

*CONTRATO DE CONSULTORÍA Y ASISTENCIA  
PARA LA REALIZACIÓN DE PRUEBAS DE CARGA  
PARA LA RECEPCIÓN DE PUENTES DE LA  
LÍNEA DE ALTA VELOCIDAD  
MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA.  
TRAMO: MADRID - LLEIDA.  
BASE DE LA CARTUJA.*



*INFORME DE PRUEBA DE CARGA*

*SUBTRAMO 23  
23VI04*

**INFORME DE RESULTADOS Y CONCLUSIONES DE  
LA PRUEBA DE CARGA  
REALIZADA EN LA ESTRUCTURA 23VI04,  
("VIADUCTO SOBRE LA ACEQUIA DE FUENTES DE  
EBRO"), PERTENECIENTE A LA L.A.V.  
MADRID-ZARAGOZA-BARCELONA-FRONTERA  
FRANCESA.  
TRAMO: MADRID-LLEIDA.  
BASE DE LA CARTUJA.**

**MAYO DE 2003**



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## **1.- INTRODUCCIÓN.**

### **1.1.- Introducción.**

A instancias del G.I.F., GEOCISA redacta el presente documento cuyo objeto es la presentación y análisis de los resultados obtenidos durante la realización de la preceptiva Prueba de Carga efectuada con anterioridad a la recepción de la estructura “Viaducto sobre la acequia de Fuentes de Ebro”, perteneciente a la L.A.V. Madrid-Zaragoza-Barcelona-Frontera francesa. Tramo: Madrid-Lleida. Base de La Cartuja.

### **1.2.- Antecedentes.**

La redacción del presente informe se efectúa dentro del marco del Contrato de Consultoría y Asistencia Técnica (Clave AV 017/00) para la “Realización de las Pruebas de Carga para la recepción de puentes de la Línea de Alta Velocidad Madrid – Zaragoza – Barcelona – Frontera Francesa. Tramo: Madrid – Lleida. Base de La Cartuja”, suscrito por GEOCISA con el GIF el 31 de mayo de 2001.

## **2.- OBJETO.**

El objeto del documento es presentar las actividades desarrolladas en la estructura de referencia exponiendo los resultados obtenidos en la misma y realizando el análisis de dichos resultados, a fin de poder emitir las conclusiones y recomendaciones oportunas.

Las actividades principales desarrolladas han consistido:

- Inspección de la estructura.
- Redacción del proyecto de Prueba de Carga.
- Realización de la Prueba de Carga.
- Análisis de los resultados.
- Redacción de la ficha de seguimiento.
- Planimetría de la estructura (si procede).

La inspección preliminar tuvo lugar el día 13 de febrero de 2002 y la ejecución de la prueba de carga el día 25 de septiembre de 2002.

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### **3.- DESCRIPCIÓN DE LA OBRA.**

De acuerdo con los datos obtenidos en la Inspección Previa realizada el día 13 de febrero de 2002 y con la documentación suministrada por el Peticionario, se describen a continuación las principales características de la estructura.

La estructura soportará el tráfico ferroviario generado por la L.A.V. Madrid-Zaragoza-Barcelona-Frontera francesa y salva un camino y la acequia de Fuentes de Ebro.

Se trata de una estructura hiperestática de planta recta sin esviaje, compuesta por cinco vanos de 15+25x3+15 metros de luz de cálculo y un ancho total de 14 m.

La solución estructural consiste en un tablero compuesto por dos vigas artesa de hormigón pretensado y losa superior in situ. El tablero está apoyado en los estribos y en las pilas mediante apoyos tipo POT. La losa de compresión tiene un canto medio de 0'25 metros. El canto total del tablero es de 1'70 metros. El tipo de hormigón de las vigas del tablero es HP-50 y la losa HA-30.

Las pilas son de fuste doble, con sección variable. Las pilas son de hormigón armado. Los estribos son de hormigón armado y son cerrados con aletas. La plataforma está compuesta por dos vías de ferrocarril, protegidas exteriormente por una barandilla metálica y una barrera antivandálica.

La numeración de los elementos de la estructura comienza en el estribo más próximo a Madrid.



#### **4.- INSPECCIÓN PRELIMINAR.**

La inspección previa a la realización de la prueba de carga fue realizada por un equipo de GEOCISA bajo la dirección del Ingeniero de Caminos D. Gonzalo Arias Hofman.

Dicha inspección se llevó a cabo el día 13 de febrero de 2002. Se comprobó que la definición geométrica de la estructura coincidía con la documentación facilitada por G.I.F.

Tanto en el momento de realizar la inspección como durante la realización de la prueba de carga, la estructura se encontraba completamente finalizada.

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## **5.- ANÁLISIS DEL PROYECTO DE LA ESTRUCTURA.**

La documentación facilitada consiste en un CD-Rom en el que se incluye el Proyecto Construido en formato PDF, disponiéndose tanto de Planos como del Anejo de Cálculo correspondiente. En el Anejo 2A contenido dentro del ANEJO 2 - Proyecto de Prueba de Carga, se incluye copia de algunos de los planos facilitados.

### **5.1.- Definición completa de elementos.**

Se trata de una estructura hiperestática de planta recta sin esviaje, compuesta por cinco vanos de 15+25x3+15 metros de luz de cálculo y un ancho total de 14 m.

La solución estructural consiste en un tablero compuesto por dos vigas artesa de hormigón pretensado y losa superior in situ. El tablero está apoyado en los estribos y en las pilas mediante apoyos tipo POT. La losa de compresión tiene un canto medio de 0'25 metros. El canto total del tablero es de 1'70 metros. El tipo de hormigón de las vigas del tablero es HP-40 y la losa HA-30.

Las pilas son de fuste doble, con sección variable. Las pilas son de hormigón armado. Los estribos son de hormigón armado y son cerrados con aletas. La plataforma está compuesta por dos vías de ferrocarriles, protegidas exteriormente por una barandilla metálica y una barrera antivandálica.

## 5.2.- Acciones consideradas.

Las acciones consideradas en el cálculo de la estructura se ajustan a la Instrucción de Acciones en Puentes de Ferrocarril. Las hipótesis empleadas fueron las siguientes:

- Peso propio de las vigas y de la losa.
- Carga muerta debida al balasto, vías, traviesas, pendienteado, soportes de catenaria, imposta y barandilla.
- Sobrecargas móviles: las envolventes de esfuerzos debidas a los trenes de carga de IPF-75 y EC-1.
- El coeficiente de impacto correspondiente.
- Los esfuerzos locales que las acciones descritas producen.
- Los esfuerzos horizontales debidos al efecto de lazo, peralte y fuerza centrífuga.

Se estudiaron diversas combinaciones de estas cargas, disponiendo la sobrecarga sobre una vía o las dos, y con ripado de las vías 30 cm o vías centradas.

### **5.3.- Modelización empleada.**

Para modelizar el tablero se desarrolló un modelo de emparrillado plano, del que se obtuvieron los esfuerzos transversales y los esfuerzos longitudinales incluyendo el efecto transversal de las cargas y de la geometría de la estructura, formado por:

- Dos barras longitudinales con las características mecánicas de las vigas más la losa de compresión (con el ancho eficaz)
- Dos barras longitudinales de borde con las características mecánicas longitudinales de la losa.
- Barras transversales con las características mecánicas transversales de la losa.

#### 5.4.- Materiales y coeficientes de cálculo.

Hay que reseñar que el proyecto constructivo fue calculado estando vigente la EH-91, en la que se consideran hormigones como el H-100 (nomenclatura EH-91) que en la EHE no se tienen en cuenta. En cuanto a los hormigones, se han empleado los siguientes tipos:

- Cajones prefabricados: HP-50  $\gamma=1,40$
- Losa: HA-30 -  $\gamma=1,50$

En cuanto a los aceros, se han empleado los siguientes tipos:

- Activo:

En torones de 0'6 ":  $f_{max,k}=19.000 \text{ kg/cm}^2$ ;  $f_{y,k}=17.100 \text{ kg/cm}^2$

En barras:  $f_{max,k}=1.030 \text{ N/mm}^2$ ;  $f_{y,k}=835 \text{ N/mm}^2$

- Pasivas: B-500 S -  $\gamma=1,10$  (prefabricación) y  $\gamma=1,15$  (in situ)

El nivel de control de la ejecución se consideró intenso.

#### 5.5.- Evaluación de la situación estructural.

El cálculo de la estructura es correcto y acorde a la normativa vigente.

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## **6.- PLAN DE PRUEBAS.**

La programación de los ensayos coincidió con lo previsto en el Proyecto de Prueba de carga, redactado por GEOCISA.

En el Anejo 2 se adjunta el Proyecto de Prueba de Carga original.

Se exponen a continuación las distintas etapas que constituyeron el plan de prueba de la estructura analizada.

### **6.1.- Acciones reproducidas.**

Las sobrecargas a utilizar en las pruebas fueron suministradas por el Peticionario. Éstas consistieron en dos locomotoras (tipo serie 37 inglesa) de 1.180 kN de peso total cada una de ellas y cuatro tolvas tipo GIF de 800 kN de peso cada una de ellas.

Se realizaron siete estados de carga.

| <b>Nº de Estado</b> | <b>Vanos sobre los que se sitúan las sobrecargas</b> |
|---------------------|------------------------------------------------------|
| 1                   | 1 y 2                                                |
| 2                   | 2 y 3                                                |
| 3                   | 3 y 4                                                |
| 4                   | 4 y 5                                                |
| 5                   | 1 y 3                                                |
| 6                   | 2 y 4                                                |
| 7                   | 3 y 5                                                |

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La colocación de las sobrecargas se realizó del siguiente modo:

- En el caso de vanos contiguos, se situó el eje delantero del primer bogie de cada una de las locomotoras sobre el eje de la pila frontal del vano cargado de mayor numeración, seguidas de dos tolvas por vía.
- En el caso de vanos alternos, en el vano de mayor numeración se situó el eje delantero del primer bogie de cada una de las locomotoras sobre el eje de la pila frontal de dicho vano. En el otro vano cargado se situaron dos tolvas, con la condición de que el eje delantero del primer bogie de la primera tolva estuviera situado sobre la pila frontal de este vano.

Las sobrecargas empleadas fueron:

| Sobrecarga | Tipo                        | Carga total (KN) |
|------------|-----------------------------|------------------|
| 1          | Locomotora serie 37 inglesa | 1.180            |
| 2          | Locomotora serie 37 inglesa | 1.180            |
| 3          | Tolva tipo GIF              | 800              |
| 4          | Tolva tipo GIF              | 800              |
| 5          | Tolva tipo GIF              | 800              |
| 6          | Tolva tipo GIF              | 800              |

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A continuación se detallan las pruebas realizadas con el tren de carga descrito:

**Pruebas estáticas:**

Los estados de carga de la prueba son los que producen las máximas flexiones sobre el tablero.

Las medidas se realizaron de acuerdo con la siguiente secuencia:

- Escalón 0: Medida de lecturas iniciales.
- Escalón 1: Colocación de la primera composición de sobrecargas en la vía 1.
- Escalón 2: Colocación de la segunda composición de sobrecargas en la vía 2.
- Escalón 3: Estabilización, medida y registro de las lecturas.
- Escalón 4: Medida y registro de las lecturas durante un tiempo no inferior a 10 minutos, comprobando la estabilidad de las medidas.
- Escalón 5: Descarga de la primera composición de sobrecargas de la vía 2.
- Escalón 6: Descarga de la segunda composición de sobrecargas de la vía 1.
- Escalón 7: Realización de lecturas comprobando que se alcanza la recuperación de, al menos, el 80% de la flecha máxima medida en un tiempo no superior al mantenimiento de la carga.



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**Pruebas dinámicas:**

Las pruebas dinámicas se realizaron con una sola locomotora circulando a lo largo de una de las vías, para la obtención de parámetros tales como el coeficiente de impacto, el amortiguamiento y la frecuencia de vibración.

Se realizaron las siguientes pruebas dinámicas:

- Paso de una sola locomotora circulando a lo largo de una de las vías a lo largo de la estructura a 5 Km/h.
- Paso de una sola locomotora circulando a lo largo de una de las vías a lo largo de la estructura a 30 Km/h.
- Paso de una sola locomotora circulando a lo largo de una de las vías a lo largo de la estructura a la máxima velocidad posible.
- Una prueba de frenado en la que la locomotora adquirió su velocidad máxima y frena a su paso por el centro del vano nº 3.

## 6.2.- Puntos de medida.

Las medidas a realizar durante la prueba fueron las siguientes:

- Descensos verticales (flechas)
- Deformaciones (bandas)
- Aceleraciones

La instrumentación de la estructura se realizó en un grupo.

Se midieron dos puntos de flecha en la sección centro de luz de cada vano, así como las deformaciones en dos puntos de la sección centro de luz de cada vano. También se instrumentaron dos puntos de medida de descensos verticales en cada apoyo (pila o estribo).

En las pruebas dinámicas se registraron aceleraciones verticales mediante la colocación de un acelerómetro situado en el centro de luz del vano nº 3.

### 6.3.- Equipos utilizados.

Los equipos empleados durante la prueba fueron los siguientes:

Para la medida de flechas en centro de vano se emplearon L.V.D.T.'s (Linear Variable Differential Transducers) SOLARTRON ST-1000 de 25 mm de rango y 0'1 mm de incertidumbre (código 8185 a 8194 en centro de luz) y para la medida de deformaciones bandas extensométricas del tipo PL-60 de longitud activa, dotadas con un complemento de puente de Wheatestone contiguo a cada banda.

Para la medida de flechas en descenso de apoyos se emplearon transductores extensométricos constituidos por aros metálicos flexibles instrumentados con bandas extensométricas modelo OV-1 con un rango de 10 mm. con una incertidumbre de  $\pm 0'02$  mm (código 8201 a 8204 y 8275 a 8282).

En las pruebas dinámicas se registraron aceleraciones verticales mediante la colocación de un acelerómetro situado en el centro de luz del vano nº 3. El acelerómetro que se utilizó fue del tipo servoacelerómetro SCHAEVITZ, mod. A-225-3001, con un rango de 0-47 Hz con compensación interna de 1 g, para medida de aceleraciones verticales lineales (código 8052).

#### 6.4.- Resultados previstos.

En el Proyecto de Prueba de Carga se obtuvieron las flechas en los puntos instrumentados durante la prueba, exponiéndose a continuación el resumen de los valores calculados.

Los valores teóricos de deformaciones se recalcularon previamente a la redacción del informe, al haberse detectado un error en los calculados para el proyecto de prueba de carga. Los valores aquí indicados son los correctos.

##### Estado 1

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 1    | G-1-1 | 20         |
| 1    | G-1-2 | 3          |
| 2    | G-2-1 | 69         |
| 2    | G-2-2 | 72         |
| 1    | P-1-1 | -0'15      |
| 1    | P-1-2 | 0'13       |
| 2    | P-2-1 | 2'61       |
| 2    | P-2-2 | 2'44       |
| 3    | P-3-1 | -0'70      |
| 3    | P-3-2 | -1'86      |
| 4    | P-4-1 | 0'11       |
| 4    | P-4-2 | 0'25       |
| 5    | P-5-1 | -0'01      |
| 5    | P-5-2 | 0'04       |

##### Estado 2

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 2    | G-2-1 | 49         |
| 2    | G-2-2 | 41         |
| 3    | G-3-1 | 61         |
| 3    | G-3-2 | 68         |
| 1    | P-1-1 | -0'35      |
| 1    | P-1-2 | -0'25      |
| 2    | P-2-1 | 1'18       |
| 2    | P-2-2 | 1'50       |
| 3    | P-3-1 | 2'36       |
| 3    | P-3-2 | 2'02       |
| 4    | P-4-1 | -0'62      |
| 4    | P-4-2 | -0'47      |
| 5    | P-5-1 | -0'07      |
| 5    | P-5-2 | 0'16       |

## Estado 3

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 3    | G-3-1 | 51         |
| 3    | G-3-2 | 43         |
| 4    | G-4-1 | 60         |
| 4    | G-4-2 | 64         |
| 1    | P-1-1 | 0'10       |
| 1    | P-1-2 | 0'04       |
| 2    | P-2-1 | -0'60      |
| 2    | P-2-2 | -0'38      |
| 3    | P-3-1 | 1'30       |
| 3    | P-3-2 | 1'65       |
| 4    | P-4-1 | 2'17       |
| 4    | P-4-2 | 1'89       |
| 5    | P-5-1 | -0'40      |
| 5    | P-5-2 | -0'60      |

## Estado 4

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 4    | G-4-1 | 81         |
| 4    | G-4-2 | 74         |
| 5    | G-5-1 | -16        |
| 5    | G-5-2 | -2         |
| 1    | P-1-1 | -0'04      |
| 1    | P-1-2 | -0'01      |
| 2    | P-2-1 | 0'28       |
| 2    | P-2-2 | 0'13       |
| 3    | P-3-1 | -1'23      |
| 3    | P-3-2 | -0'80      |
| 4    | P-4-1 | 2'73       |
| 4    | P-4-2 | 2'92       |
| 5    | P-5-1 | -0'08      |
| 5    | P-5-2 | -0'40      |

## Estado 5

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 1    | G-1-1 | 47         |
| 1    | G-1-2 | 51         |
| 3    | G-3-1 | 68         |
| 3    | G-3-2 | 68         |
| 1    | P-1-1 | 0'85       |
| 1    | P-1-2 | 0'75       |
| 2    | P-2-1 | -1'23      |
| 2    | P-2-2 | -0'97      |
| 3    | P-3-1 | 2'50       |
| 3    | P-3-2 | 2'50       |
| 4    | P-4-1 | -0'64      |
| 4    | P-4-2 | -1'04      |
| 5    | P-5-1 | 0'07       |
| 5    | P-5-2 | 0'17       |

## Estado 6

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 2    | G-2-1 | 82         |
| 2    | G-2-2 | 86         |
| 4    | G-4-1 | 70         |
| 4    | G-4-2 | 66         |
| 1    | P-1-1 | -0'86      |
| 1    | P-1-2 | -0'50      |
| 2    | P-2-1 | 3'30       |
| 2    | P-2-2 | 3'11       |
| 3    | P-3-1 | -1'70      |
| 3    | P-3-2 | -1'80      |
| 4    | P-4-1 | 2'40       |
| 4    | P-4-2 | 2'60       |
| 5    | P-5-1 | -0'40      |
| 5    | P-5-2 | -0'77      |

Estado 7

| VANO | PUNTO | Res. prev. |
|------|-------|------------|
| 3    | G-3-1 | 86         |
| 3    | G-3-2 | 86         |
| 5    | G-5-1 | 33         |
| 5    | G-5-2 | 27         |
| 1    | P-1-1 | 0'22       |
| 1    | P-1-2 | 0'08       |
| 2    | P-2-1 | -1'35      |
| 2    | P-2-2 | -0'80      |
| 3    | P-3-1 | 3'40       |
| 3    | P-3-2 | 3'30       |
| 4    | P-4-1 | -1'14      |
| 4    | P-4-2 | -1'60      |
| 5    | P-5-1 | 0'54       |
| 5    | P-5-2 | 0'67       |

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## **7.- PRUEBA DE CARGA.**

### **7.1.- Descripción.**

Los ensayos de prueba de carga fueron realizados por un equipo especializado de GEOCISA, bajo la Dirección del Ingeniero de Caminos D. Carlos Rodríguez López el día 25 de septiembre de 2002.

Tanto la instrumentación como la realización de los ensayos se efectuaron de acuerdo con lo estipulado en el Proyecto de Prueba de Carga, descrito en el apartado nº 6 del presente documento.

La secuencia de realización de las pruebas estáticas y pruebas dinámicas fue la siguiente:

|              |          | Pruebas Estáticas |            | Pruebas Dinámicas |            |
|--------------|----------|-------------------|------------|-------------------|------------|
|              | Día      | Hora inicio       | Hora final | Hora inicio       | Hora final |
| primer grupo | 25/09/02 | 15:40             | 18:40      | 15:16             | 15:31      |

Durante el desarrollo de las pruebas la temperatura se mantuvo alrededor de los 22º C y la humedad alrededor del 30%. En el Anejo 4 se adjunta el gráfico de temperaturas y humedades.



## **7.2.- Resultados obtenidos.**

### **Pruebas estáticas**

Una vez estabilizadas las medidas se obtienen los valores correspondientes a la prueba estática, que se acompañan en las tablas adjuntas.

A continuación se presenta la interpretación de algunas de las columnas de la tabla antes mencionada.

La columna "Flecha Obtenida" corresponde a las flechas medidas en cada caso por el captador correspondiente.

La columna "Flecha Neta" se obtiene restando a la anterior los descensos de apoyos de la estructura.

En la columna "Flecha remanente" se encuentra los valores residuales de flecha una vez descargado el puente, permitiéndose constatar si existe una adecuada recuperación de la estructura.

Se completa esta información con los gráficos de las pruebas estáticas que se incluyen en el Anejo 4.

No se consideran en el análisis los resultados obtenidos por los captadores P-1-1 y P-4-2, ya que están afectados por un factor de escala incorrecto.

