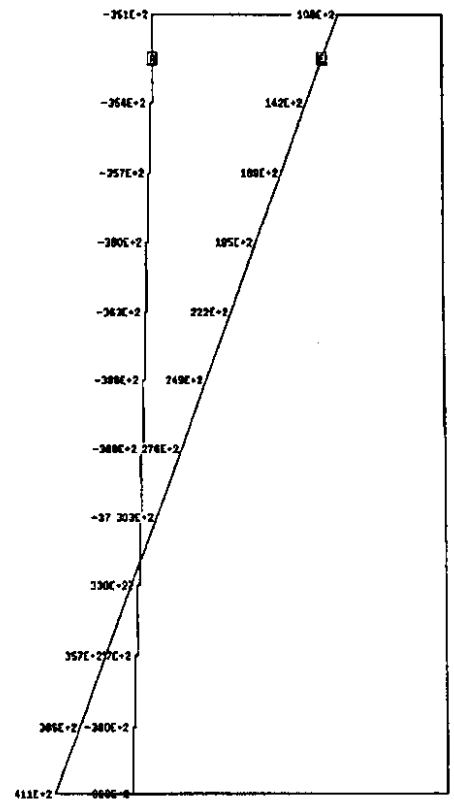
Zona	Coord-x [m]	Nombre de la sección	Armadura [cm²]	[o/o]	Agotamiento [o/o]
11	17.85	SEC10	383.3	0.75	58
	15.85	SEC10	383.3	0.75	60
10	15.85	SEC09	383.3	0.74	60
	14.26	SEC09	383.3	0.74	62
9	14.26	SEC08	949.0	1.82	51
	12.68	SEC08	949.0	1.82	53
8	12.68	SEC07	949.0	1.80	53
	11.09	SEC07	949.0	1.80	55
7	11.09	SEC06	997.3	1.88	54
	9.508	SEC06	997.3	1.88	56
6	9.508	SEC05	997.3	1.86	56
	7.923	SEC05	997.3	1.86	59
5	7.923	SEC04	997.3	1.84	58
	6.338	SEC04	997.3	1.84	61
4	6.338	SEC03	1029.4	1.88	60
	4.754	SEC03	1029.4	1.88	62
3	4.754	SEC02	1029.4	1.87	62
	3.163	SEC02	1029.4	1.87	64
2	3.163	SEC01	1029.4	1.85	64
	1.522	SEC01	1029.4	1.85	66
1	1.522	SEC00	1029.4	1.83	66
	0.000	SEC00	1029.4	1.83	68

(≤) : Armadura ≤ μ_min = 0.40%
(≥) : Armadura ≥ μ_max = 8.00%

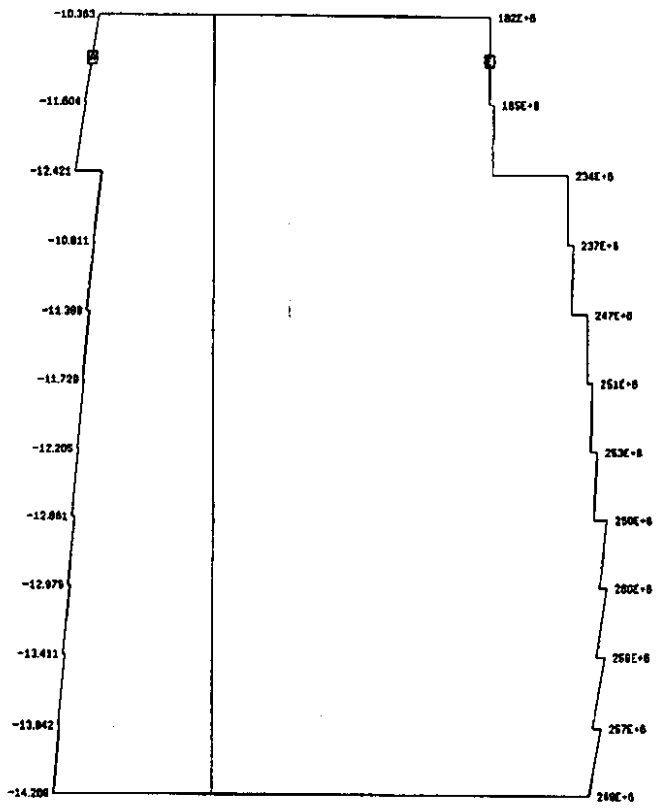
Escala 1 : 120.6
<B.PILA4.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 120.6
<B.PILA4.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



Escala 1 : 120.6
<B.PILA4.2> Carga: 1.35*G1 1.35*G2 0.90*Q1 1.50*Q2
- A: Tens. horm. fibras ext. [N/mm²]
- E: Rigidez a flexión secante/gamma_r por el eje y [kNm²]



C A R G A F I J A <F.P4-M.1>

PARAMETROS DE CALCULO:

Norma	EH
Criterio de rotura	Agotamiento de secciones o del sistema
Rotura de secciones	Limitación de deformaciones según FAGUS
- Hormigón (def. centrada)	-2.000 [o/oo]
- Hormigón (flexión)	-3.500 [o/oo]
- Acero	10.00 [o/oo]
Coef. min. resist. (gamma_r)	1.500
Coeficiente de fluencia	1.000
Carga contribuyente a fluencia	1.000 * Carga permanente G1
Factor armadura (global)	1.000
No de elementos	11
Tolerancia desequi. fuerzas	0.148 [kN]
Tolerancia desequi. momentos	0.117 [kNm]
Mayoración de cargas	1.000 * Carga permanente G1

RESULTADOS DEL CALCULO NO LINEAL:
Las cargas se han podido aplicar..

DATOS DE LA SECCION

Nombre	Ancho dy [m]	Canto dz [m]	Materiales Horm. / Acero		Distrib. de la armadura	Armadura fija[cm²]	Armadura var [cm²]
SEC00	2.722	6.000	H300	AEH500	B1	0.000	10E+2
SEC01	2.649	6.000	H300	AEH500	B1	0.000	10E+2
SEC02	2.577	6.000	H300	AEH500	B1	0.000	10E+2
SEC03	2.505	6.000	H300	AEH500	B1	0.000	10E+2
SEC04	2.433	6.000	H300	AEH500	B1	0.000	997
SEC05	2.361	6.000	H300	AEH500	B1	0.000	997
SEC06	2.289	6.000	H300	AEH500	B1	0.000	997
SEC07	2.216	6.000	H300	AEH500	B1	0.000	949.0
SEC08	2.144	6.000	H300	AEH500	B1	0.000	949.0
SEC09	2.072	6.000	H300	AEH500	B1	0.000	383.3
SEC10	2.000	6.000	H300	AEH500	B1	0.000	383.3

DATOS DE BARRAS (incl. factores de armadura)

Barra	Sección arriba	/ abajo	factor S de la armadura	Armadura variable arriba[cm²]	/abajo[cm²]
11	SEC10	SEC10	1.000	383.3	383.3
10	SEC09	SEC09	1.000	383.3	383.3
9	SEC08	SEC08	1.000	949.0	949.0
8	SEC07	SEC07	1.000	949.0	949.0
7	SEC06	SEC06	1.000	997	997
6	SEC05	SEC05	1.000	997	997
5	SEC04	SEC04	1.000	997	997
4	SEC03	SEC03	1.000	10E+2	10E+2
3	SEC02	SEC02	1.000	10E+2	10E+2
2	SEC01	SEC01	1.000	10E+2	10E+2
1	SEC00	SEC00	1.000	10E+2	10E+2

DEFORMACIONES sin deformaciones accidentales

	DX [mm]	DY [mm]	DZ [mm]	RX [o/oo]	RY [o/oo]	RZ [o/oo]
Mínima	-6.03	0.00	0.00	0.000	0.000	0.000
Máxima	0.00	30.53	0.00	0.000	0.000	2.808

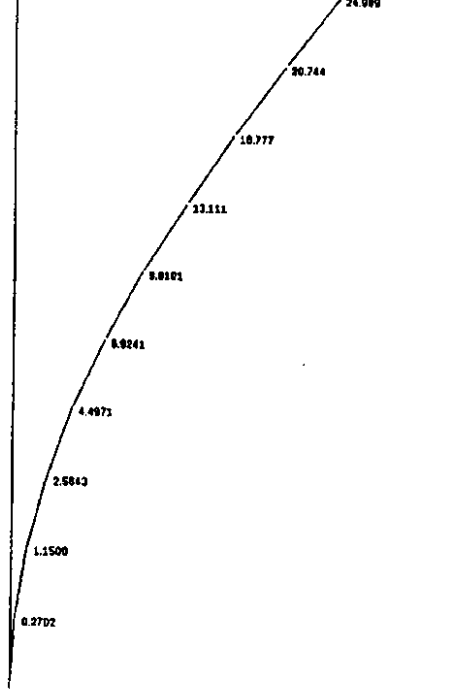
ESFUERZOS (global)

	N [kN]	Vy [kN]	Vz [kN]	Mx [kNm]	My [kNm]	Mz [kNm]
Mínima	-14812.94	-655.00	0.00	0.00	0.00	0.00
Máxima	-12657.75	-655.00	0.00	0.00	0.00	12097.36

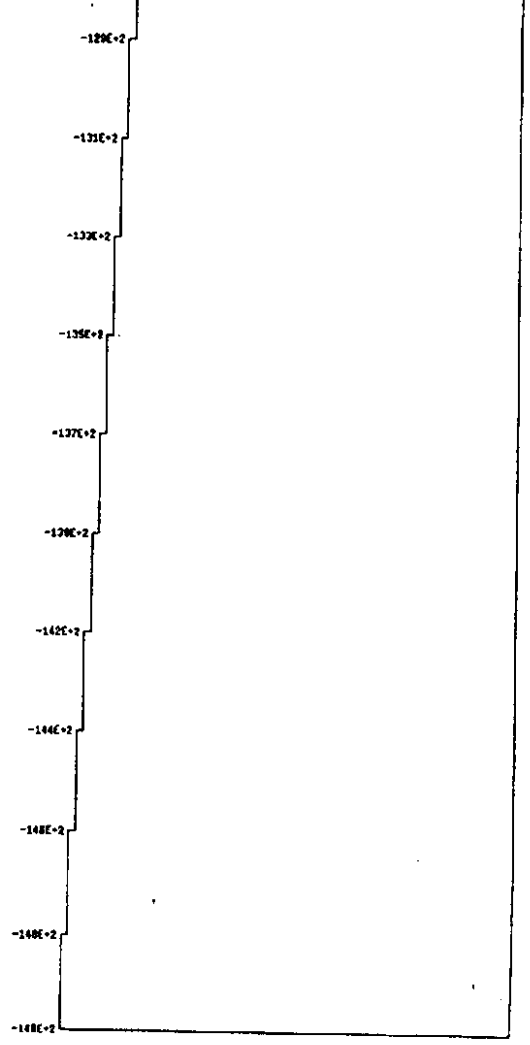
TENSIONES, DEFORMACIONES & RIGIDECES-SECANTE/gamma_r

	sigHorm. [N/mm²]	sigAcero [N/mm²]	epsHorm. [o/oo]	epsAcero [o/oo]	EIy [kNm²]	EIz [kNm²]
Mínima	-5.2	-136.6	-0.331	-0.650	1.99E+07	1.86E+07
Máxima	-0.1	-4.4	-0.005	-0.021	1.12E+10	5.04E+07

Escala 1 : 120.6
<F.P4-M.1> Carga: 1.00*G1 ß=1.0000
- B: y-Desplazamiento, BB: y-Deformaciónes accidentales [mm]



Escala 1 : 84.3
<F.P4-M.1> Carga: 1.00*G1 ß=1.0000
- A: Esfuerzo axil [kN]
- E: Momento flector por el eje y [kNm]



CALCULO DE ESTRIBOS

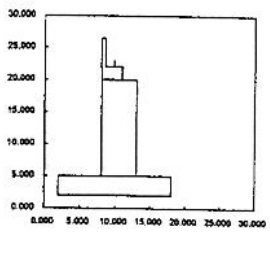
ESTRIBO Nº 1

PROYECTO DE ESTRIBOS ABIERTOS

PROYECTO..... SUBTRAMO VII L.A.V MADRID-ZARAGOZA

ESTRUCTURA..... VIADUCTO Nº 1

ESTRIBO..... E-1



DATOS DE ENTRADA

GEOMETRIA

Puntera.....	5.000	m
Talón.....	8.000	m
Canto fustes abajo.....	5.000	m
Canto fustes arriba	5.000	m
Ancho fustes	2.000	m
Eje fuste - trasdós	2.500	m
Número de fustes	2.000	
Altura total.....	24.445	m
Largo cargadero	14.000	m
Anchura cargadero	2.900	m
Altura cargadero	2.000	m
Altura muro/o.....	4.460	m
Ancho muro/o.....	0.600	m
Ancho meseta.....	2.350	m
Altura retranqueo.....	0.000	m
Altura cartela.....	0.000	m
Largo zapata.....	14.000	m
Canto zapata.....	3.000	m
Vuelo trans zapata	4.000	m
Alt tierra delante.....	18.345	m
Distan. a intrados.....	1.150	m
Alt.Cálc.Arm.	6.000	m
(desde base de alzado)		
Retranqueo muro/e.....	0.000	m
Ancho sobrecarga.....	6.000	m
Altura de fustes	14.985	m
Ancho zapata.....	16.000	m

ALETAS

Número.....	2.000	
Coef forma.....	0.500	
Altura.....	1.400	m
Vuelo.....	2.750	m
Espesor.....	0.300	m

MATERIALES

Resist hor alzado.....	250	kg/cm2
Resist hor zapata.....	200	kg/cm2
Resistencia acero.....	5100	kg/cm2
Recubrimiento.....	0.050	m
Equidist. armadu.....	0.200	m
Redondos por fuste	14	redondos/fuste

CARGAS POR SISMO IAP-98

¿Considerar? (1=si; 2=no) 2

Fuerza horizontal.....	0.000	t
(por m de cargadero)	0.000	t/m
Coef. sísmico horizontal (cargas gravitatorias)...	0.000	
Ac. sísmica de cálculo..	0.000	

GEOTECNIA

Densidad tierras.....	2.000	t/m3
Coef. emp. activo.....	0.333	
Coef. emp. pasivo.....	0.333	
Coef. rozam. zapa.....	0.600	
Efecto arco en fustes	2.000	
Tensión admisible	70.000	t/m2

CARGAS (en todo lo ancho)

Densidad hormigón.....	2.500	t/m3
Sobrecarga trasdós.....	3.000	t/m2
Cargas perman tablero	506.800	t
Sobrecarga máxima.....	520.000	t
Sobrecarga mínima.....	-32.000	t
Fuerza horiz. rft.....	25.340	t
Fuerza horiz.frenado.....	0.000	t
Torsor del tablero	0.000	tm

CARGAS (por m de cargadero)

Cargas perman tablero	36.200	t/m
Sobrecarga máxima.....	37.143	t/m
Sobrecarga mínima.....	-2.286	t/m
Fuerza horiz. rft.....	1.810	t/m
Fuerza horiz.frenado.....	0.000	t/m

COEFICIENTES DE SEGURIDAD

Minoración Hormigón....	1.500
Minoración Acero.....	1.150
Seguridad al vuelco.....	2.000
Seguridad al deslizam..	1.500
Coef.horm.vertical	0.900
γf cargas perman.....	1.35
γf sobrecargas.....	1.50
γf acciones reológicas....	1.35
γf acción del terreno.....	1.50
γA accidental-sismo....	1.00

coef acelerac horizontal	Kh		0.000	*g
coef acelerac vertical	Kv		0.000	*g
		*sexag	radianes	
ang rozamiento interno	ϕ	30.0	0.5236	
ángulos geométricos	I	0.0	0.0000	
	δ	0.0	0.0000	
	β	0.0	0.0000	
arctg Kv/(1-Kv)	θ	0.0	0.0000	
				λ
Ka, sismo = (1-Kv)* λa =		0.000	0.3333	
Kp, sismo = (1-Kv)* λp =		0.000	3.0000	

HIPOTESIS ESTRIBO NUEVO

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
SOBRECARGA TRASDOS	252.000	13.000	3276.000
PESO TIERRAS	3802.759	13.000	46835.674
(y fustes)	0.000	10.000	0.005
	0.000	10.000	0.000
	1216.782	8.550	10403.486
	149.850	7.500	1123.875
	3050.586	3.550	10829.580
	0.000	5.000	0.000
	0.000	5.000	0.000
	0.000	5.000	0.000
	0.000	6.400	0.000
PESO ESTRIBO	93.660	9.700	908.502
	0.000	8.575	0.000
	203.000	8.550	1735.650
	0.000	10.000	0.000
PESO ZAPATA	1680.000	8.000	13440.000
PESO ALETAS (DIFERENCIA)	0.578	10.917	6.304
	F.horizontal		
PASIVO	1570.356	6.115	9602.742
	-470.691	8.115	-3821.280
	-0.259	14.667	-3.801
TOTAL N =	10249.215 t	Me =	94336.94 tm
Fhor =	1099.208 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE SOBRECARGAS	341.888	12.223	4178.723
	-128.541	13.723	-1763.908
	38.721	21.215	821.471
EMPUJE TIERRAS	2785.818	8.148	22699.753
	-918.858	10.148	-9324.860
	83.380	20.138	1679.129
Fuerza volc. horiz.: Fh =	2202.407 t	Mv =	18290.309 tm
Fuerza horizontal total: Fhtot =	1103.198 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes=	5.574	CUMPLE, ES >	1.200
Cvuel=	5.158	CUMPLE, ES >	1.500

-TENSIONES

eb =	7.420	> 0.33 · ANCHO ZAPATA =	5.333 m
Fibra neutra dentro del nucleo central		ec =	0.580 m
TENSION 1=	55.711 t/m2		
TENSION 2 =	35.799 t/m2		
TENS COMPARACION =	50.733 t/m2	CUMPLE, ES < TENS. ADM.	

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPÓTESIS I		10249.215		94336.936
CARGAS PERMANENTES		506.800	8.250	4181.100
TOTAL	N =	10756.015 t	Me =	98518.04 tm
	Fhor =	1099.208 t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		2202.407		18290.309
FUERZA HOR RFT		25.340	19.985	506.420
Fuerza volc. horiz.:	Fh =	2227.747 t	Mv =	18796.728 tm
Fuerza horizontal total:	Fhtot =	1128.538 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = 5.719 CUMPLE, ES > 1.500
Cvuel = 5.241 CUMPLE, ES > 2.000

-TENSIONES

eb = 7.412 > 0.33 · ANCHO ZAPATA = 5.333 m
Fibra neutra dentro del nucleo central ec = 0.588 m

TENSION 1= 58.610 t/m2
TENSION 2 = 37.426 t/m2

TENS COMPARACION = 53.314 t/m2 CUMPLE, ES <TENS. ADM.

HIPOTESIS II: ESTRIBO+TABLERO+SOBRECARGA

1ª SOBRECARGA MAXIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS II		10756.015		98518.036
SOBRECARGA MAXIMA TABLERO		520.000	8.250	4290.000
TOTAL	N =	11276.015 t	Me =	102808.04 tm
	Fhor =	1099.208 t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		2202.407		18290.309
FUERZA FRENADO+RFT		25.340	19.985	506.420
Fuerza volc. horiz.:	Fh =	2227.747 t	Mv =	18796.728 tm
Fuerza horizontal total:	Fhtot =	1128.538 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes = 5.995 CUMPLE, ES > 1.500
Cvuel = 5.469 CUMPLE, ES > 2.000

-TENSIONES

eb = 7.450 > 0.33 · ANCHO ZAPATA = 5.333 m
Fibra neutra dentro del nucleo central ec = 0.550 m

TENSION 1= 60.713 t/m2
TENSION 2 = 39.965 t/m2

TENS COMPARACION = 55.526 t/m2 CUMPLE, ES < TENS. ADM.

2ª SOBRECARGA MINIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS II		10756.015		98518.036
SOBRECARGA MINIMA TABLERO.		-32.000	8.250	-264.000
TOTAL	N =	10724.015 t	Me =	98254.04 tm
	Fhor =	1099.208 t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		2202.407		18290.309
FUERZA FRENADO+RFT		25.340	19.985	506.420
Fuerza volc. horiz.:	Fh =	2227.747 t	Mv =	18796.728 tm
Fuerza horizontal total:	Fhtot =	1128.538 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes = 5.702 CUMPLE, ES > 1.500
Cvuel = 5.227 CUMPLE, ES > 2.000

-TENSIONES

eb = 7.409 > 0.33 · ANCHO ZAPATA = 5.333 m
Fibra neutra dentro del nucleo central ec = 0.591 m

TENSION 1= 58.480 t/m2
TENSION 2 = 37.270 t/m2

TENS COMPARACION = 53.935 t/m2 CUMPLE, ES < TENS. ADM.

HIPOTESIS IV: ESTRIBO+TABLERO+SOBRECARGA+SISMO+RFT+FRENADO

1ª SOBRECARGA MAXIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 1ª.....		11276.015		102808.036
		F.horizontal		
PASIVO		0.000	6.115	0.000
		-470.891	8.115	-3821.280
		0.259	14.667	3.801
TOTAL	N =	11276.015 t	Me =	98990.56 tm
	Fhor =	-470.632 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO	0.000	22.215	0.000
(debido al sismo)	0.000	19.985	0.000
	0.000	18.985	0.000
	0.000	19.985	0.000
	0.000	10.493	0.000
	0.000	7.995	0.000
EMPUJE ZAPATA	0.000	1.500	0.000
EMPUJE SOBRECARGAS	341.888	12.223	4178.723
	-128.541	13.723	-1763.908
	38.721	21.215	821.471
EMPUJE TIERRAS	2765.816	8.148	22698.753
	-918.856	10.148	-9324.860
	83.380	20.138	1679.129
FUERZA SISMO+RFT+FREN	25.340	19.985	506.420
Fuerza volc. horiz.: Fh =	2227.747 t	Mv =	18796.728 tm
Fuerza horizontal total: Fhtot =	2698.378 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = 2.507 CUMPLE, ES > 1
Cvuel = 5.288 CUMPLE, ES > 1

-TENSIONES

eb = 7.112 > 0.33 · ANCHO ZAPATA = 5.333 m
Fibra neutra dentro del nucleo central ec = 0.888 m

TENSION 1= 67.104 t/m2
TENSION 2 = 33.574 t/m2

TENS COMPARACION = 58.722 t/m2 CUMPLE, ES < TENS. ADM.

2ª SOBRECARGA MINIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 2ª.....		10724.015		98254.036
		F.horizontal		
PASIVO		1570.358	6.115	9602.742
		470.891	8.115	3821.280
		-0.259	14.667	-3.801
TOTAL	N =	10724.015 t	Me =	111674.28 tm
	Fhor =	2040.990 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO	0.000	22.215	0.000
(debido al sismo)	0.000	19.985	0.000
	0.000	18.985	0.000
	0.000	19.985	0.000
	0.000	10.493	0.000
	0.000	7.995	0.000
EMPUJE ZAPATA	0.000	1.500	0.000
EMPUJE SOBRECARGAS	341.888	12.223	4178.723
	-128.541	13.723	-1763.908
	38.721	21.215	821.471
EMPUJE TIERRAS	2765.816	8.148	22699.753
	-918.856	10.148	-9324.860
	83.380	20.138	1679.129
FUERZA SISMO+RFT+FREN	25.340	19.985	506.420
Fuerza volc. horiz.: Fh =	2227.747 t	Mv =	18796.728 tm
Fuerza horizontal total: Fhtot =	186.756 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = 34.453 CUMPLE, ES > 1
Cvuel = 5.941 CUMPLE, ES > 1

-TENSIONES

eb = 8.661 > 0.33 · ANCHO ZAPATA = 5.333 m
Fibra neutra dentro del nucleo central ec = -0.661 m

TENSION 1= 36.013 t/m2
TENSION 2 = 59.737 t/m2

TENS COMPARACION = 41.944 t/m2 CUMPLE, ES < TENS. ADM.

ARRANQUE

TENSIONES SOBRE EL MURO

TENSIONES ACTIVAS: (t/m2)			TENSIONES PASIVAS:	
TEN1 =	3.969	(en arranque del espaldón)	TEN1 =	
TEN2 =	11.285	(en punto del fuste elegido)	TEN2 =	6.229
TEN3 =	5.301	(en extremo superior de fustes)	TEN3 =	
TEN4 =	15.281	(en arranque de fustes)	TEN4 =	10.229

ARMADURA A FLEXIÓN Y COMPRESIÓN EN FUSTES Y ARRANQUE

		BRAZO	MOMENTO
EMPUJE TIERRAS	6.624	1.487	9.848
EMPUJE SOBRECARGA	4.456	2.230	9.936
Fh =	11.079 t	Mv =	19.783 tm
PESO PROPIO	6.690 t		

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I: Estribo + (tablero (misma que con sobrecargas y que en vacío)

M	21.456	tm	Md =	34.329	tm
N	6.690	t	Nd =	10.704	t
Q	11.079	t	Qd =	17.727	t
Uc=	825.000	t	Us=	54.272	t

HIPOTESIS II: Estribo + Tablero + Sobrecarga + sismo

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0.000	2.230	0.000
TOTAL:	0.000 t	Mv =	0.000 tm

M	23.483	tm	Md =	23.483	tm
N	6.690	t	Nd =	6.690	t
Q	11.079	t	Qd =	11.079	t
Uc=	825.000	t	Us=	37.134	t

ARMADURA MINIMA

0.04·Uc = 33.000 t alfa = 0.822

DIMENSIONAMIENTO

Us máx =	54.272 t	As =	12.238	cm2
ϕ (mm)	20	As dispues=	16.708	cm2 vale
s (cm)	20			

CORTANTE

Vcu = 33.680 t
Qd (máx) = 17.727 t

ARMADURA A FLEXIÓN Y COMPRESIÓN EN FUSTES Y ARRANQUE

		BRAZO	MOMENTO
EMPUJE TIERRAS	635.492	5.148	3271.724
EMPUJE SOBRECAR	83.380	11.138	928.711
	123.436	7.723	953.238
	38.721	12.215	472.980
PASIVO POR DELANTE	-232.854	7.115	-1656.757
	-0.259	9.105	-2.360
Fh =	647.916 t	Mv =	3967.537 tm
PESO PROPIO	93.680	2.200	206.052
	0.000	1.025	0.000
	0.000	2.500	0.000
	206.500	-1.025	-211.663
	449.250	0.000	0.000
	0.000	-2.500	0.000
N =	749.410 t	Me=	-5.610 tm

ESFUERZOS TOTALES EN TODOS LOS FUSTES:

N =	749.410 t
M =	3973.147 mt
Fh =	647.916 t
T =	0.000 mt

HIPOTESIS I: Estribo en vacío. (esfuerzos por fuste)

M =	1986.574	tm	Md =	2483.217 tm
N =	374.705	t	Nd =	468.381 t
Q =	323.958	t	Qd =	404.948

HIPOTESIS II: Estribo + Tablero. (esfuerzos por fuste)

M =	1935.704	tm	Md =	3097.126 tm
N =	628.105	t	Nd =	1004.968 t
Q =	336.628	t	Qd =	538.605 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

1ª SOBRECARGA MAXIMA:

M =	1740.704	tm	Md =	2785.126 tm
Q =	336.628	t	Qd =	538.605 t
N =	888.105	t		
Incremento de axil debido al torsor:		0.000 t		
		Nd máx =		1420.968 t
		Nd min =		1420.968 t

2ª SOBRECARGA MINIMA:

M =	1947.704	tm	Md =	3116.326 tm
Q =	336.628	t	Qd =	538.605 t
N =	612.105	t		
Incremento de axil debido al torsor:		0.000 t		
		Nd máx =		979.368 t
		Nd min =		979.368 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0.000	13.215	0.000
	0.000	10.985	0.000
	0.000	10.985	0.000
	0.000	9.985	0.000
	0.000	4.493	0.000
	0.000	2.995	0.000
TOTAL:	0.000 t	Mv =	0.000 tm

1ª SOBRECARGA MAXIMA:

M =	1740.704	tm	Md =	1740.704 tm
Q =	323.958	t	Qd =	323.958 t
N =	888.105	t		
Incremento de axil debido al torsor:		0.000 t		
		Nd máx =		888.105 t
		Nd min =		888.105 t

2ª SOBRECARGA MINIMA:

M =	1947.704	tm	Md =	1947.704 tm
Q =	323.958	t	Qd =	323.958 t
N =	612.105	t		
Incremento de axil debido al torsor:		0.000 t		
		Nd máx =		612.105 t
		Nd min =		612.105 t

CORTANTE

Vcu = 606.249 t
Qd = 538.605 t < Vcu
Vsu = -67.644 t Usu min = 60.000 t
Us = 60.000 t Diám.min. = 16.170 mm
(un cerco=dos ramas)

ARMADURA MINIMA

0.04·UC = 594.000 t alfa = 1.261

DIMENSIONAMIENTO

canto sección = 5.000
ancho sección = 2.000
recubrimiento = 0.050

Ac·fcd = 14850.000 t
Ac·fcd·d = 73507.500 tm

	HIP I	HIP II	HIP III 1ª A	HIP III 1ª B	HIP III 2ª A	HIP III 2 B	HIP IV 1ª A	HIP IV 1ª B	HIP IV2ª A	HIP IV 2ª B
Md=	3630.751	5559.297	6266.497	6266.497	5515.777	5515.777	3916.561	3916.561	3447.361	3447.361
mu=	0.049	0.076	0.085	0.085	0.075	0.075	0.053	0.053	0.047	0.047
w=	0.051	0.079	0.089	0.089	0.078	0.078	0.055	0.055	0.048	0.048
Us,0 =	752.554	1169.111	1325.078	1325.078	1159.571	1159.571	813.507	813.507	713.581	713.581
Us=	284.172	164.143	-95.890	-95.890	160.203	160.203	-74.598	-74.598	101.476	101.476

Us max= 284.172 t As = 80.790 cm2
Diámetro mínimo= 27.1 mm 14 redondos

ARMADURA A FLEXIÓN Y COMPRESIÓN EN FUSTES Y ARRANQUE

	EMPUJE	BRAZO	MOMENTO
EMPUJE TIERRAS	13.897	2.153	29.924
EMPUJE SOBRECAR	6.454	3.230	20.845
Fh=	20.350 t	Mv =	50.769 tm
PESO PROPIO	6.690	1.200	8.028
	0.000	1.450	0.000
	0.000	1.450	0.000
	14.500	0.000	0.000
N=	21.190 t	Me =	8.028 tm

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I.- ESTRIBO VACIO

M=	72.407	tm	Md=	90.509 tm
N=	21.190	t	Nd=	26.488 t
Q=	20.350	t	Qd=	25.438 t
Uc=	4275.000	t	Us=	5.389 t