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 1          | CARGA VANO/ VANOS |       | 1      | a         | 2      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | 0'26              |       |        | 0'12      | 69     |
| 1                                 | E-1-1-2 |            | 0'22              |       |        | 0'07      | >100   |
| 1                                 | E-1-2-1 |            | 0'24              |       |        | 0'02      | >100   |
| 1                                 | E-1-2-2 |            | 0'30              |       |        | 0'09      | 90     |
| 2                                 | E-2-1-1 |            | 0'18              |       |        | 0'03      | 100    |
| 2                                 | E-2-1-2 |            | 0'13              |       |        | 0'25      | -77    |
| 3                                 | E-3-1-1 |            | -0'05             |       |        | 0'10      | >100   |
| 3                                 | E-3-1-2 |            | 0'08              |       |        | 0'13      | 13     |
| 4                                 | E-4-1-1 |            | 0'10              |       |        | 0'11      | 10     |
| 4                                 | E-4-1-2 |            | 0'14              |       |        | 0'17      | 0      |
| 5                                 | E-5-1-1 |            | 0'12              |       |        | 0'05      | >100   |
| 1                                 | G-1-1   | 20         | 13                |       | 65     | 6         | 77     |
| 2                                 | G-2-1   | 69         | 68                |       | 99     | 12        | 88     |
| 2                                 | G-2-2   | 72         | -                 |       |        | -         | -      |
| 3                                 | G-3-1   |            | -10               |       |        | 11        | >100   |
| 3                                 | G-3-2   |            | -12               |       |        | 9         | >100   |
| 4                                 | G-4-1   |            | 7                 |       |        | 14        | -86    |
| 4                                 | G-4-2   |            | 17                |       |        | 18        | 12     |
| 5                                 | G-5-1   |            | 9                 |       |        | 15        | -22    |
| 5                                 | G-5-2   |            | 14                |       |        | 18        | 0      |
| 1                                 | P-1-1   | -0'15      | 0'05              | -0'20 | 133    | 0'00      | >100   |
| 1                                 | P-1-2   | 0'13       | 0'44              | 0'18  | 138    | 0'06      | 89     |
| 2                                 | P-2-1   | 2'61       | 2'72              | 2'51  | 96     | 0'21      | 93     |
| 2                                 | P-2-2   | 2'44       | 3'20              | 2'99  | 122    | 0'20      | 95     |
| 3                                 | P-3-1   | -0'70      | -0'52             | -0'59 | 84     | 0'04      | >100   |
| 3                                 | P-3-2   | -1'86      | -0'74             | -0'85 | 45     | 0'02      | >100   |
| 4                                 | P-4-1   | 0'11       | 0'19              | 0'17  | 150    | 0'06      | >100   |
| 4                                 | P-4-2   | 0'25       | 0'27              | 0'16  | 64     | 0'08      | 81     |
| 5                                 | P-5-1   | -0'01      | 0'07              | -0'04 | 400    | 0'07      | 14     |
| 5                                 | P-5-2   | 0'04       | 0'05              | -0'07 | -175   | 0'07      | 20     |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 2          | CARGA VANO/ VANOS |       | 2      | a         | 3      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | -0'06             |       |        | 0'01      | >100   |
| 1                                 | E-1-1-2 |            | -0'07             |       |        | -0'01     | >100   |
| 1                                 | E-1-2-1 |            | -0'04             |       |        | 0'02      | >100   |
| 1                                 | E-1-2-2 |            | 0'10              |       |        | 0'03      | >100   |
| 2                                 | E-2-1-1 |            | 0'22              |       |        | 0'01      | >100   |
| 2                                 | E-2-1-2 |            | 0'24              |       |        | 0'09      | 96     |
| 3                                 | E-3-1-1 |            | 0'25              |       |        | 0'03      | 96     |
| 3                                 | E-3-1-2 |            | 0'09              |       |        | 0'09      | 22     |
| 4                                 | E-4-1-1 |            | 0'02              |       |        | 0'02      | >100   |
| 4                                 | E-4-1-2 |            | 0'06              |       |        | 0'07      | 67     |
| 5                                 | E-5-1-1 |            | 0'05              |       |        | -0'04     | >100   |
| 1                                 | G-1-1   |            | -14               |       |        | 3         | >100   |
| 1                                 | G-1-2   |            | -9                |       |        | -2        | 100    |
| 2                                 | G-2-1   | 49         | 37                |       | 76     | 9         | 84     |
| 3                                 | G-3-1   | 61         | 60                |       | 98     | 12        | 83     |
| 3                                 | G-3-2   | 68         | 53                |       | 78     | 9         | 87     |
| 4                                 | G-4-2   |            | -14               |       |        | 6         | >100   |
| 5                                 | G-5-1   |            | 8                 |       |        | 1         | >100   |
| 5                                 | G-5-2   |            | 11                |       |        | 3         | >100   |
| 1                                 | P-1-1   | -0'35      | 0'02              | 0'07  | -20    | 0'02      | >100   |
| 1                                 | P-1-2   | -0'25      | -0'20             | -0'22 | 86     | 0'02      | >100   |
| 2                                 | P-2-1   | 1'18       | 1'22              | 1'13  | 96     | -0'01     | >100   |
| 2                                 | P-2-2   | 1'50       | 1'72              | 1'55  | 103    | -0'02     | >100   |
| 3                                 | P-3-1   | 2'36       | 2'54              | 2'31  | 98     | 0'08      | 100    |
| 3                                 | P-3-2   | 2'02       | 2'32              | 2'16  | 107    | 0'11      | 97     |
| 4                                 | P-4-1   | -0'62      | -0'49             | -0'63 | 101    | -0'01     | >100   |
| 4                                 | P-4-2   | -0'47      | -1'00             | -1'08 | 229    | -0'01     | >100   |
| 5                                 | P-5-2   | 0'16       | 0'11              | 0'07  | 42     | -0'02     | >100   |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 3          | CARGA VANO/ VANOS |       | 3      | a         | 4      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | 0'06              |       |        | -0'02     | >100   |
| 1                                 | E-1-1-2 |            | 0'08              |       |        | 0'06      | 63     |
| 1                                 | E-1-2-1 |            | 0'06              |       |        | 0'04      | 83     |
| 1                                 | E-1-2-2 |            | 0'09              |       |        | 0'07      | 89     |
| 2                                 | E-2-1-1 |            | 0'04              |       |        | -0'01     | >100   |
| 2                                 | E-2-1-2 |            | 0'16              |       |        | 0'09      | 50     |
| 3                                 | E-3-1-1 |            | 0'29              |       |        | 0'03      | 93     |
| 3                                 | E-3-1-2 |            | 0'36              |       |        | 0'19      | 67     |
| 4                                 | E-4-1-1 |            | 0'25              |       |        | 0'18      | 40     |
| 4                                 | E-4-1-2 |            | 0'11              |       |        | 0'10      | 36     |
| 5                                 | E-5-1-1 |            | 0'06              |       |        | 0'04      | >100   |
| 1                                 | G-1-1   |            | 10                |       |        | 4         | 80     |
| 1                                 | G-1-2   |            | 8                 |       |        | 2         | >100   |
| 2                                 | G-2-1   |            | -8                |       |        | 3         | >100   |
| 3                                 | G-3-1   | 51         | 36                |       | 71     | 4         | 97     |
| 3                                 | G-3-2   | 43         | 34                |       | 79     | 0         | >100   |
| 4                                 | G-4-1   | 60         | -                 |       |        | -         | -      |
| 4                                 | G-4-2   | 64         | 47                |       | 74     | -1        | >100   |
| 5                                 | G-5-1   |            | -14               |       |        | 0         | 86     |
| 5                                 | G-5-2   |            | -21               |       |        | 0         | >100   |
| 1                                 | P-1-1   | 0'10       | -0'06             | -0'12 | -120   | 0'17      | >100   |
| 1                                 | P-1-2   | 0'04       | 0'02              | -0'07 | -163   | 0'02      | 50     |
| 2                                 | P-2-1   | -0'60      | -0'43             | -0'48 | 80     | -0'06     | 93     |
| 2                                 | P-2-2   | -0'38      | -0'32             | -0'45 | 117    | -0'06     | 88     |
| 3                                 | P-3-1   | 1'30       | 1'49              | 1'33  | 102    | 0'02      | >100   |
| 3                                 | P-3-2   | 1'65       | 1'62              | 1'36  | 82     | 0'05      | 98     |
| 4                                 | P-4-1   | 2'17       | 2'43              | 2'16  | 100    | 0'05      | >100   |
| 4                                 | P-4-2   | 1'89       | 3'65              | 3'42  | 181    | 0'17      | 97     |
| 5                                 | P-5-1   | -0'40      | -0'30             | -0'46 | 114    | -0'05     | 93     |
| 5                                 | P-5-2   | -0'60      | -0'42             | -0'56 | 93     | 0'05      | >100   |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 4          | CARGA VANO/ VANOS |       | 4      | a         | 5      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | 0'04              |       |        | -0'01     | >100   |
| 1                                 | E-1-1-2 |            | 0'02              |       |        | 0'02      | 50     |
| 1                                 | E-1-2-1 |            | 0'02              |       |        | -0'02     | >100   |
| 1                                 | E-1-2-2 |            | 0'03              |       |        | 0'04      | 33     |
| 2                                 | E-2-1-1 |            | -0'04             |       |        | -0'04     | 25     |
| 2                                 | E-2-1-2 |            | -0'01             |       |        | 0'03      | >100   |
| 3                                 | E-3-1-1 |            | 0'05              |       |        | 0'01      | >100   |
| 3                                 | E-3-1-2 |            | 0'19              |       |        | 0'00      | >100   |
| 4                                 | E-4-1-1 |            | 0'22              |       |        | -0'01     | >100   |
| 4                                 | E-4-1-2 |            | 0'16              |       |        | 0'02      | >100   |
| 5                                 | E-5-1-1 |            | 0'21              |       |        | 0'01      | >100   |
| 1                                 | G-1-1   |            | -3                |       |        | -4        | 0      |
| 1                                 | G-1-2   |            | -4                |       |        | -6        | 0      |
| 2                                 | G-2-1   |            | 5                 |       |        | 2         | >100   |
| 2                                 | G-2-2   |            | -                 |       |        | -         | -      |
| 3                                 | G-3-1   |            | -11               |       |        | 2         | >100   |
| 3                                 | G-3-2   |            | -11               |       |        | 1         | >100   |
| 4                                 | G-4-2   | 74         | 57                |       | 77     | 0         | >100   |
| 5                                 | G-5-1   | -16        | 17                |       | -106   | 0         | >100   |
| 5                                 | G-5-2   | -2         | -2                |       | 100    | 0         | >100   |
| 1                                 | P-1-1   | -0'04      | 2'92              | 2'89  | -7225  | -0'08     | >100   |
| 1                                 | P-1-2   | -0'01      | 0'02              | -0'01 | 50     | 0'07      | -200   |
| 2                                 | P-2-1   | 0'28       | 0'12              | 0'13  | 46     | -0'01     | >100   |
| 2                                 | P-2-2   | 0'13       | 0'08              | 0'07  | 54     | -0'03     | >100   |
| 3                                 | P-3-1   | -1'23      | -0'73             | -0'74 | 60     | -0'01     | >100   |
| 3                                 | P-3-2   | -0'80      | -0'50             | -0'59 | 74     | -0'04     | 100    |
| 4                                 | P-4-1   | 2'73       | 2'63              | 2'50  | 91     | 0'05      | >100   |
| 4                                 | P-4-2   | 2'92       | 4'43              | 4'26  | 146    | 0'10      | >100   |
| 5                                 | P-5-1   | -0'08      | 0'54              | 0'33  | -406   | 0'06      | >100   |
| 5                                 | P-5-2   | -0'40      | 0'38              | 0'18  | -46    | 0'10      | 95     |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 5          | CARGA VANO/ VANOS |       | 1      | y         | 3      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | 0'24              |       |        | -0'09     | >100   |
| 1                                 | E-1-1-2 |            | 0'20              |       |        | -0'05     | >100   |
| 1                                 | E-1-2-1 |            | 0'12              |       |        | -0'02     | >100   |
| 1                                 | E-1-2-2 |            | 0'01              |       |        | -0'01     | >100   |
| 2                                 | E-2-1-1 |            | 0'08              |       |        | 0'08      | 50     |
| 2                                 | E-2-1-2 |            | 0'16              |       |        | 0'03      | >100   |
| 3                                 | E-3-1-1 |            | 0'28              |       |        | 0'07      | 93     |
| 3                                 | E-3-1-2 |            | -0'12             |       |        | -0'48     | -217   |
| 4                                 | E-4-1-1 |            | -0'04             |       |        | -0'10     | -100   |
| 4                                 | E-4-1-2 |            | -0'01             |       |        | 0'02      | >100   |
| 5                                 | E-5-1-1 |            | 0'04              |       |        | -0'05     | >100   |
| 1                                 | G-1-1   | 47         | 38                |       | 81     | 1         | >100   |
| 1                                 | G-1-2   | 51         | 32                |       | 63     | -2        | >100   |
| 2                                 | G-2-1   |            | -17               |       |        | -1        | >100   |
| 2                                 | G-2-2   |            | 7                 |       |        | 2         | 100    |
| 3                                 | G-3-1   | 68         | 53                |       | 78     | -1        | >100   |
| 3                                 | G-3-2   | 68         | 53                |       | 78     | 1         | 100    |
| 4                                 | G-4-1   |            | -1                |       |        | -2        | 0      |
| 4                                 | G-4-2   |            | -13               |       |        | 0         | >100   |
| 5                                 | G-5-1   |            | 4                 |       |        | 1         | >100   |
| 5                                 | G-5-2   |            | 8                 |       |        | -4        | >100   |
| 1                                 | P-1-1   | 0'85       | 6'93              | 6'75  | 794    | 0'02      | >100   |
| 1                                 | P-1-2   | 0'75       | 0'79              | 0'69  | 91     | 0'04      | 100    |
| 2                                 | P-2-1   | -1'23      | -0'73             | -0'83 | 67     | -0'02     | >100   |
| 2                                 | P-2-2   | -0'97      | -0'67             | -0'76 | 78     | -0'03     | >100   |
| 3                                 | P-3-1   | 2'50       | 2'36              | 2'18  | 87     | 0'02      | >100   |
| 3                                 | P-3-2   | 2'50       | 2'28              | 2'26  | 90     | 0'01      | >100   |
| 4                                 | P-4-1   | -0'64      | -0'53             | -0'65 | 102    | -0'09     | 91     |
| 4                                 | P-4-2   | -1'04      | -1'03             | -0'97 | 93     | -0'11     | 93     |
| 5                                 | P-5-1   | 0'07       | 0'02              | 0'02  | 29     | 0'04      | -50    |
| 5                                 | P-5-2   | 0'17       | 0'13              | 0'13  | 78     | 0'05      | 85     |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 6          | CARGA VANO/ VANOS |       | 2      | y         | 4      |
| FLECHAS (mm) - DEFORMACIONES (μɛ) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | -0'15             |       |        | -0'06     | 80     |
| 1                                 | E-1-1-2 |            | -0'11             |       |        | -0'07     | 73     |
| 1                                 | E-1-2-1 |            | -0'06             |       |        | -0'06     | 67     |
| 1                                 | E-1-2-2 |            | 0'10              |       |        | -0'09     | >100   |
| 2                                 | E-2-1-1 |            | 0'18              |       |        | -0'05     | >100   |
| 2                                 | E-2-1-2 |            | -0'03             |       |        | -0'03     | 67     |
| 3                                 | E-3-1-1 |            | -0'08             |       |        | -0'02     | >100   |
| 3                                 | E-3-1-2 |            | 0'05              |       |        | -0'14     | >100   |
| 4                                 | E-4-1-1 |            | 0'16              |       |        | -0'06     | >100   |
| 4                                 | E-4-1-2 |            | -0'02             |       |        | -0'02     | 50     |
| 5                                 | E-5-1-1 |            | -0'12             |       |        | -0'14     | 0      |
| 1                                 | G-1-1   |            | -27               |       |        | 0         | >100   |
| 1                                 | G-1-2   |            | -16               |       |        | -1        | >100   |
| 2                                 | G-2-1   | 82         | 66                |       | 80     | -1        | >100   |
| 2                                 | G-2-2   | 86         | 7                 |       | 8      | 1         | >100   |
| 3                                 | G-3-1   |            | -25               |       |        | 0         | >100   |
| 3                                 | G-3-2   |            | -23               |       |        | 1         | >100   |
| 4                                 | G-4-2   | 66         | 53                |       | 81     | -1        | >100   |
| 5                                 | G-5-1   |            | -18               |       |        | -1        | >100   |
| 5                                 | G-5-2   |            | -25               |       |        | 0         | >100   |
| 1                                 | P-1-1   | -0'86      | -0'11             | -0'01 | 1      | 0'00      | >100   |
| 1                                 | P-1-2   | -0'50      | -0'32             | -0'32 | 63     | -0'01     | >100   |
| 2                                 | P-2-1   | 3'30       | 2'80              | 2'74  | 83     | 0'01      | >100   |
| 2                                 | P-2-2   | 3'11       | 3'40              | 3'37  | 108    | 0'10      | 98     |
| 3                                 | P-3-1   | -1'70      | -1'20             | -1'25 | 74     | -0'04     | >100   |
| 3                                 | P-3-2   | -1'80      | -1'16             | -1'17 | 65     | -0'04     | 98     |
| 4                                 | P-4-1   | 2'40       | 2'33              | 2'29  | 95     | 0'00      | >100   |
| 4                                 | P-4-2   | 2'60       | 3'77              | 3'76  | 144    | 0'06      | 99     |
| 5                                 | P-5-1   | -0'40      | -0'25             | -0'27 | 68     | 0'02      | >100   |
| 5                                 | P-5-2   | -0'77      | -0'48             | -0'49 | 63     | -0'02     | >100   |

| RESULTADOS DE LA PRUEBA ESTÁTICA  |         |            |                   |       |        |           |        |
|-----------------------------------|---------|------------|-------------------|-------|--------|-----------|--------|
| ESTADO DE CARGA                   |         | 7          | CARGA VANO/ VANOS |       | 3      | y         | 5      |
| FLECHAS (mm) - DEFORMACIONES (µε) |         |            |                   |       |        |           |        |
| VANO                              | PUNTO   | Res. prev. | OBTENIDA          | NETA  | % ALC. | REM. NETO | % REC. |
| 1                                 | E-1-1-1 |            | -0'02             |       |        | -0'08     | -250   |
| 1                                 | E-1-1-2 |            | -0'03             |       |        | -0'07     | -67    |
| 1                                 | E-1-2-1 |            | -0'05             |       |        | -0'04     | 60     |
| 1                                 | E-1-2-2 |            | -0'04             |       |        | -0'09     | -100   |
| 2                                 | E-2-1-1 |            | 0'03              |       |        | -0'08     | >100   |
| 2                                 | E-2-1-2 |            | 0'26              |       |        | 0'05      | 88     |
| 3                                 | E-3-1-1 |            | 0'25              |       |        | -0'07     | >100   |
| 3                                 | E-3-1-2 |            | 0'07              |       |        | -0'16     | >100   |
| 4                                 | E-4-1-1 |            | -0'02             |       |        | -0'10     | -350   |
| 4                                 | E-4-1-2 |            | 0'17              |       |        | -0'01     | >100   |
| 5                                 | E-5-1-1 |            | 0'21              |       |        | -0'12     | >100   |
| 1                                 | G-1-1   |            | 6                 |       |        | -7        | >100   |
| 1                                 | G-1-2   |            | 5                 |       |        | -6        | >100   |
| 2                                 | G-2-1   |            | -20               |       |        | -4        | 95     |
| 2                                 | G-2-2   |            | 5                 |       |        | 1         | >100   |
| 3                                 | G-3-1   | 86         | 62                |       | 72     | -2        | >100   |
| 3                                 | G-3-2   | 86         | 61                |       | 71     | -5        | >100   |
| 4                                 | G-4-2   |            | -29               |       |        | -13       | 62     |
| 5                                 | G-5-1   | 33         | 41                |       | 123    | -1        | >100   |
| 5                                 | G-5-2   | 27         | 25                |       | 91     | 1         | >100   |
| 1                                 | P-1-1   | 0'22       | 0'07              | 0'11  | 48     | 0'05      | 43     |
| 1                                 | P-1-2   | 0'08       | -0'08             | -0'05 | -56    | -0'04     | 75     |
| 2                                 | P-2-1   | -1'35      | -0'88             | -0'87 | 64     | -0'07     | 97     |
| 2                                 | P-2-2   | -0'80      | -0'70             | -0'81 | 101    | -0'10     | 89     |
| 3                                 | P-3-1   | 3'40       | 3'02              | 2'88  | 85     | 0'05      | 99     |
| 3                                 | P-3-2   | 3'30       | 2'97              | 2'81  | 85     | 0'11      | 98     |
| 4                                 | P-4-1   | -1'14      | -0'79             | -0'91 | 79     | -0'07     | 94     |
| 4                                 | P-4-2   | -1'60      | -1'36             | -1'48 | 93     | 0'04      | >100   |
| 5                                 | P-5-1   | 0'54       | 0'83              | 0'74  | 136    | 0'01      | >100   |
| 5                                 | P-5-2   | 0'67       | 0'92              | 0'80  | 119    | -0'04     | >100   |



### Prueba dinámica

| RESULTADOS DE LAS PRUEBAS DINÁMICAS |       |                |                    |                          |                        |
|-------------------------------------|-------|----------------|--------------------|--------------------------|------------------------|
| VANO / VANOS                        |       |                | 1                  | a                        | 5                      |
| VANO                                | PUNTO | DINÁMICA LENTA | DINÁMICA A 30 km/h | DINÁMICA A MÁXIMA VELOC. | COEFICIENTE DE IMPACTO |
| 1                                   | G-1-1 | 6'930          | 4'610              | 6'120                    | 0'883                  |
| 1                                   | G-1-2 | 23'560         | 23'270             | 22'450                   | 0'953                  |
| 2                                   | G-2-1 | 14'620         | 15'950             | 14'550                   | 0'995                  |
| 3                                   | G-3-1 | 17'380         | 16'220             | 16'620                   | 0'956                  |
| 3                                   | G-3-2 | 37'230         | 37'890             | 36'240                   | 0'973                  |
| 4                                   | G-4-2 | 39'230         | 35'080             | 35'830                   | 0'913                  |
| 5                                   | G-5-1 | 8'610          | 10'530             | 10'560                   | 1'226                  |
| 5                                   | G-5-2 | 27'240         | 25'680             | 25'880                   | 0'950                  |
| 1                                   | P-1-2 | 0'510          | 0'410              | 0'420                    | 0'824                  |
| 2                                   | P-2-1 | 0'580          | 0'600              | 0'530                    | 0'914                  |
| 2                                   | P-2-2 | 1'830          | 1'860              | 1'730                    | 0'945                  |
| 3                                   | P-3-1 | 0'740          | 0'721              | 0'710                    | 0'959                  |
| 3                                   | P-3-2 | 1'650          | 1'610              | 1'590                    | 0'964                  |
| 4                                   | P-4-1 | 0'710          | 0'730              | 0'660                    | 0'930                  |
| 4                                   | P-4-2 | 2'720          | 2'530              | 2'610                    | 0'960                  |
| 5                                   | P-5-1 | 0'150          | 0'160              | 0'170                    | 1'133                  |
| 5                                   | P-5-2 | 0'690          | 0'680              | 0'590                    | 0'855                  |

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## **8.- ANÁLISIS DE LOS RESULTADOS.**

### **8.1.- Prueba estática.**

Los valores de las flechas y deformaciones obtenidos en la prueba son similares a los previstos en el Proyecto de la Prueba de Carga. Se resumen a continuación:

| ESTADO   | Resultados flechas (%) |        | Resultados deformaciones (%) |        |
|----------|------------------------|--------|------------------------------|--------|
|          | Mínimo                 | Máximo | Mínimo                       | Máximo |
| Estado 1 | 96                     | 138    | 65                           | 99     |
| Estado 2 | 96                     | 107    | 76                           | 98     |
| Estado 3 | 82                     | 181    | 71                           | 79     |
| Estado 4 | -406                   | 146    | 77                           | 100    |
| Estado 5 | 87                     | 91     | 63                           | 81     |
| Estado 6 | 83                     | 144    | 80                           | 81     |
| Estado 7 | 85                     | 136    | 71                           | 123    |

A partir de los resultados obtenidos que se expresan en las tablas anteriores, hay que realizar los siguientes comentarios:

- Los valores de flechas obtenidos son similares a los previstos en el proyecto, salvo en algunos puntos que superan a los teóricos.
- En dichos puntos se superan los valores previstos en el proyecto de prueba de carga, debido al modelo utilizado para los cálculos de la prueba de carga, que consideró que la unión entre las vigas prefabricadas como perfectamente rígida, mientras que en la realidad el único elemento que da continuidad a las secciones sobre apoyos es la losa superior hormigonada “in situ” y el pretensado longitudinal, cuya capacidad de transmisión de momentos es muy inferior a la que tendría la sección continua. En

---

consecuencia los valores teóricos calculados son inferiores a los que se obtendrían considerando la situación real sobre apoyos (que asemejaría más la estructura a una sucesión de vanos pseudo-isostáticos).