HIPOTESIS II.- ESTRIBO + TABLERO

M=	137.567	tm	Md=	220.107 tm
N=	57.390	t	Nd=	91.824 t
Q=	22.160	t	Qd=	35.456 t
Uc=	4275.000	t	Us=	-13.883 t

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

1ª SOBRECARGA MAXIMA:

M=	200.710	tm	Md=	321.136 tm
N=	94.533	t	Nd=	151.253 t
Q=	22.160	t	Qd=	35.456 t
Uc=	4275.000	t	Us=	-37.048 t

1ª SOBRECARGA MINIMA:

M=	133.681	tm	Md=	213.890 tm
N=	55.104	t	Nd=	88.167 t
Q=	22.160	t	Qd=	35.456 t
Uc=	4275.000	t	Us=	-12.447 t

HIPOTESIS IV.- ESTRIBO + TABLERO + SOBRECARGA

EMPUJES DEBIDOS AL SISMO.....	0.000	4.230	0.000
	0.000	2.000	0.000
	0.000	2.000	0.000
	0.000	1.000	0.000
Fh =	0.000 t	Mv =	0.000 tm

1ª SOBRECARGA MAXIMA:

M=	200.710	tm	Md=	200.710 tm
N=	94.533	t	Nd=	94.533 t
Q=	22.160	t	Qd=	22.160 t
Uc=	4275.000	t	Us=	-23.518 t

2ª SOBRECARGA MINIMA:

M=	133.681	tm	Md=	133.681 tm
N=	55.104	t	Nd=	55.104 t
Q=	22.160	t	Qd=	22.160 t
Uc=	4275.000	t	Us=	-7.938 t

CORTANTE

Vcu = 174.526 t
Qd = 35.456 t

ARMADURA MINIMA

0.04·Uc= 171.000 t alfa= 1.466

DIMENSIONAMIENTO

Us max=	5.389 t	As=	1.806	cm2
ϕ (mm)	12	As dispues=	5.655	cm2 vale
s (cm)	20			

JUNTO A CADA FUSTE

Us (corr) = Us·lc/(nf·df) = 11.211 t
Diámetro mínimo = 8.0 mm a 0.200 m

E:
ARMADO

	EMPUJE	BRAZO	MOMENTO
EMPUJE TIERRAS	1225.142	7.148	8757.721
	83.380	17.138	1428.990
EMPUJE SOBRECAR	171.388	10.723	1837.713
	38.721	18.215	705.307
PASIVO POR DELANTE	-627.855	5.115	-3211.476
	-0.691	15.105	-10.439
Fh =	890.085 t	Mv =	9507.815 tm
PESO PROPIO	93.860	2.200	206.052
	0.000	1.025	0.000
	0.000	2.500	0.000
	206.500	-1.025	-211.663
	749.250	0.000	0.000
	0.000	-2.500	0.000
N =	1049.410 t	Me=	-5.810 tm

ESFUERZOS TOTALES EN TODOS LOS FUSTES:

N = 1049.410 t
M = 9513.426 mt
Fh = 890.085 t
T = 0.000 mt

HIPOTESIS I: Estribo en vacio. (esfuerzos por fuste)

M =	4756.713 tm	Md =	5845.891 tm	1260.000
N =	524.705 t	Nd =	655.881 t	627.112
Q =	445.043 t	Qd =	556.303	-49.759

HIPOTESIS II: Estribo + Tablero. (esfuerzos por fuste)

M =	4781.863 tm	Md =	7650.980 tm	1260.000
N =	778.105 t	Nd =	1244.968 t	693.971
Q =	457.713 t	Qd =	732.340 t	10.082

HIPOTESIS III: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

1º SOBRECARGA MAXIMA:

M =	4586.863 tm	Md =	7338.980 tm	1260.000
Q =	457.713 t	Qd =	732.340 t	748.137
N =	1038.105 t			85.915

Incremento de axil debido al torsor: 0.000 t
Nd máx = 1660.968 t
Nd mín = 1660.968 t

2º SOBRECARGA MINIMA:

M =	4793.863 tm	Md =	7670.180 tm	1260.000
Q =	457.713 t	Qd =	732.340 t	690.637
N =	782.105 t			5.415

Incremento de axil debido al torsor: 0.000 t
Nd máx = 1219.368 t
Nd mín = 1219.368 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga (esfuerzos por fuste)

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0.000	18.215	0.000
	0.000	16.985	0.000
	0.000	16.985	0.000
	0.000	15.985	0.000
	0.000	7.493	0.000
	0.000	4.995	0.000
TOTAL:	0.000 t	Mv =	0.000 tm

1º SOBRECARGA MAXIMA:

M =	4586.863 tm	Md =	4586.863 tm
Q =	445.043 t	Qd =	445.043 t
N =	1038.105 t		

Incremento de axil debido al torsor: 0.000 t
Nd máx = 1038.105 t
Nd mín = 1038.105 t

2º SOBRECARGA MINIMA:

M =	4793.863 tm	Md =	4793.863 tm
Q =	445.043 t	Qd =	445.043 t
N =	782.105 t		

Incremento de axil debido al torsor: 0.000 t
Nd máx = 762.105 t
Nd mín = 762.105 t

F:
ARMADURA [illegible]

TENSIONES EN ZAPATA

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º	MAX
TENSION 1	55.711	58.610	60.713	58.480	67.104	36.013	67.104
TENSION 2	35.799	37.426	39.965	37.270	33.574	59.737	33.574
LONG TEN	0.000	0.000	0.000	0.000	0.000	0.000	

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde de ... 5.750 m

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	55.711	58.610	60.713	58.480	67.104	36.013
TENSION S =	46.556	50.997	53.257	13.588	21.480	-15.198
M =	681.549	926.942	962.582	719.378	857.911	313.151

Md = 1540.131 tm

Uc = 3933.333 t Us= 562.266 t

ARMADURA MINIMA

0.04·Uc= 157.333 t alfa = -0.257

DIMENSIONAMIENTO

Us máx = 562.266 t As = 128.785 cm2
ϕ (mm) 32 As dispues= 60.425 cm2 subir
s (cm) 10

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 3.500 m

La tensión en esta sección es: 59.770 t/m2

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	55.711	58.610	60.713	58.480	67.104	36.013
TENSION S =	51.356	53.976	56.175	53.840	59.770	41.203
Q =	187.368	197.025	204.555	196.561	222.030	135.128

Vcu = 340.637 t
Qd = 355.247 t ¡ERROR! ES > Vcu

CORTANTE

Vcu = 606.249 t
Qd = 732.340 t > Vcu
Vau = 126.092 t Usu min = 150.000 t

Us = 150.000 t Diám.min. = 25.567 mm
(un cercos dos ramas)

ARMADURA MINIMA

0.04·Uc = 564.000 t alfa = 0.563

DIMENSIONAMIENTO

canto sección = 5.000
ancho sección = 2.000
recubrimiento = 0.040

Ac·fcd = 14880.000 t
Ac·fcd·d = 73804.800 tm

	HIP I	HIP II	HIP III 1º A	HIP III 1º B	HIP III 2º A	HIP III 2 B	HIP IV 1º A	HIP IV 1º B	HIP IV2º A	HIP IV 2º B
Md=	7559.359	10713.602	11424.962	11424.962	10669.828	10669.828	7140.601	7140.601	6668.641	6668.641
mu=	0.102	0.145	0.155	0.155	0.145	0.145	0.097	0.097	0.090	0.090
w=	0.108	0.158	0.169	0.169	0.157	0.157	0.102	0.102	0.095	0.095
Us,0 =	1611.306	2344.738	2516.156	2516.156	2334.266	2334.266	1516.962	1516.962	1411.423	1411.423
Us=	855.425	1099.770	855.188	855.188	1114.898	1114.898	478.857	478.857	649.316	649.316

Us max= 1114.898 t As = 251.399 cm2
Diámetro mínimo= 47.8 mm 14 redondos

J:
ARMADURA [illegible]

Supuesta zapata descalzada por detrás

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde (por detrás) de ... 6.750 m

	PESO	BRAZO	MOMENTO	
PESO DE TIERRAS	257.340	3.750	965.025	t/m2
	0.000	0.750	0.000	
	0.000	0.750	0.000	
	0.000	0.750	0.000	
PESO DE SOBRECARGAS	18.000	3.750	67.500	t/m2
PESO PROPIO ZAPATA	50.625	3.375	170.859	t/m2
TOTAL	325.965 t		1203.384	t/m2

Md = 1925.415 tm

Uc = 3933.333 t Us = 718.264 t

ARMADURA MINIMA

0.04·Uc = 157.333 t alfa = -0.745

DIMENSIONAMIENTO

Us máx = 718.264 t As = 161.961 cm2
ϕ (mm) 25 As dispues= 49.087 cm2 subir
s (cm) 10

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 4.500 m

Vcu = 340.637 t Q = 206.505 t
Qd = 330.408 t

SOLO PARA EL CASO DE DOS FUSTES esfuerzos por metro de ancho

Vuelo transversal (desde el eje) = 4.000 m
Distancia entre fustes (entre ejes) = 6.000 m
Uc = 3933.333 t

TENSIONES EN TERRENO:

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
Tensión 1 =	55.711	58.610	60.713	58.480	67.104	36.013
Tensión 2 =	35.799	37.428	39.965	37.270	33.574	59.737
Long. Ten. =	0.000	0.000	0.000	0.000	0.000	0.000
Tensión media =	45.755	48.018	50.339	47.875	50.339	47.875

ARMADURA CARA INFERIOR

Momento voladizo	366.043	384.143	402.715	383.001	402.715	383.001
Md Voladizo	457.554	614.629	644.344	612.801	644.344	612.801
Armadura inferior (nec)..	158.288	214.180	224.848	213.525	224.848	213.525
Armadura min. inferior ..	159.135	177.917	179.283	177.810	179.283	177.810
Armadura inferior	159.135	214.180	224.848	213.525	224.848	213.525
Diám. mín. inferior (mm).	30.229	35.069	35.932	35.015	35.932	35.015

Diámetro mínimo = 35.932 mm a 0.200 m
As = 50.701 cm2

ARMADURA CARA SUPERIOR

Momento centro vano ...	160.144	168.063	176.168	167.563	176.168	167.563
Md centro de vano	200.180	268.800	281.900	268.100	281.900	268.100
Armadura superior (nec)	0.000	0.000	0.000	0.000	0.000	0.000
Armadura min.superior .	0.000	0.000	0.000	0.000	0.000	0.000
Armadura superior	0.000	0.000	0.000	0.000	0.000	0.000
Diámetro mín.sup(mm)..	0.000	0.000	0.000	0.000	0.000	0.000

Diámetro mínimo = 0.000 mm a 0.200 m
As = 0.000 cm2

RESUMEN DE RESULTADOS

Hipótesis realizadas:

	Cdes mín.	Cruel mín.
HIPOTESIS I: estribo en vacio,	1.200	1.800
HIPOTESIS II: estribo + carga permanente	1.500	2.000
HIPOTESIS III 1ª: estribo + tablero + SCmáx.	1.500	2.000
2ª: estribo + tablero + SCmín.	1.500	2.000
HIPOTESIS IV 1ª: est. + tabl. + SCmáx.	1.000	1.000
2ª: est. + tabl. + SCmín.	1.000	1.000

Valores obtenidos:

	Cdes real	Cruel real	T.Comp.
HIP I	5.574	5.158	50.733
HIP II	5.719	5.241	53.314
HIP III 1º	5.995	5.469	55.526
HIP III 2º	5.702	5.227	53.935
HIP IV 1º	2.507	5.266	58.722
HIP IV 2º	34.453	5.941	41.944

ARMADURAS: (por metro de estribo)

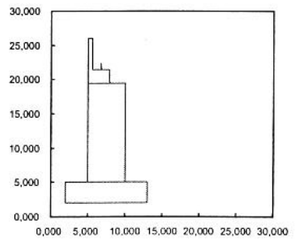
	As (cm2)	Diam.(mm)	Equidist.(m)	As dispuos
1º En arranque de espaldón	12.238	20.000	20.000	15.708
2º En punto intermedio elegido	80.790	27.106	0.146	
3º En extremo sup. fustes.....	1.806	12.000	20.000	5.655
4º En punto de arranque fustes	251.389	47.816	0.146	
5º Zapata	126.785	32.000	10.000	80.425
6º Zapata descalzada por detrás.	161.961	25.000	10.000	49.087
Estudio transversal de zapata				
Cara superior	0.000	0.000	0.200	
Cara inferior	50.701	35.932	0.200	

PROYECTO DE ESTRIBOS ABIERTOS

PROYECTO..... **SUBTRAMO VII L.A.V MASRID-ZARAGOZA**

ESTRUCTURA..... **VIADUCTO Nº 1**

ESTRIBO..... **E-1**



DATOS DE ENTRADA

GEOMETRIA

Puntera.....	3,000	m
Talón.....	3,000	m
Canto fustes abajo.....	5,000	m
Canto fustes arriba	5,000	m
Ancho fustes	2,000	m
Eje fuste - trasdós	2,500	m
Número de fustes	2,000	
Altura total.....	24,000	m
Largo cargadero	14,000	m
Anchura cargadero	2,900	m
Altura cargadero	2,000	m
Altura murete.....	4,600	m
Ancho murete.....	0,600	m
Ancho meseta.....	2,300	m
Altura retranqueo.....	0,000	m
Altura cartela.....	0,000	m
Largo zapata.....	14,000	m
Canto zapata.....	3,000	m
Vuelo trans zapata	4,000	m
Alt tierra delante.....	17,900	m
Distan. a intradós.....	1,150	m
Alt.Cálc.Arm. ..... (desde base de alzado)	7,200	m
Retranqueo murete.....	0,000	m
Ancho sobrecarga.....	3,000	m
Altura de fustes	14,400	m
Ancho zapata.....	11,000	m

ALETAS

Número.....	2,000	
Coef forma.....	0,500	
Altura.....	1,400	m
Vuelo.....	2,750	m
Espesor.....	0,300	m

MATERIALES

Resist hor alzado.....	250	kg/cm2
Resist hor zapata.....	200	kg/cm2
Resistencia acero.....	5100	kg/cm2
Recubrimiento.....	0,050	m
Equidist. armadu.....	0,200	m
Redondos por fuste	10	redondos/fuste

CARGAS POR SISMO IAP-96

¿Considerar? (1=sí; 2=no) 2

Fuerza horizontal.....	0,000	t
(por m de cargadero)	0,000	t/m
Coef. sísmico horizontal (cargas gravitatorias)...	0,000	
Ac. sísmica de cálculo..	0,000	

coef acelerac horizontal	Kh		0,000	*g
coef acelerac vertical	Kv		0,000	*g
			º sexag	**radianes**
ang rozamiento interno	ϕ		34,0	0,5934
ángulos geométricos	i		0,0	0,0000
	δ		0,0	0,0000
	β		0,0	0,0000
arctg Kh/(1-Kv)	θ		0,0	0,0000
				λ
Ka, sismo = (1-Kv)* λa =		0,000		0,2827
Kp, sismo = (1-Kv)* λp =		0,000		3,5371

GEOTECNIA

Densidad tierras.....	2,000	t/m3
Coef. emp. activo.....	0,333	
Coef. emp. pasivo.....	0,333	
Coef. rozam. zapa.....	0,600	
Efecto arco en fustes	2,000	
Tensión admisible	70,000	t/m2

CARGAS (en todo lo ancho)

Densidad hormigón.....	2,500	t/m3
Sobrecarga trasdós.....	3,000	t/m2
Cargas perman tablero	506,800	t
Sobrecarga máxima.....	520,000	t
Sobrecarga mínima.....	-32,000	t
Fuerza horiz. rft.....	25,340	t
Fuerza horiz.frenado.....	0,000	t
Torsor del tablero	0,000	tm

CARGAS (por m de cargadero)

Cargas perman tablero	36,200	t/m
Sobrecarga máxima.....	37,143	t/m
Sobrecarga mínima.....	-2,286	t/m
Fuerza horiz. rft.....	1,810	t/m
Fuerza horiz.frenado.....	0,000	t/m

COEFICIENTES DE SEGURIDAD

Minoración Hormigón....	1,500
Minoración Acero.....	1,150
Seguridad al vuelco.....	2,000
Seguridad al deslizam..	1,500
Coef.horm.vertical	0,900
γ_f cargas perman.....	1,35
γ_f sobrecargas.....	1,50
γ_f acciones reológicas.....	1,35
γ_f accción del terreno.....	1,50
γ_A accidental-sismo....	1,00

HIPOTESIS I.- ESTRIBO EN VACIO

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
SOBRECARGA TRASDOS	126,000	9,500	1197,000
PESO TIERRAS	1763,999	9,500	16757,995
(y fustes)	0,000	8,000	0,004
	0,000	8,000	0,000
	1169,280	6,550	7658,784
	144,000	5,500	792,000
	2127,720	2,550	5425,686
	0,000	3,000	0,000
	0,000	3,000	0,000
	0,000	3,000	0,000
	0,000	4,400	0,000
PESO ESTRIBO	96,600	7,700	743,820
	0,000	6,550	0,000
	203,000	6,550	1329,650
	0,000	8,000	0,000
PESO ZAPATA	1155,000	5,500	6352,500
PESO ALETAS (DIFERENCIA)	0,578	8,917	5,149
	F.horizontal		
PASIVO	1495,097	5,967	8920,746
	-443,976	7,967	-3537,006
	-0,500	0,000	0,000
TOTAL N =	**6786,177** t	Me =	**45646,33** tm
Fhor =	**1050,622** t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE SOBRECARGAS	335,664	12,000	4027,968
	-125,874	13,500	-1699,299
	39,560	20,700	818,900
EMPUJE TIERRAS	2685,312	8,000	21482,496
	-881,118	10,000	-8811,180
	87,033	19,600	1705,844
Fuerza volc. horiz.: Fh =	**2140,577** t	Mv =	**17524,730** tm
Fuerza horizontal total: Fhtot =	**1089,956** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes=	**3,736**	CUMPLE, ES >	1,200
Cvuel=	**2,605**	CUMPLE, ES >	1,600

-TENSIONES

eb =	4,144	> 0.33 · ANCHO ZAPATA =	3,667 m
Fibra neutra dentro del nucleo central		ec =	1,356 m

TENSION 1= 76,660 t/m2
TENSION 2 = 11,472 t/m2

TENS COMPARACION = **60,363 t/m2** CUMPLE, ES < TENS. ADM.

HIPOTESIS II.- ESTRIBO + TABLERO (C.P.)

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPÓTESIS I		6786,177		45646,329	
CARGAS PERMANENTES		506,800	6,250	3167,500	
TOTAL	N =	**7292,977**	t Me =	**48813,83**	tm
	Fhor =	**1050,622**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
DE LA HIPOTESIS I		2140,577		17524,730	
FUERZA HOR RFT		25,340	19,400	491,596	
Fuerza volc. horiz.:	Fh =	**2165,917**	t Mv =	**18016,326**	tm
Fuerza horizontal total:	Fhtot =	**1115,296**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes =	**3,923**	CUMPLE, ES >	1,500
Cvuel =	**2,709**	CUMPLE, ES >	2,000

-TENSIONES

eb = 4,223 > 0.33 · ANCHO ZAPATA = 3,667 m
Fibra neutra dentro del nucleo central ec = 1,277 m

TENSION 1= 80,346 t/m2
TENSION 2 = 14,368 t/m2

TENS COMPARACION = **63,851 t/m2** CUMPLE, ES <TENS. ADM.

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

1º SOBRECARGA MAXIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS II		7292,977		48813,829	
SOBRECARGA MAXIMA TABLERO		520,000	6,250	3250,000	
TOTAL	N =	**7812,977**	t Me =	**52063,83**	tm
	Fhor =	**1050,622**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
DE LA HIPOTESIS I		2140,577		17524,730	
FUERZA FRENADO+RFT		25,340	19,400	491,596	
Fuerza volc. horiz.:	Fh =	**2165,917**	t Mv =	**18016,326**	tm
Fuerza horizontal total:	Fhtot =	**1115,296**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**4,203**	CUMPLE, ES >	1,500
Cvuel =	**2,890**	CUMPLE, ES >	2,000

-TENSIONES

eb = 4,358 > 0.33 · ANCHO ZAPATA = 3,667 m
Fibra neutra dentro del nucleo central ec = 1,142 m

TENSION 1= 82,341 t/m2
TENSION 2 = 19,126 t/m2

TENS COMPARACION = **66,537 t/m2** CUMPLE, ES < TENS. ADM.

2º SOBRECARGA MINIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS II		7292,977		48813,829	
SOBRECARGA MINIMA TABLERO.		-32,000	6,250	-200,000	
TOTAL	N =	**7260,977**	t Me =	**48613,83**	tm
	Fhor =	**1050,622**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
DE LA HIPOTESIS I		2140,577		17524,730	
FUERZA FRENADO+RFT		25,340	19,400	491,596	
Fuerza volc. horiz.:	Fh =	**2165,917**	t Mv =	**18016,326**	tm
Fuerza horizontal total:	Fhtot =	**1115,296**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**3,906**	CUMPLE, ES >	1,500
Cvuel =	**2,698**	CUMPLE, ES >	2,000

-TENSIONES

eb = 4,214 > 0.33 · ANCHO ZAPATA = 3,667 m
Fibra neutra dentro del nucleo central ec = 1,286 m

TENSION 1= 80,223 t/m2
TENSION 2 = 14,075 t/m2

TENS COMPARACION = **60,143 t/m2** CUMPLE, ES < TENS. ADM.

HIPOTESIS IV.- ESTRIBO+TABLERO+SOBRECARGA

1º SOBRECARGA MAXIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 1º.....		7812,977		52063,829
		F.horizontal		
PASIVO		0,000	5,967	0,000
		-443,976	7,967	-3537,006
		0,500	0,000	0,000
TOTAL	N =	**7812,977** t	Me =	**48526,82** tm
	Fhor =	**-443,476** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO		0,000	21,700	0,000
(debido al sismo)		0,000	19,400	0,000
		0,000	18,400	0,000
		0,000	19,400	0,000
		0,000	10,200	0,000
		0,000	7,800	0,000
EMPUJE ZAPATA		0,000	1,500	0,000
EMPUJE SOBRECARGAS		335,664	12,000	4027,968
		-125,874	13,500	-1699,299
		39,560	20,700	818,900
EMPUJE TIERRAS		2685,312	8,000	21482,496
		-881,118	10,000	-8811,180
		87,033	19,600	1705,844
FUERZA SISMO+RFT+FREN		25,340	19,400	491,596
Fuerza volc. horiz.:	Fh =	**2165,917** t	Mv =	**18016,326** tm
Fuerza horizontal total:	Fhtot =	**2609,393** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = **1,797** CUMPLE, ES > 1
Cvuel = **2,693** CUMPLE, ES > 1

-TENSIONES

eb = 3,905 > 0.33 · ANCHO ZAPATA = 3,667 m
Fibra neutra dentro del nucleo central ec = 1,595 m

TENSION 1= 94,869 t/m2
TENSION 2 = 6,598 t/m2

TENS COMPARACION = **72,801 t/m2** ¡ERROR!, DEBE SER > TENS. ADM.

2º SOBRECARGA MINIMA:

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 2º.....		7260,977		48613,829
		F.horizontal		
PASIVO		1495,097	5,967	8920,746
		443,976	7,967	3537,006
		-0,500	0,000	0,000
TOTAL	N =	**7260,977** t	Me =	**61071,58** tm
	Fhor =	**1938,573** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO		0,000	21,700	0,000
(debido al sismo)		0,000	19,400	0,000
		0,000	18,400	0,000
		0,000	19,400	0,000
		0,000	10,200	0,000
		0,000	7,800	0,000
EMPUJE ZAPATA		0,000	1,500	0,000
EMPUJE SOBRECARGAS		335,664	12,000	4027,968
		-125,874	13,500	-1699,299
		39,560	20,700	818,900
EMPUJE TIERRAS		2685,312	8,000	21482,496
		-881,118	10,000	-8811,180
		87,033	19,600	1705,844
FUERZA SISMO+RFT+FREN		25,340	19,400	491,596
Fuerza volc. horiz.:	Fh =	**2165,917** t	Mv =	**18016,326** tm
Fuerza horizontal total:	Fhtot =	**227,344** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = **19,163** CUMPLE, ES > 1
Cvuel = **3,390** CUMPLE, ES > 1

-TENSIONES

eb = 5,930 > 0.33 · ANCHO ZAPATA = 3,667 m
Fibra neutra dentro del nucleo central ec = -0,430 m

TENSION 1= 36,099 t/m2
TENSION 2 = 58,200 t/m2

TENS COMPARACION = **41,624 t/m2** CUMPLE, ES < TENS. ADM.

ARMADURA ESTRIBO:

TENSIONES SOBRE EL MURO

TENSIONES ACTIVAS: (t/m2)			TENSIONES PASIVAS:	
TEN1 =	4,063	(en arranque del espaldón)	TEN1 =	
TEN2 =	10,190	(en punto del fuste elegido)	TEN2 =	5,133
TEN3 =	5,395	(en extremo superior de fustes)	TEN3 =	
TEN4 =	14,985	(en arranque de fustes)	TEN4 =	9,932

ARMADURA A1: en arranque del espaldón (por metro de cargadero)

		BRAZO	MOMENTO
EMPUJE TIERRAS	7,046	1,533	10,804
EMPUJE SOBRECARGA	4,595	2,300	10,569
Fh =	11,642 t	Mv =	21,374 tm

PESO PROPIO ..... 6,900 t

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I: Estribo + tablero (misma que con sobrecargas y que en vacío)

M	23,099 tm	Md	36,958 tm
N	6,900 t	Nd	11,040 t
Q	11,642 t	Qd	18,627 t

Uc= 825,000 t **Us=** 59,141 t

HIPOTESIS II: Estribo + Tablero + Sobrecarga + sismo

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	2,300	0,000
TOTAL:	0,000 t	Mv =	0,000 tm

M	25,169 tm	Md	25,169 tm
N	6,900 t	Nd	6,900 t
Q	11,642 t	Qd	11,642 t

Uc= 825,000 t **Us=** 40,206 t

ARMADURA MINIMA

0.04·Uc = 33,000 t alfa = 0,761

DIMENSIONAMIENTO

Us máx =	59,141 t	As :	13,336 cm2	
ϕ (mm)	10	As dispues:	3,142 cm2	subir
s (cm)	25			

CORTANTE

Vcu = 33,680 t
Qd (máx) = 18,627 t

ARMADURA A2: punto de fustes elegido ... 7,200 m desde arranque

		BRAZO	MOMENTO
EMPUJE TIERRAS	507,332	4,600	2333,728
	87,033	9,400	818,109
EMPUJE SOBRECAR	110,290	6,900	760,998
	39,560	10,500	415,384
PASIVO POR DELANTE	-158,091	7,367	-1164,603
	-0,500	7,367	-3,683
Fh =	585,624 t	Mv =	3159,934 tm
PESO PROPIO	96,600	2,200	212,520
	0,000	1,050	0,000
	0,000	2,500	0,000
	203,000	-1,050	-213,150
	360,000	0,000	0,000
	0,000	-2,500	0,000
N =	659,600 t	Me=	-0,630 tm

ESFUERZOS TOTALES EN TODOS LOS FUSTES:

N =	659,600 t
M =	3160,564 mt
Fh =	585,624 t
T =	0,000 mt

HIPOTESIS I: Estribo en vacío. (esfuerzos por fuste)

M =	1580,282 tm	Md =	1975,352 tm
N =	329,800 t	Nd =	412,250 t
Q =	292,812 t	Qd =	366,015

HIPOTESIS II: Estribo + Tablero. (esfuerzos por fuste)

M =	1506,796 tm	Md =	2410,873 tm
N =	583,200 t	Nd =	933,120 t
Q =	305,482 t	Qd =	488,771 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

1º SOBRECARGA MAXIMA:

M =	1311,796 tm	Md =	2098,873 tm
Q =	305,482 t	Qd =	488,771 t
N =	843,200 t		
Incremento de axil debido al torsor:	0,000 t		
		Nd máx =	1349,120 t
		Nd mín =	1349,120 t

2º SOBRECARGA MINIMA:

M =	1518,796 tm	Md =	2430,073 tm
Q =	305,482 t	Qd =	488,771 t
N =	567,200 t		
Incremento de axil debido al torsor:	0,000 t		
		Nd máx =	907,520 t
		Nd mín =	907,520 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	11,500	0,000
	0,000	9,200	0,000
	0,000	9,200	0,000
	0,000	8,200	0,000
	0,000	3,600	0,000
	0,000	2,400	0,000
TOTAL:	0,000 t	Mv =	0,000 tm

1º SOBRECARGA MAXIMA:

M =	1311,796 tm	Md =	1311,796 tm
Q =	292,812 t	Qd =	292,812 t
N =	843,200 t		
Incremento de axil debido al torsor:	0,000 t		
		Nd máx =	843,200 t
		Nd mín =	843,200 t

2º SOBRECARGA MINIMA:

M =	1518,796 tm	Md =	1518,796 tm
Q =	292,812 t	Qd =	292,812 t
N =	567,200 t		
Incremento de axil debido al torsor:	0,000 t		
		Nd máx =	567,200 t
		Nd mín =	567,200 t

CORTANTE

Vcu =	606,249 t		
Qd =	488,771 t < Vcu		
Vsu =	-117,477 t	Usu mín =	60,000 t
Us =	60,000 t	Diám.mín. =	16,170 mm
		(un cerco=dos ramas)	

ARMADURA MINIMA

0.04·UC = 594,000 t alfa = 1,329

DIMENSIONAMIENTO

canto sección = 5,000
ancho sección = 2,000
recubrimiento = 0,050

Ac·fcd = 14850,000 t
Ac·fcd·d = 73507,500 tm

	HIP I	HIP II	HIP III 1º A	HIP III 1º B	HIP III 2º A	HIP III 2 B	HIP IV 1º A	HIP IV 1º B	HIP IV2º A	HIP IV 2º B
Md=	2985,365	4697,017	5404,217	5404,217	4653,497	4653,497	3377,636	3377,636	2908,436	2908,436
mu=	0,041	0,064	0,074	0,074	0,063	0,063	0,046	0,046	0,040	0,040
w=	0,041	0,066	0,076	0,076	0,065	0,065	0,047	0,047	0,040	0,040
Us,0 =	615,875	981,316	1135,147	1135,147	971,905	971,905	698,792	698,792	599,671	599,671
Us=	203,625	48,196	-213,973	-213,973	64,385	64,385	-144,408	-144,408	32,471	32,471

Us max= 203,625 t As = 61,003 cm2
Diámetro mínimo= 27,9 mm 10 redondos

ARMADURA A3: extremo superior de fustes (por metro lineal)