- Debido a la diferencia de luces entre los vanos centrales y los extremos, este efecto es más acusado en los vanos extremos, cuyos valores teóricos eran en ocasiones negativos (ascensos), aun estando cargados, mientras que en la realidad fueron positivos (descensos).
- Una vez descargada la estructura se obtuvieron en todos los puntos de medida (correspondientes a vanos cargados) recuperaciones superiores al 89% en forma instantánea, siendo lo habitual la recuperación total en todos los puntos, lo que indica que la estructura permaneció en régimen elástico durante la prueba.
- Por lo tanto se considera que, a pesar de que en ocasiones los vanos extremos reflejan resultados de signo contrario al esperado al ser cargados, el comportamiento de la estructura es correcto, ya que las secciones sobre pilas funcionan como empotramientos elásticos en vez de cómo empotramientos rígidos, que es lo que se supuso en el proyecto de prueba de carga.
- Las recuperaciones permiten concluir que, durante la realización de la prueba de carga, la estructura ha permanecido en régimen elástico.

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Finalmente, en el cuadro siguiente, se adjuntan los máximos valores de flechas obtenidos, conjuntamente con la correspondiente relación entre la luz y el valor máximo citado.

| ESTADO   | FLECHA MÁXIMA (mm) | RELACIÓN LUZ/FLECHA |
|----------|--------------------|---------------------|
| Estado 1 | 2'99               | 8.361               |
| Estado 2 | 2'31               | 10.822              |
| Estado 3 | 2'16               | 11.574              |
| Estado 4 | 2'50               | 10.000              |
| Estado 5 | 2'26               | 11.062              |
| Estado 6 | 2'29               | 10.917              |
| Estado 7 | 2'88               | 8.681               |

Se puede observar que la relación luz / flecha es muy homogénea en todos los estados. Esto indica que el comportamiento de la estructura es parecido al de una viga formada por tramos pseudo-isostáticos, y distinto al de una viga continua, ya que en las pruebas de carga realizadas sobre vigas continuas, los valores máximos de flecha son mucho mayores al cargar vanos alternos que al cargar vanos contiguos, mientras que en este caso todas las flechas medidas son muy parecidas, lo que refleja la escasa transmisibilidad de momentos existente entre vanos.

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## 8.2.- Prueba dinámica.

El análisis de frecuencias se ha realizado a partir del registro de flecha obtenido de la prueba dinámica, encontrándose los valores siguientes:

| VANOS | FRECUENCIA<br>PRUEBA (Hz) | FRECUENCIA<br>TEÓRICA (Hz) |
|-------|---------------------------|----------------------------|
| 1 a 5 | 5'742                     | 5'287                      |

- El análisis de frecuencias se ha realizado a partir del registro de aceleraciones obtenido del acelerómetro situado en el vano nº 3 durante la prueba dinámica de frenado, encontrándose un primer pico en torno a 5'742 Hz, valor muy similar al teórico (5'287 Hz) calculado en el proyecto de prueba de carga para el tablero hiperestático.
- Los valores del coeficiente de impacto en las distintas pruebas se encuentran en torno a uno, lo que indica que las cargas dinámicas empleadas en la prueba no producen amplificaciones en la respuesta de la estructura.
- Del estudio de la señal registrada se ha obtenido un valor de amortiguamiento dado por el decremento logarítmico en torno a 0'056.

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## **9.- CONCLUSIONES Y RECOMENDACIONES.**

De acuerdo con lo expuesto en los apartados precedentes pueden extraerse las siguientes conclusiones y recomendaciones.

- Los resultados obtenidos de flechas son admisibles, si bien en ocasiones difieren de los teóricos, ya que en el modelo se supuso que en las secciones sobre apoyos la continuidad del tablero era plena, cuando en realidad el único elemento que da continuidad a las secciones sobre apoyos es la losa superior, hormigonada "in situ". En consecuencia la situación real sobre apoyos es la correspondiente a un empotramiento elástico, y no un empotramiento total, como se supuso en el proyecto de prueba de carga.
- La relación de la flecha máxima respecto de la luz se considera admisible en todos los casos.
- Las recuperaciones obtenidas de flechas en las pruebas han sido superiores al 89% en flechas, lo cual permite considerar el comportamiento de la estructura como esencialmente elástico.
- Durante la realización de las pruebas de carga no se detectó la aparición de fisuras ni de cualquier otro tipo de anomalías en las zonas objeto de estudio.
- El espectro obtenido de una señal de flecha en la prueba dinámica con tablón ha permitido estimar un valor de la frecuencia propia en torno a 5'742 Hz, valor muy similar al teórico (5'287 Hz). El decremento logarítmico es de 0,056. Los valores del coeficiente de impacto en las distintas pruebas se encuentran en torno a uno.

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Por todo ello, se considera que el comportamiento de la estructura en estudio ha sido correcto durante la prueba de carga. Durante la realización de los ensayos no se detectó la aparición de fisuras ni de cualquier otro tipo de anomalías en las zonas objeto de estudio.

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El presente informe consta de treinta y ocho páginas selladas y correlativamente numeradas de la número uno a la número treinta y ocho, y de ocho anejos sin paginar relacionados en el índice.

Madrid, mayo de 2003

POR EL ÁREA DE ESTRUCTURAS:



FDO.: CARLOS RODRÍGUEZ LÓPEZ  
Ingeniero de Caminos, Canales y Puertos

JEFE DEL ÁREA:



FDO.: JORGE PERELLI BOTELLO  
Ing. de Caminos, Canales y Puertos.

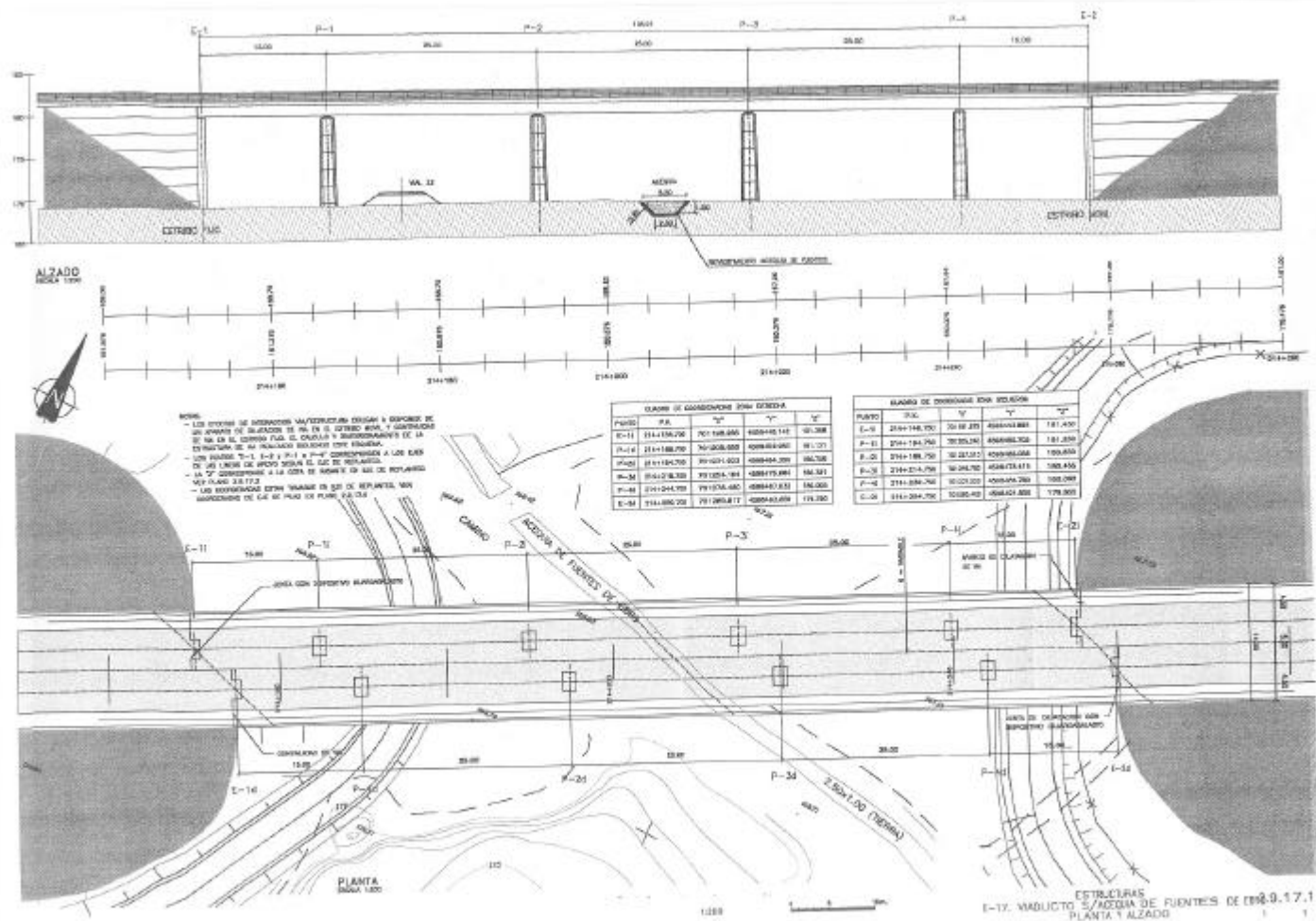
Prohibida la reproducción parcial de este documento sin la aprobación expresa de GEOCISA.



## ANEJOS

**ANEJO 1: DOCUMENTACIÓN FACILITADA POR EL GIF.**

Explorar0001.jpg (1784x1274x16M jpeg)



Technical drawing of a dam cross-section. The drawing shows the internal structure of the dam, including the water level, the dam body, and the foundation. Key features include:

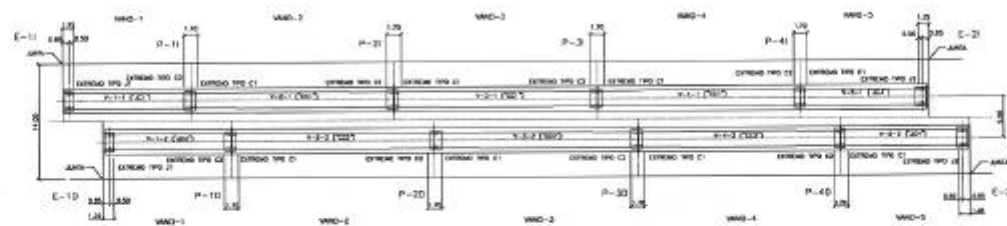
- Water Level:** Indicated by a horizontal line at the top of the dam.
- Dam Body:** The main structure of the dam, shown in cross-section.
- Foundation:** The base of the dam, shown as a horizontal line.
- Dimensions:** Various dimensions are provided, including the width of the dam at the top (1.00, 1.20, 1.40, 1.60, 1.80, 2.00, 2.20, 2.40, 2.60, 2.80, 3.00, 3.20, 3.40, 3.60, 3.80, 4.00, 4.20, 4.40, 4.60, 4.80, 5.00, 5.20, 5.40, 5.60, 5.80, 6.00, 6.20, 6.40, 6.60, 6.80, 7.00, 7.20, 7.40, 7.60, 7.80, 8.00, 8.20, 8.40, 8.60, 8.80, 9.00, 9.20, 9.40, 9.60, 9.80, 10.00, 10.20, 10.40, 10.60, 10.80, 11.00, 11.20, 11.40, 11.60, 11.80, 12.00, 12.20, 12.40, 12.60, 12.80, 13.00, 13.20, 13.40, 13.60, 13.80, 14.00, 14.20, 14.40, 14.60, 14.80, 15.00, 15.20, 15.40, 15.60, 15.80, 16.00, 16.20, 16.40, 16.60, 16.80, 17.00, 17.20, 17.40, 17.60, 17.80, 18.00, 18.20, 18.40, 18.60, 18.80, 19.00, 19.20, 19.40, 19.60, 19.80, 20.00, 20.20, 20.40, 20.60, 20.80, 21.00, 21.20, 21.40, 21.60, 21.80, 22.00, 22.20, 22.40, 22.60, 22.80, 23.00, 23.20, 23.40, 23.60, 23.80, 24.00, 24.20, 24.40, 24.60, 24.80, 25.00, 25.20, 25.40, 25.60, 25.80, 26.00, 26.20, 26.40, 26.60, 26.80, 27.00, 27.20, 27.40, 27.60, 27.80, 28.00, 28.20, 28.40, 28.60, 28.80, 29.00, 29.20, 29.40, 29.60, 29.80, 30.00, 30.20, 30.40, 30.60, 30.80, 31.00, 31.20, 31.40, 31.60, 31.80, 32.00, 32.20, 32.40, 32.60, 32.80, 33.00, 33.20, 33.40, 33.60, 33.80, 34.00, 34.20, 34.40, 34.60, 34.80, 35.00, 35.20, 35.40, 35.60, 35.80, 36.00, 36.20, 36.40, 36.60, 36.80, 37.00, 37.20, 37.40, 37.60, 37.80, 38.00, 38.20, 38.40, 38.60, 38.80, 39.00, 39.20, 39.40, 39.60, 39.80, 40.00, 40.20, 40.40, 40.60, 40.80, 41.00, 41.20, 41.40, 41.60, 41.80, 42.00, 42.20, 42.40, 42.60, 42.80, 43.00, 43.20, 43.40, 43.60, 43.80, 44.00, 44.20, 44.40, 44.60, 44.80, 45.00, 45.20, 45.40, 45.60, 45.80, 46.00, 46.20, 46.40, 46.60, 46.80, 47.00, 47.20, 47.40, 47.60, 47.80, 48.00, 48.20, 48.40, 48.60, 48.80, 49.00, 49.20, 49.40, 49.60, 49.80, 50.00, 50.20, 50.40, 50.60, 50.80, 51.00, 51.20, 51.40, 51.60, 51.80, 52.00, 52.20, 52.40, 52.60, 52.80, 53.00, 53.20, 53.40, 53.60, 53.80, 54.00, 54.20, 54.40, 54.60, 54.80, 55.00, 55.20, 55.40, 55.60, 55.80, 56.00, 56.20, 56.40, 56.60, 56.80, 57.00, 57.20, 57.40, 57.60, 57.80, 58.00, 58.20, 58.40, 58.60, 58.80, 59.00, 59.20, 59.40, 59.60, 59.80, 60.00, 60.20, 60.40, 60.60, 60.80, 61.00, 61.20, 61.40, 61.60, 61.80, 62.00, 62.20, 62.40, 62.60, 62.80, 63.00, 63.20, 63.40, 63.60, 63.80, 64.00, 64.20, 64.40, 64.60, 64.80, 65.00, 65.20, 65.40, 65.60, 65.80, 66.00, 66.20, 66.40, 66.60, 66.80, 67.00, 67.20, 67.40, 67.60, 67.80, 68.00, 68.20, 68.40, 68.60, 68.80, 69.00, 69.20, 69.40, 69.60, 69.80, 70.00, 70.20, 70.40, 70.60, 70.80, 71.00, 71.20, 71.40, 71.60, 71.80, 72.00, 72.20, 72.40, 72.60, 72.80, 73.00, 73.20, 73.40, 73.60, 73.80, 74.00, 74.20, 74.40, 74.60, 74.80, 75.00, 75.20, 75.40, 75.60, 75.80, 76.00, 76.20, 76.40, 76.60, 76.80, 77.00, 77.20, 77.40, 77.60, 77.80, 78.00, 78.20, 78.40, 78.60, 78.80, 79.00, 79.20, 79.40, 79.60, 79.80, 80.00, 80.20, 80.40, 80.60, 80.80, 81.00, 81.20, 81.40, 81.60, 81.80, 82.00, 82.20, 82.40, 82.60, 82.80, 83.00, 83.20, 83.40, 83.60, 83.80, 84.00, 84.20, 84.40, 84.60, 84.80, 85.00, 85.20, 85.40, 85.60, 85.80, 86.00, 86.20, 86.40, 86.60, 86.80, 87.00, 87.20, 87.40, 87.60, 87.80, 88.00, 88.20, 88.40, 88.60, 88.80, 89.00, 89.20, 89.40, 89.60, 89.80, 90.00, 90.20, 90.40, 90.60, 90.80, 91.00, 91.20, 91.40, 91.60, 91.80, 92.00, 92.20, 92.40, 92.60, 92.80, 93.00, 93.20, 93.40, 93.60, 93.80, 94.00, 94.20, 94.40, 94.60, 94.80, 95.00, 95.20, 95.40, 95.60, 95.80, 96.00, 96.20, 96.40, 96.60, 96.80, 97.00, 97.20, 97.40, 97.60, 97.80, 98.00, 98.20, 98.40, 98.60, 98.80, 99.00, 99.20, 99.40, 99.60, 99.80, 100.00, 100.20, 100.40, 100.60, 100.80, 101.00, 101.20, 101.40, 101.60, 101.80, 102.00, 102.20, 102.40, 102.60, 102.80, 103.00, 103.20, 103.40, 103.60, 103.80, 104.00, 104.20, 104.40, 104.60, 104.80, 105.00, 105.20, 105.40, 105.60, 105.80, 106.00, 106.20, 106.40, 106.60, 106.80, 107.00, 107.20, 107.40, 107.60, 107.80, 108.00, 108.20, 108.40, 108.60, 108.80, 109.00, 109.20, 109.40, 109.60, 109.80, 110.00, 110.20, 110.40, 110.60, 110.80, 111.00, 111.20, 111.40, 111.60, 111.80, 112.00, 112.20, 112.40, 112.60, 112.

|                  |                  |
|------------------|------------------|
| SYNOPSIS         | PLANNED 2.2.2    |
| RELEASE PLATFORM | PLANNED 2.2.12.7 |

6.7.1.5 **24**  
[REDACTED]

E-17. MADRUGA S/A CERCA DE FUENTES DE BRAS. 17.2.  
SECCIONES TRANSVERSALES

PLANTA  
CALLE V-100



| SPAN    | SPAN NO. | SPAN TYPE | SPAN LENGTH (M) | SPAN AREA (M <sup>2</sup> ) | SPAN WEIGHT (KIP) | SPAN CENTERLINE (M) | SPAN ELEVATION (M) |
|---------|----------|-----------|-----------------|-----------------------------|-------------------|---------------------|--------------------|
| V-100-1 | 1        | 1-1-1     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-2 | 2        | 2-2-2     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-3 | 3        | 3-3-3     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-4 | 4        | 4-4-4     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-5 | 5        | 5-5-5     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |

| SPAN    | SPAN NO. | SPAN TYPE | SPAN LENGTH (M) | SPAN AREA (M <sup>2</sup> ) | SPAN WEIGHT (KIP) | SPAN CENTERLINE (M) | SPAN ELEVATION (M) |
|---------|----------|-----------|-----------------|-----------------------------|-------------------|---------------------|--------------------|
| V-100-1 | 1        | 1-1-1     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-2 | 2        | 2-2-2     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-3 | 3        | 3-3-3     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-4 | 4        | 4-4-4     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-5 | 5        | 5-5-5     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |

1:200

0 10 20

ESTRUCTURAS  
E-17. VADUETO SACCUBA DE FUENTES DE ARRO  
REPLANTIO DE YEGAS

2.9.17.3

1 2

**ANEJO 2: PROYECTO DE PRUEBA DE CARGA.**

**PROYECTO DE PRUEBA DE CARGA DE LA  
ESTRUCTURA 23VI04, VIADUCTO SOBRE ACEQUIA  
DE FUENTES DE EBRO PERTENECIENTE A LA L.A.V.  
MADRID - BARCELONA - FRONTERA FRANCESA.  
TRAMO: ZARAGOZA - LLEIDA.  
BASE DE LA CARTUJA.**

**SEPTIEMBRE de 2002**

## **ÍNDICE**

- 1.- INTRODUCCIÓN.
- 2.- DESCRIPCIÓN DE LA ESTRUCTURA.
- 3.- JUSTIFICACIÓN DE LA CARGA DE LA PRUEBA.
- 4.- MEDIDAS A REALIZAR.
- 5.- PLAN DE CARGA Y PROGRAMACIÓN DEL ENSAYO.
  - 5.1.- PRUEBAS ESTÁTICAS.
  - 5.2.- PRUEBAS DINÁMICAS.
- 6.- RESULTADOS PREVISTOS.