	EMPUJE	BRAZO	MOMENTO
EMPUJE TIERRAS	14,505	2,200	31,912
EMPUJE SOBRECAR	6,593	3,300	21,758
Fh=	21,099 t	Mv =	53,670 tm
PESO PROPIO	6,900	1,150	7,935
	0,000	1,450	0,000
	0,000	1,450	0,000
	14,500	0,000	0,000
N=	21,400 t	Me =	7,935 tm

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I.- ESTRIBO VACIO

M= 75,695 tm Md= 94,619 tm
N= 21,400 t Nd= 26,750 t
Q= 21,099 t Qd= 26,374 t

Uc= 4275,000 t Us= 6,580 t

HIPOTESIS II.- ESTRIBO + TABLERO

M= 140,855 tm Md= 225,368 tm
N= 57,600 t Nd= 92,160 t
Q= 22,909 t Qd= 36,654 t

Uc= 4275,000 t Us= -12,338 t

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

1º SOBRECARGA MAXIMA:

M= 203,998 tm Md= 326,397 tm
N= 94,743 t Nd= 151,589 t
Q= 22,909 t Qd= 36,654 t

Uc= 4275,000 t Us= -35,487 t

1º SOBRECARGA MINIMA:

M= 136,970 tm Md= 219,151 tm
N= 55,314 t Nd= 88,503 t
Q= 22,909 t Qd= 36,654 t

Uc= 4275,000 t Us= -10,903 t

HIPOTESIS IV.- ESTRIBO + TABLERO + SOBRECARGA

EMPUJES DEBIDOS AL SISMO.....	0,000	4,300	0,000
	0,000	2,000	0,000
	0,000	2,000	0,000
	0,000	1,000	0,000
Fh =	0,000 t	Mv =	0,000 tm

1º SOBRECARGA MAXIMA:

M= 203,998 tm Md= 203,998 tm
N= 94,743 t Nd= 94,743 t
Q= 22,909 t Qd= 22,909 t

Uc= 4275,000 t Us= -22,555 t

2º SOBRECARGA MINIMA:

M= 136,970 tm Md= 136,970 tm
N= 55,314 t Nd= 55,314 t
Q= 22,909 t Qd= 22,909 t

Uc= 4275,000 t Us= -6,982 t

CORTANTE Vcu = 174,526 t
Qd = 36,654 t

ARMADURA MINIMA

0.04·Uc= 171,000 t alfa= 1,483

DIMENSIONAMIENTO

Us max= 6,580 t As= 2,200 cm2
ϕ (mm) 10 As dispues: 3,142 cm2 vale
s (cm) 25

JUNTO A CADA FUSTE

Us (corr) = Us·Ic/(nf·df) = 13,660 t
Diámetro mínimo = 8,9 mm a 0,200 m

ARMADURA A4: punto de arranque de fustes

	EMPUJE	BRAZO	MOMENTO
EMPUJE TIERRAS	1174,824	7,000	8223,768
	87,033	16,600	1444,746
EMPUJE SOBRECAR	167,832	10,500	1762,236
	39,560	17,700	700,219
PASIVO POR DELANTE	-591,967	4,967	-2940,105
	-0,917	14,567	-13,351
Fh =	876,365 t	Mv =	9177,513 tm
PESO PROPIO	96,600	2,200	212,520
	0,000	1,050	0,000
	0,000	2,500	0,000
	203,000	-1,050	-213,150
	720,000	0,000	0,000
	0,000	-2,500	0,000
N =	1019,600 t	Me=	-0,630 tm

ESFUERZOS TOTALES EN TODOS LOS FUSTES:

N = 1019,600 t
M = 9178,142 mt
Fh = 876,365 t
T = 0,000 mt

HIPOTESIS I: Estribo en vacío. (esfuerzos por fuste)

1155,000

M = 4589,071 tm Md = 5736,339 tm 640,801
N = 509,800 t Nd = 637,250 t -97,151
Q = 438,183 t Qd = 547,728

HIPOTESIS II: Estribo + Tablero. (esfuerzos por fuste)

1155,000

M = 4606,809 tm Md = 7370,895 tm 707,635
N = 763,200 t Nd = 1221,120 t -37,285
Q = 450,853 t Qd = 721,364 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga. (esfuerzos por fuste)

1° SOBRECARGA MAXIMA:

1260,000

M = 4411,809 tm Md = 7058,895 tm 733,543
Q = 450,853 t Qd = 721,364 t 93,057
N = 1023,200 t
Incremento de axil debido al torsor: 0,000 t
Nd máx = 1637,120 t
Nd mín = 1637,120 t

2° SOBRECARGA MINIMA:

1260,000

M = 4618,809 tm Md = 7390,095 tm 676,043
Q = 450,853 t Qd = 721,364 t 12,557
N = 747,200 t
Incremento de axil debido al torsor: 0,000 t
Nd máx = 1195,520 t
Nd mín = 1195,520 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga (esfuerzos por fuste)

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	18,700	0,000
	0,000	16,400	0,000
	0,000	16,400	0,000
	0,000	15,400	0,000
	0,000	7,200	0,000
	0,000	4,800	0,000
TOTAL:	0,000 t	Mv =	0,000 tm

1° SOBRECARGA MAXIMA:

M = 4411,809 tm Md = 4411,809 tm
Q = 438,183 t Qd = 438,183 t
N = 1023,200 t
Incremento de axil debido al torsor: 0,000 t
Nd máx = 1023,200 t
Nd mín = 1023,200 t

2° SOBRECARGA MINIMA:

M = 4618,809 tm Md = 4618,809 tm
Q = 438,183 t Qd = 438,183 t
N = 747,200 t
Incremento de axil debido al torsor: 0,000 t
Nd máx = 747,200 t
Nd mín = 747,200 t

CORTANTE

Vcu = 606,249 t
Qd = 721,364 t > Vcu
Vsu = 115,115 t Usu mín = 150,000 t

Us = 150,000 t Diám.mín. = 25,567 mm
(un cerco=dos ramas)

ARMADURA MINIMA

0.04·UC = 594,000 t alfa = 0,611

DIMENSIONAMIENTO

canto sección = 5,000
ancho sección = 2,000
recubrimiento = 0,040

Ac·fcd = 14880,000 t
Ac·fcd·d = 73804,800 tm

	HIP I	HIP II	HIP III 1º A	HIP III 1º B	HIP III 2º A	HIP III 2 B	HIP IV 1º A	HIP IV 1º B	HIP IV2º A	HIP IV 2º B
Md=	7303,974	10374,850	11086,210	11086,210	10331,074	10331,074	6928,881	6928,881	6456,921	6456,921
mu=	0,099	0,141	0,150	0,150	0,140	0,140	0,094	0,094	0,087	0,087
w=	0,104	0,152	0,164	0,164	0,151	0,151	0,099	0,099	0,092	0,092
Us,0 =	1553,689	2263,927	2434,232	2434,232	2253,522	2253,522	1469,515	1469,515	1364,347	1364,347
Us=	916,439	1042,807	797,112	797,112	1058,002	1058,002	446,315	446,315	617,147	617,147

Us max= 1058,002 t As = 238,569 cm2
Diámetro mínimo= 55,1 mm 10 redondos

ARMADURA A5 (cálculos por metro lineal)

TENSIONES EN ZAPATA

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º	MAX
TENSION 1	76,660	80,346	82,341	80,223	94,869	36,099	94,869
TENSION 2	11,472	14,368	19,126	14,075	6,598	58,200	6,598
LONG TEN	0,000	0,000	0,000	0,000	0,000	0,000	

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde de ... 3,750 m

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	76,660	80,346	82,341	80,223	94,869	36,099
TENSION S =	54,437	57,853	60,791	43,597	58,178	-14,566
M =	486,931	512,216	528,452	478,227	581,054	135,074

Md = 929,686 tm

Uc = 3933,333 t Us= 328,899 t

ARMADURA MINIMA

0.04·Uc= 157,333 t alfa = 0,472

DIMENSIONAMIENTO

Us máx =	328,899 t	As =	74,163 cm2	
ϕ (mm)	10	As dispues=	3,142 cm2	subir
s (cm)	25			

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 1,500 m

La tensión en esta sección es: 82,832 t/m2

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	76,660	80,346	82,341	80,223	94,869	36,099
TENSION S =	67,771	71,349	73,721	71,203	82,832	39,113
Q =	108,323	113,771	117,047	113,570	133,276	56,409

Vcu = 340,637 t
Qd = 213,241 t

ARMADURA A6 (cálculos por metro lineal)

Supuesta zapata descalzada por detrás

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde (por detrás) de ... 3,750 m

	PESO	BRAZO	MOMENTO	
PESO DE TIERRAS	126,000	2,250	283,500	t/m2
	0,000	0,750	0,000	
	0,000	0,750	0,000	
	0,000	0,750	0,000	
PESO DE SOBRECARGAS	9,000	2,250	20,250	t/m2
PESO PROPIO ZAPATA	28,125	1,875	52,734	t/m2
TOTAL	163,125 t		356,484	t/m2

Md = 570,375 tm

Uc = 3933,333 t Us = 198,349 t

ARMADURA MINIMA

0.04·Uc = 157,333 t alfa = 0,880

DIMENSIONAMIENTO

Us máx =	198,349 t	As =	44,726 cm2	
ϕ (mm)	10	As dispues=	3,142 cm2	subir
s (cm)	25			

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 1,500 m

Vcu = 340,637 t Q = 67,500 t
Qd = 108,000 t

ESTUDIO TRANSVERSAL DE LA ZAPATA

SOLO PARA EL CASO DE DOS FUSTES esfuerzos por metro de ancho

Vuelo transversal (desde el eje) = 4,000 m
Distancia entre fustes (entre ejes) = 6,000 m
Uc = 3933,333 t

TENSIONES EN TERRENO:

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
Tensión 1 =	76,660	80,346	82,341	80,223	94,869	36,099
Tensión 2 =	11,472	14,368	19,126	14,075	6,598	58,200
Long. Ten. =	0,000	0,000	0,000	0,000	0,000	0,000
Tensión media =	44,066	47,357	50,734	47,149	50,734	47,149

ARMADURA CARA INFERIOR

Momento voladizo	352,529	378,856	405,869	377,194	405,869	377,194
Md Voladizo	440,661	606,170	649,390	603,510	649,390	603,510
Armadura inferior (nec)..	152,326	211,149	226,663	210,196	226,663	210,196
Armadura mín. inferior ...	155,979	177,399	179,444	177,224	179,444	177,224
Armadura inferior	155,979	211,149	226,663	210,196	226,663	210,196
Diám. mín. inferior (mm).	29,927	34,820	36,076	34,741	36,076	34,741

Diámetro mínimo = 36,076 mm a 0,200 m
As = 51,110 cm2

ARMADURA CARA SUPERIOR

Momento centro vano ...	154,231	165,749	177,568	165,022	177,568	165,022
Md centro de vano	192,789	265,199	284,108	264,036	284,108	264,036
Armadura superior (nec)	0,000	0,000	0,000	0,000	0,000	0,000
Armadura mín.superior .	0,000	0,000	0,000	0,000	0,000	0,000
Armadura superior	0,000	0,000	0,000	0,000	0,000	0,000
Diámetro mín.sup(mm)..	0,000	0,000	0,000	0,000	0,000	0,000

Diámetro mínimo = 0,000 mm a 0,200 m
As = 0,000 cm2

RESUMEN DE RESULTADOS:

Hipótesis realizadas:

		Cdes mín.	Cvuel mín.
HIPOTESIS I:	estribo en vacío,	1,200	1,600
HIPOTESIS II:	estribo + carga permanente	1,500	2,000
HIPOTESIS III	1º: estribo + tablero + SCmáx.	1,500	2,000
	2º: estribo + tablero + SCmín.	1,500	2,000
HIPOTESIS IV	1º: est. + tabl. + SCmáx.	1,000	1,000
	2º: est. + tabl. + SCmín.	1,000	1,000

Valores obtenidos:

	Cdes real	Cvuel real	T.Comp.
HIP I	3,736	2,605	60,363
HIP II	3,923	2,709	63,851
HIP III 1º	4,203	2,890	66,537
HIP III 2º	3,906	2,698	60,143
HIP IV 1º	1,797	2,693	¡ERROR!
HIP IV 2º	19,163	3,390	41,624

ARMADURAS: (por metro de estribo)

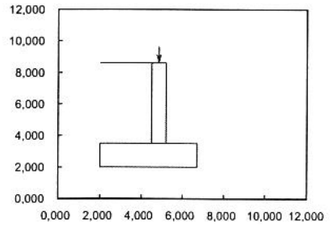
	As (cm2)	Diam.(mm)		Equidist.(m)
1º En arranque de espaldón	13,336	As dispues=	cm2	
2º En punto intermedio elegido	61,003	27,870		0,211
3º En extremo sup. fustes.....	2,200	As dispues=	cm2	
4º En punto de arranque fustes	238,569	55,114		0,211
5º Zapata	74,163	As dispues=	cm2	
6º Zapata descalzada por detrás.	44,726	As dispues=	cm2	
Estudio transversal de zapata				
Cara superior	0,000	0,000		0,200
Cara inferior	51,110	36,076		0,200

PROYECTO DE ESTRIBOS CERRADOS

PROYECTO..... **SUBTRAMO VII**

ESTRUCTURA..... **VIADUCTO Nº 2**

ESTRIBO..... **1**



DATOS DE ENTRADA

GEOMETRIA

Talón.....	2,500	m
Ancho alzado.....	0,700	m
Puntera.....	1,500	m
Canto zapata.....	1,500	m
Altura total.....	6,600	m
Altura murete.....	0,000	m
Ancho murete.....	0,000	m
Ancho meseta.....	0,700	m
Altura retranqueo.....	0,000	m
Altura cartela.....	0,000	m
Largo zapata.....	1,000	m
Largo estribo.....	1,000	m
Alt tierra delante.....	1,500	m
Distan. a intradós.....	0,350	m
Alt.Cálc.Arm. ..... (desde base de alzado)	2,550	m
Retranqueo murete.....	0,000	m
Ancho sobrecarga.....	0,750	m
Altura de alzado.....	5,100	m
Ancho zapata.....	4,700	m

ALETAS

Número.....	0,000	
Coef forma.....	0,500	
Altura.....	2,050	m
Vuelo.....	2,100	m
Espesor.....	0,300	m

GEOTECNIA

Densidad tierras.....	2,000	t/m3
Coef. emp. activo.....	0,330	
Coef. emp. pasivo.....	3,000	
Coef. rozam. zapata.....	0,600	
Tensión admisible	30,000	t/m2

CARGAS (en todo lo ancho)

Densidad hormigón.....	2,500	t/m3
Sobrecarga trasdós.....	3,000	t/m2
Cargas perman tablero	0,000	t
Sobrecarga máxima.....	0,000	t
Sobrecarga mínima.....	0,000	t
Fuerza horiz. rft.....	0,000	t
Fuerza horiz.frenado.....	0,000	t

MATERIALES

Resist hor alzado.....	250	kg/cm2
Resist hor zapata.....	250	kg/cm2
Resistencia acero.....	5100	kg/cm2
Recubrimiento.....	0,040	m
Equidist. armadu.....	0,250	m

CARGAS (por m de estribo)

Cargas perman tablero	0,000	t/m
Sobrecarga máxima.....	0,000	t/m
Sobrecarga mínima.....	0,000	t/m
Fuerza horiz. rft.....	0,000	t/m
Fuerza horiz.frenado.....	0,000	t/m

CARGAS POR SISMO IAP-96

¿Considerar? (1=sí; 2=no) 2

Fuerza horizontal.....	0,000	t	
(por m de estribo).....	0,000	t/m	
Coef. sísmico horizontal (cargas gravitatorias)...	0,120	*g	
densidad terreno	γ	2,000	t/m3
coef acelerac horizontal	Kh	0,208	*g
coef acelerac vertical	Kv	0,000	*g
		° sexag	radianes
ang rozamiento interno	ϕ	30,0	0,5236
ángulos geométricos	i	0,0	0,0000
	δ	0,0	0,0000
	β	0,0	0,0000
arctg Kh/(1-Kv)	θ	11,7	0,2051
			λ
Ka, sismo = (1-Kv)* λa =	0,000		0,4801
Kp, sismo = (1-Kv)* λp =	0,000		2,6130

COEFICIENTES DE SEGURIDAD

Minoración Hormigón....	1,50
Minoración Acero.....	1,15
Seguridad al vuelco.....	1,80
Seguridad al deslizam..	1,50
Coef.horm.vertical	0,90
γf cargas perman.....	1,35
γf sobrecargas.....	1,50
γf acciones reológicas.....	1,35
γf accción del terreno.....	1,50
γA accidental-sismo....	1,00

HIPOTESIS I.- ESTRIBO EN VACIO

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
SOBRECARGA TRASDOS	2,250	4,325	9,731
PESO TIERRAS	7,650	4,325	33,086
	0,000	2,200	0,000
	0,000	2,200	0,000
PESO ESTRIBO	0,000	2,200	0,000
	0,000	1,850	0,000
	8,925	1,850	16,511
	0,000	2,200	0,000
PESO ZAPATA	17,625	2,350	41,419
PESO ALETAS (DIFERENCIA)	0,000	2,900	0,000
	F.horizontal		
PASIVO	6,750	0,500	3,375
	0,000	1,500	0,000
TOTAL N =	**36,450** t	Me =	**104,122** tm
Fhor =	**6,750** t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE SOBRECARGAS	6,534	3,300	21,562
EMPUJE TIERRAS	14,375	2,200	31,625
	0,000	3,200	0,000
Fuerza volc. horiz.: Fh =	**20,909** t	Mv =	**53,187** tm
Fuerza horizontal total: Fhtot =	**14,159** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes=	**1,545**	CUMPLE, ES >	1,200
Cvuel=	**1,958**	CUMPLE, ES >	1,440

-TENSIONES

eb = 1,397 < 0.33 * ANCHO DE ZAPATA = 1,567 m

Fibra neutra fuera del nucleo central ec = 0,953 m

TENSION 1= 17,389 t/m2

LONG TEN = 4,192 m

TENS COMPARACION = **13,042 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	5,049	1,50	7,574 t
	sc tierras	8,583	1,50	12,875 t
		13,632		20,448 t

Vcu = canto·larg·0.5·fcv·10 = 42,866 t

Qd= **20,448 t** CUMPLE, ES <Vcu

HIPOTESIS II.- ESTRIBO + TABLERO (C.P.)

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPÓTESIS I		36,450		104,122
CARGAS PERMANENTES		0,000	1,850	0,000
TOTAL	N =	**36,450** t	Me =	**104,122** tm
	Fhor =	**6,750** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		20,909		53,187
FUERZA HOR RFT		0,000	6,600	0,000
Fuerza volc. horiz.:	Fh =	**20,909** t	Mv =	**53,187** tm
Fuerza horizontal total:	Fhtot =	**14,159** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes =	**1,545**	CUMPLE, ES >	1,500
Cvuel =	**1,958**	CUMPLE, ES >	1,800

-TENSIONES

eb = 1,397 < 0.33 · ANCHO DE ZAPATA = 1,567 m
Fibra neutra fuera del nucleo central ec = 0,953 m

TENSION 1= 17,389 t/m2
LONG TEN = 4,192 m

TENS COMPARACION = **13,042 t/m2** CUMPLE, ES <TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado	sc trasdós	5,049	1,50	7,574
	sc tierras	8,583	1,50	12,875
	retr+fl+t^a	0,000	1,35	0,000
		13,632		20,448

Vcu = canto·larg·0.5·fcv·10 = 42,866 t
Qd= **20,448 t** CUMPLE, ES <Vcu

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

****************** 1º SOBRECARGA MAXIMA *******************

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS II		36,450		104,122
SOBRECARGA MAXIMA TABLERO		0,000	1,850	0,000
TOTAL	N =	**36,450** t	Me =	**104,123** tm
	Fhor =	**6,750** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		20,909		53,187
FUERZA FRENADO+RFT		0,000	6,600	0,000
Fuerza volc. horiz.:	Fh =	**20,909** t	Mv =	**53,187** tm
Fuerza horizontal total:	Fhtot =	**14,159** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**1,545**	CUMPLE, ES >	1,500
Cvuel =	**1,958**	CUMPLE, ES >	1,800

-TENSIONES

eb = 1,397 < 0.33 * ANCHO DE ZAPATA = 1,567 m
Fibra neutra fuera del nucleo central ec = 0,953 m

TENSION 1= 17,389 t/m2
LONG TEN = 4,192 m

TENS COMPARACION = **13,042 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	5,049	1,50	7,574 t
	sc tierras	8,583	1,50	12,875 t
	retr+fl+t^a	0,000	1,35	0,000 t
	frenado	0,000	1,50	0,000 t
		13,632		20,448 t

Vcu= canto·larg·0.5·fcv·10 = 42,866 t
Qd= **20,448 t** CUMPLE, ES <Vcu

****************** 2º SOBRECARGA MINIMA *******************

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS II		36,450		104,122
SOBRECARGA MINIMA TABLERO.		0,000	1,850	0,000
TOTAL	N =	**36,450** t	Me =	**104,123** tm
	Fhor =	**6,750** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I		20,909		53,187
FUERZA FRENADO+RFT		0,000	6,600	0,000
Fuerza volc. horiz.:	Fh =	**20,909** t	Mv =	**53,187** tm
Fuerza horizontal total:	Fhtot =	**14,159** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**1,545**	CUMPLE, ES >	1,500
Cvuel =	**1,958**	CUMPLE, ES >	1,800

-TENSIONES

eb = 1,397 < 0.33 · ANCHO DE ZAPATA = 1,567 m
Fibra neutra fuera del nucleo central ec = 0,953 m

TENSION 1= 17,389 t/m2
LONG TEN = 4,192 m

TENS COMPARACION = **13,042 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd	
En arranque de alzado:	sc trasdós	5,049	1,50	7,574	t
	sc tierras	8,583	1,50	12,875	t
	retr+fl+t^a	0,000	1,35	0,000	t
	frenado	0,000	1,50	0,000	t
		13,632		20,448	

Vcu= canto·larg·0.5·fcv·10 = 42,866 t

Qd = **20,448 t** CUMPLE, ES <Vcu

|::

HIPOTESIS IV.- ESTRIBO+TABLERO+SOBRECARGA+SISMO (no hay sismo)

****************** 1º SOBRECARGA MAXIMA *******************

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS III 1º.....		36,450		104,123	
		F.horizontal			
PASIVO		0,000	0,500	0,000	
		0,000	1,500	0,000	
TOTAL	N =	**36,450**	t Me =	**104,123**	tm
	Fhor =	**0,000**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
EMPUJE ESTRIBO		0,000	6,600	0,000	
(debido al sismo)		0,000	6,600	0,000	
		0,000	6,600	0,000	
		1,071	4,050	4,338	
EMPUJE ZAPATA		2,115	0,750	1,586	
EMPUJE SOBRECARGAS		0,000	3,300	0,000	
EMPUJE TIERRAS		0,000	2,200	0,000	
		0,000	3,200	0,000	
FUERZA SISMO+RFT+FREN		0,000	6,600	0,000	
Fuerza volc. horiz.:	Fh =	**3,186**	t Mv =	**5,924**	tm
Fuerza horizontal total:	Fhtot =	**3,186**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = 6,864 CUMPLE, ES > 1

Cvuel = 17,577 CUMPLE, ES > 1

-TENSIONES

eb = 2,694 > 0.33 · ANCHO ZAPATA = 1,567 m

Fibra neutra dentro del nucleo central ec = -0,344 m

TENSION 1= 4,349 t/m2

TENSION 2 = 11,162 m

TENS COMPARACION = **6,052 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	0,000	0,20	0,000
	sc tierras	0,000	1,00	0,000
	retr+fl+t^a	0,000	1,00	0,000
	frenado	0,000	0,20	0,000
	Fh sismo	0,000	1,00	0,000
	empujes	33,710	1,00	33,710
		33,710		33,710

Vcu = canto·larg·0.5·fcv·10 = 42,866 t

Qd = **33,710 t** CUMPLE, ES <Vcu

****************** 2º SOBRECARGA MINIMA *******************

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS III 2º.....		36,450		104,123	
		F.horizontal			
PASIVO		0,000	0,500	0,000	
		0,000	1,500	0,000	
TOTAL	N =	**36,450**	t Me =	**104,123**	tm
	Fhor =	**0,000**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO		0,000	6,600	0,000
(debido al sismo)		0,000	6,600	0,000
		0,000	6,600	0,000
		1,071	4,050	4,338
EMPUJE ZAPATA		2,115	0,750	1,586
EMPUJE SOBRECARGAS		0,000	3,300	0,000

EMPUJE TIERRAS		0,000	2,200	0,000	
		0,000	3,200	0,000	
FUERZA SISMO+RFT+FREN		0,000	6,600	0,000	
Fuerza volc. horiz.:	Fh =	**3,186**	t Mv =	**5,924**	tm
Fuerza horizontal total:	Fhtot =	**3,186**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = 6,864 CUMPLE, ES > 1
Cvuel = 17,577 CUMPLE, ES > 1

-TENSIONES

eb = 2,694 > 0.33 · ANCHO ZAPATA = 1,567 m
Fibra neutra dentro del nucleo central ec = -0,344 m

TENSION 1= 4,349 t/m2
TENSION 2 = 11,162 m

TENS COMPARACION = **6,052 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	0,000	0,20	0,000
	sc tierras	0,000	1,00	0,000
	retr+fl+t^a	0,000	1,00	0,000
	frenado	0,000	0,20	0,000
	Fh sismo	0,000	1,00	0,000
	empujes	3,186	1,00	3,186
		3,186		3,186

Vcu = canto·larg·0.5·fcv·10 = 42,866 t
Qd = **3,186 t** CUMPLE, ES <Vcu

|::

ARMADURA ESTRIBO: (en todos los casos armadura por metro lineal)

TENSIONES SOBRE EL MURO

TEN1= 0,990 (en arranque del espaldón)
TEN2= 2,673 (en punto del alzado elegido)
TEN3= 4,356 (en arranque de alzado)

ARMADURA A1: en arranque del espaldón

		BRAZO	MOMENTO
EMPUJE TIERRAS	0,000	0,000	0,000
EMPUJE SOBRECARGA	0,000	0,000	0,000
Fh =	0,000 t	Mv =	0,000 tm

PESO PROPIO ..... 0,000 t

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I: Estribo + tablero (misma que con sobrecargas y que en vacío)

			γf		
M= tierras	0,000 tm	*	1,50	Md =	0,000 tm
sc trasdós	0,000 tm	*	1,50		
pp	0,000 tm	*	1,35		
N = pp	0,000 t	*	1,35	Nd =	0,000 t
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t
sc trasdós	0,000 t	*	1,50		

Uc= -59,850 t **Us=** 0,000 t

HIPOTESIS II: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	0,000	0,000
TOTAL:	0,000 t	Mv =	0,000 tm

			γf		
M= tierras	0,000 tm	*	1,50	Md =	0,000 tm
sc trasdós	0,000 tm	*	1,50		
pp	0,000 tm	*	1,35		
sismo	0,000 tm	*	0,00		
N = pp	0,000 t	*	1,35	Nd =	0,000 t
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t
sc trasdós	0,000 t	*	1,50		
sismo	0,000 t	*	0,00		

Uc= -59,850 t **Us=** 0,000 t

ARMADURA MINIMA

0.04·Uc= -2,394 t α = 1,500

DIMENSIONAMIENTO

Us máx = 0,000 t As = 0,000 cm2
ϕ (mm) 10 As dispues= 3,927 cm2 vale
s (cm) 20

CORTANTE

Vcu = -2,443 t
Qd (máx) = 0,000 t disponer armadura de cortante

|::

ARMADURA A2: Punto del alzado elegido para armar, a 2,550 m desde arranque

		BRAZO	MOMENTO
EMPUJE TIERRAS	2,146	0,850	1,824
EMPUJE SOBRECAR	2,525	1,275	3,219
Fh =	4,670 t	Mv =	5,043 tm
PESO PROPIO	0,000	-0,350	0,000
	0,000	0,000	0,000
	0,000	-0,350	0,000
	8,925	0,000	0,000
N =	8,925 t	Me=	0,000 tm

Vcu = 40,417 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	1,824 tm	*	1,50	Md =	11,299 tm	
sc trasdós	3,219 tm	*	1,50			
pp	2,767 tm	*	1,35			
N =	8,925 t	*	1,35	Nd =	11,156 t	
Q= tierras	2,146 t	*	1,50	Qd =	7,005 t	< Vcu
sc trasdós	2,525 t	*	1,50			

Uc = 990,000 t **Us =** 6,114 t

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	7,809 tm			Md =	11,299 tm	
cp tablero	0,000 tm	*	1,35			
retr+fluen	0,000 tm	*	1,35			
N= hip I	8,925 t			Nd =	11,156 t	
cp tablero	0,000 t	*	1,35			
Q= hip I	4,670 t			Qd =	7,005 t	< Vcu
retr+fluen	0,000 t	*	1,35			

Uc = 990,000 t **Us =** 6,114 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1º SOBRECARGA MAXIMA:

			γf			
M= hip II	7,809 tm			Md =	11,299 tm	
sc max	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	8,925 t			Nd =	11,156 t	
sc max	0,000 t	*	1,50			
Q= hip I	4,670 t			Qd =	7,005 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 990,000 t **Us =** 6,114 t

2º SOBRECARGA MINIMA:

			γf			
M= hip II	7,809 tm			Md =	11,299 tm	
sc min	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	8,925 t			Nd =	11,156 t	
sc min	0,000 t	*	1,50			
Q= hip I	4,670 t			Qd =	7,005 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 990,000 t **Us =** 6,114 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	2,550	0,000
	0,000	5,100	0,000
	0,000	2,550	0,000
	0,535	1,275	0,683
TOTAL:	0,535 t	Mv =	0,683 tm

1º SOBRECARGA MAXIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	3,735 tm	
sc trasdós	0,000 tm	*	1,50			
pp	2,767 tm	*	1,35			
empujes	0,683 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc max	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	8,925 t	*	1,35	Nd =	12,049 t	
cp tablero	0,000 t	*	1,35			
sc max	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	0,535 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			

Uc = 990,000 t **Us =** -6,373 t

2º SOBRECARGA MINIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	3,735 tm	
sc trasdós	0,000 tm	*	1,50			
pp	2,767 tm	*	1,35			
empujes	0,683 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc min	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	8,925 t	*	1,35	Nd =	12,049 t	
cp tablero	0,000 t	*	1,35			
sc min	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	0,535 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			