## **ANEJOS**

- I.- DOCUMENTACIÓN FACILITADA.
- II.- CÁLCULOS DE LA PRUEBA DE CARGA.
- III.- FIGURAS.



## **1.- INTRODUCCIÓN.**

A instancias del G.I.F., GEOCISA redacta el presente documento cuyo objeto es la especificación de la Prueba de Carga preceptiva con anterioridad a la recepción de la estructura 23VI04, Viaducto s/ acequia de Fuentes de Ebro perteneciente a la L.A.V. Madrid - Barcelona - Frontera Francesa. Tramo: Zaragoza - Lleida. Subtramo: 23.

## **2.- DESCRIPCIÓN DE LA ESTRUCTURA.**

Se ha realizado una inspección previa, que tuvo lugar el día 13 de febrero de 2002 y la estructura estaba completamente finalizada. De acuerdo con los datos obtenidos en la Inspección Previa realizada y con la documentación suministrada por el Peticionario, se describen a continuación las principales características de la estructura.

La estructura soportará el tráfico ferroviario generado por la L.A.V. Madrid - Barcelona - Frontera Francesa y salva la acequia de Fuentes de Ebro y dos caminos vecinales.

Se trata de una estructura hiperestática de planta recta con un esviaje de  $45.29^\circ$ , compuesta por cinco vanos de 15+25x3+15 metros de luz de cálculo y un ancho total de 14 m.

La solución estructural consiste en un tablero compuesto por dos vigas cajón de hormigón pretensado. El tablero está apoyado en los estribos y en las pilas mediante neoprenos. El canto total del tablero es de 1,70 metros. El tipo de hormigón de la losa del tablero es HP-40.

Las pilas son de fuste múltiple, con sección fija de hormigón armado. Los estribos son cerrados con aletas y de hormigón armado. La plataforma está compuesta por dos vías de ferrocarril, protegidas exteriormente por una barandilla metálica.

### **3.- JUSTIFICACIÓN DE LA CARGA DE LA PRUEBA.**

Las sobrecargas a utilizar en las pruebas serán suministradas por el Peticionario. Éstas consistirán en dos locomotoras inglesas de 1180 KN de peso total y 4 tolvas de 800 KN.

Se han previsto siete estados de carga:

- Un primer estado en el que las sobrecargas se sitúan en los vanos 1 y 2, para obtener los momentos flectores negativos máximos sobre pila 1.
- Un segundo estado en el que las sobrecargas se sitúan en los vanos 2 y 3, para obtener los momentos flectores negativos máximos sobre pila 2.
- Un tercer estado en el que las sobrecargas se sitúan en los vanos 3 y 4, para obtener los momentos flectores negativos máximos sobre pila 3.
- Un cuarto estado en el que las sobrecargas se sitúan en los vanos 4 y 5, para obtener los momentos flectores negativos máximos sobre pila 4.
- Un quinto estado en el que las sobrecargas se sitúan en los vanos 1 y 3, para obtener los momentos flectores positivos máximos en dichos vanos.
- Un sexto estado en el que las sobrecargas se sitúan en los vanos 2 y 4, para obtener los momentos flectores positivos máximos en dichos vanos.
- Un séptimo estado en el que las sobrecargas se sitúan en los vanos 3 y 5, para obtener los momentos flectores positivos máximos en dichos vanos.

La colocación de los trenes se realizará del siguiente modo:

- En el caso de carga de vanos contiguos, se situará el eje delantero del primer boggye de la locomotora sobre el eje de la pila correspondiente al vano más alejado del estribo del lado Zaragoza que hay que cargar y el resto del tren de cargas unido a la locomotora.
- En el caso de vanos alternos, se situará el eje delantero del primer boggye de la locomotora sobre el eje de la pila correspondiente al vano más alejado del estribo del lado Zaragoza que hay que cargar, las otras dos tolvas que componen el tren de carga

se colocarán en el otro vano a cargar, situando el eje delantero del primer boggye sobre el eje de la pila.

En el Anejo III se adjunta el croquis del tren de carga descrito, así como la disposición del mismo sobre la estructura para los distintos estados de carga.

Además de las hipótesis de carga propias de la prueba, se han considerado las hipótesis de proyecto dadas por la publicación "Instrucción sobre las acciones a considerar en el proyecto de puentes de ferrocarril" de 1976.

Las hipótesis de carga, así como sus combinaciones correspondientes, válidas todas ellas para la estructura considerada en el presente documento, se detallan a continuación:

- Hipótesis 1: Peso Propio.
- Hipótesis 2: Tren tipo B de la instrucción (vanos 1 y 2).
- Hipótesis 3: Tren tipo B de la instrucción (vanos 2 y 3).
- Hipótesis 4: Tren tipo B de la instrucción (vanos 3 y 4).
- Hipótesis 5: Tren tipo B de la instrucción (vanos 4 y 5).
- Hipótesis 6: Tren tipo B de la instrucción (vanos 1 y 3).
- Hipótesis 7: Tren tipo B de la instrucción (vanos 2 y 4).
- Hipótesis 8: Tren tipo B de la instrucción (vanos 3 y 5).
- Hipótesis 9: Dos locomotoras y cuatro tolvas en vanos 1 y 2.
- Hipótesis 10: Dos locomotoras y cuatro tolvas en vanos 2 y 3.
- Hipótesis 11: Dos locomotoras y cuatro tolvas en vanos 3 y 4.
- Hipótesis 12: Dos locomotoras y cuatro tolvas en vanos 4 y 5.
- Hipótesis 13: Dos locomotoras y cuatro tolvas en vanos 1 y 3.
- Hipótesis 14: Dos locomotoras y cuatro tolvas en vanos 2 y 4.
- Hipótesis 15: Dos locomotoras y cuatro tolvas en vanos 3 y 5.

En función de las hipótesis consideradas, se ha realizado el cálculo de la estructura modelizándola mediante un emparrillado.

Para el análisis del modelo se ha empleado el Programa STAAD/Pro 2001, de la casa RESEARCH ENGINEERS.

Este programa se basa en el análisis matricial mediante modelos de barras, pudiéndose acoplar a su vez elementos finitos tipo placa triangulares o cuadrangulares. La ejecución se efectúa con la modalidad de proceso por lotes, leyéndose los datos de entrada en un archivo y escribiéndose los de salida en otro. De esta forma se consigue que la variación de un parámetro no implique la introducción de todos los datos de nuevo.

Los resultados obtenidos del análisis y la información gráfica del cálculo de la estructura están contenidos en el Anejo II.

Con el objeto de establecer una comparación entre las acciones de la Instrucción y las acciones debidas a la Prueba, se han calculado los momentos flectores y las flechas en las secciones centrales.

Las distintas comparaciones realizadas se detallan a continuación:

Estado 1:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 3850                            | 1980                         | 51.43      | 4.820                           | 2.539                        | 52.68      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

Estado 2:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 3590                            | 1880                         | 52.37      | 4.227                           | 2.285                        | 54.06      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

Estado 3:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 3380                            | 1770                         | 52.37      | 3.869                           | 2.096                        | 54.17      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

Estado 4:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 3250                            | 2220                         | 68.31      | 4.074                           | 2.907                        | 71.35      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

Estado 5:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 4230                            | 1880                         | 44.44      | 5.663                           | 2.498                        | 44.11      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

Estado 6:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 4100                            | 2370                         | 57.80      | 5.572                           | 3.285                        | 58.96      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.



Estado 7:

Considerando únicamente las sobrecargas:

| MOM. MAX.<br>INSTRUCC.<br>KN m. | MOM. MAX.<br>PRUEBA<br>KN m. | PORCENTAJE | FLECHA MAX.<br>INSTRUCC.<br>mm. | FLECHA MAX.<br>PRUEBA<br>mm. | PORCENTAJE |
|---------------------------------|------------------------------|------------|---------------------------------|------------------------------|------------|
| 4100                            | 2380                         | 57.49      | 5.572                           | 3.318                        | 59.55      |

En todos los casos los porcentajes alcanzados de los momentos máximos y flechas de la prueba resultan inferiores a los alcanzados aplicando las sobrecargas de la Instrucción.

#### **4.- MEDIDAS A REALIZAR.**

Las medidas a realizar durante la prueba serán las siguientes:

- Descensos verticales (flechas)
- Deformaciones
- Aceleraciones

La instrumentación de la estructura se realizará en un grupo.

Se medirán dos puntos de flecha en la sección situada en el centro de luz de los 5 vanos. Se instrumentarán también dos puntos de medida de descensos verticales próximos a los apoyos y otros dos puntos en la zona de pilas correspondiente a cada vano.

Para la medida de flechas en la sección centro de luz se utilizarán L.V.D.T.'s (Linear Variable Differential Transducers) SOLARTRON ST-1000, de 25 mm de rango y 0,1 mm de incertidumbre.

Para la medida de flechas en descenso de apoyos se emplearán transductores extensométricos constituidos por aros metálicos flexibles, instrumentados con bandas extensométricas modelo OV-1, con un rango de 10 mm y una incertidumbre de  $\pm 0,02$  mm.

En las pruebas dinámicas se registrarán aceleraciones verticales mediante la colocación de un acelerómetro situado en el centro de luz del vano 3. El acelerómetro que se utilizará será del tipo servoacelerómetro SCHAEVITZ, mod. A-225-30001, con un rango de 0-40 Hz con compensación interna de 1 g, para medida de aceleraciones verticales lineales.

## **5.- PLAN DE CARGA Y PROGRAMACIÓN DEL ENSAYO.**

### **5.1.- Pruebas estáticas.**

Los estados de carga de la prueba son los que producen los máximos esfuerzos sobre el tablero.

Las medidas se realizarán de acuerdo con la siguiente secuencia:

- Escalón 0: Medida de lecturas iniciales.
- Escalón 1: Colocación del tren de cargas en vía derecha
- Escalón 2: Colocación del tren de cargas en vía izquierda
- Escalón 3: Estabilización, medida y registro de las lecturas.
- Escalón 4: Medida y registro de las lecturas durante un tiempo no inferior a 10 minutos, comprobando la estabilidad de las medidas.
- Escalón 6: Descarga del tren de cargas de la vía izquierda
- Escalón 7: Descarga del tren de cargas de la vía derecha
- Escalón 8: Realización de lecturas comprobando que se alcanza la recuperación de, al menos, el 80% de la flecha máxima medida en un tiempo no superior al mantenimiento de la carga.

## **5.2.- Pruebas dinámicas.**

Las pruebas dinámicas se realizarán con una sola locomotora circulando a lo largo de una de las vías, para la obtención de parámetros tales como el coeficiente de impacto, el amortiguamiento y la frecuencia de vibración.

Se realizarán las siguientes pruebas dinámicas:

- Paso de la locomotora por el centro de la estructura a 5 km/h.
- Paso de la locomotora por el centro de la estructura a 30 km/h.
- Paso de la locomotora por el centro de la estructura a la máxima velocidad posible.
- Una prueba de frenado, en la que la locomotora adquirirá una velocidad máxima.

## **6.- RESULTADOS PREVISTOS.**

En el Anejo II (Cálculos) se han obtenido las flechas esperadas durante la prueba, exponiéndose a continuación el resumen de los valores calculados (los valores negativos representan ascensos del tablero, mientras que los valores positivos representan los descensos):

### **Estado 1**

#### **FLECHAS PREVISTAS (mm)**

| <b>PUNTO N°</b> | <b>SECCIÓN</b>                  | <b>FLECHA</b> |
|-----------------|---------------------------------|---------------|
| P – 1 – 1       | L/2 vano 1 en eje vía derecha   | -0.184        |
| P – 1 – 2       | L/2 vano 1 en eje vía izquierda | 0.136         |
| P – 2 – 1       | L/2 vano 2 en eje vía derecha   | 2.539         |
| P – 2 – 2       | L/2 vano 2 en eje vía izquierda | 2.420         |
| P – 3 – 1       | L/2 vano 3 en eje vía derecha   | -0.715        |
| P – 3 – 2       | L/2 vano 3 en eje vía izquierda | -1.076        |
| P – 4 – 1       | L/2 vano 4 en eje vía derecha   | 0.124         |
| P – 4 – 2       | L/2 vano 4 en eje vía izquierda | 0.252         |
| P – 5 – 1       | L/2 vano 5 en eje vía derecha   | -0.014        |
| P – 5 – 2       | L/2 vano 5 en eje vía izquierda | -0.037        |

#### **DEFORMACIONES (µε)**

| <b>PUNTO</b> | <b>POSICIÓN</b> | <b>DEFORMACIÓN</b> |
|--------------|-----------------|--------------------|
| G-1-1        | L/2             | 11                 |
| G-1-2        | L/2             | 1                  |
| G-2-1        | L/2             | 39                 |
| G-2-2        | L/2             | 40                 |

**Estado 2****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | -0.359 |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | -0.245 |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | 1.120  |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | 1.504  |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | 2.285  |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | 2.007  |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | -0.631 |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | -0.965 |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | 0.072  |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | 0.161  |

**DEFORMACIONES (µε)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-2-1 | L/2      | 28          |
| G-2-2 | L/2      | 23          |
| G-3-1 | L/2      | 35          |
| G-3-2 | L/2      | 38          |

**Estado 3****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | 0.105  |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | 0.037  |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | -0.601 |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | -0.375 |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | 1.229  |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | 1.636  |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | 2.096  |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | 1.887  |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | -0.434 |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | -0.573 |

**DEFORMACIONES (με)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-3-1 | L/2      | 29          |
| G-3-2 | L/2      | 24          |
| G-4-1 | L/2      | 34          |
| G-4-2 | L/2      | 36          |

**Estado 4****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | -0.045 |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | -0.013 |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | 0.291  |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | 0.135  |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | -1.244 |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | -0.794 |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | 2.664  |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | 2.907  |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | -0.118 |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | -0.369 |

**DEFORMACIONES (με)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-4-1 | L/2      | 45          |
| G-4-2 | L/2      | 42          |
| G-5-1 | L/2      | -9          |
| G-5-2 | L/2      | -1          |



**Estado 5****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | 0.847  |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | 0.752  |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | -1.250 |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | -0.980 |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | 2.458  |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | 2.498  |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | -0.657 |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | -1.042 |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | 0.075  |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | 0.171  |

**DEFORMACIONES (με)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-1-1 | L/2      | 26          |
| G-1-2 | L/2      | 29          |
| G-3-1 | L/2      | 38          |
| G-3-2 | L/2      | 38          |

**Estado 6****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | -0.891 |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | -0.528 |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | 3.285  |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | 3.106  |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | -1.736 |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | -1.840 |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | 2.365  |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | 2.594  |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | -0.459 |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | -0.668 |

**DEFORMACIONES (με)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-2-1 | L/2      | 46          |
| G-2-2 | L/2      | 48          |
| G-4-1 | L/2      | 39          |
| G-4-2 | L/2      | 37          |

**Estado 7****FLECHAS PREVISTAS (mm)**

| PUNTO N°  | SECCIÓN                         | FLECHA |
|-----------|---------------------------------|--------|
| P – 1 – 1 | L/2 vano 1 en eje vía derecha   | 0.234  |
| P – 1 – 2 | L/2 vano 1 en eje vía izquierda | 0.082  |
| P – 2 – 1 | L/2 vano 2 en eje vía derecha   | -1.368 |
| P – 2 – 2 | L/2 vano 2 en eje vía izquierda | -0.816 |
| P – 3 – 1 | L/2 vano 3 en eje vía derecha   | 3.318  |
| P – 3 – 2 | L/2 vano 3 en eje vía izquierda | 3.308  |
| P – 4 – 1 | L/2 vano 4 en eje vía derecha   | -1.167 |
| P – 4 – 2 | L/2 vano 4 en eje vía izquierda | -1.584 |
| P – 5 – 1 | L/2 vano 5 en eje vía derecha   | 0.547  |
| P – 5 – 2 | L/2 vano 5 en eje vía izquierda | 0.673  |

**DEFORMACIONES (με)**

| PUNTO | POSICIÓN | DEFORMACIÓN |
|-------|----------|-------------|
| G-3-1 | L/2      | 48          |
| G-3-2 | L/2      | 49          |
| G-5-1 | L/2      | 19          |
| G-5-2 | L/2      | 15          |

Mediante un análisis modal realizado con el STAAD/Pro 2001 se calcularon las frecuencias y los correspondientes períodos de los tres primeros modos de vibración, que se presentan a continuación:

| MODO | FRECUENCIA (Hz.) | PERIODO (seg.) |
|------|------------------|----------------|
| 1    | 5.287            | 0.189          |
| 2    | 6.708            | 0.149          |
| 3    | 8.477            | 0.118          |

El presente proyecto consta de veintitrés páginas selladas y correlativamente numeradas de la número uno a la número veintitrés, y de tres anejos sin paginar relacionados en el índice.

Madrid, septiembre de 2002.

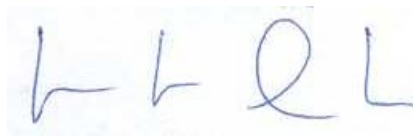
**POR EL ÁREA DE ESTRUCTURAS:**



FDO.: CARLOS RODRÍGUEZ LOPEZ.

Ing. de Caminos, Canales y Puertos.

**EL JEFE DEL ÁREA:**



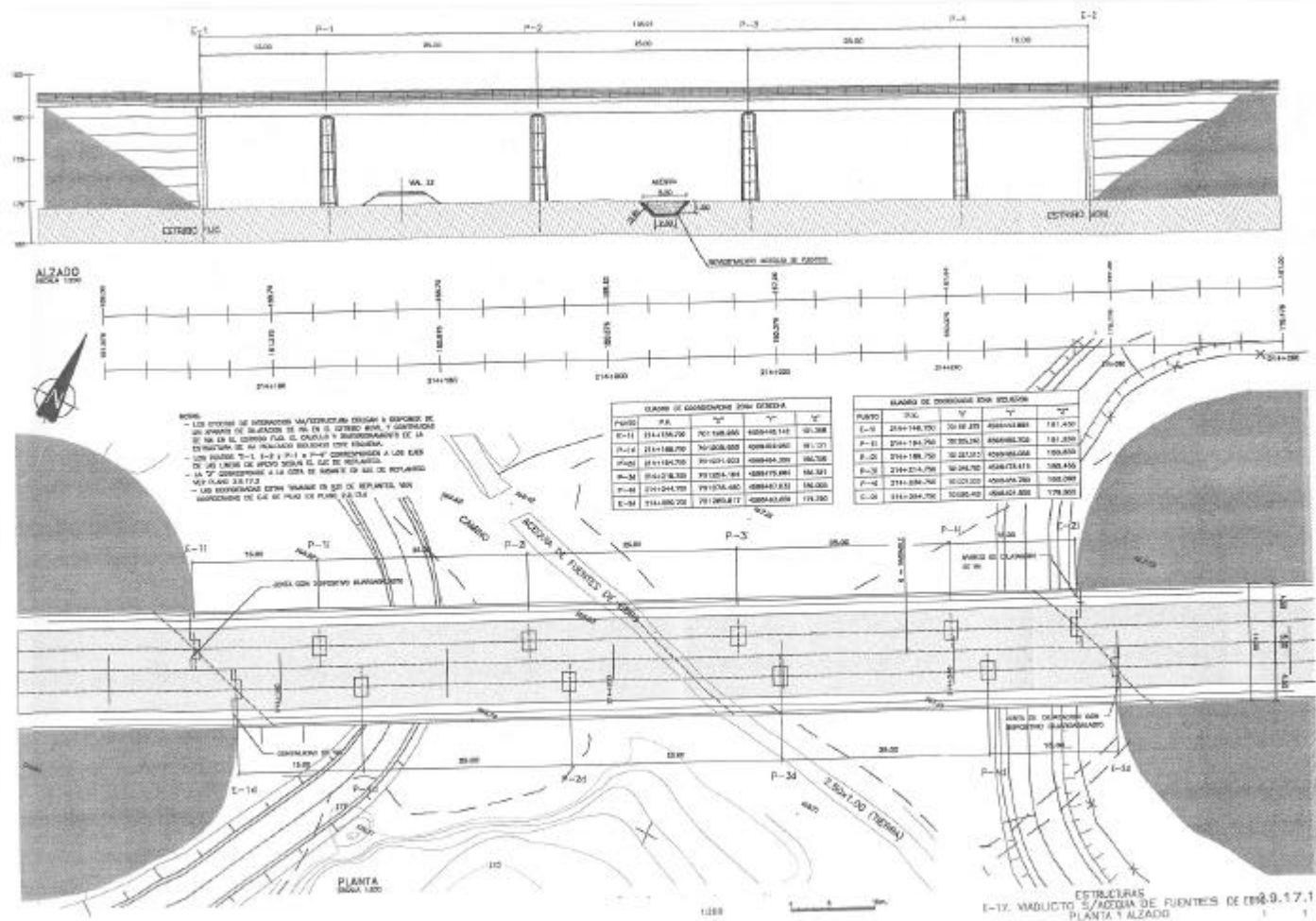
FDO.: JORGE PERELLI BOTELLO

Ing. de Caminos, Canales y Puertos.

## ANEJOS

**ANEJO 2A: DOCUMENTACIÓN FACILITADA.**

Explorar0001.jpg (1784x1274x16M jpeg)





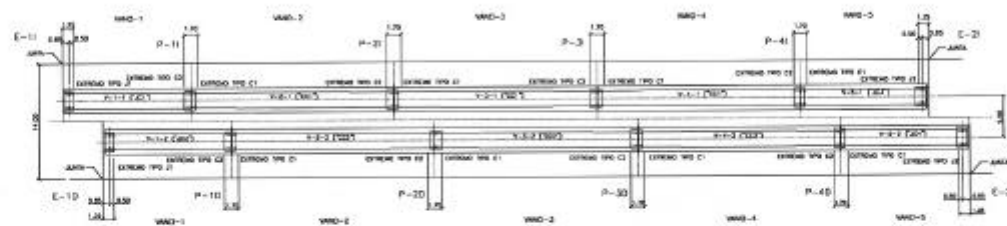
[illegible]

|                               |
|-------------------------------|
| NOTE:                         |
| STUDIOS PLATFORM: P/AMD 2.8.2 |
| FIELD PLATFORM: P/AMD 2.8.127 |

**Figure 6**

E-17. MADRUGA S/A CERCA DE FUENTES DE BRAS. 17.2.  
SECCIONES TRANSVERSALES

PLANTA  
CALLE V-100



| SPAN    | SPAN NO. | SPAN TYPE | SPAN LENGTH (M) | SPAN AREA (M <sup>2</sup> ) | SPAN WEIGHT (KIP) | SPAN CENTERLINE (M) | SPAN ELEVATION (M) |
|---------|----------|-----------|-----------------|-----------------------------|-------------------|---------------------|--------------------|
| V-100-1 | 1        | 1-1-1     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-2 | 2        | 2-2-2     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-3 | 3        | 3-3-3     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-4 | 4        | 4-4-4     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-5 | 5        | 5-5-5     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |

| SPAN    | SPAN NO. | SPAN TYPE | SPAN LENGTH (M) | SPAN AREA (M <sup>2</sup> ) | SPAN WEIGHT (KIP) | SPAN CENTERLINE (M) | SPAN ELEVATION (M) |
|---------|----------|-----------|-----------------|-----------------------------|-------------------|---------------------|--------------------|
| V-100-1 | 1        | 1-1-1     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-2 | 2        | 2-2-2     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-3 | 3        | 3-3-3     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-4 | 4        | 4-4-4     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |
| V-100-5 | 5        | 5-5-5     | 15.00           | 15.00                       | 15.00             | 15.00               | 15.00              |

1:200

0 10 20

ESTRUCTURAS  
E-17. VADUETO SACCUBA DE FUENTES DE ARRO  
REPLANTIO DE YEGAS

2.9.17.3

1 2

**ANEJO 2B: CÁLCULOS DE LA PRUEBA DE CARGA.**

|                                                                                                                                |                             |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>1</b>        | Rev |
|                                                                                                                                | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     |                             | Ref                         |     |
| By CARLOS ROD                                                                                                                  |                             | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Job Information**

|       | Engineer   | Checked | Approved |
|-------|------------|---------|----------|
| Name: | CARLOS ROD |         |          |
| Date: | 23-Sep-02  |         |          |

|                |       |
|----------------|-------|
| Structure Type | FLOOR |
|----------------|-------|

|                    |     |              |     |
|--------------------|-----|--------------|-----|
| Number of Nodes    | 189 | Highest Node | 189 |
| Number of Elements | 262 | Highest Beam | 262 |

|                                  |   |
|----------------------------------|---|
| Number of Basic Load Cases       | 1 |
| Number of Combination Load Cases | 0 |

Included in this printout are data for:

|     |                     |
|-----|---------------------|
| All | The Whole Structure |
|-----|---------------------|

Included in this printout are results for load cases:

| Type       | L/C | Name                               |
|------------|-----|------------------------------------|
| Generation | 1   | LOAD GENERATION, LOAD #1, (1 of 2) |
| Generation | 2   | LOAD GENERATION, LOAD #2, (2 of 2) |
| Primary    | 3   | PESO PROPIO                        |

**Nodes**

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 1    | 0.000    | 0.000    | 0.000    |
| 2    | 1.350    | 0.000    | 0.000    |
| 3    | 3.150    | 0.000    | 0.000    |
| 4    | 4.950    | 0.000    | 0.000    |
| 5    | 6.300    | 0.000    | 0.000    |
| 6    | 7.500    | 0.000    | 0.000    |
| 7    | 8.738    | 0.000    | 0.000    |
| 8    | 9.975    | 0.000    | 0.000    |
| 9    | 11.212   | 0.000    | 0.000    |
| 10   | 12.450   | 0.000    | 0.000    |
| 11   | 14.150   | 0.000    | 0.000    |
| 12   | 15.000   | 0.000    | 0.000    |
| 13   | 15.850   | 0.000    | 0.000    |
| 14   | 17.475   | 0.000    | 0.000    |
| 15   | 19.100   | 0.000    | 0.000    |

|                                                                                                                                                                                                                  |                         |                                                |                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------------------------|------------------------------------|
|   <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b> | Sheet No<br><b>2</b>                           | Rev                                |
|                                                                                                                                                                                                                  | Part                    |                                                |                                    |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                                                                                                                |                         | Ref                                            |                                    |
| Client <b>G.I.F.</b>                                                                                                                                                                                             |                         | By <b>CARLOS ROD</b> Date <b>23-Sep-02</b> Chd |                                    |
|                                                                                                                                                                                                                  |                         | File <b>23VI04 final 12 23.std</b>             | Date/Time <b>26-Sep-2002 16:48</b> |

**Nodes Cont...**

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 16   | 19.950   | 0.000    | 0.000    |
| 17   | 20.800   | 0.000    | 0.000    |
| 18   | 22.475   | 0.000    | 0.000    |
| 19   | 24.150   | 0.000    | 0.000    |
| 20   | 25.825   | 0.000    | 0.000    |
| 21   | 27.500   | 0.000    | 0.000    |
| 22   | 28.737   | 0.000    | 0.000    |
| 23   | 29.975   | 0.000    | 0.000    |
| 24   | 31.212   | 0.000    | 0.000    |
| 25   | 32.450   | 0.000    | 0.000    |
| 26   | 34.125   | 0.000    | 0.000    |
| 27   | 35.800   | 0.000    | 0.000    |
| 28   | 37.475   | 0.000    | 0.000    |
| 29   | 39.150   | 0.000    | 0.000    |
| 30   | 40.000   | 0.000    | 0.000    |
| 31   | 40.850   | 0.000    | 0.000    |
| 32   | 42.475   | 0.000    | 0.000    |
| 33   | 44.100   | 0.000    | 0.000    |
| 34   | 44.950   | 0.000    | 0.000    |
| 35   | 45.800   | 0.000    | 0.000    |
| 36   | 47.475   | 0.000    | 0.000    |
| 37   | 49.150   | 0.000    | 0.000    |
| 38   | 50.825   | 0.000    | 0.000    |
| 39   | 52.500   | 0.000    | 0.000    |
| 40   | 53.737   | 0.000    | 0.000    |
| 41   | 54.975   | 0.000    | 0.000    |
| 42   | 56.213   | 0.000    | 0.000    |
| 43   | 57.450   | 0.000    | 0.000    |
| 44   | 59.125   | 0.000    | 0.000    |
| 45   | 60.800   | 0.000    | 0.000    |
| 46   | 62.475   | 0.000    | 0.000    |
| 47   | 64.150   | 0.000    | 0.000    |
| 48   | 65.000   | 0.000    | 0.000    |
| 49   | 65.850   | 0.000    | 0.000    |
| 50   | 67.475   | 0.000    | 0.000    |
| 51   | 69.100   | 0.000    | 0.000    |
| 52   | 69.950   | 0.000    | 0.000    |
| 53   | 70.800   | 0.000    | 0.000    |
| 54   | 72.475   | 0.000    | 0.000    |

|                                                                                                                                |                             |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>3</b>        | Rev |
|                                                                                                                                | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     |                             | Ref                         |     |
| By CARLOS ROD                                                                                                                  |                             | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Nodes Cont...**

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 55   | 74.150   | 0.000    | 0.000    |
| 56   | 75.825   | 0.000    | 0.000    |
| 57   | 77.500   | 0.000    | 0.000    |
| 58   | 78.738   | 0.000    | 0.000    |
| 59   | 79.975   | 0.000    | 0.000    |
| 60   | 81.213   | 0.000    | 0.000    |
| 61   | 82.450   | 0.000    | 0.000    |
| 62   | 84.125   | 0.000    | 0.000    |
| 63   | 85.800   | 0.000    | 0.000    |
| 64   | 87.475   | 0.000    | 0.000    |
| 65   | 89.150   | 0.000    | 0.000    |
| 66   | 90.000   | 0.000    | 0.000    |
| 67   | 90.850   | 0.000    | 0.000    |
| 68   | 92.475   | 0.000    | 0.000    |
| 69   | 94.100   | 0.000    | 0.000    |
| 70   | 94.950   | 0.000    | 0.000    |
| 71   | 95.800   | 0.000    | 0.000    |
| 72   | 97.500   | 0.000    | 0.000    |
| 73   | 98.738   | 0.000    | 0.000    |
| 74   | 99.975   | 0.000    | 0.000    |
| 75   | 101.213  | 0.000    | 0.000    |
| 76   | 102.451  | 0.000    | 0.000    |
| 77   | 103.650  | 0.000    | 0.000    |
| 78   | 4.950    | 0.000    | 5.000    |
| 79   | 6.300    | 0.000    | 5.000    |
| 80   | 7.500    | 0.000    | 5.000    |
| 81   | 8.738    | 0.000    | 5.000    |
| 82   | 9.975    | 0.000    | 5.000    |
| 83   | 11.212   | 0.000    | 5.000    |
| 84   | 12.450   | 0.000    | 5.000    |
| 85   | 14.150   | 0.000    | 5.000    |
| 86   | 15.000   | 0.000    | 5.000    |
| 87   | 15.850   | 0.000    | 5.000    |
| 88   | 17.475   | 0.000    | 5.000    |
| 89   | 19.100   | 0.000    | 5.000    |
| 90   | 19.950   | 0.000    | 5.000    |
| 91   | 20.800   | 0.000    | 5.000    |
| 92   | 22.475   | 0.000    | 5.000    |
| 93   | 24.150   | 0.000    | 5.000    |



**GEOCISA**  
GEOTECNIA Y CEMENTOS, S.A.

Software licensed to GEOCISA

Job No

23VI04

Sheet No

4

Rev

Part

Ref

By CARLOS ROD

Date 23-Sep-02

Chd

Client

G.I.F.

File 23VI04 final 12 23.std

Date/Time 26-Sep-2002 16:48

### Nodes Cont...

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 94   | 25.825   | 0.000    | 5.000    |
| 95   | 27.500   | 0.000    | 5.000    |
| 96   | 28.737   | 0.000    | 5.000    |
| 97   | 29.975   | 0.000    | 5.000    |
| 98   | 31.212   | 0.000    | 5.000    |
| 99   | 32.450   | 0.000    | 5.000    |
| 100  | 34.125   | 0.000    | 5.000    |
| 101  | 35.800   | 0.000    | 5.000    |
| 102  | 37.475   | 0.000    | 5.000    |
| 103  | 39.150   | 0.000    | 5.000    |
| 104  | 40.000   | 0.000    | 5.000    |
| 105  | 40.850   | 0.000    | 5.000    |
| 106  | 42.475   | 0.000    | 5.000    |
| 107  | 44.100   | 0.000    | 5.000    |
| 108  | 44.950   | 0.000    | 5.000    |
| 109  | 45.800   | 0.000    | 5.000    |
| 110  | 47.475   | 0.000    | 5.000    |
| 111  | 49.150   | 0.000    | 5.000    |
| 112  | 50.825   | 0.000    | 5.000    |
| 113  | 52.500   | 0.000    | 5.000    |
| 114  | 53.737   | 0.000    | 5.000    |
| 115  | 54.975   | 0.000    | 5.000    |
| 116  | 56.213   | 0.000    | 5.000    |
| 117  | 57.450   | 0.000    | 5.000    |
| 118  | 59.125   | 0.000    | 5.000    |
| 119  | 60.800   | 0.000    | 5.000    |
| 120  | 62.475   | 0.000    | 5.000    |
| 121  | 64.150   | 0.000    | 5.000    |
| 122  | 65.000   | 0.000    | 5.000    |
| 123  | 65.850   | 0.000    | 5.000    |
| 124  | 67.475   | 0.000    | 5.000    |
| 125  | 69.100   | 0.000    | 5.000    |
| 126  | 69.950   | 0.000    | 5.000    |
| 127  | 70.800   | 0.000    | 5.000    |
| 128  | 72.475   | 0.000    | 5.000    |
| 129  | 74.150   | 0.000    | 5.000    |
| 130  | 75.825   | 0.000    | 5.000    |
| 131  | 77.500   | 0.000    | 5.000    |
| 132  | 78.738   | 0.000    | 5.000    |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>5</b>        | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std      | Date/Time 26-Sep-2002 16:48 |     |

**Nodes Cont...**

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 133  | 79.975   | 0.000    | 5.000    |
| 134  | 81.213   | 0.000    | 5.000    |
| 135  | 82.450   | 0.000    | 5.000    |
| 136  | 84.125   | 0.000    | 5.000    |
| 137  | 85.800   | 0.000    | 5.000    |
| 138  | 87.475   | 0.000    | 5.000    |
| 139  | 89.150   | 0.000    | 5.000    |
| 140  | 90.000   | 0.000    | 5.000    |
| 141  | 90.850   | 0.000    | 5.000    |
| 142  | 92.475   | 0.000    | 5.000    |
| 143  | 94.100   | 0.000    | 5.000    |
| 144  | 94.950   | 0.000    | 5.000    |
| 145  | 95.800   | 0.000    | 5.000    |
| 146  | 97.500   | 0.000    | 5.000    |
| 147  | 98.738   | 0.000    | 5.000    |
| 148  | 99.975   | 0.000    | 5.000    |
| 149  | 101.213  | 0.000    | 5.000    |
| 150  | 102.450  | 0.000    | 5.000    |
| 151  | 103.650  | 0.000    | 5.000    |
| 152  | 105.000  | 0.000    | 5.000    |
| 153  | 106.800  | 0.000    | 5.000    |
| 154  | 108.600  | 0.000    | 5.000    |
| 155  | 109.950  | 0.000    | 5.000    |
| 156  | 0.000    | 0.000    | 2.500    |
| 157  | 1.350    | 0.000    | 2.500    |
| 158  | 3.150    | 0.000    | 2.500    |
| 159  | 4.950    | 0.000    | 2.500    |
| 160  | 6.300    | 0.000    | 2.500    |
| 161  | 14.150   | 0.000    | 2.500    |
| 162  | 15.000   | 0.000    | 2.500    |
| 163  | 15.850   | 0.000    | 2.500    |
| 164  | 19.100   | 0.000    | 2.500    |
| 165  | 19.950   | 0.000    | 2.500    |
| 166  | 20.800   | 0.000    | 2.500    |
| 167  | 39.150   | 0.000    | 2.500    |
| 168  | 40.000   | 0.000    | 2.500    |
| 169  | 40.850   | 0.000    | 2.500    |
| 170  | 44.100   | 0.000    | 2.500    |
| 171  | 44.950   | 0.000    | 2.500    |



|                                                                                                                                                                                                                 |                             |                             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|   <b>GEOCISA</b><br>GEOTECNIA Y CAMBIOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>6</b>        | Rev |
|                                                                                                                                                                                                                 | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                                                                                                      | Ref                         |                             |     |
| Client G.I.F.                                                                                                                                                                                                   | By CARLOS ROD               | Date 23-Sep-02              | Chd |
|                                                                                                                                                                                                                 | File 23VI04 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Nodes Cont...**

| Node | X<br>(m) | Y<br>(m) | Z<br>(m) |
|------|----------|----------|----------|
| 172  | 45.800   | 0.000    | 2.500    |
| 173  | 64.150   | 0.000    | 2.500    |
| 174  | 65.000   | 0.000    | 2.500    |
| 175  | 65.850   | 0.000    | 2.500    |
| 176  | 69.100   | 0.000    | 2.500    |
| 177  | 69.950   | 0.000    | 2.500    |
| 178  | 70.800   | 0.000    | 2.500    |
| 179  | 89.150   | 0.000    | 2.500    |
| 180  | 90.000   | 0.000    | 2.500    |
| 181  | 105.000  | 0.000    | 0.000    |
| 182  | 90.850   | 0.000    | 2.500    |
| 183  | 94.100   | 0.000    | 2.500    |
| 184  | 94.950   | 0.000    | 2.500    |
| 185  | 95.800   | 0.000    | 2.500    |
| 186  | 105.000  | 0.000    | 2.500    |
| 187  | 106.800  | 0.000    | 2.500    |
| 188  | 108.600  | 0.000    | 2.500    |
| 189  | 109.950  | 0.000    | 2.500    |

**Beams**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 1    | 1      | 2      | 1.350         | 2        | 0                    |
| 2    | 2      | 3      | 1.800         | 1        | 0                    |
| 3    | 3      | 4      | 1.800         | 1        | 0                    |
| 4    | 4      | 5      | 1.350         | 1        | 0                    |
| 5    | 5      | 6      | 1.200         | 1        | 0                    |
| 6    | 6      | 7      | 1.238         | 1        | 0                    |
| 7    | 7      | 8      | 1.238         | 1        | 0                    |
| 8    | 8      | 9      | 1.237         | 1        | 0                    |
| 9    | 9      | 10     | 1.238         | 1        | 0                    |
| 10   | 10     | 11     | 1.700         | 1        | 0                    |
| 11   | 11     | 12     | 0.850         | 2        | 0                    |
| 12   | 12     | 13     | 0.850         | 2        | 0                    |
| 13   | 13     | 14     | 1.625         | 1        | 0                    |
| 14   | 14     | 15     | 1.625         | 1        | 0                    |
| 15   | 15     | 16     | 0.850         | 1        | 0                    |
| 16   | 16     | 17     | 0.850         | 1        | 0                    |
| 17   | 17     | 18     | 1.675         | 1        | 0                    |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>7</b>        | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std      | Date/Time 26-Sep-2002 16:48 |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 18   | 18     | 19     | 1.675         | 1        | 0                    |
| 19   | 19     | 20     | 1.675         | 1        | 0                    |
| 20   | 20     | 21     | 1.675         | 1        | 0                    |
| 21   | 21     | 22     | 1.237         | 1        | 0                    |
| 22   | 22     | 23     | 1.238         | 1        | 0                    |
| 23   | 23     | 24     | 1.237         | 1        | 0                    |
| 24   | 24     | 25     | 1.238         | 1        | 0                    |
| 25   | 25     | 26     | 1.675         | 1        | 0                    |
| 26   | 26     | 27     | 1.675         | 1        | 0                    |
| 27   | 27     | 28     | 1.675         | 1        | 0                    |
| 28   | 28     | 29     | 1.675         | 1        | 0                    |
| 29   | 29     | 30     | 0.850         | 2        | 0                    |
| 30   | 30     | 31     | 0.850         | 2        | 0                    |
| 31   | 31     | 32     | 1.625         | 1        | 0                    |
| 32   | 32     | 33     | 1.625         | 1        | 0                    |
| 33   | 33     | 34     | 0.850         | 1        | 0                    |
| 34   | 34     | 35     | 0.850         | 1        | 0                    |
| 35   | 35     | 36     | 1.675         | 1        | 0                    |
| 36   | 36     | 37     | 1.675         | 1        | 0                    |
| 37   | 37     | 38     | 1.675         | 1        | 0                    |
| 38   | 38     | 39     | 1.675         | 1        | 0                    |
| 39   | 39     | 40     | 1.237         | 1        | 0                    |
| 40   | 40     | 41     | 1.237         | 1        | 0                    |
| 41   | 41     | 42     | 1.238         | 1        | 0                    |
| 42   | 42     | 43     | 1.237         | 1        | 0                    |
| 43   | 43     | 44     | 1.675         | 1        | 0                    |
| 44   | 44     | 45     | 1.675         | 1        | 0                    |
| 45   | 45     | 46     | 1.675         | 1        | 0                    |
| 46   | 46     | 47     | 1.675         | 1        | 0                    |
| 47   | 47     | 48     | 0.850         | 2        | 0                    |
| 48   | 48     | 49     | 0.850         | 2        | 0                    |
| 49   | 49     | 50     | 1.625         | 1        | 0                    |
| 50   | 50     | 51     | 1.625         | 1        | 0                    |
| 51   | 51     | 52     | 0.850         | 1        | 0                    |
| 52   | 52     | 53     | 0.850         | 1        | 0                    |
| 53   | 53     | 54     | 1.675         | 1        | 0                    |
| 54   | 54     | 55     | 1.675         | 1        | 0                    |
| 55   | 55     | 56     | 1.675         | 1        | 0                    |
| 56   | 56     | 57     | 1.675         | 1        | 0                    |

|                                                                                                                                |                                    |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>            | Sheet No<br><b>8</b>               | Rev |
|                                                                                                                                | Part                               |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              |                                    | Ref                                |     |
| By <b>CARLOS ROD</b> Date <b>23-Sep-02</b> Chd                                                                                 |                                    |                                    |     |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 12 23.std</b> | Date/Time <b>26-Sep-2002 16:48</b> |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 57   | 57     | 58     | 1.238         | 1        | 0                    |
| 58   | 58     | 59     | 1.237         | 1        | 0                    |
| 59   | 59     | 60     | 1.238         | 1        | 0                    |
| 60   | 60     | 61     | 1.237         | 1        | 0                    |
| 61   | 61     | 62     | 1.675         | 1        | 0                    |
| 62   | 62     | 63     | 1.675         | 1        | 0                    |
| 63   | 63     | 64     | 1.675         | 1        | 0                    |
| 64   | 64     | 65     | 1.675         | 1        | 0                    |
| 65   | 65     | 66     | 0.850         | 2        | 0                    |
| 66   | 66     | 67     | 0.850         | 2        | 0                    |
| 67   | 67     | 68     | 1.625         | 1        | 0                    |
| 68   | 68     | 69     | 1.625         | 1        | 0                    |
| 69   | 69     | 70     | 0.850         | 1        | 0                    |
| 70   | 70     | 71     | 0.850         | 1        | 0                    |
| 71   | 71     | 72     | 1.700         | 1        | 0                    |
| 72   | 72     | 73     | 1.238         | 1        | 0                    |
| 73   | 73     | 74     | 1.237         | 1        | 0                    |
| 74   | 74     | 75     | 1.238         | 1        | 0                    |
| 75   | 75     | 76     | 1.238         | 1        | 0                    |
| 76   | 76     | 77     | 1.199         | 1        | 0                    |
| 77   | 78     | 79     | 1.350         | 4        | 0                    |
| 78   | 79     | 80     | 1.200         | 3        | 0                    |
| 79   | 80     | 81     | 1.238         | 3        | 0                    |
| 80   | 81     | 82     | 1.238         | 3        | 0                    |
| 81   | 82     | 83     | 1.237         | 3        | 0                    |
| 82   | 83     | 84     | 1.238         | 3        | 0                    |
| 83   | 84     | 85     | 1.700         | 3        | 0                    |
| 84   | 85     | 86     | 0.850         | 3        | 0                    |
| 85   | 86     | 87     | 0.850         | 3        | 0                    |
| 86   | 87     | 88     | 1.625         | 3        | 0                    |
| 87   | 88     | 89     | 1.625         | 3        | 0                    |
| 88   | 89     | 90     | 0.850         | 4        | 0                    |
| 89   | 90     | 91     | 0.850         | 4        | 0                    |
| 90   | 91     | 92     | 1.675         | 3        | 0                    |
| 91   | 92     | 93     | 1.675         | 3        | 0                    |
| 92   | 93     | 94     | 1.675         | 3        | 0                    |
| 93   | 94     | 95     | 1.675         | 3        | 0                    |
| 94   | 95     | 96     | 1.237         | 3        | 0                    |
| 95   | 96     | 97     | 1.238         | 3        | 0                    |