Uc = 990,000 t **Us =** -6,373 t

ARMADURA MINIMA

0.04·Uc = 39,600 t alfa = 1,423

DIMENSIONAMIENTO

Us max =	6,114 t	As =	1,962	cm2
ϕ (mm)	20	As dispues=	15,708	cm2 vale
s (cm)	20			

CORTANTE

Vcu =	40,417
Qd (Máx) =	7,005

|::

ARMADURA A3: punto de arranque del alzado

		BRAZO	MOMENTO
EMPUJE TIERRAS	8,583	1,700	14,592
EMPUJE SOBRECAR	5,049	2,550	12,875
Fh =	13,632 t	Mv =	27,467 tm
PESO PROPIO	0,000	-0,350	0,000
	0,000	0,000	0,000
	0,000	-0,350	0,000
	8,925	0,000	0,000
N =	8,925 t	Me=	0,000 tm

Vcu = 40,417 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	14,592 tm	*	1,50	Md =	44,935 tm	
sc trasdós	12,875 tm	*	1,50			
pp	2,767 tm	*	1,35			
N =	8,925 t	*	1,35	Nd =	11,156 t	
Q= tierras	8,583 t	*	1,50	Qd =	20,448 t	< Vcu
sc trasdós	5,049 t	*	1,50			
	Uc =		990,000 t	**Us =**	59,444 t	

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	30,233 tm			Md =	44,935 tm	
cp tablero	0,000 tm	*	1,35			
retr+fluen	0,000 tm	*	1,35			
N= hip I	8,925 t			Nd =	11,156 t	
cp tablero	0,000 t	*	1,35			
Q= hip I	13,632 t			Qd =	20,448 t	< Vcu
retr+fluen	0,000 t	*	1,35			
	Uc =		990,000 t	**Us =**	59,444 t	

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1º SOBRECARGA MAXIMA:

			γf			
M= hip II	30,233 tm			Md =	44,935 tm	
sc max	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	8,925 t			Nd =	11,156 t	
sc max	0,000 t	*	1,50			
Q= hip I	13,632 t			Qd =	20,448 t	< Vcu
frenado	0,000 t	*	1,50			
	Uc =		990,000 t	**Us =**	59,444 t	

2º SOBRECARGA MINIMA:

			γf			
M= hip II	30,233 tm			Md =	44,935 tm	
sc min	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	8,925 t			Nd =	11,156 t	
sc min	0,000 t	*	1,50			
Q= hip I	13,632 t			Qd =	20,448 t	< Vcu
frenado	0,000 t	*	1,50			
	Uc =		990,000 t	**Us =**	59,444 t	

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	5,100	0,000
	0,000	5,100	0,000
	0,000	5,100	0,000
	1,071	2,550	2,731
TOTAL:	1,071 t	Mv =	2,731 tm

1º SOBRECARGA MAXIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	3,735 tm	
sc trasdós	0,000 tm	*	1,50			
pp	2,767 tm	*	1,35			
empujes	2,731 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc max	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	8,925 t	*	1,35	Nd =	12,049 t	
cp tablero	0,000 t	*	1,35			
sc max	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	1,071 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			
	Uc =		990,000 t	**Us =**	-6,373 t	

2º SOBRECARGA MINIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	3,735 tm	
sc trasdós	0,000 tm	*	1,50			
pp	2,767 tm	*	1,35			
empujes	2,731 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc max	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	8,925 t	*	1,35	Nd =	12,049 t	
cp tablero	0,000 t	*	1,35			
sc max	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	1,071 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			
	Uc =		990,000 t	**Us =**	-6,373 t	

ARMADURA MINIMA

0.04·Uc = 39,600 t alfa = 0,749

DIMENSIONAMIENTO

Us max =	59,444 t	As =	13,404 cm2	
ϕ (mm)	20	As dispues=	15,708 cm2	vale
s (cm)	20			

CORTANTE

Vcu =	40,417
Qd (Máx) =	20,448

ARMADURA A4

TENSIONES EN ZAPATA

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º	MAX
TENSION 1	17,389	17,389	17,389	17,389	4,349	4,349	17,389
TENSION 2	0,000	0,000	0,000	0,000	11,162	11,162	0,000
LONG TEN	4,192	4,192	4,192	4,192	0,000	0,000	

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde de ... 1,605 m

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	17,389	17,389	17,389	17,389	4,349	4,349
TENSION S =	10,732	10,732	10,732	11,451	-4,486	-4,486
M =	19,539	19,539	19,539	19,848	1,808	1,808

γf para tensiones 1,40 Md = 27,787 tm

Uc = 2433,333 t Us= 19,107 t

ARMADURA MINIMA

0.04·Uc= 97,333 t alfa = 1,402

DIMENSIONAMIENTO

Us máx = 26,786 t As = 6,040 cm2
ϕ (mm) 20 As dispues= 15,708 cm2 vale
s (cm) 20

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 0,750 m

La tensión en esta sección es: 14,614 t/m2

	HIP I	HIP II	HIP III 1º	HIP III 2º	HIP IV 1º	HIP IV 2º
TENSION 1 =	17,389	17,389	17,389	17,389	4,349	4,349
TENSION S =	14,278	14,278	14,278	14,278	5,436	5,436
Q =	11,875	11,875	11,875	11,875	3,669	3,669

Vcu = 94,243 t

γf para tensiones 1,40 Qd = 16,625 t CUMPLE, ES <Vcu

ARMADURA A5

Supuesta zapata descalzada por detrás

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde (por detrás) de ... 2,605 m

	PESO	BRAZO	MOMENTO		γf
PESO DE TIERRAS	7,650	2,230	17,060	t/m2	1,50
	0,000	1,855	0,000		1,50
	0,000	1,855	0,000		1,50
PESO DE SOBRECARGAS	2,250	2,230	5,018	t/m2	1,50
PESO PROPIO ZAPATA	9,769	1,303	12,724	t/m2	1,35
TOTAL	19,669	t	34,801	t/m2	

Md = 50,293 tm

Uc = 2433,333 t Us = 34,694 t

ARMADURA MINIMA

0.04·Uc = 97,333 t alfa = 1,322

DIMENSIONAMIENTO

Us máx = 45,858 t As = 10,341 cm2
ϕ (mm) 20 As dispues= 15,708 cm2 vale
s (cm) 20

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 1,750 m

Q = 29,663 t γf 1,50

Vcu = 94,243 t
Qd = 44,494 t CUMPLE, ES <Vcu

RESUMEN DE RESULTADOS:

VALORES MÍNIMOS

	Cdes mín.	Cvuel mín.	Vcu
HIPOTESIS I: estribo en vacío,	1,20	1,44	42,866
HIPOTESIS II: estribo + carga permanente	1,50	1,80	42,866
HIPOTESIS III 1º: estribo + tablero + SCmáx.	1,50	1,80	42,866
2º: estribo + tablero + SCmín.	1,50	1,80	42,866
HIPOTESIS IV 1º: est. + tabl. + Scmáx.	1,00	1,00	42,866
2º: est. + tabl. + SCmín.	1,00	1,00	42,866

VALORES REALES

	Cdes real	Cvuel real	T.Comp.	Cortante Alz.
HIP I	1,54	1,96	13,04	20,45
HIP II	1,54	1,96	13,04	20,45
HIP III 1º	1,54	1,96	13,04	20,45
HIP III 2º	1,54	1,96	13,04	20,45
HIP IV 1º	6,86	17,58	6,05	33,71
HIP IV 2º	6,86	17,58	6,05	3,19
	1,54	**1,96**	**13,04**	**33,71**

ARMADURA (por metro de estribo)

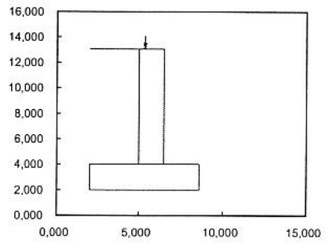
	As nec	As dispues	f (mm)	s (cm)	Qd (t)
A1	0,000	3,927	**10**	**20**	0,000
A2	1,962	15,708	**20**	**20**	7,005
A3	13,404	15,708	**20**	**20**	20,448
A4	6,040	15,708	**20**	**20**	16,625
A5	10,341	15,708	**20**	**20**	44,494

PROYECTO DE ESTRIBOS CERRADOS

PROYECTO..... **SUBTRAMO VII**

ESTRUCTURA..... **VIADUCTO Nº 2**

ESTRIBO..... **1**



DATOS DE ENTRADA

GEOMETRIA

Talón.....	3,000	m
Ancho alzado.....	1,100	m
Puntera.....	2,500	m
Canto zapata.....	2,000	m
Altura total.....	11,048	m
Altura murete.....	0,000	m
Ancho murete.....	0,000	m
Ancho meseta.....	1,500	m
Altura retranqueo.....	0,000	m
Altura cartela.....	0,000	m
Largo zapata.....	1,000	m
Largo estribo.....	1,000	m
Alt tierra delante.....	2,000	m
Distan. a intradós.....	0,750	m
Alt.Cálc.Arm.	4,000	m
(desde base de alzado)		
Retranqueo murete.....	0,000	m
Ancho sobrecarga.....	0,750	m
Altura de alzado.....	9,048	m
Ancho zapata.....	6,600	m

ALETAS

Número.....	0,000	
Coef forma.....	0,500	
Altura.....	2,050	m
Vuelo.....	2,100	m
Espesor.....	0,300	m

GEOTECNIA

Densidad tierras.....	2,000	t/m3
Coef. emp. activo.....	0,330	
Coef. emp. pasivo.....	5,000	
Coef. rozam. zapata.....	0,600	
Tensión admisible	70,000	t/m2

CARGAS (en todo lo ancho)

Densidad hormigón.....	2,500	t/m3
Sobrecarga trasdós.....	3,000	t/m2
Cargas perman tablero	0,000	t
Sobrecarga máxima.....	0,000	t
Sobrecarga mínima.....	0,000	t
Fuerza horiz. rft.....	0,000	t
Fuerza horiz.frenado.....	0,000	t

MATERIALES

Resist hor alzado.....	250	kg/cm2
Resist hor zapata.....	250	kg/cm2
Resistencia acero.....	5100	kg/cm2
Recubrimiento.....	0,040	m
Equidist. armadu.....	0,250	m

CARGAS (por m de estribo)

Cargas perman tablero	0,000	t/m
Sobrecarga máxima.....	0,000	t/m
Sobrecarga mínima.....	0,000	t/m
Fuerza horiz. rft.....	0,000	t/m
Fuerza horiz.frenado.....	0,000	t/m

CARGAS POR SISMO IAP-96

¿Considerar? (1=sí; 2=no) 2

Fuerza horizontal.....		0,000	t	
(por m de estribo).....		0,000	t/m	
Coef. sísmico horizontal				
(cargas gravitatorias)...		0,120	*g	
densidad terreno	γ	2,000	t/m3	
coef acelerac horizontal	Kh	0,208	*g	
coef acelerac vertical	Kv	0,000	*g	
		° sexag		**radianes**
ang rozamiento interno	ϕ	30,0		0,5236
ángulos geométricos	i	0,0		0,0000
	δ	0,0		0,0000
	β	0,0		0,0000
arctg Kh/(1-Kv)	θ	11,7		0,2051
				λ
Ka, sismo = (1-Kv)* λa =		0,000		0,4801
Kp, sismo = (1-Kv)* λp =		0,000		2,6130

COEFICIENTES DE SEGURIDAD

Minoración Hormigón....	1,50
Minoración Acero.....	1,15
Seguridad al vuelco.....	2,00
Seguridad al deslizam..	1,50
Coef.horm.vertical	0,90
γ_f cargas perman.....	1,35
γ_f sobrecargas.....	1,50
γ_f acciones reológicas.....	1,35
γ_f accción del terreno.....	1,50
γ_A accidental-sismo....	1,00

HIPOTESIS I.- ESTRIBO EN VACIO

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
SOBRECARGA TRASDOS	2,250	6,225	14,006
PESO TIERRAS	13,572	6,225	84,486
	0,000	3,600	0,000
	0,000	3,600	0,000
PESO ESTRIBO	0,000	3,600	0,000
	0,000	3,050	0,000
	24,882	3,050	75,890
	0,000	3,600	0,000
PESO ZAPATA	33,000	3,300	108,900
PESO ALETAS (DIFERENCIA)	0,000	4,700	0,000
	F.horizontal		
PASIVO	20,000	0,667	13,333
	0,000	2,000	0,000
TOTAL N =	**73,704** t	Me =	**296,615** tm
Fhor =	**20,000** t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE SOBRECARGAS	10,938	5,524	60,419
EMPUJE TIERRAS	40,279	3,683	148,335
	0,000	5,016	0,000
Fuerza volc. horiz.: Fh =	**51,217** t	Mv =	**208,754** tm
Fuerza horizontal total: Fhtot =	**31,217** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes= **1,417** CUMPLE, ES > 1,200
Cvuel= **1,421** ¡ERROR! ** EL COEFICIENTE DEBE SER > 1,600

-TENSIONES

eb = 1,192 < 0.33 * ANCHO DE ZAPATA = 2,200 m
Fibra neutra fuera del nucleo central ec = 2,108 m

TENSION 1= 41,219 t/m2
LONG TEN = 3,576 m

TENS COMPARACION = **30,914 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	8,958	1,50	13,436 t
	sc tierras	27,016	1,50	40,524 t
		35,973		53,960 t

Vcu = canto·larg·0.5·fcv·10 = 67,361 t
Qd= **53,960 t** CUMPLE, ES <Vcu

HIPOTESIS II.- ESTRIBO + TABLERO (C.P.)

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
DE LA HIPÓTESIS I	73,704		296,615
CARGAS PERMANENTES	0,000	3,250	0,000
TOTAL N =	**73,704** t	Me =	**296,615** tm
Fhor =	**20,000** t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I	51,217		208,754
FUERZA HOR RFT	0,000	11,048	0,000
Fuerza volc. horiz.: Fh =	**51,217** t	Mv =	**208,754** tm
Fuerza horizontal total: Fhtot =	**31,217** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = **1,417** ¡ERROR!, EL COEFICIENTE DEBE SER > 1,500
Cvuel = **1,421** ¡ERROR!, EL COEFICIENTE DEBE SER > 2,000

-TENSIONES

eb = 1,192 < 0.33 · ANCHO DE ZAPATA = 2,200 m
Fibra neutra fuera del nucleo central ec = 2,108 m

TENSION 1= 41,219 t/m2
LONG TEN = 3,576 m

TENS COMPARACION = **30,914 t/m2** CUMPLE, ES <TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado	sc trasdós	8,958	1,50	13,436
	sc tierras	27,016	1,50	40,524
	retr+fl+t[a]	0,000	1,35	0,000
		35,973		53,960

Vcu = canto·larg·0.5·fcv·10 = 67,361 t
Qd= **53,960 t** CUMPLE, ES <Vcu

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

********** 1º SOBRECARGA MAXIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS II		73,704		296,615	
SOBRECARGA MAXIMA TABLERO		0,000	3,250	0,000	
TOTAL	N =	**73,704**	t Me =	**296,615**	tm
	Fhor =	**20,000**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
DE LA HIPOTESIS I		51,217		208,754	
FUERZA FRENADO+RFT		0,000	11,048	0,000	
Fuerza volc. horiz.:	Fh =	**51,217**	t Mv =	**208,754**	tm
Fuerza horizontal total:	Fhtot =	**31,217**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**1,417**	¡ERROR!, EL COEFICIENTE DEBE SER >	1,500
Cvuel =	**1,421**	¡ERROR!, EL COEFICIENTE DEBE SER >	2,000

-TENSIONES

eb = 1,192 < 0.33 * ANCHO DE ZAPATA = 2,200 m
Fibra neutra fuera del nucleo central ec = 2,108 m

TENSION 1= 41,219 t/m2
LONG TEN = 3,576 m

TENS COMPARACION = **30,914 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd	
En arranque de alzado:	sc trasdós	8,958	1,50	13,436	t
	sc tierras	27,016	1,50	40,524	t
	retr+fl+t^a	0,000	1,35	0,000	t
	frenado	0,000	1,50	0,000	t
		35,973		53,960	t

Vcu= canto·larg·0.5·fcv·10 = 67,361 t
Qd= **53,960 t** CUMPLE, ES <Vcu

********** 2º SOBRECARGA MINIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO	
DE LA HIPOTESIS II		73,704		296,615	
SOBRECARGA MINIMA TABLERO.		0,000	3,250	0,000	
TOTAL	N =	**73,704**	t Me =	**296,616**	tm
	Fhor =	**20,000**	t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO	
DE LA HIPOTESIS I		51,217		208,754	
FUERZA FRENADO+RFT		0,000	11,048	0,000	
Fuerza volc. horiz.:	Fh =	**51,217**	t Mv =	**208,754**	tm
Fuerza horizontal total:	Fhtot =	**31,217**	t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	**1,417**	¡ERROR!, EL COEFICIENTE DEBE SER >	1,500
Cvuel =	**1,421**	¡ERROR!, EL COEFICIENTE DEBE SER >	2,000

-TENSIONES

eb = 1,192 < 0.33 · ANCHO DE ZAPATA = 2,200 m
Fibra neutra fuera del nucleo central ec = 2,108 m

TENSION 1= 41,218 t/m2
LONG TEN = 3,576 m

TENS COMPARACION = **30,914 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd	
En arranque de alzado:	sc trasdós	8,958	1,50	13,436	t
	sc tierras	27,016	1,50	40,524	t
	retr+fl+t^a	0,000	1,35	0,000	t
	frenado	0,000	1,50	0,000	t
		35,973		53,960	

Vcu= canto·larg·0.5·fcv·10 = 67,361 t
Qd = **53,960 t** CUMPLE, ES <Vcu

|::

HIPOTESIS IV.- ESTRIBO+TABLERO+SOBRECARGA+SISMO (no hay sismo)

********** 1º SOBRECARGA MAXIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 1º.....		73,704		296,615
		F.horizontal		
PASIVO		0,000	0,667	0,000
		0,000	2,000	0,000
TOTAL	N =	**73,704** t	Me =	**296,615** tm
	Fhor =	**0,000** t		

-FUERZAS VOLCADORAS

		Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO		0,000	11,048	0,000
(debido al sismo)		0,000	11,048	0,000
		0,000	11,048	0,000
		2,986	6,524	19,480
EMPUJE ZAPATA		3,960	1,000	3,960
EMPUJE SOBRECARGAS		0,000	5,524	0,000
EMPUJE TIERRAS		0,000	3,683	0,000
		0,000	5,016	0,000
FUERZA SISMO+RFT+FREN		0,000	11,048	0,000
Fuerza volc. horiz.:	Fh =	**6,946** t	Mv =	**23,440** tm
Fuerza horizontal total:	Fhtot =	**6,946** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = **6,367** CUMPLE, ES > 1
Cvuel = **12,654** CUMPLE, ES > 1

-TENSIONES

eb = 3,706 > 0.33 · ANCHO ZAPATA = 2,200 m
Fibra neutra dentro del nucleo central ec = -0,406 m

TENSION 1= 7,042 t/m2
TENSION 2 = 15,293 m

TENS COMPARACION = **9,104 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	0,000	0,20	0,000
	sc tierras	0,000	1,00	0,000
	retr+fl+tª	0,000	1,00	0,000
	frenado	0,000	0,20	0,000
	Fh sismo	0,000	1,00	0,000
	empujes	71,053	1,00	71,053
		71,053		71,053

Vcu = canto·larg·0.5·fcv·10 = 67,361 t
Qd = **#¿NOMBRE?** t #¿NOMBRE?

********** 2º SOBRECARGA MINIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 2º.....		73,704		296,616
		F.horizontal		
PASIVO		0,000	0,667	0,000
		0,000	2,000	0,000
TOTAL	N =	**73,704** t	Me =	**296,616** tm
	Fhor =	**0,000** t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO	0,000	11,048	0,000
(debido al sismo)	0,000	11,048	0,000
	0,000	11,048	0,000
	2,986	6,524	19,480
EMPUJE ZAPATA	3,960	1,000	3,960
EMPUJE SOBRECARGAS	0,000	5,524	0,000
EMPUJE TIERRAS	0,000	3,683	0,000
	0,000	5,016	0,000
FUERZA SISMO+RFT+FREN	0,000	11,048	0,000
Fuerza volc. horiz.: Fh =	**6,946** t	Mv =	**23,440** tm
Fuerza horizontal total: Fhtot =	**6,946** t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes = **6,367** CUMPLE, ES > 1
Cvuel = **12,654** CUMPLE, ES > 1

-TENSIONES

eb = 3,706 > 0.33 · ANCHO ZAPATA = 2,200 m
Fibra neutra dentro del nucleo central ec = -0,406 m

TENSION 1= 7,042 t/m2
TENSION 2 = 15,293 m

TENS COMPARACION = **9,104 t/m2** CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	0,000	0,20	0,000
	sc tierras	0,000	1,00	0,000
	retr+fl+tª	0,000	1,00	0,000
	frenado	0,000	0,20	0,000
	Fh sismo	0,000	1,00	0,000
	empujes	6,946	1,00	6,946
		6,946		6,946

Vcu = canto·larg·0.5·fcv·10 = 67,361 t
Qd = **6,946 t** CUMPLE, ES <Vcu

ARMADURA ESTRIBO: (en todos los casos armadura por metro lineal)

TENSIONES SOBRE EL MURO

TEN1=	0,990	(en arranque del espaldón)
TEN2=	4,322	(en punto del alzado elegido)
TEN3=	6,962	(en arranque de alzado)

ARMADURA A1: en arranque del espaldón

		BRAZO	MOMENTO
EMPUJE TIERRAS	0,000	0,000	0,000
EMPUJE SOBRECARGA	0,000	0,000	0,000
Fh =	0,000 t	Mv =	0,000 tm

PESO PROPIO ..... 0,000 t

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I: Estribo + tablero (misma que con sobrecargas y que en vacío)

			γf		
M= tierras	0,000 tm	*	1,50	Md =	0,000 tm
sc trasdós	0,000 tm	*	1,50		
pp	0,000 tm	*	1,35		
N = pp	0,000 t	*	1,35	Nd =	0,000 t
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t
sc trasdós	0,000 t	*	1,50		

Uc= -59,850 t **Us=** 0,000 t

HIPOTESIS II: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	0,000	0,000
TOTAL:	0,000 t	Mv =	0,000 tm

			γf		
M= tierras	0,000 tm	*	1,50	Md =	0,000 tm
sc trasdós	0,000 tm	*	1,50		
pp	0,000 tm	*	1,35		
sismo	0,000 tm	*	0,00		
N = pp	0,000 t	*	1,35	Nd =	0,000 t
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t
sc trasdós	0,000 t	*	1,50		
sismo	0,000 t	*	0,00		

Uc= -59,850 t **Us=** 0,000 t

ARMADURA MINIMA

0.04·Uc= -2,394 t α = 1,500

DIMENSIONAMIENTO

Us máx =	0,000 t	As =	0,000 cm2
φ (mm)	10	As dispues=	3,927 cm2 vale
s (cm)	20		

CORTANTE

Vcu =	-2,443 t	
Qd (máx) =	0,000 t	disponer armadura de cortante

ARMADURA A2: Punto del alzado elegido para armar, a 4,000 m desde arranque

		BRAZO	MOMENTO
EMPUJE TIERRAS	8,409	1,683	14,150
EMPUJE SOBRECAR	4,998	2,524	12,614
Fh =	13,407 t	Mv =	26,764 tm

PESO PROPIO	0,000	-0,950	0,000
	0,000	-0,200	0,000
	0,000	-0,550	0,000
	24,882	0,000	0,000
N =	24,882 t	Me=	0,000 tm

Vcu = 64,911 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	14,150 tm	*	1,50	Md =	57,277 tm	
sc trasdós	12,614 tm	*	1,50			
pp	12,690 tm	*	1,35			
N =	24,882 t	*	1,35	Nd =	31,102 t	
Q= tierras	8,409 t	*	1,50	Qd =	20,110 t	< Vcu
sc trasdós	4,998 t	*	1,50			

Uc = 1590,000 t **Us =** 23,883 t

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	39,453 tm			Md =	57,277 tm	
cp tablero	0,000 tm	*	1,35			
retr+fluen	0,000 tm	*	1,35			
N= hip I	24,882 t			Nd =	31,102 t	
cp tablero	0,000 t	*	1,35			
Q= hip I	13,407 t			Qd =	20,110 t	< Vcu
retr+fluen	0,000 t	*	1,35			

Uc = 1590,000 t **Us =** 23,883 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1° SOBRECARGA MAXIMA:

			γf			
M= hip II	39,453 tm			Md =	57,277 tm	
sc max	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	24,882 t			Nd =	31,102 t	
sc max	0,000 t	*	1,50			
Q= hip I	13,407 t			Qd =	20,110 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** 23,883 t

2° SOBRECARGA MINIMA:

			γf			
M= hip II	39,453 tm			Md =	57,277 tm	
sc min	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	24,882 t			Nd =	31,103 t	
sc min	0,000 t	*	1,50			
Q= hip I	13,407 t			Qd =	20,110 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** 23,883 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	5,048	0,000
	0,000	9,048	0,000
	0,000	5,048	0,000
	1,666	2,524	4,205
TOTAL:	1,666 t	Mv =	4,205 tm

1° SOBRECARGA MAXIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	17,131 tm	
sc trasdós	0,000 tm	*	1,50			

pp	12,690 tm	*	1,35			
empujes	4,205 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc max	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	24,882 t	*	1,35	Nd =	33,591 t	
cp tablero	0,000 t	*	1,35			
sc max	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	1,666 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** -17,346 t

2º SOBRECARGA MINIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	17,131 tm	
sc trasdós	0,000 tm	*	1,50			
pp	12,690 tm	*	1,35			
empujes	4,205 tm	*	0,00			
cp tablero	0,000 tm	*	1,35			
sc min	0,000 tm	*	1,50			
retr+flue	0,000 tm	*	1,35			
frenado	0,000 tm	*	1,50			
N= pp	24,882 t	*	1,35	Nd =	33,591 t	
cp tablero	0,000 t	*	1,35			
sc min	0,000 t	*	1,50			
Q= tierras	0,000 t	*	1,50	Qd =	0,000 t	< Vcu
sc trasdós	0,000 t	*	1,50			
empujes	1,666 t	*	0,00			
retr+flue	0,000 t	*	1,35			
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** -17,346 t

ARMADURA MINIMA

0.04·Uc = 63,600 t alfa = 1,312

DIMENSIONAMIENTO

Us max =	23,883 t	As =	7,067 cm2	
ϕ (mm)	20	As dispues=	15,708 cm2	vale
s (cm)	20			

CORTANTE

Vcu = 64,911

Qd (Máx) = 20,110

ARMADURA A3: punto de arranque del alzado

		BRAZO	MOMENTO
EMPUJE TIERRAS	27,016	3,016	81,480
EMPUJE SOBRECAR	8,958	4,524	40,524
Fh =	35,973 t	Mv =	122,004 tm
PESO PROPIO	0,000	-0,950	0,000
	0,000	-0,200	0,000
	0,000	-0,550	0,000
	24,882	0,000	0,000
N =	24,882 t	Me=	0,000 tm

Vcu = 64,911 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	81,480 tm	*	1,50	Md =	200,137 tm	
sc trasdós	40,524 tm	*	1,50			
pp	12,690 tm	*	1,35			
N =	24,882 t	*	1,35	Nd =	31,102 t	
Q= tierras	27,016 t	*	1,50	Qd =	53,960 t	< Vcu
sc trasdós	8,958 t	*	1,50			

Uc = 1590,000 t **Us =** 170,485 t

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	134,694 tm			Md =	200,137 tm	
cp tablero	0,000 tm	*	1,35			
retr+fluen	0,000 tm	*	1,35			
N= hip I	24,882 t			Nd =	31,102 t	
cp tablero	0,000 t	*	1,35			
Q= hip I	35,973 t			Qd =	53,960 t	< Vcu
retr+fluen	0,000 t	*	1,35			

Uc = 1590,000 t **Us =** 170,485 t

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1º SOBRECARGA MAXIMA:

			γf			
M= hip II	134,694 tm			Md =	200,137 tm	
sc max	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	24,882 t			Nd =	31,102 t	
sc max	0,000 t	*	1,50			
Q= hip I	35,973 t			Qd =	53,960 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** 170,485 t

2º SOBRECARGA MINIMA:

			γf			
M= hip II	134,694 tm			Md =	200,137 tm	
sc min	0,000 tm	*	1,50			
frenado	0,000 tm	*	1,50			
N= hip II	24,882 t			Nd =	31,103 t	
sc min	0,000 t	*	1,50			
Q= hip I	35,973 t			Qd =	53,960 t	< Vcu
frenado	0,000 t	*	1,50			

Uc = 1590,000 t **Us =** 170,485 t

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	0,000	9,048	0,000
	0,000	9,048	0,000
	0,000	9,048	0,000
	2,986	4,524	13,508
TOTAL:	2,986 t	Mv =	13,508 tm

1º SOBRECARGA MAXIMA:

			γf			
M= tierras	0,000 tm	*	1,50	Md =	17,131 tm	
sc trasdós	0,000 tm	*	1,50			

pp	12,690	tm	*	1,35			
empujes	13,508	tm	*	0,00			
cp tablero	0,000	tm	*	1,35			
sc max	0,000	tm	*	1,50			
retr+flue	0,000	tm	*	1,35			
frenado	0,000	tm	*	1,50			
N= pp	24,882	t	*	1,35	Nd =	33,591	t
cp tablero	0,000	t	*	1,35			
sc max	0,000	t	*	1,50			
Q= tierras	0,000	t	*	1,50	Qd =	0,000	t < Vcu
sc trasdós	0,000	t	*	1,50			
empujes	2,986	t	*	0,00			
retr+flue	0,000	t	*	1,35			
frenado	0,000	t	*	1,50			

Uc = 1590,000 t **Us =** -17,346 t

2° SOBRECARGA MINIMA:

				γf			
M= tierras	0,000	tm	*	1,50	Md =	17,131	tm
sc trasdós	0,000	tm	*	1,50			
pp	12,690	tm	*	1,35			
empujes	13,508	tm	*	0,00			
cp tablero	0,000	tm	*	1,35			
sc max	0,000	tm	*	1,50			
retr+flue	0,000	tm	*	1,35			
frenado	0,000	tm	*	1,50			
N= pp	24,882	t	*	1,35	Nd =	33,591	t
cp tablero	0,000	t	*	1,35			
sc max	0,000	t	*	1,50			
Q= tierras	0,000	t	*	1,50	Qd =	0,000	t < Vcu
sc trasdós	0,000	t	*	1,50			
empujes	2,986	t	*	0,00			
retr+flue	0,000	t	*	1,35			
frenado	0,000	t	*	1,50			

Uc = 1590,000 t **Us =** -17,346 t

ARMADURA MINIMA

0.04·Uc = 63,600 t alfa = 0,160

DIMENSIONAMIENTO

Us max = 170,485 t As = 38,443 cm2
ϕ (mm) 25 As dispues= 49,087 cm2 vale
s (cm) 10

CORTANTE

Vcu = 64,911
Qd (Máx) = 53,960

ARMADURA A4

TENSIONES EN ZAPATA

	HIP I	HIP II	HIP III 1°	HIP III 2°	HIP IV 1°	HIP IV 2°	MAX
TENSION 1	41,219	41,219	41,219	41,218	7,042	7,042	41,219
TENSION 2	0,000	0,000	0,000	0,000	15,293	15,293	0,000
LONG TEN	3,576	3,576	3,576	3,576	0,000	0,000	

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde de ... 2,665 m

	HIP I	HIP II	HIP III 1°	HIP III 2°	HIP IV 1°	HIP IV 2°
TENSION 1 =	41,219	41,219	41,219	41,218	7,042	7,042
TENSION S =	10,503	10,503	10,503	24,575	-4,920	-4,920
M =	110,013	110,013	110,013	126,670	10,847	10,847

γf para tensiones 1,40 Md = 177,339 tm

Uc = 3266,667 t Us= 91,768 t

ARMADURA MINIMA

0.04·Uc= 130,667 t alfa = 1,149

DIMENSIONAMIENTO

Us máx = 105,427 t As = 23,773 cm2
ϕ (mm) 25 As dispues= 24,544 cm2 vale
s (cm) 20

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 1,500 m

La tensión en esta sección es: 31,851 t/m2

	HIP I	HIP II	HIP III 1°	HIP III 2°	HIP IV 1°	HIP IV 2°
TENSION 1 =	41,219	41,219	41,219	41,218	7,042	7,042
TENSION S =	23,930	23,930	23,930	23,930	8,917	8,917
Q =	48,861	48,861	48,861	48,861	11,969	11,969

Vcu = 126,517 t

γf para tensiones 1,40 Qd = 68,406 t CUMPLE, ES <Vcu

ARMADURA A5

Supuesta zapata descalzada por detrás

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde (por detrás) de ... 3,165 m

	PESO	BRAZO	MOMENTO		γf
PESO DE TIERRAS	13,572	2,790	37,866	t/m2	1,50
	0,000	2,415	0,000		1,50
	0,000	2,415	0,000		1,50
PESO DE SOBRECARGAS	2,250	2,790	6,278	t/m2	1,50
PESO PROPIO ZAPATA	15,825	1,583	25,043	t/m2	1,35
TOTAL	31,647	t	69,186	t/m2	

Md = 100,023 tm

Uc = 3266,667 t Us = 51,437 t

ARMADURA MINIMA

0.04·Uc = 130,667 t alfa = 1,303

DIMENSIONAMIENTO

Us máx =	67,032 t	As =	15,115 cm2	
ϕ (mm)	20	As dispues=	15,708 cm2	vale
s (cm)	20			

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 2,000 m

Q = 52,192 t γf 1,50

Vcu = 126,517 t

Qd = 78,288 t CUMPLE, ES <Vcu

RESUMEN DE RESULTADOS:

VALORES MÍNIMOS

	Cdes mín.	Cvuel mín.	Vcu
HIPOTESIS I: estribo en vacío,	1,20	1,60	67,361
HIPOTESIS II: estribo + carga permanente	1,50	2,00	67,361
HIPOTESIS III 1º: estribo + tablero + SCmáx.	1,50	2,00	67,361
2º: estribo + tablero + SCmín.	1,50	2,00	67,361
HIPOTESIS IV 1º: est. + tabl. + Scmáx.	1,00	1,00	67,361
2º: est. + tabl. + SCmín.	1,00	1,00	67,361

VALORES REALES

	Cdes real	Cvuel real	T.Comp.	Cortante Alz.
HIP I	1,42	¡ERROR!	30,91	53,96
HIP II	¡ERROR!	¡ERROR!	30,91	53,96
HIP III 1º	¡ERROR!	¡ERROR!	30,91	53,96
HIP III 2º	1,42	¡ERROR!	30,91	53,96
HIP IV 1º	6,37	12,65	9,10	#¿NOMBRE?
HIP IV 2º	6,37	12,65	9,10	6,95
	1,42	**12,65**	**30,91**	##########

ARMADURA

(por metro de estribo)

	As nec	As dispues	f (mm)	s (cm)	Qd (t)
A1	0,000	3,927	**10**	**20**	0,000
A2	7,067	15,708	**20**	**20**	20,110
A3	38,443	49,087	**25**	**10**	53,960
A4	23,773	24,544	**25**	**20**	68,406
A5	15,115	15,708	**20**	**20**	78,288

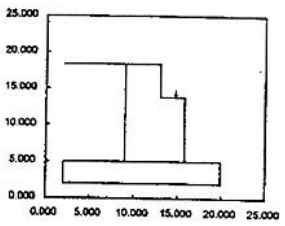
ESTRIBO Nº 2

PROYECTO DE ESTRIBOS CERRADOS

PROYECTO..... SUBTRAMO VII

ESTRUCTURA..... VIADUCTO Nº 1

ESTRIBO..... 2



DATOS DE ENTRADA

GEOMETRIA

Talón	7.000	m
Ancho alzado	6.900	m
Puntera	4.000	m
Canto zapata	3.000	m
Altura total	16.395	m
Altura murete	4.600	m
Ancho murete	4.000	m
Ancho meseta	2.600	m
Altura retranqueo	0.000	m
Altura cartela	0.000	m
Largo zapata	17.000	m
Largo estribo	14.000	m
Alt tierra delante	3.000	m
Distan. a intradós	1.150	m
Alt.Cálc.Arm. (desde base de alzado)	0.000	m
Retranqueo murete	0.000	m
Ancho sobrecarga	0.750	m
Altura de alzado	8.795	m
Ancho zapata	17.900	m

ALETAS

Número	2.000	
Coef forma	0.500	
Altura	2.050	m
Vuelo	2.100	m
Espesor	0.300	m

MATERIALES

Resist hor alzado	250	kg/cm2
Resist hor zapata	250	kg/cm2
Resistencia acero	5100	kg/cm2
Recubrimiento	0.040	m
Equidist. armadu	0.250	m

CARGAS POR SISMO (AP-96

¿Considerar? (1=sí; 2=no) 2

Fuerza horizontal	0.000	t
(por m de estribo)	0.000	t/m
Coef. sísmico horizontal (cargas gravitatorias)	0.120	*g

densidad terreno	γ		1.800	t/m3
coef acelerac horizontal	Kh		0.208	*g
coef acelerac vertical	Kv		0.000	*g
		* sexag		radianes
ang rozamiento interno	ϕ		34.0	0.5934
ángulos geométricos	ι		0.0	0.0000
	δ		0.0	0.0000
	β		0.0	0.0000
arctg Kh/(1-Kv)	θ		11.7	0.2051
				λ
Ka, sismo = (1-Kv)* λa =		0.000		0.4164
Kp, sismo = (1-Kv)* λp =		0.000		3.1229

GEOTECNIA

Densidad tierras	1.800	t/m3
Coef. emp. activo	0.330	
Coef. emp. pasivo	3.000	
Coef. rozam. zapata	0.600	
Tensión admisible	40.000	t/m2

CARGAS (en todo lo ancho)

Densidad hormigón	2.500	t/m3
Sobrecarga trasdós	3.000	t/m2
Cargas perman tablero	506.800	t
Sobrecarga máxima	520.000	t
Sobrecarga mínima	-32.000	t
Fuerza horiz. rft	361.240	t
Fuerza horiz.frenado	888.000	t

CARGAS (por m de estribo)

Cargas perman tablero	36.200	t/m
Sobrecarga máxima	37.143	t/m
Sobrecarga mínima	-2.286	t/m
Fuerza horiz. rft	25.803	t/m
Fuerza horiz.frenado	63.429	t/m

COEFICIENTES DE SEGURIDAD

Minoración Hormigón	1.50
Minoración Acero	1.15
Seguridad al vuelco	1.50
Seguridad al deslizam.	1.50
Coef.horm.vertical	0.90
γf cargas perman.	1.35
γf sobrecargas	1.50
γf acciones reológicas	1.35
γf acción del terreno	1.50
γA accidental-sismo	1.00

HIPOTESIS I.- ESTRIBO EN VACIO

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
SOBRECARGA TRASDOS	31.500	17.525	552.038
PESO TIERRAS	253.166	17.525	4436.725
	0.000	10.900	0.000
PESO ESTRIBO	0.000	10.900	0.000
	644.000	8.900	5731.600
	-1110.900	7.450	-8276.205
	3234.893	7.450	24099.949
PESO ZAPATA	0.000	10.900	0.000
PESO ALETAS (DIFERENCIA)	2282.250	8.950	20426.138
	0.904	11.500	10.397
	F.horizontal		
PASIVO	413.100	1.000	413.100
	0.000	3.000	0.000
TOTAL N =	5335.812 t	Mo =	47393.741 tm
Fhor =	413.100 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE SOBRECARGAS	227.235	8.198	1862.756
EMPUJE TIERRAS	1357.151	5.465	7416.831
	-159.869	7.465	-1193.419
Fuerza volc. horiz.: Fh =	1424.517 t	Mv =	8086.168 tm
Fuerza horizontal total: Fhtot =	1011.417 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes=	3.165	CUMPLE, ES >	1.200
Cvuel=	5.861	CUMPLE, ES >	1.200

-TENSIONES

eb = 7.367 > 0.33 * ANCHO ZAPATA = 5.967 m
Fibra neutra dentro del nucleo central ec = 1.583 m

TENSION 1= 26.840 t/m2
TENSION 2 = 8.229 t/m2

TENS COMPARACION = 22.188 t/m2 CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	185.655	1.50	278.482 t
	sc tierras	746.053	1.50	1119.080 t
		931.708		1397.562 t

Vcu = canto·larg·0.5·fcv·10 = 5915.518 t
Qd= 1397.562 t CUMPLE, ES <Vcu

HIPOTESIS II.- ESTRIBO + TABLERO (C.P.)

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
DE LA HIPÓTESIS I	5335.812		47393.741
CARGAS PERMANENTES	506.800	5.150	2610.020
TOTAL N =	5842.612 t	Mo =	50003.761 tm
Fhor =	413.100 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I	1424.517		8086.168
FUERZA HOR RFT	361.240	11.795	4260.826
Fuerza volc. horiz.: Fh =	1785.757 t	Mv =	12346.994 tm
Fuerza horizontal total: Fhtot =	1372.657 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes =	2.554	CUMPLE, ES >	1.500
Cvuel =	4.050	CUMPLE, ES >	1.500

-TENSIONES

eb = 6.445 > 0.33 · ANCHO ZAPATA = 5.967 m
Fibra neutra dentro del nucleo central ec = 2.505 m

TENSION 1= 35.321 t/m2
TENSION 2 = 3.080 t/m2

TENS COMPARACION = 27.260 t/m2 CUMPLE, ES <TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado	sc trasdós	185.655	1.50	278.482
	sc tierras	746.053	1.50	1119.080
	retr+fl+t°	361.240	1.35	487.674
		1292.948		1885.236

Vcu = canto·larg·0.5·fcv·10 = 5915.518 t
Qd= 1885.236 t CUMPLE, ES <Vcu

HIPOTESIS III.- ESTRIBO + TABLERO + SOBRECARGA

********** 1º SOBRECARGA MAXIMA **********

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
DE LA HIPOTESIS II	5842.612		50003.761
SOBRECARGA MAXIMA TABLERO	520.000	5.150	2678.000
TOTAL N =	6362.612 t	Mo =	52681.761 tm
Fhor =	413.100 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I	1424.517		8086.168
FUERZA FRENADO+RFT	1249.240	11.795	14734.786
Fuerza volc. horiz.: Fh =	2673.757 t	Mv =	22820.954 tm
Fuerza horizontal total: Fhtot =	2260.657 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	1.689	CUMPLE, ES >	1.500
Cvuel =	2.308	CUMPLE, ES >	1.500

-TENSIONES

eb = 4.693 < 0.33 * ANCHO DE ZAPATA = 5.967 m
Fibra neutra fuera del nucleo central ec = 4.257 m

TENSION 1= 53.165 t/m2
LONG TEN = 14.080 m

TENS COMPARACION = 39.874 t/m2 CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef γf	Qd
En arranque de alzado:	sc trasdós	185.655	1.50	278.482 t
	sc tierras	746.053	1.50	1119.080 t
	retr+fl+t°	361.240	1.35	487.674 t
	frenado	888.000	1.50	1332.000 t
		2180.948		3217.236 t

Vcu= canto·larg·0.5·fcv·10 = 5915.518 t
Qd= 3217.236 t CUMPLE, ES <Vcu

********** 2º SOBRECARGA MINIMA **********

-FUERZAS ESTABILIZADORAS

	N	EXCEN	MOMENTO
DE LA HIPOTESIS II	5842.612		50003.761
SOBRECARGA MINIMA TABLERO.	-32.000	5.150	-164.800
TOTAL N =	5810.612 t	Mo =	49838.961 tm
Fhor =	413.100 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
DE LA HIPOTESIS I	1424.517		8086.168
FUERZA FRENADO+RFT	1249.240	11.795	14734.786
Fuerza volc. horiz.: Fh =	2673.757 t	Mv =	22820.954 tm
Fuerza horizontal total: Fhtot =	2260.657 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO

Cdes =	1.542	CUMPLE, ES >	1.500
Cvuel =	2.184	CUMPLE, ES >	1.500

-TENSIONES

eb =	4.650	< 0.33 · ANCHO DE ZAPATA =	5.967	m
Fibra neutra fuera del nucleo central		ec =	4.300	m
TENSION 1=	49.006	t/m2		
LONG TEN =	13.949	m		

TENS COMPARACION = 36.755 t/m2 CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef yf	Qd	
En arranque de alzado:	sc trasdós	185.655	1.50	278.482	t
	sc tierras	746.053	1.50	1119.080	t
	retr+fl+t°	361.240	1.35	487.674	t
	frenado	888.000	1.50	1332.000	t
		2180.948		3217.236	

Vcu= canto·larg·0.5·fcv·10 = 5915.518 t

Qd = 3217.236 t CUMPLE, ES <Vcu

********** 2ª SOBRECARGA MINIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 2ª.....		5810.612		49838.961
		F.horizontal		
PASIVO		0.000	1.000	0.000
		0.000	3.000	0.000
TOTAL	N =	5810.612 t	Me =	49838.961 tm
	Fhor =	0.000 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO	77.280	14.095	1089.262
(debido al sismo)	0.000	11.795	0.000
	0.000	16.395	0.000
	254.879	7.398	1886.468
EMPUJE ZAPATA	273.870	1.500	410.805
EMPUJE SOBRECARGAS	0.000	8.198	0.000
EMPUJE TIERRAS	0.000	5.465	0.000
	0.000	7.465	0.000
FUERZA SISMO+RFT+FREN	1249.240	11.795	14734.788
Fuerza volc. horiz.: Fh =	1855.269 t	Mv =	18120.321 tm
Fuerza horizontal total: Fhtot =	1855.269 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes =	1.879	CUMPLE, ES > 1
Cvuel =	2.750	CUMPLE, ES > 1

-TENSIONES

eb =	5.459	< 0.33 · ANCHO DE ZAPATA =	5.967	m
Fibra neutra fuera del nucleo central		ec =	3.491	m
TENSION 1=	41.744	t/m2		
LONG TEN =	16.376	m		

TENS COMPARACION = 31.308 t/m2 CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef yf	Qd
En arranque de alzado:	sc trasdós	0.000	1.50	0.000
	sc tierras	0.000	1.00	0.000
	retr+fl+t°	361.240	1.00	361.240
	frenado	888.000	0.20	177.600
	Fh sismo	0.000	1.00	0.000
	empujes	606.029	1.00	606.029
		1855.269		1144.869

Vcu = canto·larg·0.5·fcv·10 = 5915.518 t

Qd = 1144.869 t CUMPLE, ES <Vcu

HIPOTESIS IV: ESTRIBO+TABLERO+SOBRECARGA+SISMO (no hay sismo)

********** 1ª SOBRECARGA MAXIMA **********

-FUERZAS ESTABILIZADORAS

		N	EXCEN	MOMENTO
DE LA HIPOTESIS III 1ª.....		6362.612		52681.761
		F.horizontal		
PASIVO		0.000	1.000	0.000
		0.000	3.000	0.000
TOTAL	N =	6362.612 t	Me =	52681.761 tm
	Fhor =	0.000 t		

-FUERZAS VOLCADORAS

	Fh	EXCEN	MOMENTO
EMPUJE ESTRIBO	77.280	14.095	1089.262
(debido al sismo)	0.000	11.795	0.000
	0.000	16.395	0.000
	254.879	7.398	1885.468
EMPUJE ZAPATA	273.870	1.500	410.805
EMPUJE SOBRECARGAS	0.000	8.198	0.000
EMPUJE TIERRAS	0.000	5.465	0.000
	0.000	7.465	0.000
FUERZA SISMO+RFT+FREN	1249.240	11.795	14734.788
Fuerza volc. horiz.: Fh =	1855.269 t	Mv =	18120.321 tm
Fuerza horizontal total: Fhtot =	1855.269 t		

-COMPROBACION DE LA ESTABILIDAD AL VUELCO Y AL DESLIZAMIENTO:

Cdes =	2.058	CUMPLE, ES > 1
Cvuel =	2.907	CUMPLE, ES > 1

-TENSIONES

eb =	5.432	< 0.33 · ANCHO DE ZAPATA =	5.967	m
Fibra neutra fuera del nucleo central		ec =	3.518	m
TENSION 1=	45.934	t/m2		
LONG TEN =	16.296	m		

TENS COMPARACION = 34.451 t/m2 CUMPLE, ES < TENS. ADM.

-CORTANTE EN ALZADO

		Fh	coef yf	Qd
En arranque de alzado:	sc trasdós	0.000	1.50	0.000
	sc tierras	0.000	1.00	0.000
	retr+fl+t°	361.240	1.00	361.240
	frenado	888.000	0.20	177.600
	Fh sismo	0.000	1.00	0.000
	empujes	4042.746	1.00	4042.746
		5291.986		4581.586

Vcu = canto·larg·0.5·fcv·10 = 5915.518 t

Qd = 4581.586 t CUMPLE, ES <Vcu

ARMADURA ESTRIBO: (en todos los casos armadura por metro lineal)

TENSIONES SOBRE EL MURO

TEN1=	3.722	(en arranque del espaldón)
TEN2=	8.947	(en punto del alzado elegido)
TEN3=	8.947	(en arranque de alzado)

ARMADURA A1: en arranque del espaldón

		BRAZO	MOMENTO
EMPUJE TIERRAS	6.285	1.533	9.636
EMPUJE SOBRECARGA	4.554	2.300	10.474
Fh =	10.839 t	Mv =	20.110 tm
PESO PROPIO	46.000 t		

Los esfuerzos respecto de la armadura de tracción serán :

HIPOTESIS I: Estribo + tablero (misma que con sobrecargas y que en vacío)

			γf		
M= tierras	9.636	tm	1.50	Md =	151.882 tm
sc trasdós	10.474	tm	1.50		
pp	90.160	tm	1.35		
N = pp	46.000	t	1.35	Nd =	62.100 t
Q= tierras	6.285	t	1.50	Qd =	16.258 t
sc trasdós	4.554	t	1.50		
Uc=	5940.000	t		Us=	-23.621 t

HIPOTESIS II: Estribo + Tablero + Sobrecarga

		EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO		5.520	2.300	12.696
TOTAL:		5.520 t	Mv =	12.696 tm

			γf		
M= tierras	0.000	tm	1.50	Md =	245.916 tm
sc trasdós	0.000	tm	1.50		
pp	182.160	tm	1.35		
sismo	5.520	tm	0.00		
N = pp	46.000	t	1.35	Nd =	62.100 t
Q= tierras	0.000	t	1.50	Qd =	0.000 t
sc trasdós	0.000	t	1.50		
sismo	5.520	t	0.00		
Uc=	5940.000	t		Us=	0.328 t

ARMADURA MINIMA

0.04·Uc= 237.600 t α = 1.499

DIMENSIONAMIENTO

Us máx =	0.328 t	As =	0.111	cm2
ϕ (mm)	10	As dispues=	3.142	cm2 vale
s (cm)	25			

CORTANTE

Vcu =	242.499 t	
Qd (máx) =	16.258 t	vale

ARMADURA A2: Punto del alzado elegido para armar: z = 0.000 m desde arranque

		BRAZO	MOMENTO
EMPUJE TIERRAS	53.290	4.465	237.938
EMPUJE SOBRECAR	13.261	6.698	88.816
Fh =	66.551 t	Mv =	326.754 tm
PESO PROPIO	46.000	-1.350	-62.100
	0.000	0.050	0.000
	0.000	-3.450	0.000
	151.714	0.000	0.000
N =	197.714 t	Me=	-62.100 tm

Vcu = 420.087 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	237.938 tm	*	1.50	Md =	1316.471 tm	
sc trasdós	88.816 tm	*	1.50			
pp	612.104 tm	*	1.35			
N =	197.714 t	*	1.35	Nd =	247.142 t	
Q= tierras	53.290 t	*	1.50	Qd =	99.826 t	< Vcu
sc trasdós	13.261 t	*	1.50			
	Uc =	10290.000 t		Us =	-53.413 t	

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	938.858 tm			Md =	1901.882 tm	
cp tablero	206.702 tm	*	1.35			
retr+fluen	226.936 tm	*	1.35			
N= hip I	197.714 t			Nd =	296.012 t	
cp tablero	36.200 t	*	1.35			
Q= hip I	66.551 t			Qd =	134.660 t	< Vcu
retr+fluen	25.803 t	*	1.35			
	Uc =	10290.000 t		Us =	-14.931 t	

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1º SOBRECARGA MAXIMA:

			γf			
M= hip II	1372.496 tm			Md =	3056.792 tm	
sc max	212.086 tm	*	1.50			
frenado	557.854 tm	*	1.50			
N= hip II	233.914 t			Nd =	351.726 t	
sc max	37.143 t	*	1.50			
Q= hip I	92.353 t			Qd =	229.803 t	< Vcu
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	103.960 t	

2º SOBRECARGA MINIMA:

			γf			
M= hip II	1372.496 tm			Md =	2719.086 tm	
sc min	-13.051 tm	*	1.50			
frenado	557.854 tm	*	1.50			
N= hip II	233.914 t			Nd =	292.584 t	
sc min	-2.286 t	*	1.50			
Q= hip I	92.353 t			Qd =	229.803 t	< Vcu
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	111.728 t	

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	5.520	11.095	61.244
	0.000	8.795	0.000
	0.000	8.795	0.000
	18.206	4.398	80.059
TOTAL:	23.726 t	Mv =	141.304 tm

1º SOBRECARGA MAXIMA:

			γf			
M= tierras	0.000 tm	*	1.50	Md =	2566.662 tm	
sc trasdós	0.000 tm	*	1.50			
pp	612.104 tm	*	1.35			
empujes	141.304 tm	*	0.00			
cp tablero	206.702 tm	*	1.35			
sc max	212.086 tm	*	1.50			
retr+flue	226.936 tm	*	1.35			
frenado	557.854 tm	*	1.50			
N= pp	197.714 t	*	1.35	Nd =	371.498 t	
cp tablero	36.200 t	*	1.35			
sc max	37.143 t	*	1.50			
Q= tierras	0.000 t	*	1.50	Qd =	129.977 t	< Vcu
sc trasdós	0.000 t	*	1.50			
empujes	23.726 t	*	0.00			
retr+flue	25.803 t	*	1.35			
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	9.712 t	

2º SOBRECARGA MINIMA:

			γf			
M= tierras	0.000 tm	*	1.50	Md =	2228.956 tm	
sc trasdós	0.000 tm	*	1.50			
pp	612.104 tm	*	1.35			
empujes	141.304 tm	*	0.00			
cp tablero	206.702 tm	*	1.35			
sc min	-13.051 tm	*	1.50			
retr+flue	226.936 tm	*	1.35			
frenado	557.854 tm	*	1.50			
N= pp	197.714 t	*	1.35	Nd =	312.355 t	
cp tablero	36.200 t	*	1.35			
sc min	-2.286 t	*	1.50			
Q= tierras	0.000 t	*	1.50	Qd =	129.977 t	< Vcu
sc trasdós	0.000 t	*	1.50			
empujes	23.726 t	*	0.00			
retr+flue	25.803 t	*	1.35			
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	17.864 t	

ARMADURA MINIMA

0.04·Uc = 411.600 t alfa = 1.364

DIMENSIONAMIENTO

Us max =	111.728 t	As =	34.371 cm2
ϕ (mm)	25	As dispues=	24.544 cm2 subir
s (cm)	20		

CORTANTE

Vcu = 420.087

Qd (Máx) = 229.803

ARMADURA A3: punto de arranque del alzado:

		BRAZO	MOMENTO
EMPUJE TIERRAS	53.290	4.465	237.938
EMPUJE SOBRECAR	13.261	6.698	88.816
Fh =	66.551 t	Mv =	326.754 tm
PESO PROPIO	46.000	-1.350	-62.100
	0.000	0.050	0.000
	0.000	-3.450	0.000
	151.714	0.000	0.000
N =	197.714 t	Me=	-62.100 tm

Vcu = 420.087 t

Esfuerzos respecto de la armadura de tracción:

HIPOTESIS I: Estribo en vacío.

			γf			
M= tierras	237.938 tm	*	1.50	Md =	1316.471 tm	
sc trasdós	88.816 tm	*	1.50			
pp	612.104 tm	*	1.35			
N =	197.714 t	*	1.35	Nd =	247.142 t	
Q= tierras	53.290 t	*	1.50	Qd =	99.826 t	< Vcu
sc trasdós	13.261 t	*	1.50			
	Uc =	10290.000 t		Us =	-53.413 t	

HIPOTESIS II: Estribo + Tablero.

			γf			
M= hip I	938.858 tm			Md =	1901.882 tm	
cp tablero	206.702 tm	*	1.35			
retr+fluen	226.936 tm	*	1.35			
N= hip I	197.714 t			Nd =	296.012 t	
cp tablero	36.200 t	*	1.35			
Q= hip I	66.551 t			Qd =	134.660 t	< Vcu
retr+fluen	25.803 t	*	1.35			
	Uc =	10290.000 t		Us =	-14.931 t	

HIPOTESIS III: Estribo + Tablero + Sobrecarga.

1º SOBRECARGA MAXIMA:

			γf			
M= hip II	1372.496 tm			Md =	3056.792 tm	
sc max	212.086 tm	*	1.50			
frenado	557.854 tm	*	1.50			
N= hip II	233.914 t			Nd =	351.726 t	
sc max	37.143 t	*	1.50			
Q= hip I	92.353 t			Qd =	229.803 t	< Vcu
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	103.960 t	

2º SOBRECARGA MINIMA:

			γf			
M= hip II	1372.496 tm			Md =	2719.086 tm	
sc min	-13.051 tm	*	1.50			
frenado	557.854 tm	*	1.50			
N= hip II	233.914 t			Nd =	292.584 t	
sc min	-2.286 t	*	1.50			
Q= hip I	92.353 t			Qd =	229.803 t	< Vcu
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	111.728 t	

HIPOTESIS IV: Estribo + Tablero + Sobrecarga

	EMPUJE	BRAZO	MOMENTO
EMPUJES DEBIDOS AL SISMO	5.520	11.095	61.244
	0.000	8.795	0.000
	0.000	8.795	0.000
	18.206	4.398	80.059
TOTAL:	23.726 t	Mv =	141.304 tm

1º SOBRECARGA MAXIMA:

			γf			
M= tierras	0.000 tm	*	1.50	Md =	2566.662 tm	
sc trasdós	0.000 tm	*	1.50			
pp	612.104 tm	*	1.35			
empujes	141.304 tm	*	0.00			
cp tablero	206.702 tm	*	1.35			
sc max	212.086 tm	*	1.50			
retr+flue	226.936 tm	*	1.35			
frenado	557.854 tm	*	1.50			
N= pp	197.714 t	*	1.35	Nd =	371.498 t	
cp tablero	36.200 t	*	1.35			
sc max	37.143 t	*	1.50			
Q= tierras	0.000 t	*	1.50	Qd =	129.977 t	< Vcu
sc trasdós	0.000 t	*	1.50			
empujes	23.726 t	*	0.00			
retr+flue	25.803 t	*	1.35			
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	9.712 t	

2º SOBRECARGA MINIMA:

			γf			
M= tierras	0.000 tm	*	1.50	Md =	2228.956 tm	
sc trasdós	0.000 tm	*	1.50			
pp	612.104 tm	*	1.35			
empujes	141.304 tm	*	0.00			
cp tablero	206.702 tm	*	1.35			
sc min	-13.051 tm	*	1.50			
retr+flue	226.936 tm	*	1.35			
frenado	557.854 tm	*	1.50			
N= pp	197.714 t	*	1.35	Nd =	312.355 t	
cp tablero	36.200 t	*	1.35			
sc min	-2.286 t	*	1.50			
Q= tierras	0.000 t	*	1.50	Qd =	129.977 t	< Vcu
sc trasdós	0.000 t	*	1.50			
empujes	23.726 t	*	0.00			
retr+flue	25.803 t	*	1.35			
frenado	63.429 t	*	1.50			
	Uc =	10290.000 t		Us =	17.864 t	

ARMADURA MINIMA

0.04·Uc = 411.600 t alfa = 1.364

DIMENSIONAMIENTO

Us max =	111.728 t	As =	34.371 cm2
ϕ (mm)	25	As dispues=	24.544 cm2 subir
s (cm)	20		

CORTANTE

Vcu = 420.087

Qd (Máx) = 229.803

ARMADURA A4

TENSIONES EN ZAPATA

	HIP I	HIP II	HIP III 1ª	HIP III 2ª	HIP IV 1ª	HIP IV 2ª	MAX
TENSION 1	26.840	35.321	53.165	49.006	45.934	41.744	53.165
TENSION 2	8.229	3.080	0.000	0.000	0.000	0.000	0.000
LONG TEN	0.000	0.000	14.080	13.949	16.296	16.376	

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde de ... 5.035 m

	HIP I	HIP II	HIP III 1ª	HIP III 2ª	HIP IV 1ª	HIP IV 2ª
TENSION 1 =	26.840	35.321	53.165	49.006	45.934	41.744
TENSION S =	21.505	26.252	34.153	35.221	33.014	30.002
M =	318.099	409.393	593.572	562.939	527.655	479.513

γf para tensiones 1.40 Md = 831.001 tm

Uc = 4933.333 t Us= 289.221 t

ARMADURA MINIMA

0.04·Uc= 197.333 t alfa = 0.767

DIMENSIONAMIENTO

Us máx = 289.221 t As = 65.217 cm2
ϕ (mm) 32 As dispues= 53.617 cm2 subir
s (cm) 15

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 2.500 m

La tensión en esta sección es: 45.740 t/m2

	HIP I	HIP II	HIP III 1ª	HIP III 2ª	HIP IV 1ª	HIP IV 2ª
TENSION 1 =	26.840	35.321	53.165	49.006	45.934	41.744
TENSION S =	24.241	30.818	43.725	40.223	38.868	35.371
Q =	83.852	82.573	121.113	111.537	106.028	96.393

Vcu = 191.067 t
γf para tensiones 1.40 Qd = 169.559 t CUMPLE, ES <Vcu

ARMADURA A5

Supuesta zapata descalzada por detrás

COMPROBACION A FLEXION

Sección de comprobación a una distancia del borde (por detrás) de ... 8.035 m

	PESO	BRAZO	MOMENTO		γf
PESO DE TIERRAS	18.083	7.660	138.518	t/m2	1.50
	0.000	7.285	0.000		1.50
	0.000	7.285	0.000		1.50
PESO DE SOBRECARGAS	2.250	7.660	17.235	t/m2	1.50
PESO PROPIO ZAPATA	60.263	4.018	242.105	t/m2	1.35
TOTAL	80.596	t	397.857	t/m2	

Md = 560.470 tm

Uc = 4933.333 t Us = 193.128 t

ARMADURA MINIMA

0.04·Uc = 197.333 t alfa = 1.011

DIMENSIONAMIENTO

Us máx = 195.188 t As = 44.013 cm2
ϕ (mm) 32 As dispues= 53.617 cm2 vale
s (cm) 15

COMPROBACION A CORTANTE

Sección de comprobación a una distancia del borde de ... 5.500 m

Q = 190.361 t γf 1.50
¡ERROR!, ES > Vcu
Vcu = 191.067 t
Qd = 285.541 t

RESUMEN DE RESULTADOS

VALORES MÍNIMOS

	Cdes mín.	Cvuel mín.	Vcu
HIPOTESIS I: estribo en vacío,	1.20	1.20	5915.518
HIPOTESIS II: estribo + carga permanente	1.50	1.50	5915.518
HIPOTESIS III 1ª: estribo + tablero + SCmáx.	1.50	1.50	5915.518
2ª: estribo + tablero + SCmín.	1.50	1.50	5915.518
HIPOTESIS IV 1ª: est. + tabl. + Scmáx.	1.00	1.00	5915.518
2ª: est. + tabl. + SCmín.	1.00	1.00	5915.518

VALORES REALES

	Cdes real	Cvuel real	T.Comp.	Cortante Alz.
HIP I	3.17	5.86	22.19	1397.56
HIP II	2.55	4.05	27.26	1885.24
HIP III 1ª	1.69	2.31	39.87	3217.24
HIP III 2ª	1.54	2.18	36.75	3217.24
HIP IV 1ª	2.06	2.91	34.45	4581.59
HIP IV 2ª	1.88	2.75	31.31	1144.87
	1.54	2.18	39.87	4581.59

ARMADURA (por metro de estribo)

	As nec	As dispues	f (mm)	s (cm)	Qd (t)
A1	0.111	3.142	10	25	16.258
A2	34.371	24.544	25	20	229.803
A3	34.371	24.544	25	20	229.803
A4	65.217	53.617	32	15	169.559
A5	44.013	53.617	32	15	285.541

Oficina Técnica | PROYECTO: VIADUCTO nº 1 | ASUNTO:
ESCRITO POR: | FECHA: | REVISADO POR: | FECHA: | HOJA | DE

DEFINICION PRETENSADO DE COSIDO AL ESTRIBO

Fuerza que ejerce tablero contra el estribo.