|                                                                                                                                                                                                                 |                             |                             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|   <b>GEOCISA</b><br>GEOTECNIA Y CAMBIOS, S.A. | Job No<br><b>23V104</b>     | Sheet No<br><b>9</b>        | Rev |
|                                                                                                                                                                                                                 | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                                                                                                      |                             | Ref                         |     |
| By CARLOS ROD                                                                                                                                                                                                   |                             | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                                                                                                   | File 23V104 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 96   | 97     | 98     | 1.237         | 3        | 0                    |
| 97   | 98     | 99     | 1.238         | 3        | 0                    |
| 98   | 99     | 100    | 1.675         | 3        | 0                    |
| 99   | 100    | 101    | 1.675         | 3        | 0                    |
| 100  | 101    | 102    | 1.675         | 3        | 0                    |
| 101  | 102    | 103    | 1.675         | 3        | 0                    |
| 102  | 103    | 104    | 0.850         | 3        | 0                    |
| 103  | 104    | 105    | 0.850         | 3        | 0                    |
| 104  | 105    | 106    | 1.625         | 3        | 0                    |
| 105  | 106    | 107    | 1.625         | 3        | 0                    |
| 106  | 107    | 108    | 0.850         | 4        | 0                    |
| 107  | 108    | 109    | 0.850         | 4        | 0                    |
| 108  | 109    | 110    | 1.675         | 3        | 0                    |
| 109  | 110    | 111    | 1.675         | 3        | 0                    |
| 110  | 111    | 112    | 1.675         | 3        | 0                    |
| 111  | 112    | 113    | 1.675         | 3        | 0                    |
| 112  | 113    | 114    | 1.237         | 3        | 0                    |
| 113  | 114    | 115    | 1.237         | 3        | 0                    |
| 114  | 115    | 116    | 1.238         | 3        | 0                    |
| 115  | 116    | 117    | 1.237         | 3        | 0                    |
| 116  | 117    | 118    | 1.675         | 3        | 0                    |
| 117  | 118    | 119    | 1.675         | 3        | 0                    |
| 118  | 119    | 120    | 1.675         | 3        | 0                    |
| 119  | 120    | 121    | 1.675         | 3        | 0                    |
| 120  | 121    | 122    | 0.850         | 3        | 0                    |
| 121  | 122    | 123    | 0.850         | 3        | 0                    |
| 122  | 123    | 124    | 1.625         | 3        | 0                    |
| 123  | 124    | 125    | 1.625         | 3        | 0                    |
| 124  | 125    | 126    | 0.850         | 4        | 0                    |
| 125  | 126    | 127    | 0.850         | 4        | 0                    |
| 126  | 127    | 128    | 1.675         | 3        | 0                    |
| 127  | 128    | 129    | 1.675         | 3        | 0                    |
| 128  | 129    | 130    | 1.675         | 3        | 0                    |
| 129  | 130    | 131    | 1.675         | 3        | 0                    |
| 130  | 131    | 132    | 1.238         | 3        | 0                    |
| 131  | 132    | 133    | 1.237         | 3        | 0                    |
| 132  | 133    | 134    | 1.238         | 3        | 0                    |
| 133  | 134    | 135    | 1.237         | 3        | 0                    |
| 134  | 135    | 136    | 1.675         | 3        | 0                    |

|                                                                                                                                                                                                                 |                             |                             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|   <b>GEOCISA</b><br>GEOTECNIA Y CAMBIOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>10</b>       | Rev |
|                                                                                                                                                                                                                 | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                                                                                                      |                             | Ref                         |     |
| By CARLOS ROD                                                                                                                                                                                                   |                             | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                                                                                                   | File 23VI04 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 135  | 136    | 137    | 1.675         | 3        | 0                    |
| 136  | 137    | 138    | 1.675         | 3        | 0                    |
| 137  | 138    | 139    | 1.675         | 3        | 0                    |
| 138  | 139    | 140    | 0.850         | 3        | 0                    |
| 139  | 140    | 141    | 0.850         | 3        | 0                    |
| 140  | 141    | 142    | 1.625         | 3        | 0                    |
| 141  | 143    | 144    | 0.850         | 4        | 0                    |
| 142  | 144    | 145    | 0.850         | 4        | 0                    |
| 143  | 145    | 146    | 1.700         | 3        | 0                    |
| 144  | 146    | 147    | 1.238         | 3        | 0                    |
| 145  | 147    | 148    | 1.237         | 3        | 0                    |
| 146  | 148    | 149    | 1.238         | 3        | 0                    |
| 147  | 149    | 150    | 1.237         | 3        | 0                    |
| 148  | 150    | 151    | 1.200         | 3        | 0                    |
| 149  | 151    | 152    | 1.350         | 3        | 0                    |
| 150  | 152    | 153    | 1.800         | 3        | 0                    |
| 151  | 153    | 154    | 1.800         | 3        | 0                    |
| 152  | 154    | 155    | 1.350         | 3        | 0                    |
| 153  | 1      | 156    | 2.500         | 5        | 0                    |
| 154  | 2      | 157    | 2.500         | 6        | 0                    |
| 155  | 3      | 158    | 2.500         | 7        | 0                    |
| 156  | 4      | 159    | 2.500         | 8        | 0                    |
| 157  | 159    | 78     | 2.500         | 9        | 0                    |
| 158  | 5      | 160    | 2.500         | 10       | 0                    |
| 159  | 160    | 79     | 2.500         | 11       | 0                    |
| 160  | 6      | 80     | 5.000         | 12       | 0                    |
| 161  | 7      | 81     | 5.000         | 13       | 0                    |
| 162  | 8      | 82     | 5.000         | 14       | 0                    |
| 163  | 9      | 83     | 5.000         | 15       | 0                    |
| 164  | 10     | 84     | 5.000         | 16       | 0                    |
| 165  | 11     | 161    | 2.500         | 17       | 0                    |
| 166  | 161    | 85     | 2.500         | 18       | 0                    |
| 167  | 12     | 162    | 2.500         | 19       | 0                    |
| 168  | 162    | 86     | 2.500         | 20       | 0                    |
| 169  | 13     | 163    | 2.500         | 21       | 0                    |
| 170  | 163    | 87     | 2.500         | 22       | 0                    |
| 171  | 14     | 88     | 5.000         | 23       | 0                    |
| 172  | 15     | 164    | 2.500         | 24       | 0                    |
| 173  | 164    | 89     | 2.500         | 25       | 0                    |

|                                                                                                                                |                             |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>11</b>       | Rev |
|                                                                                                                                | Part                        |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     |                             |                             |     |
| Ref                                                                                                                            |                             |                             |     |
| By CARLOS ROD Date 23-Sep-02 Cnd                                                                                               |                             |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std | Date/Time 26-Sep-2002 16:48 |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 174  | 16     | 165    | 2.500         | 26       | 0                    |
| 175  | 165    | 90     | 2.500         | 27       | 0                    |
| 176  | 17     | 166    | 2.500         | 28       | 0                    |
| 177  | 166    | 91     | 2.500         | 29       | 0                    |
| 178  | 18     | 92     | 5.000         | 30       | 0                    |
| 179  | 19     | 93     | 5.000         | 31       | 0                    |
| 180  | 20     | 94     | 5.000         | 32       | 0                    |
| 181  | 21     | 95     | 5.000         | 33       | 0                    |
| 182  | 22     | 96     | 5.000         | 34       | 0                    |
| 183  | 23     | 97     | 5.000         | 35       | 0                    |
| 184  | 24     | 98     | 5.000         | 36       | 0                    |
| 185  | 25     | 99     | 5.000         | 37       | 0                    |
| 186  | 26     | 100    | 5.000         | 38       | 0                    |
| 187  | 27     | 101    | 5.000         | 39       | 0                    |
| 188  | 28     | 102    | 5.000         | 40       | 0                    |
| 189  | 29     | 167    | 2.500         | 41       | 0                    |
| 190  | 167    | 103    | 2.500         | 42       | 0                    |
| 191  | 30     | 168    | 2.500         | 19       | 0                    |
| 192  | 168    | 104    | 2.500         | 20       | 0                    |
| 193  | 31     | 169    | 2.500         | 21       | 0                    |
| 194  | 169    | 105    | 2.500         | 22       | 0                    |
| 195  | 32     | 106    | 5.000         | 23       | 0                    |
| 196  | 33     | 170    | 2.500         | 24       | 0                    |
| 197  | 170    | 107    | 2.500         | 25       | 0                    |
| 198  | 34     | 171    | 2.500         | 26       | 0                    |
| 199  | 171    | 108    | 2.500         | 27       | 0                    |
| 200  | 35     | 172    | 2.500         | 28       | 0                    |
| 201  | 172    | 109    | 2.500         | 29       | 0                    |
| 202  | 36     | 110    | 5.000         | 30       | 0                    |
| 203  | 37     | 111    | 5.000         | 31       | 0                    |
| 204  | 38     | 112    | 5.000         | 32       | 0                    |
| 205  | 39     | 113    | 5.000         | 33       | 0                    |
| 206  | 40     | 114    | 5.000         | 34       | 0                    |
| 207  | 41     | 115    | 5.000         | 35       | 0                    |
| 208  | 42     | 116    | 5.000         | 36       | 0                    |
| 209  | 43     | 117    | 5.000         | 37       | 0                    |
| 210  | 44     | 118    | 5.000         | 38       | 0                    |
| 211  | 45     | 119    | 5.000         | 39       | 0                    |
| 212  | 46     | 120    | 5.000         | 40       | 0                    |

|                                                                                                                                |                         |                              |                             |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------|------------------------------|-----------------------------|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b> | Sheet No<br><b>12</b>        | Rev                         |
|                                                                                                                                | Part                    |                              |                             |
| Job Title PRUEBAS DE CARGA                                                                                                     |                         | Ref                          |                             |
| Client G.I.F.                                                                                                                  |                         | By CARLOS ROD Date 23-Sep-02 | Chd                         |
|                                                                                                                                |                         | File 23VI04 final 12 23.std  | Date/Time 26-Sep-2002 16:48 |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 213  | 47     | 173    | 2.500         | 41       | 0                    |
| 214  | 173    | 121    | 2.500         | 42       | 0                    |
| 215  | 48     | 174    | 2.500         | 19       | 0                    |
| 216  | 174    | 122    | 2.500         | 20       | 0                    |
| 217  | 49     | 175    | 2.500         | 21       | 0                    |
| 218  | 175    | 123    | 2.500         | 22       | 0                    |
| 219  | 50     | 124    | 5.000         | 23       | 0                    |
| 220  | 51     | 176    | 2.500         | 24       | 0                    |
| 221  | 176    | 125    | 2.500         | 25       | 0                    |
| 222  | 52     | 177    | 2.500         | 26       | 0                    |
| 223  | 177    | 126    | 2.500         | 27       | 0                    |
| 224  | 53     | 178    | 2.500         | 28       | 0                    |
| 225  | 178    | 127    | 2.500         | 29       | 0                    |
| 226  | 54     | 128    | 5.000         | 30       | 0                    |
| 227  | 55     | 129    | 5.000         | 31       | 0                    |
| 228  | 56     | 130    | 5.000         | 32       | 0                    |
| 229  | 57     | 131    | 5.000         | 33       | 0                    |
| 230  | 58     | 132    | 5.000         | 34       | 0                    |
| 231  | 59     | 133    | 5.000         | 35       | 0                    |
| 232  | 60     | 134    | 5.000         | 36       | 0                    |
| 233  | 61     | 135    | 5.000         | 37       | 0                    |
| 234  | 62     | 136    | 5.000         | 38       | 0                    |
| 235  | 63     | 137    | 5.000         | 39       | 0                    |
| 236  | 64     | 138    | 5.000         | 40       | 0                    |
| 237  | 65     | 179    | 2.500         | 41       | 0                    |
| 238  | 179    | 139    | 2.500         | 42       | 0                    |
| 239  | 66     | 180    | 2.500         | 17       | 0                    |
| 240  | 180    | 140    | 2.500         | 20       | 0                    |
| 241  | 142    | 143    | 1.625         | 3        | 0                    |
| 242  | 77     | 181    | 1.350         | 2        | 0                    |
| 243  | 67     | 182    | 2.500         | 43       | 0                    |
| 244  | 182    | 141    | 2.500         | 44       | 0                    |
| 245  | 68     | 142    | 5.000         | 45       | 0                    |
| 246  | 69     | 183    | 2.500         | 46       | 0                    |
| 247  | 183    | 143    | 2.500         | 47       | 0                    |
| 248  | 70     | 184    | 2.500         | 48       | 0                    |
| 249  | 184    | 144    | 2.500         | 49       | 0                    |
| 250  | 71     | 185    | 2.500         | 50       | 0                    |
| 251  | 185    | 145    | 2.500         | 51       | 0                    |

|                                                                                                                                |                                                |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>                        | Sheet No<br><b>13</b>              | Rev |
|                                                                                                                                | Part                                           |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                                            |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b> Date <b>23-Sep-02</b> Chd |                                    |     |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 12 23.std</b>             | Date/Time <b>26-Sep-2002 16:48</b> |     |

**Beams Cont...**

| Beam | Node A | Node B | Length<br>(m) | Property | $\beta$<br>(degrees) |
|------|--------|--------|---------------|----------|----------------------|
| 252  | 72     | 146    | 5.000         | 52       | 0                    |
| 253  | 73     | 147    | 5.000         | 53       | 0                    |
| 254  | 74     | 148    | 5.000         | 54       | 0                    |
| 255  | 75     | 149    | 5.000         | 55       | 0                    |
| 256  | 76     | 150    | 5.000         | 56       | 0                    |
| 257  | 77     | 151    | 5.000         | 57       | 0                    |
| 258  | 181    | 186    | 2.500         | 58       | 0                    |
| 259  | 186    | 152    | 2.500         | 59       | 0                    |
| 260  | 187    | 153    | 2.500         | 60       | 0                    |
| 261  | 188    | 154    | 2.500         | 61       | 0                    |
| 262  | 189    | 155    | 2.500         | 62       | 0                    |

**Section Properties**

| Prop | Section           | Area<br>(m <sup>2</sup> ) | I <sub>yy</sub><br>(m <sup>4</sup> ) | I <sub>zz</sub><br>(m <sup>4</sup> ) | J<br>(m <sup>4</sup> ) | Material |
|------|-------------------|---------------------------|--------------------------------------|--------------------------------------|------------------------|----------|
| 1    | Prismatic General | 3.437                     | 10.009                               | 1.104                                | 1.720                  | -        |
| 2    | Prismatic General | 5.789                     | 10.979                               | 1.676                                | 2.625                  | -        |
| 3    | Prismatic General | 3.436                     | 10.010                               | 1.097                                | 1.722                  | -        |
| 4    | Prismatic General | 5.788                     | 10.984                               | 1.664                                | 2.628                  | -        |
| 5    | Prismatic General | 0.748                     | 0.028                                | 0.077                                | 0.153                  | -        |
| 6    | Prismatic General | 0.659                     | 0.136                                | 0.010                                | 0.019                  | -        |
| 7    | Prismatic General | 0.753                     | 0.203                                | 0.011                                | 0.022                  | -        |
| 8    | Prismatic General | 0.659                     | 0.136                                | 0.010                                | 0.019                  | -        |
| 9    | Prismatic General | 1.746                     | 0.361                                | 0.179                                | 0.358                  | -        |
| 10   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 11   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 12   | Prismatic General | 0.510                     | 0.063                                | 0.007                                | 0.015                  | -        |
| 13   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 14   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 15   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 16   | Prismatic General | 0.615                     | 0.111                                | 0.009                                | 0.018                  | -        |
| 17   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 18   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 19   | Prismatic General | 0.942                     | 0.057                                | 0.096                                | 0.193                  | -        |
| 20   | Prismatic General | 0.356                     | 0.021                                | 0.005                                | 0.010                  | -        |
| 21   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 22   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 23   | Prismatic General | 0.680                     | 0.150                                | 0.010                                | 0.020                  | -        |
| 24   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |



|                                                                                                                                                                               |                                |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>        | Sheet No<br><b>14</b>          | Rev |
|                                                                                                                                                                               | Part                           |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                            |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD               | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final 12 23.std | Date/Time<br>26-Sep-2002 16:48 |     |

**Section Properties Cont...**

| Prop | Section           | Area<br>(m <sup>2</sup> ) | I <sub>yy</sub><br>(m <sup>4</sup> ) | I <sub>zz</sub><br>(m <sup>4</sup> ) | J<br>(m <sup>4</sup> ) | Material |
|------|-------------------|---------------------------|--------------------------------------|--------------------------------------|------------------------|----------|
| 25   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 26   | Prismatic General | 0.010                     | 0.021                                | 0.005                                | 0.010                  | -        |
| 27   | Prismatic General | 0.942                     | 0.057                                | 0.096                                | 0.193                  | -        |
| 28   | Prismatic General | 0.528                     | 0.070                                | 0.008                                | 0.015                  | -        |
| 29   | Prismatic General | 0.528                     | 0.070                                | 0.008                                | 0.015                  | -        |
| 30   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 31   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 32   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 33   | Prismatic General | 0.609                     | 0.108                                | 0.009                                | 0.018                  | -        |
| 34   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 35   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 36   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 37   | Prismatic General | 0.609                     | 0.108                                | 0.009                                | 0.018                  | -        |
| 38   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 39   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 40   | Prismatic General | 0.701                     | 0.164                                | 0.010                                | 0.020                  | -        |
| 41   | Prismatic General | 0.528                     | 0.070                                | 0.008                                | 0.015                  | -        |
| 42   | Prismatic General | 0.528                     | 0.070                                | 0.008                                | 0.015                  | -        |
| 43   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 44   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 45   | Prismatic General | 0.680                     | 0.150                                | 0.010                                | 0.020                  | -        |
| 46   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 47   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 48   | Prismatic General | 0.356                     | 0.021                                | 0.005                                | 0.010                  | -        |
| 49   | Prismatic General | 0.942                     | 0.057                                | 0.096                                | 0.193                  | -        |
| 50   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 51   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 52   | Prismatic General | 0.615                     | 0.111                                | 0.009                                | 0.018                  | -        |
| 53   | Prismatic General | 0.518                     | 0.066                                | 0.008                                | 0.015                  | -        |
| 54   | Prismatic General | 0.615                     | 0.111                                | 0.009                                | 0.018                  | -        |
| 55   | Prismatic General | 0.547                     | 0.078                                | 0.008                                | 0.016                  | -        |
| 56   | Prismatic General | 0.539                     | 0.074                                | 0.008                                | 0.016                  | -        |
| 57   | Prismatic General | 0.534                     | 0.072                                | 0.008                                | 0.016                  | -        |
| 58   | Prismatic General | 1.746                     | 0.361                                | 0.179                                | 0.358                  | -        |
| 59   | Prismatic General | 0.659                     | 0.136                                | 0.010                                | 0.019                  | -        |
| 60   | Prismatic General | 0.753                     | 0.203                                | 0.011                                | 0.022                  | -        |
| 61   | Prismatic General | 0.659                     | 0.136                                | 0.010                                | 0.019                  | -        |
| 62   | Prismatic General | 0.748                     | 0.028                                | 0.077                                | 0.153                  | -        |


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 GEOTECNIA Y CIMENTOS, S.A.

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|--------|------------------------|-----------|-------------------|-----|
| Job No | 23VI04                 | Sheet No  | 15                | Rev |
| Part   |                        |           |                   |     |
| Ref    |                        |           |                   |     |
| By     | CARLOS ROD             | Date      | 23-Sep-02         | Chd |
| File   | 23VI04 final 12 23.std | Date/Time | 26-Sep-2002 16:48 |     |

Job Title PRUEBAS DE CARGA

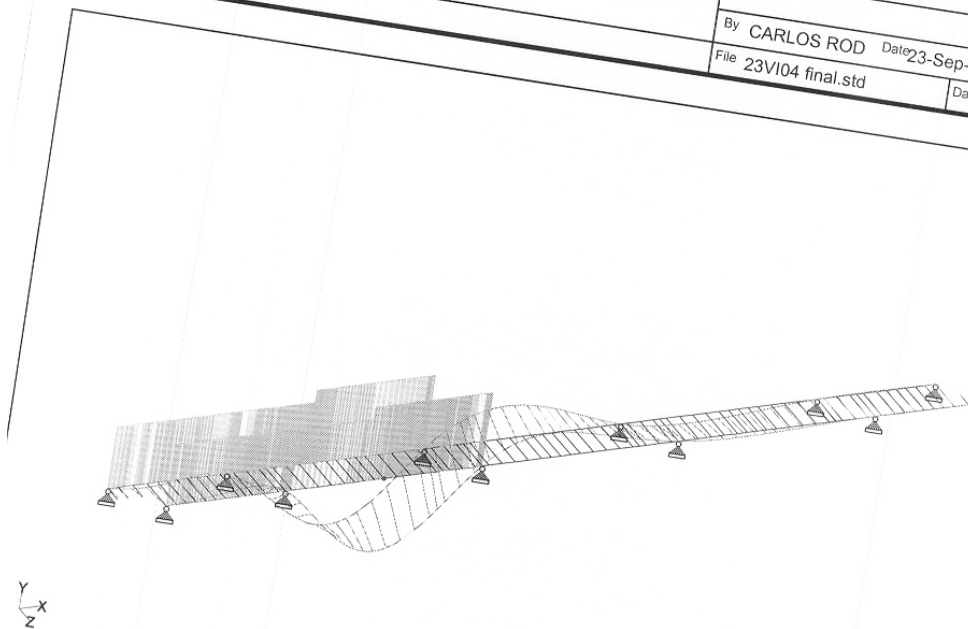
Client G.I.F.