Fmax. Frenado + Retracción. fluencia y temp.

F. Retracción. fluencia y temperatura es igual a la fuerza resistida en cabeza de pilas

5% de la carga vertical para P1, P2 y P3 y una fuerza de 63 t. + 5% carga vertical en estribo 1

F = 888 + 3×90,3 + 63 + 25,3 = ~~888,6~~ 1247,2

nº de tendones necesarios = $\frac{1247,2}{4 \cdot 26,5 \times 0,75}$ = 15,68 cordones → 16 cordones

Oficina Técnica | PROYECTO: VIADUCTO nº 1 | ASUNTO:
ESCRITO POR: | FECHA: | REVISADO POR: | FECHA: | HOJA | DE

COMPROBACION FUERZA DE FRENADO

- IAPF-75

Tren de cargas tipo A

$F = \frac{90}{8} = 11,25$ t

Tren de cargas tipo B

$F = \frac{1}{8}[30 \times 12 + (222-30) \times 10] = 285$ t.

Fuerza máxima = 2×285 = 570 t (2 trenes tipo B)

- EC1. 3

Tren de carga 71 F = 2×222 = 444 t

Tren de carga SW/2 F = 3,5×(25+25) = 175 t.

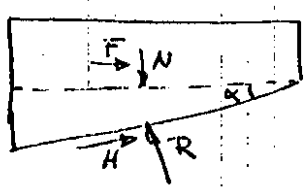
Fuerza máxima = 2×444 (2 trenes tipo 71)

Oficina Técnica | PROYECTO: VIADUCTO nº 1 | ASUNTO:
ESCRITO POR: | FECHA: | REVISADO POR: | FECHA: | HOJA | DE

COMPROBACION DESLIZAMIENTO DE ESTRIBO 2

Hip III. ESTRIBO + TABLERO + SOBRECARGA

1º) SOBRECARGA MAXIMA



Esfuerzos en cara inferior de zapata.

F = 2260,6 t

N = 6362,6 + ½ 1,65 × 17,4 × 17 × 2,5 = 6972,7 t.

α = 5,45°

R = N cosα + F sen α = 7155,8 t

H = F cosα − N sen α = 1588,13 t

Comprobación coef. seguridad al deslizamiento.

$\gamma_d = \frac{7155,8 \times 0,5}{1588,13} = 2,25 > 1,5 \rightarrow$ VALE.

Oficina Técnica | PROYECTO: VIADUCTO nº 1 | ASUNTO:
ESCRITO POR: | FECHA: | REVISADO POR: | FECHA: | HOJA | DE

COMPROBACION DESLIZAMIENTO DE ESTRIBO 2

Hip III. ESTRIBO + TABLERO + SOBRECARGA

2º) SOBRECARGA MINIMA

Esfuerzos en cara inferior de zapata.

F = 2260,6 t

N = 5810,6 + ½ 1,65 × 17,4 × 17 × 2,5 = 6420,7 t.

α = 5,45°

R = N cosα + F sen α = 6606,4 t

H = F cosα − N sen α = 1690,6 t.

Comprobación coef. seguridad al deslizamiento.

$\gamma_d = \frac{6606,4 \times 0,5}{1690,6} = 2,01 > 1,5 \rightarrow$ VALE.

Oficina Técnica	PROYECTO:
	ASUNTO:

ESCRITO POR: | FECHA: | REVISADO POR: | FECHA: ..... | HOJA | DE

DEFINICION DE BARRAS DE ANCLAJE DEL ESTRIBO

Esfuerzos en cara superior de zapata

Hip 1

$N = 506,8 + 6,49 \times 6,90 \times 14,00 \times 2,50 = 2079,1\ t$

$H = [888 + 359,2] \times (6,49 + 3,13) = 11998,0\ t \cdot m.$

$H_{empujes\ tierras} = \left[\frac{1}{2} \cdot 11 \times 2 \times 11 \times \frac{1}{3} \cdot 11 + 3 \times 11 \times 11/2\right] \times 933 = 206\ t \cdot m.$

Hip 2

$N = 506,8 + 6,49 \times 6,9 \times 14 \times 2,50 = 2074,1\ t$

$H = 888 \times (6,49 + 3,13) = 8542,5\ t \cdot m.$

Esfuerzos en sección de meseta.

Hip 1

$N = 506,8$

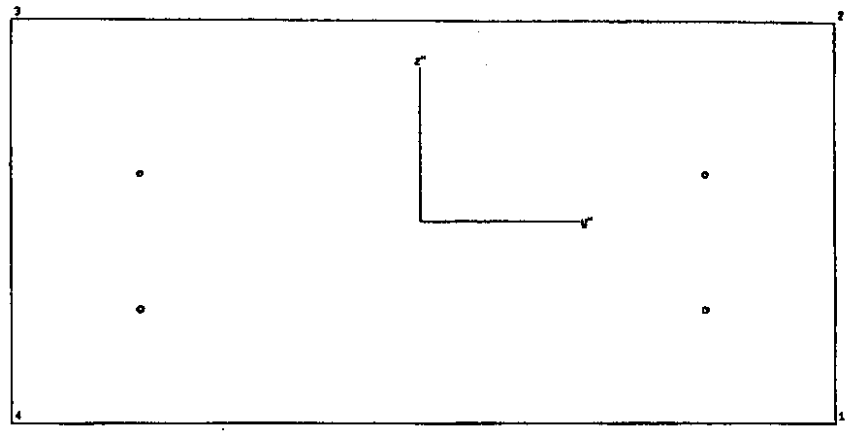
$H = [888 + 359,2] \times 3,13 = 3903,7$

Hip 2

$N = 506,8$

$H = -888 \times 3,13 = -2779,4$

Mstb. 1 : 90.0



Sección :"EST2VIA1" Armadura :"B1"
Tipo : tipo pila/ Rectángulo Unidades :[cm]
Material :"H250" Coef. homogeneización: 1.00

Ancho = 1400.00 cm Canto = 690.00 cm

Características mecánicas de la sección:
Area : Ax= 96.885 [m2]
Momentos de inercia : Iy= 383.705 [m4] Iz= 1584.367 [m4]
Inercia a torsión : Ix= 1062.476 [m4]

Posición del centro de gravedad: ys= 0.000 [m] zs= 3.448 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-7.000	-226.338	2.336
dch.	Iz	7.000	226.338	-2.336
abajo	Iy	-3.448	-111.267	1.147
arriba	Iy	3.452	111.170	-1.148

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	DYWIDAG	(0)	81.43	-480.00	195.00			10.00
2	DYWIDAG	(0)	81.43	480.00	195.00			10.00
3	DYWIDAG	(0)	61.07	-480.00	425.00			10.00
4	DYWIDAG	(0)	61.07	480.00	425.00			10.00
Total:			285.01	Cuantía de armadura: 0.029 [o/o]				

Cód. dimensionamiento: (0) = As constante

Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Armaduras pretensadas :

N°	Def.Impuesta	N°	Def.Impuesta	N°	Def.Impuesta
1	4.500E-0003	2	4.500E-0003	3	4.500E-0003
4	4.500E-0003				

Dimens. a cortante (valores por defecto): (Acero"AEH500"/Hormigón"H250")

Cortante	Area mín.cercos	Ancho alma ideal	Canto útil	Incl.bielas
Vz	0.00 [cm2/m]	1400.00 [cm]	686.00 [cm]	0.00
Vy	0.00 [cm2/m]	690.00 [cm]	1396.00 [cm]	0.00

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H250"	300000.0	-141.600	-2.000	0.0	6.460	250.000
"DYWIDAG"	2.00E+06	10800.0				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

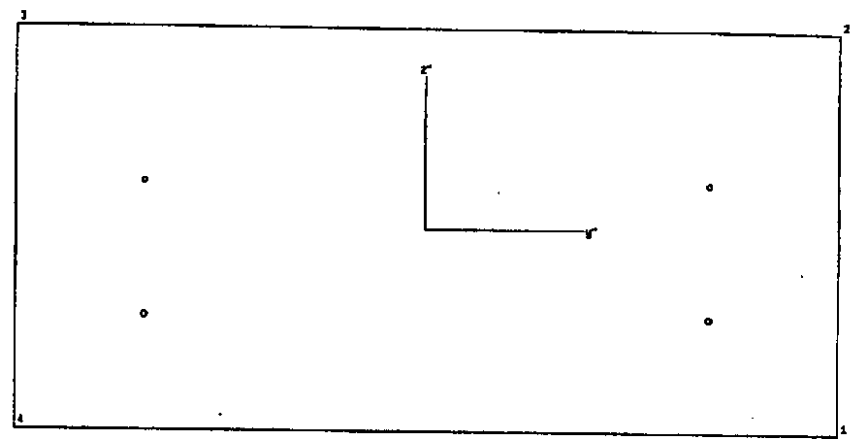
Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Mstb. 1 : 90.0



Sección :"EST2VIA1" Armadura :"B1"
Tipo : tipo pila/ Rectángulo Unidades :[cm]
Material :"H250" Coef. homogeneización: 1.00

Ancho = 1400.00 cm Canto = 690.00 cm

Características mecánicas de la sección:

Area	: Ax= 96.885 [m2]		
Momentos de inercia	: Iy= 383.705 [m4]	Iz= 1584.367	[m4]
Inercia a torsión	: Ix= 1062.476 [m4]		

Posición del centro de gravedad: ys= 0.000 [m] zs= 3.448 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-7.000	-226.338	2.336
dch.	Iz	7.000	226.338	-2.336
abajo	Iy	-3.448	-111.267	1.147
arriba	Iy	3.452	111.170	-1.148

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]	Coef.Homog
1	DYWIDAG	(0)	81.43	-480.00	195.00			10.00
2	DYWIDAG	(0)	81.43	480.00	195.00			10.00
3	DYWIDAG	(0)	61.07	-480.00	425.00			10.00
4	DYWIDAG	(0)	61.07	480.00	425.00			10.00
	Total:		285.01	Cuantía de armadura: 0.029 [o/o]				

Cód. dimensionamiento: (0) = As constante

Armaduras pretensadas :

N°	Def.Impuesta	N°	Def.Impuesta	N°	Def.Impuesta
1	4.500E-0003	2	4.500E-0003	3	4.500E-0003
4	4.500E-0003				

Dimens. a cortante (valores por defecto): (Acero"AEH500"/Hormigón"H250")

Cortante	Area mín.cercos	Ancho alma ideal	Canto útil	Incl.bielas
Vz	0.00 [cm2/m]	1400.00 [cm]	686.00 [cm]	0.00
Vy	0.00 [cm2/m]	690.00 [cm]	1396.00 [cm]	0.00

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H250"	300000.0	-141.600	-2.000	0.0	6.460	250.000
"DYWIDAG"	2.00E+06	10800.0				

Leyenda:
fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

Cálculo Resistencia Ultima: Pila "EST2VIA1"/"B1"

Solicitación

N	Vy	Vz	Mx	My	Mz
-2074.100				12204.0	

Unidades : [tm]

Coeficiente de seguridad 2.072

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	-700.00	690.00	-1.524	-133.579	"H250"
Armadura-Min	-480.00	425.00	4.645	10800.0	"DYWIDAG"
Hormigón-Max	700.00	0.00	14.540	0.000	"H250"
Armadura-Max	480.00	195.00	10.000	10800.0	"DYWIDAG"

Fibra neutra zn 624.54 cm yn -0.00 cm Angulo 0.0
Ancho zona comprim. 65.46 cm Zona comprimida/Canto útil 0.17

Esfuerzos (Rotura)	: Rigideces secantes:		Deformaciones:	
N = -4298.452 [t]	EAx=	--1-- [t]	6.511399E-03	
My= 25292.1 [tm]	EIy=	--1-- [tm2]	2.328082E-03	[1/m]
Mz= 0.000 [tm]	*EIz=	--1-- [tm2]	-1.743725E-12	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
700.00	0.00	14.540		0.0	-7376.916	321.47
700.00	690.00	-1.524		-133.6		
-700.00	690.00	-1.524		-133.6		
-700.00	0.00	14.540		0.0		

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-480.000	195.000	4.500	10.000	14.500	1800.000	10800.0
2	480.000	195.000	4.500	10.000	14.500	1800.000	10800.0
3	-480.000	425.000	4.500	4.645	9.145	1800.000	10800.0
4	480.000	425.000	4.500	4.645	9.145	1800.000	10800.0

Cálculo Resistencia Ultima: Pila "EST2VIA1"/"B1"

Solicitación

N	Vy	Vz	Mx	My	Mz
-2074.100				-8542.000	

Unidades : [tm]

Coeficiente de seguridad 3.982

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	700.00	0.00	-2.325	-141.600	"H250"
Armadura-Min	480.00	195.00	3.330	10800.0	"DYWIDAG"
Hormigón-Max	-700.00	690.00	17.685	0.000	"H250"
Armadura-Max	-480.00	425.00	10.000	10800.0	"DYWIDAG"

Fibra neutra zn 80.18 cm yn 0.00 cm Angulo 0.0
Ancho zona comprim. 80.18 cm Zona comprimida/Canto útil 0.20

Esfuerzos (Rotura)	: Rigideces secantes:		Deformaciones:	
N = -8258.783 [t]	EAx=	--1-- [t]	7.675590E-03	
My= -34013.1 [tm]	EIy=	--1-- [tm2]	-2.900028E-03	[1/m]
Mz= 0.000 [tm]	*EIz=	--1-- [tm2]	6.624985E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
700.00	0.00	-2.325		-141.6	-11336.8	313.94
700.00	690.00	17.685		0.0		
-700.00	690.00	17.685		0.0		
-700.00	0.00	-2.325		-141.6		

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	-480.000	195.000	4.500	3.330	7.830	1800.000	10800.0
2	480.000	195.000	4.500	3.330	7.830	1800.000	10800.0
3	-480.000	425.000	4.500	10.000	14.500	1800.000	10800.0
4	480.000	425.000	4.500	10.000	14.500	1800.000	10800.0

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional

CALCULO DE CIMENTACION

TRABAJO: AVE Madrid - Zaragoza. Subtramo VII
CIMENTACION: Viaducto 1

CIMENTACION:	Estribo 1	Estribo 1	Estribo 1	Pila 2	Pila 2	Pila 2	Pila 3	Pila 3	Pila 3	Pila 4	Pila 4	Pila 4
HIP:	E1-1	E1-2	E1-3	P1-1	P1-2	P1-3	P2-1	P2-2	P2-3	P3-1	P3-2	P3-3
NOTAS:	ZNF=6m	ZNF=0	ZNF=0	ZNF=6m	ZNF=0	ZNF=0	ZNF=6m	ZNF=0	ZNF=0	ZNF=6m	ZNF=0	ZNF=0
LITAX:	1,50	1,50	1,50	1,50	1,50	1,50	1,50	1,50	1,50	1,50	1,50	1,50
Dens sup:	1,80	1,10	1,10	1,80	1,10	1,10	1,80	1,10	1,10	1,10	1,10	1,10
Z0:	3,00	3,00	3,00	3,40	3,40	3,40	6,00	6,00	6,00	6,00	6,00	6,00
Z1:	6,00	6,00	6,00	6,00	6,00	6,00	9,40	9,40	9,40	11,00	11,00	11,00
Den 0-1:	1,80	1,10	1,10	1,80	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10
C1:	2,00	2,00	2,00	2,00	2,00	2,00	0,00	0,00	0,00	0,00	0,00	0,00
Fi1:	19,00	19,00	19,00	19,00	19,00	19,00	0,00	0,00	0,00	0,00	0,00	0,00
K01:	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50
f'(C):	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
f'(Fi):	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Pv 0-1:	8,10	4,95	4,95	5,17	5,17	5,17	12,67	8,47	8,47	13,55	9,35	8,35
qf 0-1(Tm2):	3,19	2,65	2,65	2,69	2,69	2,69	0,00	0,00	0,00	0,00	0,00	0,00
Q1 0-1(T):	45,16	37,49	37,49	38,96	32,96	32,96	0,00	0,00	0,00	0,00	0,00	0,00
Z2:	28,00	28,00	31,20	25,00	25,00	25,00	27,50	27,50	30,36	27,70	27,70	30,80
Den 1-2:	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10	1,10
C2:	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
Fi2:	19,00	19,00	19,00	19,00	19,00	19,00	19,00	19,00	19,00	19,00	19,00	19,00
K02:	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50	0,50
f'(C):	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
f'(Fi):	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Pv 1-2:	22,90	18,70	20,48	21,25	17,05	19,24	24,50	20,50	21,87	25,49	21,28	22,90
qf 1-2(Tm2):	5,74	5,02	5,32	5,66	4,74	5,11	6,02	5,29	5,50	6,19	5,45	5,74
Q1 1-2(T):	595,34	520,38	631,99	488,73	423,09	553,80	513,23	451,55	549,68	496,94	430,04	531,45
Q(T):	640,51	557,88	688,48	526,63	456,94	586,88	513,23	451,55	549,68	496,94	430,04	531,45
P-PUNTA:	35,00	30,80 √	34,32	31,70	27,50	31,89	34,45	30,25 √	33,40	34,67	30,47	33,70
FIPUNTA:	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00
3*Nc:	19,2	19,2	19,2	19,2	19,2	19,2	19,2	19,2	19,2	19,2	19,2	19,2
qp(Tm2):	671,9	691,3	608,6	608,6	527,9	612,2	691,4	660,7	641,2	665,8	585,0	647,0
Qp(T):	1187,41	1044,92	1075,45	932,98	1081,81	1168,75	1028,26	1133,02	1176,21	1033,72	1143,38
Qf(T):	1827,92	1602,79	1604,08	1389,91	1868,67	1681,98	1477,81	1682,70	1693,16	1463,78	1674,82
Fseg FUSTE:	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Fseg PUNTA:	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Qadm(T):	731,17	641,12	641,63	555,86	867,47	672,79	591,13	673,08	685,28	585,51	688,93
qadm(kg/cm2):	41,38	36,28	36,31	31,48	37,77	38,07	33,45	38,09	37,65	33,13	37,91
N DIAM. EMPOTR:	9,73	9,73	11,87	7,73	7,73	10,39	6,60	6,00	8,51	6,60	6,60	8,56

CALCULO CIMENTACION ESTRIBO 1

PILOTE Φ1500

a) Condiciones Generales

Diámetro D	1.5 m.
Area A	1.767 m².
Perimetro P	4.712 m.
Profundidad Cara Superior Encepado	0.50 m.
Canto Encepado	2.50 m.
Profundidad N.F.	0.00 m.
Profundidad Techo Keuper Alterado	2.00 m.
Profundidad Techo Keuper Sano	6.00 m.
Profundidad Punta L	31.70 m.
Longitud desde Cara Inferior Encepado	28.7 m.
Empotramiento en el Sustrato	29.70 m.
Empotramiento en el Keuper Sano	25.70 m. > 6D = 9 m.

b) Resistencia por Punta

Profundidad (m)	σ'_{vp} (T/m²)	N_q (T/m²)	q_p (T/m²)	P (T)
31.70	34.87	6.40	669.50	**1183.11**

c) Resistencia por Fuste

Capa	Espesor (m)	σ'_v (T/m²)	K	f_ϕ	f_c	τ_f (T/m)	F (T)
Keuper Alt.	4.00	4.40	0.5	1	0.90	2.56	**48.21**
Keuper Sano	25.70	20.74	0.5	1	0.90	5.37	**650.33**
						SUMA =	**698.54**

d) Carga Admisible

Diámetro (m)	Longitud Cara Inferior Encepado (m)	P (T)	F (T)	N_{pilote} (T)	Q_{adm} (T)	OK/NO	Tensión Hormigón (Kg/cm²)
1.50	28.7	1183.11	698.54	748.00	752.66	**OK**	42.33

CALCULO CIMENTACION PILA 1

PILOTE Φ1500

a) Condiciones Generales

Diámetro D	1.5 m.
Area A	1.767 m².
Perimetro P	4.712 m.
Profundidad Cara Superior Encepado	0.50 m.
Canto Encepado	2.50 m.
Profundidad N.F.	0.00 m.
Profundidad Techo Keuper Alterado	2.00 m.
Profundidad Techo Keuper Sano	6.00 m.
Profundidad Punta L	29.20 m.
Longitud desde Cara Inferior Encepado	26.2 m.
Empotramiento en el Sustrato	27.20 m.
Empotramiento en el Keuper Sano	23.20 m. > 6D = 9 m.

b) Resistencia por Punta

Profundidad (m)	σ'_{vp} (T/m²)	N_q (T/m²)	q_p (T/m²)	P (T)
29.20	32.12	6.40	616.70	**1089.81**

c) Resistencia por Fuste

Capa	Espesor (m)	σ'_v (T/m²)	K	f_ϕ	f_c	τ_f (T/m)	F (T)
Keuper Alt.	4.00	4.40	0.5	1	0.90	2.56	**48.21**
Keuper Sano	23.20	19.36	0.5	1	0.90	5.13	**561.19**
						SUMA =	**609.40**

d) Carga Admisible

Diámetro (m)	Longitud Cara Inferior Encepado (m)	P (T)	F (T)	N_{pilote} (T)	Q_{adm} (T)	OK/NO	Tensión Hormigón (Kg/cm²)
1.50	26.2	1089.81	609.40	670.34	679.68	**OK**	37.93

CALCULO CIMENTACION PILA 2

PILOTE Φ1500

a) Condiciones Generales

Diámetro D	1.5 m.
Area A	1.767 m².
Perimetro P	4.712 m.
Profundidad Cara Superior Encepado	0.50 m.
Canto Encepado	2.50 m.
Profundidad N.F.	0.00 m.
Profundidad Techo Keuper Alterado	3.40 m.
Profundidad Techo Keuper Sano	6.00 m.
Profundidad Punta L	29.50 m.
Longitud desde Cara Inferior Encepado	26.5 m.
Empotramiento en el Sustrato	26.10 m.
Empotramiento en el Keuper Sano	23.50 m. > 6D = 9 m.

b) Resistencia por Punta

Profundidad (m)	σ'_{vp} (T/m²)	N_q (T/m²)	q_p (T/m²)	P (T)
29.50	32.45	6.40	623.04	**1101.00**

c) Resistencia por Fuste

Capa	Espesor (m)	σ'_v (T/m²)	K	f_ϕ	f_c	τ_f (T/m)	F (T)
Keuper Alt.	2.60	5.17	0.5	1	0.90	2.69	**32.96**
Keuper Sano	23.50	19.53	0.5	1	0.90	5.16	**571.59**
						SUMA =	**604.55**

d) Carga Admisible

Diámetro (m)	Longitud Cara Inferior Encepado (m)	P (T)	F (T)	N_{pilote} (T)	Q_{adm} (T)	OK/NO	Tensión Hormigón (Kg/cm²)
1.50	26.5	1101.00	604.55	676.47	682.22	**OK**	38.28

DIMENSIONAMIENTO GEOTECNICO DE LONGITUD DE PILOTES DE PILAS 1, 2, 3, 4 Y DE ESTRIBO 1

PILA1	SEP.LONG		3.5	
	SEP TRANS		3.5	
	HIP-1	HIP-2		MAX
2784.7 AXIL MAX	670.34	618.13		670.34
113.3 AXIL MIN	208.82	157.36		
90.3				
2642				
1697.1 PILA2	SEP.LONG		3.50	
	SEP TRANS		3.50	
	HIP-1	HIP-2		MAX
2741.2 AXIL MAX	676.47	624.45		676.47
113.6 AXIL MIN	197.27	145.81		
90.3				
2738.6				
1777.5 PILA3	SEP.LONG		3.50	
	SEP TRANS		3.50	
	HIP-1	HIP-2		MAX
2767.5 AXIL MAX	673.02	623.69		673.02
113.4 AXIL MIN	206.58	152.42		
90.3				
2667.1				
1771.9 PILA4	SEP.LONG		3.50	
	SEP TRANS		3.50	
	HIP-1	HIP-2		MAX
2773.9 AXIL MAX	649.14	597.49		649.14
113.6 AXIL MIN	231.68	180.05		
63				
2715.1				
1226.5				

CALCULO DE LONGITUDES DE PILOTES

CON ESFUERZOS DE PROGRAMA PYRUS

	ALTURA	PESO
ENCEPADO		2.5

ESFUERZOS EN CARA INFERIOR DE ENCEPADO

PILA1	HIP-1	HIP-2	ALTURA	
N	3955.30	3489.70	17.217	3230.3
Mt	103.70	113.30		103.7
MI	90.30	90.30		90.3
Mt	2910.35	2925.25		2651.1
MI	1937.75	1912.85		1712
PILA2	HIP-1	HIP-2	ALTURA	
N	3931.80	3468.20	18.039	3206.8
Mt	103.90	113.60		103.9
MI	90.30	90.30		90.3
Mt	3000.55	3022.50		2740.8
MI	2031.05	2003.25		1805.3
PILA3	HIP-1	HIP-2	ALTURA	
N	3958.10	3492.50	17.431	3233.1
Mt	103.70	113.40		103.7
MI	90.30	90.30		90.3
Mt	2934.45	2950.60		2675.2
MI	1963.45	1997.85		1737.7
PILA4	HIP-1	HIP-2	ALTURA	
N	3963.70	3498.90	17.846	3238.7
Mt	103.80	113.60		103.8
MI	63.00	63.00		63
Mt	2978.30	2999.10		2719.8
MI	1404.00	1384.00		1246.5

CEDEX

AVE MADRID – ZARAGOZA. SUBTRAMO VII

Recomendaciones en relación al cálculo de la cimentación del Viaducto nº1.

En vista de los sondeos realizados en el emplazamiento del viaducto nº 1 y una vez analizados los condicionantes topográficos de su entorno se hacen las siguientes observaciones:

- **Cimentación del Estribo 1**

- Se indica la posibilidad de la sustitución de la cimentación pilotada por otra cimentación directa debido a que en el sondeo localizado en este punto se encuentra el material considerado con Keuper alterado a la cota –1.5 m.

- En los cálculos de la cimentación directa se deberá tener en cuenta el peso del terraplén que gravite sobre ésta.

- En el dimensionamiento de ésta cimentación se deberá realizar un cálculo de los asientos diferenciales entre el Estribo 1 y la Pila 1, ajustando las dimensiones de la zapata hasta obtener un valor adecuado de movimiento diferencial.

- Análogamente se debe considerar este aspecto entre el Estribo 2 y la Pila 3.

- **Cimentación de las pilas**

- Se ha realizado un análisis de la repercusión de la eventual elevación del nivel freático hasta la superficie resultando una reducción notable de la seguridad de los pilotes como puede comprobarse en tabla adjunta. Para confirmar este punto se ha procedido a la evaluación de la capacidad portante de los pilotes, en este supuesto, por un método alternativo acentuándose la pérdida de seguridad en los pilotes.

- Al considerarse que una elevación del nivel freático se puede producir a lo largo de la vida útil de la obra se recomienda recalcular la capacidad portante de los pilotes por el método indicado por el Laboratorio de Geotecnia en anteriores comunicaciones, suponiendo el nivel freático en la superficie. Ello viene a representar la necesidad de incrementar en torno a 3 m la longitud de pilotaje inicialmente prevista, según resulta en los resultados de cálculo adjuntos.