### Supports

| Node | X<br>(kN/m) | Y<br>(kN/m) | Z<br>(kN/m) | rX<br>(kN·m/deg) | rY<br>(kN·m/deg) | rZ<br>(kN·m/deg) |
|------|-------------|-------------|-------------|------------------|------------------|------------------|
| 1    | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 12   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 30   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 48   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 66   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 78   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 90   | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 108  | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 126  | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 144  | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 155  | Fixed       | Fixed       | Fixed       | -                | -                | -                |
| 181  | Fixed       | Fixed       | Fixed       | -                | -                | -                |

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|                                                                          |  |                              |                      |
|--------------------------------------------------------------------------|--|------------------------------|----------------------|
| Software licensed to <b>GEOCISA</b><br><b>GEOTECNIA Y CEMENTOS, S.A.</b> |  | Job No<br><b>23VI04</b>      | Sheet No             |
| Job Title <b>PRUEBAS DE CARGA</b>                                        |  | Part                         |                      |
| Client <b>G.I.F.</b>                                                     |  | Ref                          |                      |
|                                                                          |  | By <b>CARLOS ROD</b>         | Date <b>23-Sep-0</b> |
|                                                                          |  | File <b>23VI04 final.std</b> | Date                 |



### Displacements

| L/C      | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) |          |
|----------|------|-----------|-----------|-----------|-------------------|-------------|-------------|----------|
| N B V1 Y | 5    | 0.000     | -0.127    | 0.000     | 0.127             | -0.00009    | 0.00000     | 0.00000  |
|          | 21   | 0.000     | -4.406    | 0.000     | 4.406             | -0.00003    | 0.00000     | -0.00000 |
|          | 39   | 0.000     | 2.095     | 0.000     | 2.095             | 0.00009     | 0.00000     | -0.00000 |
|          | 57   | 0.000     | -0.517    | 0.000     | 0.517             | -0.00003    | 0.00000     | 0.00000  |
|          | 72   | 0.000     | 0.082     | 0.000     | 0.082             | -0.00000    | 0.00000     | -0.00000 |
|          | 84   | 0.000     | 0.409     | 0.000     | 0.409             | -0.00007    | 0.00000     | 0.00000  |
|          | 99   | 0.000     | -4.820    | 0.000     | 4.820             | 0.00020     | 0.00000     | -0.00000 |
|          | 117  | 0.000     | 1.579     | 0.000     | 1.579             | 0.00005     | 0.00000     | 0.00000  |
|          | 135  | 0.000     | -0.310    | 0.000     | 0.310             | -0.00001    | 0.00000     | -0.00000 |
|          | 150  | 0.000     | 0.043     | 0.000     | 0.043             | 0.00001     | 0.00000     | -0.00000 |

|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>17</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
| Client<br>G.I.F.                                                                                                                                                              | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
|                                                                                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

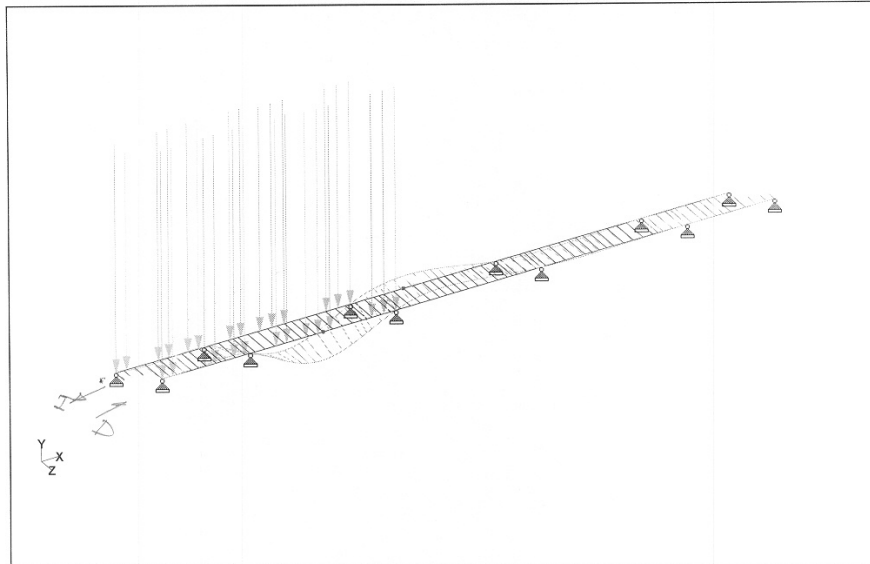
| L/C           | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|---------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|               |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 2:TREN B V1 \ | 5    | 5    | 0.000        | -19.535      | 0.000        | 42.561      | 0.000       | -853.716    |
|               |      | 6    | 0.000        | 31.535       | 0.000        | -42.561     | 0.000       | 553.222     |
|               | 6    | 6    | 0.000        | -32.132      | 0.000        | 59.192      | 0.000       | -554.733    |
|               |      | 7    | 0.000        | 44.507       | 0.000        | -59.192     | 0.000       | 89.696      |
|               | 20   | 20   | 0.000        | 38.907       | 0.000        | -569.574    | 0.000       | -2.98E 3    |
|               |      | 21   | 0.000        | -18.807      | 0.000        | 569.574     | 0.000       | 3.45E 3     |
|               | 21   | 21   | 0.000        | 21.801       | 0.000        | -635.883    | 0.000       | -3.47E 3    |
|               |      | 22   | 0.000        | -6.951       | 0.000        | 635.883     | 0.000       | 3.65E 3     |
|               | 38   | 38   | 0.000        | 12.771       | 0.000        | 407.600     | 0.000       | 1.33E 3     |
|               |      | 39   | 0.000        | -12.771      | 0.000        | -407.600    | 0.000       | -1.12E 3    |
|               | 39   | 39   | 0.000        | 13.529       | 0.000        | 390.932     | 0.000       | 1.13E 3     |
|               |      | 40   | 0.000        | -13.529      | 0.000        | -390.932    | 0.000       | -964.139    |
|               | 56   | 56   | 0.000        | -3.998       | 0.000        | -74.367     | 0.000       | -318.826    |
|               |      | 57   | 0.000        | 3.998        | 0.000        | 74.367      | 0.000       | 253.149     |
|               | 57   | 57   | 0.000        | -3.928       | 0.000        | -75.624     | 0.000       | -255.007    |
|               |      | 58   | 0.000        | 3.928        | 0.000        | 75.624      | 0.000       | 207.338     |
|               | 71   | 71   | 0.000        | 1.745        | 0.000        | 6.137       | 0.000       | 140.951     |
|               |      | 72   | 0.000        | -1.745       | 0.000        | -6.137      | 0.000       | -111.864    |
|               | 72   | 72   | 0.000        | 1.630        | 0.000        | 9.514       | 0.000       | 112.539     |
|               |      | 73   | 0.000        | -1.630       | 0.000        | -9.514      | 0.000       | -92.757     |
|               | 82   | 83   | 0.000        | -25.338      | 0.000        | 134.047     | 0.000       | -218.176    |
|               |      | 84   | 0.000        | 37.713       | 0.000        | -134.047    | 0.000       | -164.415    |
|               | 83   | 84   | 0.000        | -36.807      | 0.000        | 154.050     | 0.000       | 159.449     |
|               |      | 85   | 0.000        | 53.807       | 0.000        | -154.050    | 0.000       | -914.769    |
|               | 97   | 98   | 0.000        | 16.864       | 0.000        | -429.246    | 0.000       | -3.74E 3    |
|               |      | 99   | 0.000        | -2.014       | 0.000        | 429.246     | 0.000       | 3.85E 3     |
|               | 98   | 99   | 0.000        | 2.758        | 0.000        | -417.375    | 0.000       | -3.84E 3    |
|               |      | 100  | 0.000        | 17.342       | 0.000        | 417.375     | 0.000       | 3.72E 3     |
|               | 115  | 116  | 0.000        | 17.004       | 0.000        | 348.004     | 0.000       | 905.621     |
|               |      | 117  | 0.000        | -17.004      | 0.000        | -348.004    | 0.000       | -699.267    |
|               | 116  | 117  | 0.000        | 15.812       | 0.000        | 317.117     | 0.000       | 694.982     |
|               |      | 118  | 0.000        | -15.812      | 0.000        | -317.117    | 0.000       | -435.256    |
|               | 133  | 134  | 0.000        | -3.536       | 0.000        | -68.486     | 0.000       | -186.441    |
|               |      | 135  | 0.000        | 3.536        | 0.000        | 68.486      | 0.000       | 143.527     |
|               | 134  | 135  | 0.000        | -3.354       | 0.000        | -64.442     | 0.000       | -142.158    |
|               |      | 136  | 0.000        | 3.354        | 0.000        | 64.442      | 0.000       | 87.072      |
|               | 147  | 149  | 0.000        | 1.120        | 0.000        | 9.685       | 0.000       | 73.481      |
|               |      | 150  | 0.000        | -1.120       | 0.000        | -9.685      | 0.000       | -59.896     |

|                                                                                                                                                                               |                         |                             |                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------|--------------------|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b> | Sheet No<br><b>18</b>       | Rev                |
|                                                                                                                                                                               | Part                    |                             |                    |
| Job Title PRUEBAS DE CARGA                                                                                                                                                    |                         | Ref                         |                    |
|                                                                                                                                                                               |                         | By CARLOS ROD               | Date 23-Sep-02 Chd |
| Client G.I.F.                                                                                                                                                                 | File 23VI04 final.std   | Date/Time 03-Oct-2002 16:29 |                    |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 1.086        | 0.000        | 8.330       | 0.000       | 59.382      |
|     |      | 151  | 0.000        | -1.086       | 0.000        | -8.330      | 0.000       | -46.605     |

|                                                                                                                                |                                    |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>            | Sheet No<br><b>19</b>              | Rev |
|                                                                                                                                | Part                               |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                                |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b>               | Date <b>23-Sep-02</b>              | Chd |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 12 23.std</b> | Date/Time <b>03-Oct-2002 16:37</b> |     |



real 12 (Input data was modified after picture taken)

### Node Displacements

| Node | L/C         | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|------|-------------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 6    | 1:LOAD GENE | 0.000     | -0.136    | 0.000     | 0.136             | -0.00004    | 0.00000     | 0.00004     |
| 21   | 1:LOAD GENE | 0.000     | -2.420    | 0.000     | 2.420             | -0.00001    | 0.00000     | -0.00004    |
| 39   | 1:LOAD GENE | 0.000     | 1.076     | 0.000     | 1.076             | 0.00007     | 0.00000     | -0.00004    |
| 57   | 1:LOAD GENE | 0.000     | -0.252    | 0.000     | 0.252             | -0.00002    | 0.00000     | 0.00001     |
| 72   | 1:LOAD GENE | 0.000     | 0.037     | 0.000     | 0.037             | 0.00000     | 0.00000     | -0.00000    |
| 84   | 1:LOAD GENE | 0.000     | 0.184     | 0.000     | 0.184             | -0.00007    | 0.00000     | 0.00004     |
| 99   | 1:LOAD GENE | 0.000     | -2.539    | 0.000     | 2.539             | 0.00005     | 0.00000     | 0.00002     |
| 117  | 1:LOAD GENE | 0.000     | 0.715     | 0.000     | 0.715             | 0.00002     | 0.00000     | -0.00005    |
| 135  | 1:LOAD GENE | 0.000     | -0.124    | 0.000     | 0.124             | -0.00001    | 0.00000     | 0.00001     |
| 150  | 1:LOAD GENE | 0.000     | 0.014     | 0.000     | 0.014             | 0.00000     | 0.00000     | -0.00000    |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>20</b>       | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std      | Date/Time 03-Oct-2002 16:37 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

| Beam | Node | L/C         | Axial        | Shear        |              | Torsion     | Bending     |             |
|------|------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|
|      |      |             | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 5    | 5    | 1:LOAD GENE | 0.000        | 2.090        | 0.000        | 21.318      | 0.000       | -579.966    |
|      | 6    | 1:LOAD GENE | 0.000        | 17.910       | 0.000        | -21.318     | 0.000       | 553.565     |
| 6    | 6    | 1:LOAD GENE | 0.000        | -18.247      | 0.000        | 28.296      | 0.000       | -553.929    |
|      | 7    | 1:LOAD GENE | 0.000        | 18.247       | 0.000        | -28.296     | 0.000       | 332.489     |
| 20   | 20   | 1:LOAD GENE | 0.000        | 20.381       | 0.000        | -383.753    | 0.000       | -1.73E 3    |
|      | 21   | 1:LOAD GENE | 0.000        | -0.781       | 0.000        | 383.753     | 0.000       | 1.89E 3     |
| 21   | 21   | 1:LOAD GENE | 0.000        | 2.402        | 0.000        | -427.009    | 0.000       | -1.9E 3     |
|      | 22   | 1:LOAD GENE | 0.000        | 17.198       | 0.000        | 427.009     | 0.000       | 1.91E 3     |
| 38   | 38   | 1:LOAD GENE | 0.000        | 5.860        | 0.000        | 246.385     | 0.000       | 633.776     |
|      | 39   | 1:LOAD GENE | 0.000        | -5.860       | 0.000        | -246.385    | 0.000       | -537.517    |
| 39   | 39   | 1:LOAD GENE | 0.000        | 6.303        | 0.000        | 235.167     | 0.000       | 538.971     |
|      | 40   | 1:LOAD GENE | 0.000        | -6.303       | 0.000        | -235.167    | 0.000       | -462.485    |
| 56   | 56   | 1:LOAD GENE | 0.000        | -1.786       | 0.000        | -42.889     | 0.000       | -141.379    |
|      | 57   | 1:LOAD GENE | 0.000        | 1.786        | 0.000        | 42.889      | 0.000       | 112.039     |
| 57   | 57   | 1:LOAD GENE | 0.000        | -1.733       | 0.000        | -44.265     | 0.000       | -112.436    |
|      | 58   | 1:LOAD GENE | 0.000        | 1.733        | 0.000        | 44.265      | 0.000       | 91.404      |
| 71   | 71   | 1:LOAD GENE | 0.000        | 0.766        | 0.000        | 4.227       | 0.000       | 58.792      |
|      | 72   | 1:LOAD GENE | 0.000        | -0.766       | 0.000        | -4.227      | 0.000       | -46.024     |
| 72   | 72   | 1:LOAD GENE | 0.000        | 0.685        | 0.000        | 6.548       | 0.000       | 46.145      |
|      | 73   | 1:LOAD GENE | 0.000        | -0.685       | 0.000        | -6.548      | 0.000       | -37.837     |
| 82   | 83   | 1:LOAD GENE | 0.000        | -1.565       | 0.000        | 129.391     | 0.000       | -143.236    |
|      | 84   | 1:LOAD GENE | 0.000        | 21.565       | 0.000        | -129.391    | 0.000       | 73.149      |
| 83   | 84   | 1:LOAD GENE | 0.000        | -20.316      | 0.000        | 162.665     | 0.000       | -73.762     |
|      | 85   | 1:LOAD GENE | 0.000        | 40.316       | 0.000        | -162.665    | 0.000       | -296.321    |
| 97   | 98   | 1:LOAD GENE | 0.000        | 7.245        | 0.000        | -445.448    | 0.000       | -2.07E 3    |
|      | 99   | 1:LOAD GENE | 0.000        | 12.355       | 0.000        | 445.448     | 0.000       | 1.98E 3     |
| 98   | 99   | 1:LOAD GENE | 0.000        | -11.081      | 0.000        | -411.038    | 0.000       | -1.98E 3    |
|      | 100  | 1:LOAD GENE | 0.000        | 30.681       | 0.000        | 411.038     | 0.000       | 1.7E 3      |
| 115  | 116  | 1:LOAD GENE | 0.000        | 7.860        | 0.000        | 186.079     | 0.000       | 377.328     |
|      | 117  | 1:LOAD GENE | 0.000        | -7.860       | 0.000        | -186.079    | 0.000       | -281.947    |
| 116  | 117  | 1:LOAD GENE | 0.000        | 7.232        | 0.000        | 170.709     | 0.000       | 280.856     |
|      | 118  | 1:LOAD GENE | 0.000        | -7.232       | 0.000        | -170.709    | 0.000       | -162.056    |
| 133  | 134  | 1:LOAD GENE | 0.000        | -1.551       | 0.000        | -45.740     | 0.000       | -69.891     |
|      | 135  | 1:LOAD GENE | 0.000        | 1.551        | 0.000        | 45.740      | 0.000       | 51.066      |
| 134  | 135  | 1:LOAD GENE | 0.000        | -1.453       | 0.000        | -43.335     | 0.000       | -50.735     |
|      | 136  | 1:LOAD GENE | 0.000        | 1.453        | 0.000        | 43.335      | 0.000       | 26.870      |
| 147  | 149  | 1:LOAD GENE | 0.000        | 0.463        | 0.000        | 6.531       | 0.000       | 23.365      |
|      | 150  | 1:LOAD GENE | 0.000        | -0.463       | 0.000        | -6.531      | 0.000       | -17.748     |

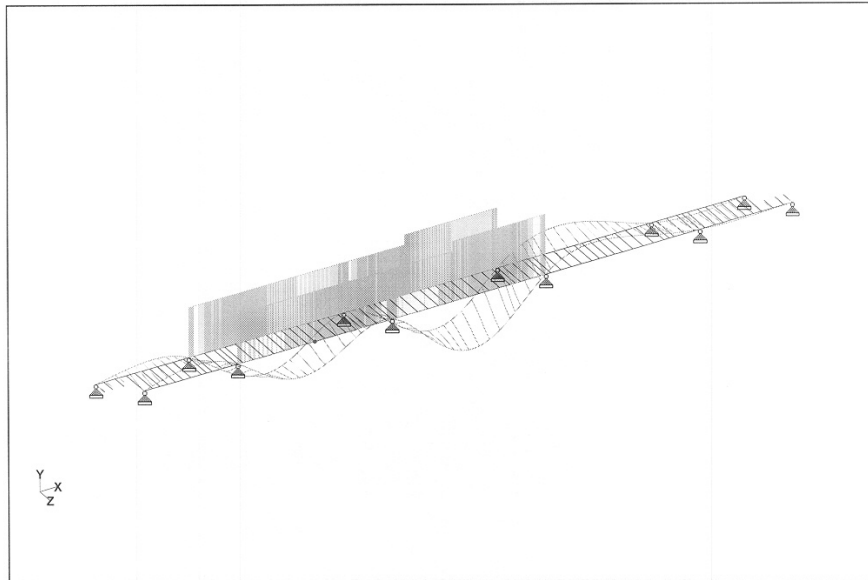
|                                                                                                                                |                             |                             |                    |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|--------------------|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>     | Sheet No<br><b>21</b>       | Rev                |
|                                                                                                                                | Part                        |                             |                    |
| Job Title PRUEBAS DE CARGA                                                                                                     |                             | Ref                         |                    |
|                                                                                                                                |                             | By CARLOS ROD               | Date 23-Sep-02 Chd |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std | Date/Time 03-Oct-2002 16:37 |                    |

**Beam End Forces Cont...**

| Beam | Node | L/C         | Axial        | Shear        |              | Torsion     | Bending     |             |
|------|------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|
|      |      |             | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 148  | 150  | 1:LOAD GENE | 0.000        | 0.445        | 0.000        | 5.754       | 0.000       | 17.638      |
|      | 151  | 1:LOAD GENE | 0.000        | -0.445       | 0.000        | -5.754      | 0.000       | -12.404     |



|                                                                                                                                                                               |                                 |                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>         | Sheet No<br><b>22</b>                 | Rev |
|                                                                                                                                                                               | Part                            |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                             |                                       |     |
|                                                                                                                                                                               | By<br><b>CARLOS ROD</b>         | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | File<br><b>23VI04 final.std</b> | Date/Time<br><b>03-Oct-2002 16:29</b> |     |



23

### Node Displacements

| L/C            | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|----------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 3:TREN B V 2 : | 5    | 0.000     | 0.658     | 0.000     | 0.658             | -0.00006    | 0.00000     | 0.00007     |
|                | 21   | 0.000     | -3.113    | 0.000     | 3.113             | -0.00010    | 0.00000     | 0.00005     |
|                | 39   | 0.000     | -3.534    | 0.000     | 3.534             | 0.00003     | 0.00000     | -0.00015    |
|                | 57   | 0.000     | 1.846     | 0.000     | 1.846             | 0.00010     | 0.00000     | -0.00008    |
|                | 72   | 0.000     | -0.316    | 0.000     | 0.316             | -0.00000    | 0.00000     | 0.00001     |
|                | 84   | 0.000     | 0.911     | 0.000     | 0.911             | -0.00007    | 0.00000     | 0.00004     |
|                | 99   | 0.000     | -2.441    | 0.000     | 2.441             | -0.00005    | 0.00000     | 0.00013     |
|                | 117  | 0.000     | -4.227    | 0.000     | 4.227             | 0.00022     | 0.00000     | -0.00006    |
|                | 135  | 0.000     | 1.386     | 0.000     | 1.386             | 0.00005     | 0.00000     | -0.00010    |
|                | 150  | 0.000     | -0.187    | 0.000     | 0.187             | -0.00002    | 0.00000     | 0.00001     |

|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>23</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
| Client<br>G.I.F.                                                                                                                                                              | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
|                                                                                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