- Se considera necesario el control de la ejecución de los pilotes mediante la realización del ensayo de transparencia sónica. Para el control del estado de la punta de los pilotes se reperforarán los tubos embebidos en el hormigón y se comprobará la existencia de un contacto adecuado hormigón-terreno.

- Para el seguimiento y comprobación de la transferencia de cargas al terreno de los pilotes resulta necesario la instrumentación de algunos de éstos. Se emplearán a tal fin elementos de medida de deformaciones convenientemente dispuestos en el interior de los tubos de transparencia sónica.

- La excavación de los pilotes se realizará, en todo caso, con entubación recuperable a nivel de acarreos y empleando lodos tixotrópicos en el Keuper.

Madrid, 26 de julio de 1999

Antonio Santos Moreno

Javier Moreno Robles

CALCULO DE PILOTES FRENTE A ESFUERZOS TRANSVERSALES

AGROMAN

DIRECCION TECNICA

Campo de las Naciones
Avda. Barcelón, 4-6
28042 MADRID

Tfno.: (91) 3.00.85.00
FAX : (91) 3.00.88.04

TELEFAX Nº: 91 - 5860250	Nº DE PAGINAS INCLUYENDO ESTA: 1
A: D. EMILIO HERRERO	
COMPAÑIA: FERROVIAL	
DE: D. GABRIEL DE BONA	
FECHA: 12 de enero de 1999	

ASUNTO: MODULOS DE REACCION PARA ESTRUCTURAS VIADUCTO Nº 2

Adjunto le envío los valores de los módulos de reacción definidos en el Apartado 4 del Anejo 6 del Proyecto de Construcción, que son:

- Coluvial:

  K_v = 5000 T/m³

- Keuper Alterado:

  K_h = 1200 T/m³

- Keuper Sano:

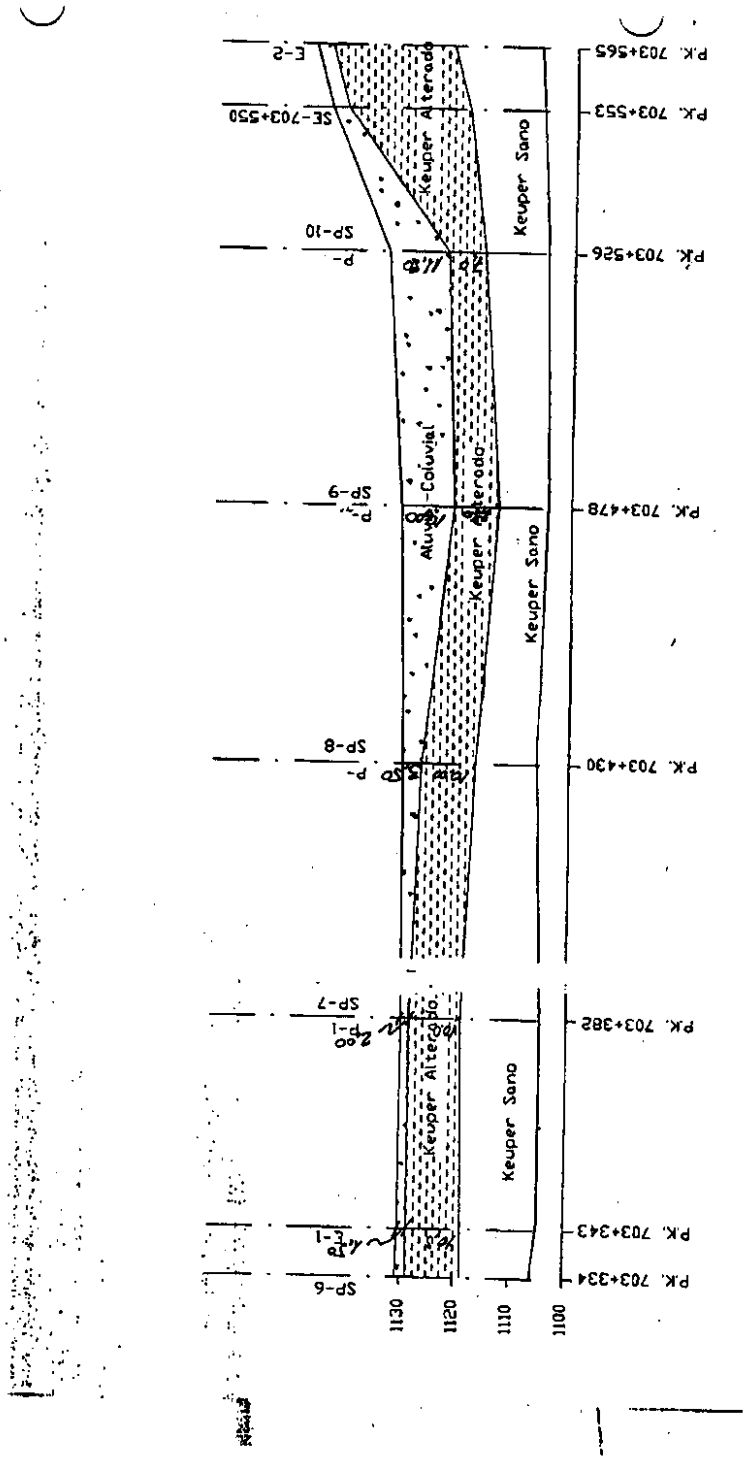
  K_v = 8000 - 10000 T/m³

  K_h = 4400 T/m³

Quedamos a su disposición para cualquier aclaración adicional.

Saludos

PERFIL GEOTECNICO



CALCULO MATRICIAL DE PILOTES FRENTE A FUERZAS HORIZONTALES

TITULO....AVE VIADUCTO NS1 PILA 2

Fuerza horizontal en cabeza (positiva izda-dacha)= 15.85 Tn.
Momento en cabeza (positivo anti-horario)= 0 m.Tn.

Di metro del pilote= 1.5 m.
Resistencia caracteristica del horm del pilote fck= 200 kg/cm2.
Longitud total del pilote= 28.99 m.

Rigidez superior al giro= empotrado
Rigidez inferior al giro= empotrado

DATOS DEL TERRENO

PROFUNDIDAD	MODULO DE BALASTO (Tn/m3)
3.50	0.0
13.50	1200.0
200.00	4400.0

MODELO DE CALCULO EMPLEADO

El pilote se divide en 40 barras. El terreno es representado por muelles cuya constante es deducida del módulo de balasto. Los módulos de balasto en cada nudo se obtienen calculando la media ponderada de los módulos del terreno en la zona coberi-centrica al nudo. Las constantes de muelle ser n el producto del módulo de balasto por el di metro del pilote por la distancia entre muelles.

POSICION DE NUDOS CON MODULOS DE BALASTO INTERPOLADOS

NUDO	PROFUNDIDAD	M.BALASTO	K MUELLE	ESQUEMA
1	0.00	0.0	0.0	>XXXÒ·
2	0.72	0.0	0.0	>XXX¶·
3	1.45	0.0	0.0	>XXX¶·
4	2.17	0.0	0.0	>XXX¶·
5	2.90	0.0	0.0	>XXX¶·
6	3.62	804.9	875.0	>XXX¶·
7	4.35	1200.0	1304.6	>XXX¶·
8	5.07	1200.0	1304.6	>XXX¶·
9	5.80	1200.0	1304.6	>XXX¶·
10	6.52	1200.0	1304.6	>XXX¶·
11	7.25	1200.0	1304.6	>XXX¶·
12	7.97	1200.0	1304.5	>XXX¶·
13	8.70	1200.0	1304.6	>XXX¶·
14	9.42	1200.0	1304.6	>XXX¶·
15	10.15	1200.0	1304.6	>XXX¶·
16	10.87	1200.0	1304.6	>XXX¶·
17	11.60	1200.0	1304.6	>XXX¶·
18	12.32	1200.0	1304.6	>XXX¶·
19	13.05	1200.0	1304.6	>XXX¶·
20	13.77	3993.2	4341.2	>XXX¶·
21	14.50	4400.0	4783.4	>XXX¶·
22	15.22	4400.0	4783.4	>XXX¶·
23	15.94	4400.0	4783.3	>XXX¶·
24	16.67	4400.0	4783.4	>XXX¶·
25	17.39	4400.0	4783.4	>XXX¶·
26	18.12	4400.0	4783.4	>XXX¶·
27	18.84	4400.0	4783.4	>XXX¶·
28	19.57	4400.0	4783.4	>XXX¶·
29	20.29	4400.0	4783.4	>XXX¶·
30	21.02	4400.0	4783.4	>XXX¶·
31	21.74	4400.0	4783.4	>XXX¶·
32	22.47	4400.0	4783.4	>XXX¶·
33	23.19	4400.0	4783.4	>XXX¶·
34	23.92	4400.0	4783.4	>XXX¶·
35	24.64	4400.0	4783.4	>XXX¶·
36	25.37	4400.0	4783.4	>XXX¶·
37	26.09	4400.0	4783.4	>XXX¶·
38	26.82	4400.0	4783.4	>XXX¶·
39	27.54	4400.0	4783.4	>XXX¶·
40	28.27	4400.0	4783.4	>XXX¶·
41	28.99	4400.0	2391.7	>XXXÒ·

RESULTADOS DEL CALCULO MATRICIAL

Formada la matriz de rigidez del pilote dividido en 40 barras se ha sumado en la diagonal principal las constantes de muelle que se deducen de los módulos de balasto del terreno. Tambien se han sumado en los nudos extremos las constantes de rigidez al giro introducidas en los datos. Resolviendo el sistema p=k*d para la estructura, se obtienen los desplazamientos, que multiplicados por la matriz de rigidez de barra se obtienen los esfuerzos.

ESFUERZOS EN EL PILOTE

NUDO	PROFUN	M(m.Tn.)	Q (Tn.)	DESPL(m.)	GIRO(rad.)
1	0.0	76.67	15.85	0.002736	-0.0000000
2	0.7	65.19	15.85	0.002707	-0.0000770
3	1.4	53.70	15.85	0.002627	-0.0001415
4	2.2	42.21	15.85	0.002505	-0.0001936
5	2.9	30.72	15.85	0.002350	-0.0002331
6	3.6	19.24	13.95	0.002170	-0.0002602
7	4.3	9.13	11.37	0.001975	-0.0002756
8	5.1	0.88	9.06	0.001773	-0.0002811
9	5.8	-5.68	7.01	0.001570	-0.0002785
10	6.5	-10.77	5.22	0.001371	-0.0002695
11	7.2	-14.55	3.68	0.001180	-0.0002558
12	8.0	-17.22	2.38	0.001001	-0.0002385
13	8.7	-18.95	1.29	0.000835	-0.0002189
14	9.4	-19.88	0.40	0.000684	-0.0001978
15	10.1	-20.17	-0.32	0.000549	-0.0001761
16	10.9	-19.93	-0.88	0.000429	-0.0001544
17	11.6	-19.30	-1.30	0.000325	-0.0001331
18	12.3	-18.35	-1.61	0.000236	-0.0001126
19	13.0	-17.18	-1.82	0.000161	-0.0000933
20	13.8	-15.86	-2.26	0.000100	-0.0000754
21	14.5	-14.23	-2.50	0.000052	-0.0000591
22	15.2	-12.42	-2.57	0.000014	-0.0000446
23	15.9	-10.55	-2.51	-0.000014	-0.0000322
24	16.7	-8.74	-2.35	-0.000033	-0.0000217
25	17.4	-7.04	-2.13	-0.000045	-0.0000131
26	18.1	-5.49	-1.88	-0.000052	-0.0000063
27	18.8	-4.13	-1.62	-0.000055	-0.0000011
28	19.6	-2.96	-1.36	-0.000054	0.0000027
29	20.3	-1.98	-1.11	-0.000051	0.0000054
30	21.0	-1.17	-0.89	-0.000047	0.0000071
31	21.7	-0.53	-0.69	-0.000041	0.0000081
32	22.5	-0.03	-0.52	-0.000035	0.0000084
33	23.2	0.35	-0.38	-0.000029	0.0000082
34	23.9	0.63	-0.27	-0.000023	0.0000077
35	24.6	0.82	-0.18	-0.000018	0.0000069
36	25.4	0.95	-0.12	-0.000014	0.0000059
37	26.1	1.04	-0.07	-0.000010	0.0000048
38	26.8	1.09	-0.04	-0.000007	0.0000037
39	27.5	1.12	-0.02	-0.000004	0.0000025
40	28.3	1.14	-0.01	-0.000003	0.0000012
41	29.0	1.14	-0.01	-0.000003	0.0000000

POSICION DE NUDOS CON MODULOS DE BALASTO INTERPOLADOS

NUDO	PROFUNDIDAD	M.BALASTO	K NUELLE	ESQUEMA
1	0.00	0.0	0.0	>ÄÄÄÒ·
2	0.76	0.0	0.0	>ÄÄÄ¶°
3	1.52	0.0	0.0	>ÄÄÄ¶°
4	2.28	0.0	0.0	>ÄÄÄ¶°
5	3.04	0.0	0.0	>ÄÄÄ¶°
6	3.80	0.0	0.0	>ÄÄÄ¶°
7	4.55	0.0	0.0	>ÄÄÄ¶°
8	5.31	0.0	0.0	>ÄÄÄ¶°
9	6.07	0.0	0.0	>ÄÄÄ¶°
10	6.83	0.0	0.0	>ÄÄÄ¶°
11	7.59	0.0	0.0	>ÄÄÄ¶°
12	8.35	0.0	0.0	>ÄÄÄ¶°
13	9.11	0.0	0.0	>ÄÄÄ¶°
14	9.87	389.7	443.7	>ÄÄÄ¶°
15	10.63	1200.0	1366.2	>ÄÄÄ¶°
16	11.39	1200.0	1366.2	>ÄÄÄ¶°
17	12.14	1200.0	1366.2	>ÄÄÄ¶°
18	12.90	1200.0	1366.2	>ÄÄÄ¶°
19	13.66	1200.0	1366.2	>ÄÄÄ¶°
20	14.42	1200.0	1366.2	>ÄÄÄ¶°
21	15.18	1200.0	1366.2	>ÄÄÄ¶°
22	15.94	1200.0	1366.2	>ÄÄÄ¶°
23	16.70	1200.0	1366.2	>ÄÄÄ¶°
24	17.46	1200.0	1366.2	>ÄÄÄ¶°
25	18.22	1602.6	1824.6	>ÄÄÄ¶°
26	18.98	4400.0	5009.4	>ÄÄÄ¶°
27	19.73	4400.0	5009.4	>ÄÄÄ¶°
28	20.49	4400.0	5009.4	>ÄÄÄ¶°
29	21.25	4400.0	5009.4	>ÄÄÄ¶°
30	22.01	4400.0	5009.4	>ÄÄÄ¶°
31	22.77	4400.0	5009.4	>ÄÄÄ¶°
32	23.53	4400.0	5009.4	>ÄÄÄ¶°
33	24.29	4400.0	5009.4	>ÄÄÄ¶°
34	25.05	4400.0	5009.4	>ÄÄÄ¶°
35	25.81	4400.0	5009.4	>ÄÄÄ¶°
36	26.57	4400.0	5009.4	>ÄÄÄ¶°
37	27.32	4400.0	5009.4	>ÄÄÄ¶°
38	28.08	4400.0	5009.4	>ÄÄÄ¶°
39	28.84	4400.0	5009.4	>ÄÄÄ¶°
40	29.60	4400.0	5009.4	>ÄÄÄ¶°
41	30.36	4400.0	2504.7	>ÄÄÄÐ¼

CALCULO MATRICIAL DE PILOTES FRENTE A FUERZAS HORIZONTALES

TITULO....AVE VIADUCTO NS1 PILA3

Fuerza horizontal en cabeza (positiva izda-decha)= 15.85 Tn.
Momento en cabeza (positivo anti-horario)= 0 m.Tn.

Di metro del pilote= 1.5 m.
Resistencia caracteristica del horm del pilote fck= 200 kg/cm2.
Longitud total del pilote= 30.36 m.

Rigidez superior al giro= empotrado
Rigidez inferior al giro= empotrado

DATOS DEL TERRENO

PROFUNDIDAD	MODULO DE BALASTO (Tn/m3)
10.00	0.0
18.50	1200.0
200.00	4400.0

MODELO DE CALCULO EMPLEADO

El pilote se divide en 40 barras. El terreno es representado por muelles cuya constante es deducida del módulo de balasto. Los módulos de balasto en cada nudo se obtienen calculando la media ponderada de los módulos del terreno en la zona cobaricentrica al nudo. Las constantes de muelle ser n el producto del módulo de balasto por el di metro del pilote por la distancia entre muelles.

RESULTADOS DEL CALCULO MATRICIAL

Formada la matriz de rigidez del pilote dividido en 40 barras se ha sumado en la diagonal principal las constantes de muelle que se deducen de los módulos de balasto del terreno. Tambien se han sumado en los nudos extremos las constantes de rigidez al giro introducidas en los datos. Resolviendo el sistema p=k*d para la estructura, se obtienen los desplazamientos, que multiplicados por la matriz de rigidez de barra se obtienen los esfuerzos.

ESFUERZOS EN EL PILOTE

NUDO	PROFUN	M(m.Tn.)	Q (Tn.)	DESPL(m.)	GIRO(rad.)
1	0.0	127.49	15.85	0.009257	-0.0000000
2	0.8	115.46	15.85	0.009203	-0.0001381
3	1.5	103.43	15.85	0.009050	-0.0002625
4	2.3	91.40	15.85	0.008808	-0.0003732
5	3.0	79.37	15.85	0.008487	-0.0004703
6	3.8	67.34	15.85	0.008098	-0.0005536
7	4.6	55.31	15.85	0.007650	-0.0006234
8	5.3	43.28	15.85	0.007155	-0.0006794
9	6.1	31.25	15.85	0.006623	-0.0007217
10	6.8	19.22	15.85	0.006063	-0.0007504
11	7.6	7.19	15.85	0.005487	-0.0007654
12	8.3	-4.84	15.85	0.004905	-0.0007668
13	9.1	-16.87	15.85	0.004326	-0.0007544
14	9.9	-28.90	14.18	0.003763	-0.0007284
15	10.6	-39.66	9.78	0.003224	-0.0006894
16	11.4	-47.08	6.06	0.002719	-0.0006401
17	12.1	-51.69	2.98	0.002254	-0.0005840
18	12.9	-53.95	0.48	0.001833	-0.0005240
19	13.7	-54.31	-1.52	0.001459	-0.0004624
20	14.4	-53.16	-3.06	0.001131	-0.0004014
21	15.2	-50.84	-4.22	0.000849	-0.0003423
22	15.9	-47.63	-5.06	0.000611	-0.0002863
23	16.7	-43.80	-5.62	0.000414	-0.0002343
24	17.5	-39.53	-5.97	0.000254	-0.0001870
25	18.2	-35.00	-6.20	0.000128	-0.0001446
26	19.0	-30.29	-6.37	0.000033	-0.0001075
27	19.7	-25.46	-6.19	-0.000036	-0.0000758
28	20.5	-20.77	-5.77	-0.000083	-0.0000495
29	21.3	-16.39	-5.20	-0.000113	-0.0000284
30	22.0	-12.44	-4.56	-0.000128	-0.0000120
31	22.8	-8.97	-3.90	-0.000132	0.0000001
32	23.5	-6.01	-3.26	-0.000128	0.0000086
33	24.3	-3.54	-2.66	-0.000120	0.0000141
34	25.0	-1.52	-2.12	-0.000108	0.0000169
35	25.8	0.09	-1.65	-0.000094	0.0000178
36	26.6	1.34	-1.24	-0.000081	0.0000169
37	27.3	2.28	-0.90	-0.000069	0.0000149
38	28.1	2.96	-0.60	-0.000059	0.0000119
39	28.8	3.42	-0.34	-0.000051	0.0000083
40	29.6	3.68	-0.11	-0.000046	0.0000042
41	30.4	3.77	-0.11	-0.000045	0.0000000

CALCULO DE ARMADURA

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TN4 Versión 2.0

Obra : VIADUCTO N° 1 SUBTRAMO VII
Fecha: 5/8/1999
Hora : 20:22

CALCULO DE SECCIONES CIRCULARES A FLEXION COMPUESTA RECTA

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
þc = 1.50
þs = 1.15

- Sección

Ý Sección [cm] = 150.00
r [cm] = 5.0
n° de redondos = 18

2. Comprobación

Ý [mm] = 25.0
Nk [Mp] = 59.30
Mk [m·Mp] = 76.67

Nu [Mp] = 275.92
Mu [m·Mp] = 356.76
þ = 4.65

Plano de deformación de agotamiento

x [cm] = 46.23
1/r [1/m]·1.E-3 = 7.57
¯s ·1.E-3 = 3.50
¯i ·1.E-3 = -7.86

Deformación y tensión de armaduras superior e inferior

Profundidad [cm]	Deformación ·1.E-3	Tensión [kp/cm²]
5.0	3.12	4434.8
145.0	-7.48	-4434.8

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TN4 Versión 2.0

Obra : VIADUCTO N° 1 SUBTRAMO VII
Fecha: 5/8/1999
Hora : 20:23

CALCULO DE SECCIONES CIRCULARES A FLEXION COMPUESTA RECTA

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
þc = 1.50
þs = 1.15

- Sección

Ý Sección [cm] = 150.00
r [cm] = 5.0
n° de redondos = 18

2. Comprobación

Ý [mm] = 25.0
Nk [Mp] = 64.00
Mk [m·Mp] = 127.50

Nu [Mp] = 157.19
Mu [m·Mp] = 313.14
þ = 2.46

Plano de deformación de agotamiento

x [cm] = 38.92
1/r [1/m]·1.E-3 = 8.99
¯s ·1.E-3 = 3.50
¯i ·1.E-3 = -9.99

Deformación y tensión de armaduras superior e inferior

Profundidad [cm]	Deformación ·1.E-3	Tensión [kp/cm²]
5.0	3.05	4434.8
145.0	-9.54	-4434.8

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TN4 Versión 2.0

Obra : VIADUCTO N° 1 SUBTRAMO VII
Fecha: 5/8/1999
Hora : 20:23

CALCULO DE SECCIONES CIRCULARES A FLEXION COMPUESTA RECTA

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
þc = 1.50
þs = 1.15

- Sección

Ý Sección [cm] = 150.00
r [cm] = 5.0
n° de redondos = 18

2. Comprobación

Ý [mm] = 25.0
Nk [Mp] = 60.80
Mk [m·Mp] = 123.05

Nu [Mp] = 154.06
Mu [m·Mp] = 311.78
þ = 2.53

Plano de deformación de agotamiento

x [cm] = 38.70
1/r [1/m]·1.E-3 = 9.04
εs ·1.E-3 = 3.50
εi ·1.E-3 = -10.07

Deformación y tensión de armaduras superior e inferior

Profundidad [cm]	Deformación ·1.E-3	Tensión [kp/cm²]
5.0	3.05	4434.8
145.0	-9.61	-4434.8

PRONTUARIO INFORMATICO DEL HORMIGON. PROGRAMA TT1 Versión 2.0

Obra : VIADUCTO N° 1 SUBTRAMO VII
Fecha: 5/8/1999
Hora : 20:24

CALCULO A CORTANTE DE SECCIONES RECTANGULARES

1. Datos

- Materiales:

fck [kp/cm²] = 200
fyk [kp/cm²] = 5100
þc = 1.50
þs = 1.15

- Tipo de Elemento Estructural:

Tipo: pilar
Ýlong = 25

- Sección

b [cm] = 106.0
h [cm] = 150.0
r [cm] = 5.0

2. Dimensionamiento con cercos a 90°

Vd [Mp] = 23.70 A90_est [cm²/m] = 6.06 (*)

Ý [mm]	s [cm]	n° ramas	tipo	A90 [cm²/m]	Vsu [Mp]
6	15	4	2	7.54	41.33
8	30	4	2	6.70	36.73
10	30	4	2	10.47	57.40

Vcu [Mp] = 84.18
Vu1 [Mp] = 553.32

(*) Armadura mínima de cortante

Armadura dispuesta cφ12a20 = 11,31 cm²/m

Oficina Técnica	PROYECTO:	
	ASUNTO:	
ESCRITO POR: FECHA:	REVISADO POR: FECHA:	HOJA DE

CALCULO DE ARMADURA DE ENCEPADOS.

El calculo de estos elementos se realiza aplicando el método de las bielas y tirantes, puesto que se trata de elementos rigidos.

Los resultados numéricos se adjuntan a continuación.

ARMADURA ENCEPADOS

BANDAS EXTREMAS

PILA1	HIP-1	HIP-2		HIP-1	HIP-2	MAXIMOS	ϕ32	SEP. ARMA BASE ϕ25
N	5514.26	4815.86	TRANS	493.15	464.72	493.15	14	1E+022
Mt	3978.65	3963.00	LONG	1085.82	1001.34	1085.82	31	1E+022
Ml	2311.20	2277.59						

PILA2	HIP-1	HIP-2		HIP-1	HIP-2	MAXIMOS	ϕ32	SEP. ARMA BASE ϕ25
N	5482.53	4784.13	TRANS	501.25	473.52	501.25	15	1E+022
Mt	4111.20	4107.75	LONG	1104.81	1019.58	1104.81	31	1E+022
Ml	2437.16	2399.63						

PILA3	HIP-1	HIP-2		HIP-1	HIP-2	MAXIMOS	ϕ32	SEP. ARMA BASE ϕ25
N	5518.04	4819.64	TRANS	495.81	487.48	495.81	14	1E+022
Mt	4012.60	4000.65	LONG	1092.52	1024.36	1092.52	31	1E+022
Ml	2345.90	2392.07						

PILA4	HIP-1	HIP-2		HIP-1	HIP-2	MAXIMOS	ϕ32	SEP. ARMA BASE ϕ25
N	5525.30	4828.10	TRANS	500.74	472.82	500.74	15	1E+022
Mt	4079.70	4072.65	LONG	956.67	873.71	956.67	27	1E+022
Ml	1682.78	1655.78						

CALCULO DEL PESCANTE

CALCULO DE PESCANTE METALICO

MOMENTOS FLECTORES

X	FASE1	FASE2	FASE3	FASE4	FASE5	FASE6	FASE7	FASE8	FASE9	FASE10	FASE11	FASE12	FASE13	FASE14	FASE15	FASE41	FASE42	FASE43	FASE44	FASE45	FASE46
26.00	-716.66	-66.67	-716.66	-716.55	362.92	-716.66	-716.55	374.94	-716.66	-716.56	313.67	-716.56	-716.56	312.49	-716.66	797.70	1799.44	1774.19	2161.14	2302.66	2135.06
23.60	-567.34	-5.84	-567.34	-567.34	417.66	-567.34	-567.34	410.36	-567.34	-567.34	366.76	-567.34	-567.34	366.52	-567.34	757.70	1151.33	1509.39	1726.81	1697.06	1334.33
19.60	-325.26	106.27	-325.26	-325.26	450.63	-325.26	-325.26	426.07	-325.26	-325.26	363.16	-325.26	-325.26	362.63	-325.26	631.29	830.45	920.11	821.62	429.86	-325.26
16.60	-231.06	136.97	-231.06	-231.06	418.28	-231.06	-231.06	406.66	-231.06	-231.06	370.66	-231.06	-231.06	369.72	-231.06	536.08	639.20	669.17	342.46	-231.06	-231.06
13.60	-153.94	148.62	-153.94	-153.94	372.69	-153.94	-153.94	368.68	-153.94	-153.94	338.60	-153.94	-153.94	339.58	-153.94	413.93	418.91	261.19	-153.94	-153.94	-153.94
10.60	-93.16	142.29	-93.16	-93.16	319.12	-93.16	-93.16	318.99	-93.16	-93.16	293.23	-93.16	-93.16	293.06	-93.16	265.40	193.25	-93.16	-93.16	-93.16	-93.16
7.60	-48.14	121.85	-48.14	-48.14	246.63	-48.14	-48.14	247.44	-48.14	-48.14	230.93	-48.14	-48.14	230.80	-48.14	141.15	-48.14	-48.14	-48.14	-48.14	-48.14
4.60	-16.16	86.44	-16.16	-16.16	166.67	-16.16	-16.16	163.72	-16.16	-16.16	153.36	-16.16	-16.16	153.46	-16.16	-16.16	-16.16	-16.16	-16.16	-16.16	-16.16
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mpos mayo/mog mayorado		ESPESOR CANTO	ESPESOR ALMA	INERCIA
3108.62	-667.34	0.00	4.00	12.00	0.27
2331.28	-765.91	3.00	3.00	12.00	0.23
1732.71	-660.12	8.00	3.60	12.00	0.21
1242.16	-430.14	8.00	3.40	12.00	0.18
848.97	-311.86	12.00	3.20	12.00	0.15
566.53	-307.82	16.00	3.00	12.00	0.13
430.81	-126.79	16.00	2.80	12.00	0.11
337.09	-64.96	21.00	2.60	12.00	0.09
222.64	-34.64	24.00	2.40	12.00	0.08
0.00	0.00	30.00	2.20	12.00	0.06

SIGMA pos	SIGMA neg
2539.68	-729.25
1747.77	-67.37
1298.08	-442.43
931.28	-329.29
636.02	-233.86
424.00	-186.81
332.99	-64.31
252.66	-48.73
167.07	-16.40
0.00	0.00

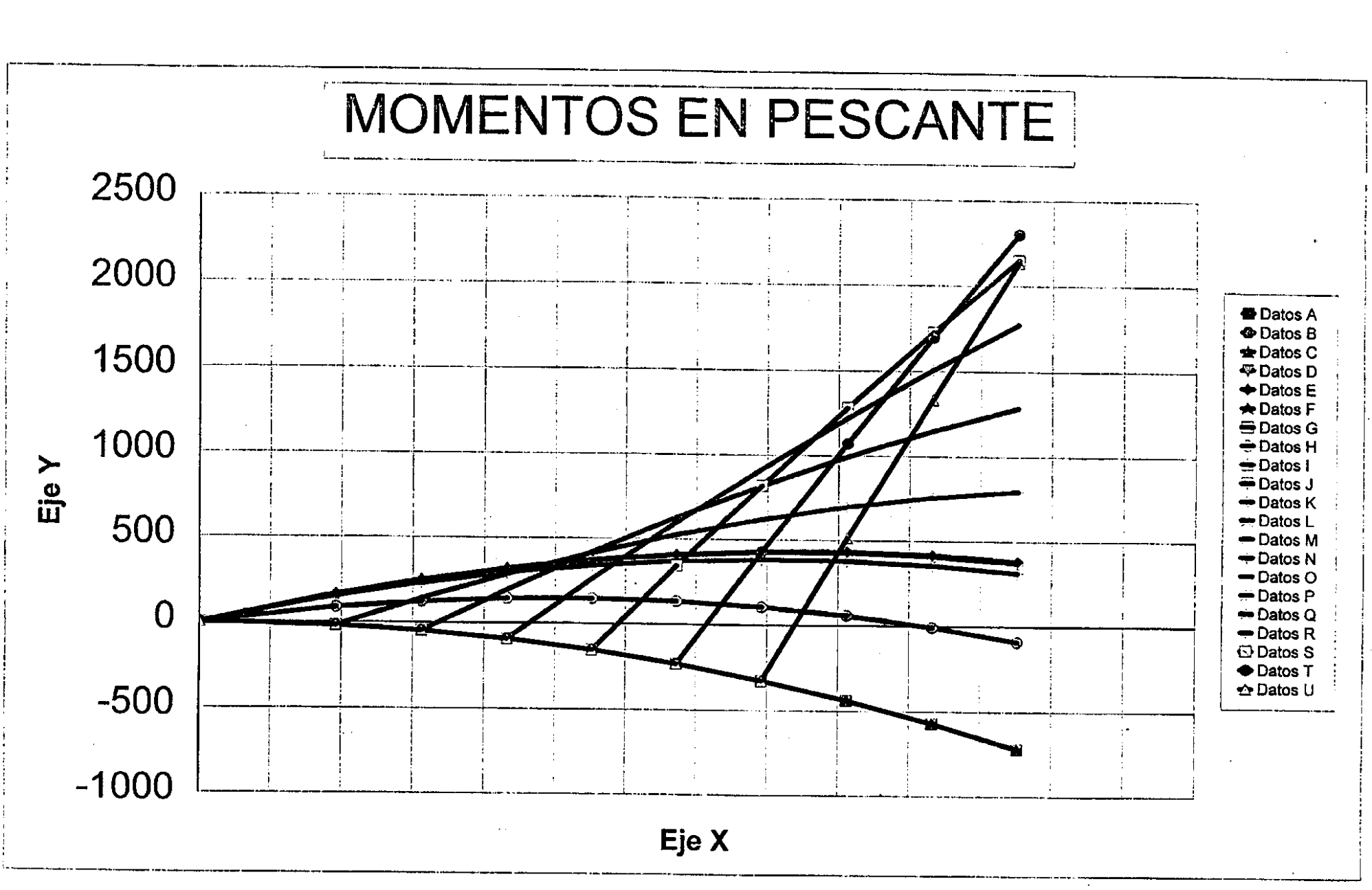
SIGMA COMP KP/CM2 pos	neg
2417.70	736.82
1662.78	668.29
1483.45	463.17
1071.21	330.62
749.21	343.96
508.79	186.80
374.62	103.66
261.19	57.26
163.01	25.85
0.00	0.00

ESFUERZOS CORTANTES

X	FASE1	FASE2	FASE3	FASE4	FASE5	FASE6	FASE7	FASE8	FASE9	FASE10	FASE11	FASE12	FASE13	FASE14	FASE15	FASE41	FASE42	FASE43	FASE44	FASE45	FASE46
26.00	-52.94	-31.15	-52.94	-52.94	-14.76	-52.94	-52.94	-15.06	-52.94	-52.94	-17.16	-52.94	-52.94	-17.18	-52.94	10.16	42.94	84.42	136.24	188.08	264.81
23.60	-46.30	-24.70	-46.30	-46.30	-4.53	-46.30	-46.30	-9.80	-46.30	-46.30	-18.72	-46.30	-46.30	-19.74	-46.30	16.80	48.98	81.96	144.68	208.11	270.48
19.60	-34.27	-13.47	-34.27	-34.27	3.91	-34.27	-34.27	-3.26	-34.27	-34.27	-4.50	-34.27	-34.27	-4.51	-34.27	22.82	59.26	96.10	160.51	211.33	276.67
16.60	-28.48	-8.66	-28.48	-28.48	8.76	-28.48	-28.48	0.42	-28.48	-28.48	1.51	-34.27	-34.27	1.48	-34.27	26.83	61.31	104.11	158.91	217.33	-34.27
13.60	-22.91	-1.12	-22.91	-22.91	15.27	-22.91	-22.91	14.98	-22.91	-22.91	7.30	-28.48	-28.48	7.36	-28.48	34.62	67.00	109.90	162.70	-28.48	-28.48
10.60	-17.56	4.22	-17.56	-17.56	20.62	-17.56	-17.56	20.34	-17.56	-17.56	12.87	-22.91	-22.91	12.86	-22.91	40.19	72.57	115.46	-22.91	-22.91	-22.91
7.60	-12.43	9.37	-12.43	-12.43	25.75	-12.43	-12.43	25.47	-12.43	-12.43	18.22	-17.56	-17.56	18.30	-17.56	45.54	77.82	-17.56	-17.56	-17.56	-17.56
4.60	-7.51	14.28	-7.51	-7.51	30.68	-7.51	-7.51	30.38	-7.51	-7.51	23.36	-12.43	-12.43	23.33	-12.43	50.87	-12.43	-12.43	-12.43	-12.43	-12.43
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mpos mayo/mog mayorado		ESPESOR CANTO	ESPESOR ALMA
356.41	-71.47	0.00	4.00	12.00
366.16	-62.77	3.00	3.80	12.00
373.31	-54.37	8.00	3.80	12.00
293.40	-46.38	8.00	3.40	12.00
219.64	-38.45	12.00	3.20	12.00
153.88	-30.93	16.00	3.00	12.00
105.18	-23.71	16.00	2.80	12.00
66.40	-16.79	21.00	2.60	12.00
41.30	-10.14	24.00	2.40	12.00
0.00	0.00	30.00	2.20	12.00

TAU pos	TAU neg
321.26	-74.45
340.32	-66.38
349.57	-58.64
305.63	-49.19
228.60	-40.06
162.37	-32.22
109.51	-24.69
77.25	-17.48
43.12	-10.57
0.00	0.00



```
L 'cm'  Q T
A
T  /
0.000 0.000  /
90.000 0.000  /
90.000 111.500  /
46.200 111.500  /
46.200 281.000  /
90.000 281.000  /
90.000 392.000  /
0.000 392.000  /
0.000 281.000  /
43.800 281.000  /
43.800 111.500  /
0.000 111.500 M 'H400'

* B 'B1'
P 6.500 35.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 17.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 35.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 17.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 52.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 52.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 69.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 69.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 86.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 86.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 103.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 103.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 342.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 342.000 2 d 36 M 'DYWIDAG' V 0.004700
P 6.500 362.000 2 d 36 M 'DYWIDAG' V 0.004700
P 83.500 362.000 2 d 36 M 'DYWIDAG' V 0.004700
* S 'm' 't'  /
0.000 3108.600 0.000 0.000  /
0.000 -967.340 0.000 0.000  /
0.000 3108.600 0.000 0.000
*
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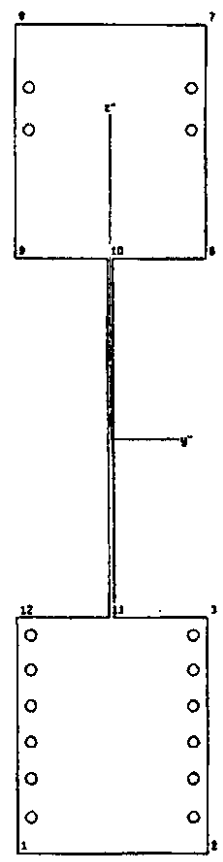
Características mecánicas de la sección:
Area : Ax= 2.043 [m2]

Mstb. 1 : 25.0



Sección :"PESCANTE" Armadura :"B1"
Tipo : tipo viga/ Genérico Unidades :[cm]

Sección parcial 1: Hormigón = H400

Pto	Coord-Y	Coord-Z	Pto	Coord-Y	Coord-Z
1	0.00	0.00	2	90.00	0.00
3	90.00	111.50	4	46.20	111.50
5	46.20	281.00	6	90.00	281.00
7	90.00	392.00	8	0.00	392.00
9	0.00	281.00	10	43.80	281.00
11	43.80	111.50	12	0.00	111.50

Momentos de inercia : Iy= 4.162 [m4] Iz= 0.135171 [m4]
Inercia a torsión : Ix= 0.664404 [m4] (de un círculo del mismo área)

Posición del centro de gravedad: ys= 0.450000 [m] zs= 1.958 [m]

	I:	R=dist.borde [m]	W=I/R [m3]	W/Ax [m]
izq.	Iz	-0.450	-0.300379	0.147
dch.	Iz	0.450	0.300379	-0.147
abajo	Iy	-1.958	-2.126	1.038
arriba	Iy	1.962	2.122	-1.040

Armadura: "B1"

N°	Nom.mat	Cod.dim.	Area [cm2]	y1 [cm]	z1 [cm]	y2 [cm]	z2 [cm]
1	DYWIDAG	(0)	20.36	6.50	35.00		
2	DYWIDAG	(0)	20.36	6.50	17.00		
3	DYWIDAG	(0)	20.36	83.50	35.00		
4	DYWIDAG	(0)	20.36	83.50	17.00		
5	DYWIDAG	(0)	20.36	6.50	52.00		
6	DYWIDAG	(0)	20.36	83.50	52.00		
7	DYWIDAG	(0)	20.36	6.50	69.00		
8	DYWIDAG	(0)	20.36	83.50	69.00		
9	DYWIDAG	(0)	20.36	6.50	86.00		
10	DYWIDAG	(0)	20.36	83.50	86.00		
11	DYWIDAG	(0)	20.36	6.50	103.00		
12	DYWIDAG	(0)	20.36	83.50	103.00		
13	DYWIDAG	(0)	20.36	6.50	342.00		
14	DYWIDAG	(0)	20.36	83.50	342.00		
15	DYWIDAG	(0)	20.36	6.50	362.00		
16	DYWIDAG	(0)	20.36	83.50	362.00		

Total: 325.72 Cuantía de armadura: 1.594 [o/o]

Cód. dimensionamiento: (0) = As constante
Cód. dimensionamiento: (1) = Aumentar As en zonas comprimida y traccionada
Cód. dimensionamiento: (2) = Aumentar As solo en zona traccionada

Armaduras pretensadas :

N°	Def.Impuesta	N°	Def.Impuesta	N°	Def.Impuesta
1	4.700E-0003	2	4.700E-0003	3	4.700E-0003
4	4.700E-0003	5	4.700E-0003	6	4.700E-0003
7	4.700E-0003	8	4.700E-0003	9	4.700E-0003
10	4.700E-0003	11	4.700E-0003	12	4.700E-0003
13	4.700E-0003	14	4.700E-0003	15	4.700E-0003
16	4.700E-0003				

¡No se han definido valores para el cálculo a cortante!

Características del material:

Nom.Mat.	Módulo E [kp/cm2]	0.85*fcd,fyd [kp/cm2]	eps-fc [o/oo]	fct [kp/cm2]	fcv [kp/cm2]	fcw,mín [kp/cm2]
"H400"	380000.0	-226.600	-2.000	0.0	8.170	400.000
"DYWIDAG"	2.00E+06	10800.0				

Leyenda:

fcd,fyd resistencia de cálculo del hormigón,acero
eps-fc deformación al final de la parábola (fig.2.3, cap.2.2)
fct resistencia de cálculo a tracción del hormigón
fcv resistencia virtual de cálculo del hormigón a esfuerzo cortante

4	83.500	17.000	4.700	-0.228	4.472	-455.289	8944.711
5	6.500	52.000	4.700	-0.255	4.445	-510.082	8889.918

Comprobación de las tensiones en el estado II: Viga "PESCANTE"/"B1"

Esfuerzos (E.L.S.) Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
				3108.600	

Deformaciones y tensiones extremas:

3	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	Estado-I [kp/cm2]	
Hormigón-Min	90.00	392.00	-0.521	-198.047	-191.206	"H400"
Armadura-Min	6.50	362.00	-0.498	8404.610		"DYWIDAG"
Hormigón-Max	0.00	0.00	-0.214	-81.448	-72.607	"H400"
Armadura-Max	6.50	17.00	-0.228	8944.711		"DYWIDAG"

Esfuerzos : Rigideces secantes: Deformaciones:

N =	0.000 [t]	*EAx=	--1-- [t]	-3.608812E-04	
My=	3108.600 [tm]	EIy=	--1-- [tm2]	7.827550E-05	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	2.567374E-20	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección:

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	-0.214	-72.607	-81.448	-2854.196	51.98
90.00	0.00	-0.214	-72.607	-81.448		
90.00	111.50	-0.302	-106.341	-114.614		
46.20	111.50	-0.302	-106.341	-114.614		
46.20	281.00	-0.434	-157.623	-165.031		
90.00	281.00	-0.434	-157.623	-165.031		
90.00	392.00	-0.521	-191.206	-198.047		
0.00	392.00	-0.521	-191.206	-198.047		
0.00	281.00	-0.434	-157.623	-165.031		
43.80	281.00	-0.434	-157.623	-165.031		
43.80	111.50	-0.302	-106.341	-114.614		
0.00	111.50	-0.302	-106.341	-114.614		

Suma fuerzas de pretensado iniciales (usado en cálculo estado I)
Np= -3061.771 [t] Myp= -1652.293 [tm] Mzp=-2.37167E-13 [tm]

Deformaciones y tensiones de armadura de pretensado:

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	-0.242	4.458	-483.468	8916.532
2	6.500	17.000	4.700	-0.228	4.472	-455.289	8944.711
3	83.500	35.000	4.700	-0.242	4.458	-483.468	8916.532

6	83.500	52.000	4.700	-0.255	4.445	-510.082	8889.918
7	6.500	69.000	4.700	-0.268	4.432	-536.695	8863.305
8	83.500	69.000	4.700	-0.268	4.432	-536.695	8863.305
9	6.500	86.000	4.700	-0.282	4.418	-563.309	8836.691
10	83.500	86.000	4.700	-0.282	4.418	-563.309	8836.691
11	6.500	103.000	4.700	-0.295	4.405	-589.923	8810.077
12	83.500	103.000	4.700	-0.295	4.405	-589.923	8810.077
13	6.500	342.000	4.700	-0.482	4.218	-964.080	8435.920
14	83.500	342.000	4.700	-0.482	4.218	-964.080	8435.920
15	6.500	362.000	4.700	-0.498	4.202	-995.390	8404.610
16	83.500	362.000	4.700	-0.498	4.202	-995.390	8404.610

Comprobación de las tensiones en el estado II: Viga "PESCANTE"/"B1"

Esfuerzos (E.L.S.) Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
				-967.340	

Deformaciones y tensiones extremas:

3	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	Estado-I [kp/cm2]	
Hormigón-Min	90.00	0.00	-0.705	-226.600	-231.136	"H400"
Armadura-Min	83.50	17.00	-0.676	8048.587		"DYWIDAG"
Hormigón-Max	0.00	392.00	-0.034	-12.739	-17.799	"H400"
Armadura-Max	6.50	362.00	-0.085	9230.202		"DYWIDAG"

Esfuerzos		: Rigideces secantes:		Deformaciones:	
N =	0.000 [t]	*EAx=	--1-- [t]	-3.842151E-04	
My=	-967.340 [tm]	EIy=	--1-- [tm2]	-1.712486E-04	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	1.090519E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección:

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	-0.705	-231.136	-226.600	-2751.136	82.38
90.00	0.00	-0.705	-231.136	-226.600		
90.00	111.50	-0.514	-170.455	-195.273		
46.20	111.50	-0.514	-170.455	-195.273		
46.20	281.00	-0.224	-78.208	-84.972		
90.00	281.00	-0.224	-78.208	-84.972		
90.00	392.00	-0.034	-17.799	-12.739		
0.00	392.00	-0.034	-17.799	-12.739		
0.00	281.00	-0.224	-78.208	-84.972		
43.80	281.00	-0.224	-78.208	-84.972		
43.80	111.50	-0.514	-170.455	-195.273		
0.00	111.50	-0.514	-170.455	-195.273		

Np= -3061.771 [t] Myp= -1652.293 [tm] Mzp=-2.37167E-13 [tm]

Deformaciones y tensiones de armadura de pretensado:

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	-0.645	4.055	-1289.763	8110.237
2	6.500	17.000	4.700	-0.676	4.024	-1351.413	8048.587
3	83.500	35.000	4.700	-0.645	4.055	-1289.763	8110.237
4	83.500	17.000	4.700	-0.676	4.024	-1351.413	8048.587
5	6.500	52.000	4.700	-0.616	4.084	-1231.539	8168.461
6	83.500	52.000	4.700	-0.616	4.084	-1231.539	8168.461
7	6.500	69.000	4.700	-0.587	4.113	-1173.314	8226.686
8	83.500	69.000	4.700	-0.587	4.113	-1173.314	8226.686
9	6.500	86.000	4.700	-0.558	4.142	-1115.090	8284.910
10	83.500	86.000	4.700	-0.558	4.142	-1115.090	8284.910
11	6.500	103.000	4.700	-0.528	4.172	-1056.865	8343.135
12	83.500	103.000	4.700	-0.528	4.172	-1056.865	8343.135
13	6.500	342.000	4.700	-0.119	4.581	-238.297	9161.703
14	83.500	342.000	4.700	-0.119	4.581	-238.297	9161.703
15	6.500	362.000	4.700	-0.085	4.615	-169.798	9230.202
16	83.500	362.000	4.700	-0.085	4.615	-169.798	9230.202

Comprobación de las tensiones en el estado II: Viga "PESCANTE"/"B1"

Esfuerzos (E.L.S.) Unidades : [tm]

N	Vy	Vz	Mx	My	Mz
				3108.600	

Deformaciones y tensiones extremas:

3	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	Estado-I [kp/cm2]	
Hormigón-Min	90.00	392.00	-0.521	-198.047	-191.206	"H400"
Armadura-Min	6.50	362.00	-0.498	8404.610		"DYWIDAG"
Hormigón-Max	0.00	0.00	-0.214	-81.448	-72.607	"H400"
Armadura-Max	6.50	17.00	-0.228	8944.711		"DYWIDAG"

Esfuerzos		: Rigideces secantes:		Deformaciones:	
N =	0.000 [t]	*EAx=	--1-- [t]	-3.608812E-04	
My=	3108.600 [tm]	EIy=	--1-- [tm2]	7.827550E-05	[1/m]
Mz=	0.000 [tm]	*EIz=	--1-- [tm2]	2.567374E-20	[1/m]

Aviso: --1-- Sección pretensada !

Suma fuerzas de pretensado iniciales (usado en cálculo estado I)

Deformaciones y tensiones en vertices de la sección:

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	-0.214	-72.607	-81.448	-2854.196	51.98
90.00	0.00	-0.214	-72.607	-81.448		
90.00	111.50	-0.302	-106.341	-114.614		
46.20	111.50	-0.302	-106.341	-114.614		
46.20	281.00	-0.434	-157.623	-165.031		
90.00	281.00	-0.434	-157.623	-165.031		
90.00	392.00	-0.521	-191.206	-198.047		
0.00	392.00	-0.521	-191.206	-198.047		
0.00	281.00	-0.434	-157.623	-165.031		
43.80	281.00	-0.434	-157.623	-165.031		
43.80	111.50	-0.302	-106.341	-114.614		
0.00	111.50	-0.302	-106.341	-114.614		

Suma fuerzas de pretensado iniciales (usado en cálculo estado I)
Np= -3061.771 [t] Myp= -1652.293 [tm] Mzp=-2.37167E-13 [tm]

Deformaciones y tensiones de armadura de pretensado:

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	-0.242	4.458	-483.468	8916.532
2	6.500	17.000	4.700	-0.228	4.472	-455.289	8944.711
3	83.500	35.000	4.700	-0.242	4.458	-483.468	8916.532
4	83.500	17.000	4.700	-0.228	4.472	-455.289	8944.711
5	6.500	52.000	4.700	-0.255	4.445	-510.082	8889.918
6	83.500	52.000	4.700	-0.255	4.445	-510.082	8889.918
7	6.500	69.000	4.700	-0.268	4.432	-536.695	8863.305
8	83.500	69.000	4.700	-0.268	4.432	-536.695	8863.305
9	6.500	86.000	4.700	-0.282	4.418	-563.309	8836.691
10	83.500	86.000	4.700	-0.282	4.418	-563.309	8836.691
11	6.500	103.000	4.700	-0.295	4.405	-589.923	8810.077
12	83.500	103.000	4.700	-0.295	4.405	-589.923	8810.077
13	6.500	342.000	4.700	-0.482	4.218	-964.080	8435.920
14	83.500	342.000	4.700	-0.482	4.218	-964.080	8435.920
15	6.500	362.000	4.700	-0.498	4.202	-995.390	8404.610
16	83.500	362.000	4.700	-0.498	4.202	-995.390	8404.610

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]

Cálculo Resistencia Ultima: Viga "PESCANTE"/"B1"

Solicitación

N	Vy	Vz	Mx	My	Mz
				3108.600	

Unidades : [tm]

Coeficiente de seguridad 1.840

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	0.00	392.00	-3.500	-226.600	"H400"
Armadura-Min	6.50	362.00	-3.181	3038.231	"DYWIDAG"
Hormigón-Max	90.00	0.00	0.670	0.000	"H400"
Armadura-Max	83.50	17.00	0.489	10377.9	"DYWIDAG"

Fibra neutra zn 62.97 cm yn 45.00 cm Angulo 0.0
Ancho zona comprim. 329.03 cm Zona comprimida/Canto útil 1.08

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N =	0.000 [t]	*EAx=	--1--	[t]	-1.321667E-03	
My=	5719.759 [tm]	EIy=	--1--	[tm2]	1.063719E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1--	[tm2]	-6.868431E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	0.670		0.0	-2575.518	123.39
90.00	0.00	0.670		0.0		
90.00	111.50	-0.516		-101.9		
46.20	111.50	-0.516		-101.9		
46.20	281.00	-2.319		-226.6		
90.00	281.00	-2.319		-226.6		
90.00	392.00	-3.500		-226.6		
0.00	392.00	-3.500		-226.6		
0.00	281.00	-2.319		-226.6		
43.80	281.00	-2.319		-226.6		
43.80	111.50	-0.516		-101.9		
0.00	111.50	-0.516		-101.9		

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	-2.665	2.035	-5329.280	4070.720
2	6.500	17.000	4.700	-3.094	1.606	-6188.508	3211.492
3	83.500	35.000	4.700	-2.665	2.035	-5329.280	4070.720
4	83.500	17.000	4.700	-3.094	1.606	-6188.508	3211.492
5	6.500	52.000	4.700	-2.259	2.441	-4517.788	4882.212
6	83.500	52.000	4.700	-2.259	2.441	-4517.788	4882.212
7	6.500	69.000	4.700	-1.853	2.847	-3706.295	5693.705
8	83.500	69.000	4.700	-1.853	2.847	-3706.295	5693.705
9	6.500	86.000	4.700	-1.447	3.253	-2894.803	6505.197
10	83.500	86.000	4.700	-1.447	3.253	-2894.803	6505.197
11	6.500	103.000	4.700	-1.042	3.658	-2083.310	7316.690
12	83.500	103.000	4.700	-1.042	3.658	-2083.310	7316.690
13	6.500	342.000	4.700	4.663	9.363	1400.000	10800.0
14	83.500	342.000	4.700	4.663	9.363	1400.000	10800.0
15	6.500	362.000	4.700	5.140	9.840	1400.000	10800.0
16	83.500	362.000	4.700	5.140	9.840	1400.000	10800.0

Cálculo Resistencia Ultima: Viga "PESCANTE"/"B1"

Solicitación

N	Vy	Vz	Mx	My	Mz
				3108.600	

Unidades : [tm]

Coeficiente de seguridad 1.840

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	0.297	4.997	594.951	9994.951
2	6.500	17.000	4.700	0.489	5.189	977.890	10377.9
3	83.500	35.000	4.700	0.297	4.997	594.951	9994.951
4	83.500	17.000	4.700	0.489	5.189	977.890	10377.9
5	6.500	52.000	4.700	0.117	4.817	233.287	9633.287
6	83.500	52.000	4.700	0.117	4.817	233.287	9633.287
7	6.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
8	83.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
9	6.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
10	83.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
11	6.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
12	83.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
13	6.500	342.000	4.700	-2.968	1.732	-5936.281	3463.719
14	83.500	342.000	4.700	-2.968	1.732	-5936.281	3463.719
15	6.500	362.000	4.700	-3.181	1.519	-6361.769	3038.231
16	83.500	362.000	4.700	-3.181	1.519	-6361.769	3038.231

Cálculo Resistencia Ultima: Viga "PESCANTE"/"B1"

Solicitación

N	Vy	Vz	Mx	My	Mz
				-967.340	

Unidades : [tm]

Coeficiente de seguridad 2.903

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	90.00	0.00	-3.500	-226.600	"H400"
Armadura-Min	83.50	17.00	-3.094	3211.492	"DYWIDAG"
Hormigón-Max	0.00	392.00	5.856	0.000	"H400"
Armadura-Max	6.50	362.00	5.140	10800.0	"DYWIDAG"

Fibra neutra zn 146.64 cm yn 45.00 cm Angulo 0.0
Ancho zona comprim. 146.64 cm Zona comprimida/Canto útil 0.77

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N =	0.000 [t]	*EAx=	--1--	[t]	9.683466E-04	
My=	-2808.427 [tm]	EIy=	--1--	[tm2]	-2.386743E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1--	[tm2]	3.653372E-16	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	-3.500		-226.6	-2169.331	133.49
90.00	0.00	-3.500		-226.6		
90.00	111.50	-0.839		-150.2		
46.20	111.50	-0.839		-150.2		
46.20	281.00	3.207		0.0		
90.00	281.00	3.207		0.0		
90.00	392.00	5.856		0.0		
0.00	392.00	5.856		0.0		
0.00	281.00	3.207		0.0		
43.80	281.00	3.207		0.0		
43.80	111.50	-0.839		-150.2		
0.00	111.50	-0.839		-150.2		

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	0.297	4.997	594.951	9994.951
2	6.500	17.000	4.700	0.489	5.189	977.890	10377.9
3	83.500	35.000	4.700	0.297	4.997	594.951	9994.951
4	83.500	17.000	4.700	0.489	5.189	977.890	10377.9
5	6.500	52.000	4.700	0.117	4.817	233.287	9633.287
6	83.500	52.000	4.700	0.117	4.817	233.287	9633.287
7	6.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
8	83.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
9	6.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
10	83.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
11	6.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
12	83.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
13	6.500	342.000	4.700	-2.968	1.732	-5936.281	3463.719

Deformaciones y tensiones extremas (Rotura):

1	Coordenadas y [cm]	z [cm]	Eps [o/oo]	Estado-II [kp/cm2]	
Hormigón-Min	0.00	392.00	-3.500	-226.600	"H400"
Armadura-Min	6.50	362.00	-3.181	3038.231	"DYWIDAG"
Hormigón-Max	90.00	0.00	0.670	0.000	"H400"
Armadura-Max	83.50	17.00	0.489	10377.9	"DYWIDAG"

Fibra neutra zn 62.97 cm yn 45.00 cm Angulo 0.0
Ancho zona comprim. 329.03 cm Zona comprimida/Canto útil 1.08

Esfuerzos (Rotura) : Rigideces secantes: Deformaciones:

N =	0.000 [t]	*EAx=	--1--	[t]	-1.321667E-03	
My=	5719.759 [tm]	EIy=	--1--	[tm2]	1.063719E-03	[1/m]
Mz=	0.000 [tm]	*EIz=	--1--	[tm2]	-6.868431E-13	[1/m]

Aviso: --1-- Sección pretensada !

Deformaciones y tensiones en vertices de la sección (Rotura):

Coordenadas y [cm]	z [cm]	Eps [o/oo]	Est. I [kp/cm2]	Est. II [kp/cm2]	Dist.Fuerz.Compr. [t]	[cm]
0.00	0.00	0.670		0.0	-2575.518	123.39
90.00	0.00	0.670		0.0		
90.00	111.50	-0.516		-101.9		
46.20	111.50	-0.516		-101.9		
46.20	281.00	-2.319		-226.6		
90.00	281.00	-2.319		-226.6		
90.00	392.00	-3.500		-226.6		
0.00	392.00	-3.500		-226.6		
0.00	281.00	-2.319		-226.6		
43.80	281.00	-2.319		-226.6		
43.80	111.50	-0.516		-101.9		
0.00	111.50	-0.516		-101.9		

Deformaciones y tensiones de armadura de pretensado (Rotura):

N°	Coordenadas y [cm]	z [cm]	Eps-0 [o/oo]	D-Eps [o/oo]	Eps-tot [o/oo]	D-Sigma-p [kp/cm2]	Sigma-p [kp/cm2
1	6.500	35.000	4.700	0.297	4.997	594.951	9994.951
2	6.500	17.000	4.700	0.489	5.189	977.890	10377.9
3	83.500	35.000	4.700	0.297	4.997	594.951	9994.951
4	83.500	17.000	4.700	0.489	5.189	977.890	10377.9
5	6.500	52.000	4.700	0.117	4.817	233.287	9633.287
6	83.500	52.000	4.700	0.117	4.817	233.287	9633.287
7	6.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
8	83.500	69.000	4.700	-0.064	4.636	-128.378	9271.622
9	6.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
10	83.500	86.000	4.700	-0.245	4.455	-490.042	8909.958
11	6.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
12	83.500	103.000	4.700	-0.426	4.274	-851.706	8548.294
13	6.500	342.000	4.700	-2.968	1.732	-5936.281	3463.719

14	83.500	342.000	4.700	-2.968	1.732	-5[illegible].281	3463.719
15	6.500	362.000	4.700	-3.181	1.519	-6361.769	3038.231

16	83.500	362.000	4.700	-3.181	1.519	-6361.769	3038.231

Parámetros globales de cálculo :

Norma	EH-1991	
Inclinación estándar bielas comprimidas hormigón	45.00	[Grados]
Coeficiente de fluencia phi	0.00	
Factor minoración de la resistencia de la sección	1.00	
Def. máxima en compresión centrada del hormigón	-2.00	[o/oo]
Deformación máxima en flexión en vigas	-3.50	[o/oo]
Def. máxima en tracción del acero en vigas	10.00	[o/oo]
Modo de análisis / Inclinación del eje neutro	flexión esviada	
Cuantía mínima de armadura long. para pilas	0.40	[o/o]
Cuantía máxima de armadura long.	8.00	[o/o]
Modo de pretensado	adherente	

Se usaron coef. de homogeneización para calcular las caract. mecánicas

Modelo para dimensionamiento a cortante:

Usar un canto útil constante en los cálculos a cortante
Se tomará el cortante como tracción longitudinal adicional