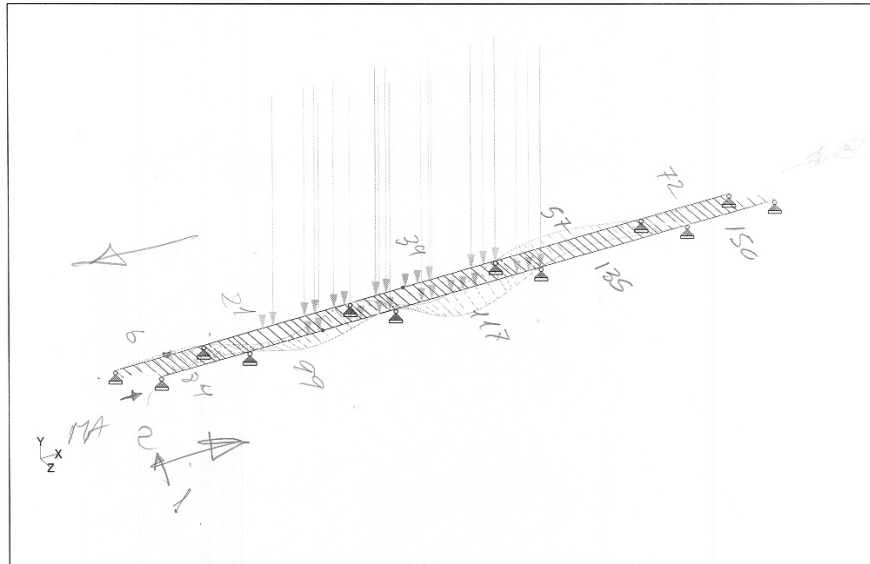
| L/C            | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|----------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|                |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 3:TREN B V 2 : | 5    | 5    | 0.000        | -19.731      | 0.000        | 164.661     | 0.000       | 733.791     |
|                |      | 6    | 0.000        | 19.731       | 0.000        | -164.661    | 0.000       | -965.990    |
|                | 6    | 6    | 0.000        | -21.008      | 0.000        | 199.563     | 0.000       | 970.717     |
|                |      | 7    | 0.000        | 21.008       | 0.000        | -199.563    | 0.000       | -1.23E 3    |
|                | 20   | 20   | 0.000        | 10.263       | 0.000        | -306.390    | 0.000       | -2.75E 3    |
|                |      | 21   | 0.000        | 6.487        | 0.000        | 306.390     | 0.000       | 2.78E 3     |
|                | 21   | 21   | 0.000        | -5.640       | 0.000        | -327.412    | 0.000       | -2.79E 3    |
|                |      | 22   | 0.000        | 18.015       | 0.000        | 327.412     | 0.000       | 2.65E 3     |
|                | 38   | 38   | 0.000        | 44.611       | 0.000        | -402.658    | 0.000       | -2.44E 3    |
|                |      | 39   | 0.000        | -24.511      | 0.000        | 402.658     | 0.000       | 3.01E 3     |
|                | 39   | 39   | 0.000        | 27.608       | 0.000        | -472.184    | 0.000       | -3.02E 3    |
|                |      | 40   | 0.000        | -12.758      | 0.000        | 472.184     | 0.000       | 3.27E 3     |
|                | 56   | 56   | 0.000        | 11.694       | 0.000        | 351.273     | 0.000       | 1.2E 3      |
|                |      | 57   | 0.000        | -11.694      | 0.000        | -351.273    | 0.000       | -1.01E 3    |
|                | 57   | 57   | 0.000        | 12.595       | 0.000        | 330.041     | 0.000       | 1.02E 3     |
|                |      | 58   | 0.000        | -12.595      | 0.000        | -330.041    | 0.000       | -862.626    |
|                | 71   | 71   | 0.000        | -6.479       | 0.000        | -52.235     | 0.000       | -541.007    |
|                |      | 72   | 0.000        | 6.479        | 0.000        | 52.235      | 0.000       | 432.999     |
|                | 72   | 72   | 0.000        | -6.129       | 0.000        | -62.074     | 0.000       | -435.792    |
|                |      | 73   | 0.000        | 6.129        | 0.000        | 62.074      | 0.000       | 361.413     |
|                | 82   | 83   | 0.000        | -15.883      | 0.000        | 398.925     | 0.000       | 1.11E 3     |
|                |      | 84   | 0.000        | 15.883       | 0.000        | -398.925    | 0.000       | -1.3E 3     |
|                | 83   | 84   | 0.000        | -15.598      | 0.000        | 403.259     | 0.000       | 1.29E 3     |
|                |      | 85   | 0.000        | 15.598       | 0.000        | -403.259    | 0.000       | -1.55E 3    |
|                | 97   | 98   | 0.000        | -10.817      | 0.000        | -301.409    | 0.000       | -2.57E 3    |
|                |      | 99   | 0.000        | 23.192       | 0.000        | 301.409     | 0.000       | 2.36E 3     |
|                | 98   | 99   | 0.000        | -21.386      | 0.000        | -256.938    | 0.000       | -2.35E 3    |
|                |      | 100  | 0.000        | 38.136       | 0.000        | 256.938     | 0.000       | 1.86E 3     |
|                | 115  | 116  | 0.000        | 22.926       | 0.000        | -295.850    | 0.000       | -3.4E 3     |
|                |      | 117  | 0.000        | -8.076       | 0.000        | 295.850     | 0.000       | 3.59E 3     |
|                | 116  | 117  | 0.000        | 8.436        | 0.000        | -292.884    | 0.000       | -3.57E 3    |
|                |      | 118  | 0.000        | 11.664       | 0.000        | 292.884     | 0.000       | 3.54E 3     |
|                | 133  | 134  | 0.000        | 16.124       | 0.000        | 303.643     | 0.000       | 791.544     |
|                |      | 135  | 0.000        | -16.124      | 0.000        | -303.643    | 0.000       | -595.874    |
|                | 134  | 135  | 0.000        | 14.856       | 0.000        | 272.235     | 0.000       | 592.281     |
|                |      | 136  | 0.000        | -14.856      | 0.000        | -272.235    | 0.000       | -348.253    |
|                | 147  | 149  | 0.000        | -4.991       | 0.000        | -41.878     | 0.000       | -316.729    |
|                |      | 150  | 0.000        | 4.991        | 0.000        | 41.878      | 0.000       | 256.183     |

|                                                                                                                                |                              |                                    |                           |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------|---------------------------|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>      | Sheet No<br><b>24</b>              | Rev                       |
|                                                                                                                                | Part                         |                                    |                           |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              |                              | Ref                                |                           |
|                                                                                                                                |                              | By <b>CARLOS ROD</b>               | Date <b>23-Sep-02</b> Chd |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final.std</b> | Date/Time <b>03-Oct-2002 16:29</b> |                           |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | -4.806       | 0.000        | -35.989     | 0.000       | -254.267    |
|     |      | 151  | 0.000        | 4.806        | 0.000        | 35.989      | 0.000       | 197.705     |

|                                                                                                                                |                                       |                                       |     |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>               | Sheet No<br><b>25</b>                 | Rev |
|                                                                                                                                | Part                                  |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                           | Ref                                   |                                       |     |
| Client<br><b>G.I.F.</b>                                                                                                        | By<br><b>CARLOS ROD</b>               | Date<br><b>23-Sep-02</b>              | Chd |
|                                                                                                                                | File<br><b>23VI04 final 12 23.std</b> | Date/Time<br><b>03-Oct-2002 16:37</b> |     |



real 23 (Input data was modified after picture taken)

### Node Displacements

| Node | L/C         | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|------|-------------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 6    | 2:LOAD GENE | 0.000     | 0.245     | 0.000     | 0.245             | -0.00002    | 0.00000     | 0.00002     |
| 21   | 2:LOAD GENE | 0.000     | -1.504    | 0.000     | 1.504             | -0.00006    | 0.00000     | 0.00000     |
| 39   | 2:LOAD GENE | 0.000     | -2.007    | 0.000     | 2.007             | 0.00001     | 0.00000     | -0.00006    |
| 57   | 2:LOAD GENE | 0.000     | 0.965     | 0.000     | 0.965             | 0.00006     | 0.00000     | -0.00004    |
| 72   | 2:LOAD GENE | 0.000     | -0.161    | 0.000     | 0.161             | -0.00001    | 0.00000     | 0.00001     |
| 84   | 2:LOAD GENE | 0.000     | 0.359     | 0.000     | 0.359             | -0.00004    | 0.00000     | 0.00001     |
| 99   | 2:LOAD GENE | 0.000     | -1.120    | 0.000     | 1.120             | -0.00004    | 0.00000     | 0.00006     |
| 117  | 2:LOAD GENE | 0.000     | -2.285    | 0.000     | 2.285             | 0.00006     | 0.00000     | 0.00001     |
| 135  | 2:LOAD GENE | 0.000     | 0.631     | 0.000     | 0.631             | 0.00002     | 0.00000     | -0.00005    |
| 150  | 2:LOAD GENE | 0.000     | -0.072    | 0.000     | 0.072             | -0.00001    | 0.00000     | 0.00001     |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>26</b>       | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std      | Date/Time 03-Oct-2002 16:37 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

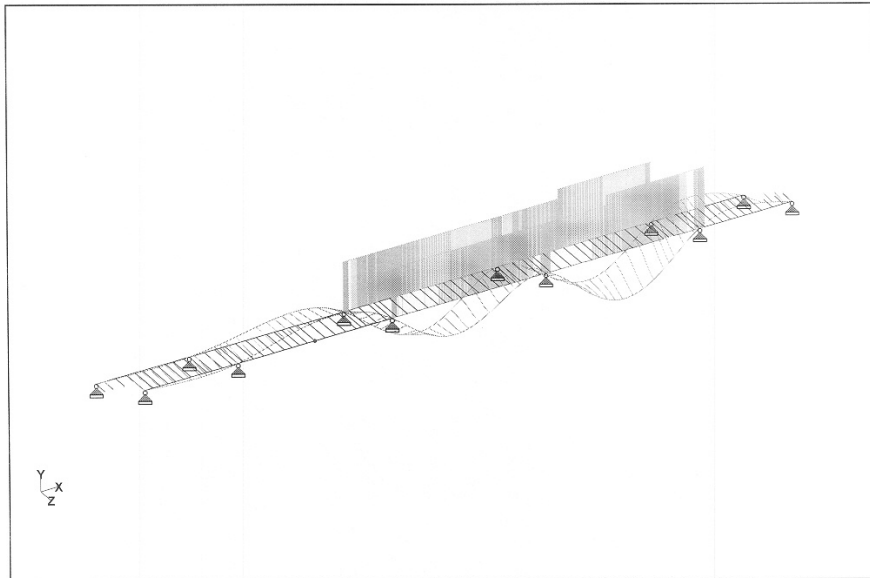
| Beam | Node | L/C         | Axial        | Shear        |              | Torsion     | Bending     |             |
|------|------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|
|      |      |             | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 5    | 5    | 2:LOAD GENE | 0.000        | -7.333       | 0.000        | 86.588      | 0.000       | 201.621     |
|      | 6    | 2:LOAD GENE | 0.000        | 7.333        | 0.000        | -86.588     | 0.000       | -287.917    |
| 6    | 6    | 2:LOAD GENE | 0.000        | -8.000       | 0.000        | 105.129     | 0.000       | 288.790     |
|      | 7    | 2:LOAD GENE | 0.000        | 8.000        | 0.000        | -105.129    | 0.000       | -385.871    |
| 20   | 20   | 2:LOAD GENE | 0.000        | 10.688       | 0.000        | -159.666    | 0.000       | -1.3E 3     |
|      | 21   | 2:LOAD GENE | 0.000        | 9.312        | 0.000        | 159.666     | 0.000       | 1.35E 3     |
| 21   | 21   | 2:LOAD GENE | 0.000        | -8.337       | 0.000        | -185.718    | 0.000       | -1.35E 3    |
|      | 22   | 2:LOAD GENE | 0.000        | 8.337        | 0.000        | 185.718     | 0.000       | 1.25E 3     |
| 38   | 38   | 2:LOAD GENE | 0.000        | 22.774       | 0.000        | -292.949    | 0.000       | -1.49E 3    |
|      | 39   | 2:LOAD GENE | 0.000        | -3.174       | 0.000        | 292.949     | 0.000       | 1.69E 3     |
| 39   | 39   | 2:LOAD GENE | 0.000        | 4.876        | 0.000        | -338.383    | 0.000       | -1.7E 3     |
|      | 40   | 2:LOAD GENE | 0.000        | 14.724       | 0.000        | 338.383     | 0.000       | 1.74E 3     |
| 56   | 56   | 2:LOAD GENE | 0.000        | 5.427        | 0.000        | 216.907     | 0.000       | 581.751     |
|      | 57   | 2:LOAD GENE | 0.000        | -5.427       | 0.000        | -216.907    | 0.000       | -492.602    |
| 57   | 57   | 2:LOAD GENE | 0.000        | 5.937        | 0.000        | 203.438     | 0.000       | 493.864     |
|      | 58   | 2:LOAD GENE | 0.000        | -5.937       | 0.000        | -203.438    | 0.000       | -421.813    |
| 71   | 71   | 2:LOAD GENE | 0.000        | -3.054       | 0.000        | -33.063     | 0.000       | -253.174    |
|      | 72   | 2:LOAD GENE | 0.000        | 3.054        | 0.000        | 33.063      | 0.000       | 202.256     |
| 72   | 72   | 2:LOAD GENE | 0.000        | -2.814       | 0.000        | -40.504     | 0.000       | -202.814    |
|      | 73   | 2:LOAD GENE | 0.000        | 2.814        | 0.000        | 40.504      | 0.000       | 168.661     |
| 82   | 83   | 2:LOAD GENE | 0.000        | -5.315       | 0.000        | 204.759     | 0.000       | 416.422     |
|      | 84   | 2:LOAD GENE | 0.000        | 5.315        | 0.000        | -204.759    | 0.000       | -480.923    |
| 83   | 84   | 2:LOAD GENE | 0.000        | -5.020       | 0.000        | 210.895     | 0.000       | 479.369     |
|      | 85   | 2:LOAD GENE | 0.000        | 5.020        | 0.000        | -210.895    | 0.000       | -563.066    |
| 97   | 98   | 2:LOAD GENE | 0.000        | -0.513       | 0.000        | -153.255    | 0.000       | -1.28E 3    |
|      | 99   | 2:LOAD GENE | 0.000        | 20.513       | 0.000        | 153.255     | 0.000       | 1.14E 3     |
| 98   | 99   | 2:LOAD GENE | 0.000        | -19.417      | 0.000        | -123.542    | 0.000       | -1.14E 3    |
|      | 100  | 2:LOAD GENE | 0.000        | 19.417       | 0.000        | 123.542     | 0.000       | 819.337     |
| 115  | 116  | 2:LOAD GENE | 0.000        | 9.926        | 0.000        | -370.202    | 0.000       | -1.93E 3    |
|      | 117  | 2:LOAD GENE | 0.000        | 9.674        | 0.000        | 370.202     | 0.000       | 1.88E 3     |
| 116  | 117  | 2:LOAD GENE | 0.000        | -8.607       | 0.000        | -340.789    | 0.000       | -1.88E 3    |
|      | 118  | 2:LOAD GENE | 0.000        | 28.207       | 0.000        | 340.789     | 0.000       | 1.64E 3     |
| 133  | 134  | 2:LOAD GENE | 0.000        | 7.549        | 0.000        | 162.098     | 0.000       | 330.899     |
|      | 135  | 2:LOAD GENE | 0.000        | -7.549       | 0.000        | -162.098    | 0.000       | -239.288    |
| 134  | 135  | 2:LOAD GENE | 0.000        | 6.881        | 0.000        | 146.577     | 0.000       | 238.348     |
|      | 136  | 2:LOAD GENE | 0.000        | -6.881       | 0.000        | -146.577    | 0.000       | -125.328    |
| 147  | 149  | 2:LOAD GENE | 0.000        | -2.337       | 0.000        | -33.192     | 0.000       | -116.154    |
|      | 150  | 2:LOAD GENE | 0.000        | 2.337        | 0.000        | 33.192      | 0.000       | 87.806      |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>27</b>       | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 12 23.std      | Date/Time 03-Oct-2002 16:37 |     |

**Beam End Forces Cont...**

| Beam | Node | L/C         | Axial        | Shear        |              | Torsion     | Bending     |             |
|------|------|-------------|--------------|--------------|--------------|-------------|-------------|-------------|
|      |      |             | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 148  | 150  | 2:LOAD GENE | 0.000        | -2.204       | 0.000        | -28.358     | 0.000       | -87.344     |
|      | 151  | 2:LOAD GENE | 0.000        | 2.204        | 0.000        | 28.358      | 0.000       | 61.407      |

|                                                                                                                                |                              |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>      | Sheet No<br><b>28</b>              | Rev |
|                                                                                                                                | Part                         |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                          |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b>         | Date <b>23-Sep-02</b>              | Chd |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final.std</b> | Date/Time <b>03-Oct-2002 16:29</b> |     |



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### Node Displacements

| L/C          | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|--------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 4:TREN B V 3 | 5    | 0.000     | -0.121    | 0.000     | 0.121             | 0.00001     | 0.00000     | -0.00001    |
|              | 21   | 0.000     | 1.094     | 0.000     | 1.094             | -0.00003    | 0.00000     | 0.00008     |
|              | 39   | 0.000     | -3.427    | 0.000     | 3.427             | -0.00012    | 0.00000     | 0.00006     |
|              | 57   | 0.000     | -3.274    | 0.000     | 3.274             | -0.00002    | 0.00000     | -0.00013    |
|              | 72   | 0.000     | 1.093     | 0.000     | 1.093             | 0.00002     | 0.00000     | -0.00004    |
|              | 84   | 0.000     | -0.269    | 0.000     | 0.269             | 0.00001     | 0.00000     | -0.00001    |
|              | 99   | 0.000     | 1.497     | 0.000     | 1.497             | -0.00009    | 0.00000     | 0.00007     |
|              | 117  | 0.000     | -2.702    | 0.000     | 2.702             | -0.00005    | 0.00000     | 0.00014     |
|              | 135  | 0.000     | -3.869    | 0.000     | 3.869             | 0.00021     | 0.00000     | -0.00005    |
|              | 150  | 0.000     | 0.963     | 0.000     | 0.963             | 0.00011     | 0.00000     | -0.00006    |

|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>29</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

| L/C          | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|--------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|              |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 4:TREN B V 3 | 5    | 5    | 0.000        | 3.649        | 0.000        | -30.811     | 0.000       | -138.225    |
|              |      | 6    | 0.000        | -3.649       | 0.000        | 30.811      | 0.000       | 181.166     |
|              | 6    | 6    | 0.000        | 3.794        | 0.000        | -35.208     | 0.000       | -182.756    |
|              |      | 7    | 0.000        | -3.794       | 0.000        | 35.208      | 0.000       | 228.796     |
|              | 20   | 20   | 0.000        | -11.927      | 0.000        | 216.217     | 0.000       | 276.477     |
|              |      | 21   | 0.000        | 11.927       | 0.000        | -216.217    | 0.000       | -472.391    |
|              | 21   | 21   | 0.000        | -12.878      | 0.000        | 239.367     | 0.000       | 475.439     |
|              |      | 22   | 0.000        | 12.878       | 0.000        | -239.367    | 0.000       | -631.724    |
|              | 38   | 38   | 0.000        | 9.023        | 0.000        | -354.042    | 0.000       | -2.94E 3    |
|              |      | 39   | 0.000        | 7.727        | 0.000        | 354.042     | 0.000       | 2.95E 3     |
|              | 39   | 39   | 0.000        | -7.017       | 0.000        | -372.295    | 0.000       | -2.96E 3    |
|              |      | 40   | 0.000        | 19.392       | 0.000        | 372.295     | 0.000       | 2.8E 3      |
|              | 56   | 56   | 0.000        | 43.022       | 0.000        | -265.383    | 0.000       | -2.36E 3    |
|              |      | 57   | 0.000        | -22.922      | 0.000        | 265.383     | 0.000       | 2.9E 3      |
|              | 57   | 57   | 0.000        | 25.685       | 0.000        | -323.359    | 0.000       | -2.92E 3    |
|              |      | 58   | 0.000        | -10.835      | 0.000        | 323.359     | 0.000       | 3.14E 3     |
|              | 71   | 71   | 0.000        | 18.757       | 0.000        | 408.026     | 0.000       | 1.87E 3     |
|              |      | 72   | 0.000        | -18.757      | 0.000        | -408.026    | 0.000       | -1.55E 3    |
|              | 72   | 72   | 0.000        | 18.961       | 0.000        | 412.705     | 0.000       | 1.57E 3     |
|              |      | 73   | 0.000        | -18.961      | 0.000        | -412.705    | 0.000       | -1.34E 3    |
|              | 82   | 83   | 0.000        | 5.208        | 0.000        | -57.012     | 0.000       | -307.532    |
|              |      | 84   | 0.000        | -5.208       | 0.000        | 57.012      | 0.000       | 370.740     |
|              | 83   | 84   | 0.000        | 5.479        | 0.000        | -49.650     | 0.000       | -368.641    |
|              |      | 85   | 0.000        | -5.479       | 0.000        | 49.650      | 0.000       | 459.988     |
|              | 97   | 98   | 0.000        | -10.631      | 0.000        | 300.435     | 0.000       | 682.668     |
|              |      | 99   | 0.000        | 10.631       | 0.000        | -300.435    | 0.000       | -811.681    |
|              | 98   | 99   | 0.000        | -9.984       | 0.000        | 316.578     | 0.000       | 806.900     |
|              |      | 100  | 0.000        | 9.984        | 0.000        | -316.578    | 0.000       | -970.893    |
|              | 115  | 116  | 0.000        | -12.370      | 0.000        | -381.928    | 0.000       | -2.7E 3     |
|              |      | 117  | 0.000        | 24.745       | 0.000        | 381.928     | 0.000       | 2.48E 3     |
|              | 116  | 117  | 0.000        | -22.718      | 0.000        | -332.048    | 0.000       | -2.46E 3    |
|              |      | 118  | 0.000        | 39.468       | 0.000        | 332.048     | 0.000       | 1.95E 3     |
|              | 133  | 134  | 0.000        | 21.436       | 0.000        | -235.273    | 0.000       | -3.21E 3    |
|              |      | 135  | 0.000        | -6.586       | 0.000        | 235.273     | 0.000       | 3.38E 3     |
|              | 134  | 135  | 0.000        | 7.345        | 0.000        | -227.239    | 0.000       | -3.36E 3    |
|              |      | 136  | 0.000        | 12.755       | 0.000        | 227.239     | 0.000       | 3.32E 3     |
|              | 147  | 149  | 0.000        | 26.338       | 0.000        | 247.989     | 0.000       | 1.61E 3     |
|              |      | 150  | 0.000        | -26.338      | 0.000        | -247.989    | 0.000       | -1.29E 3    |

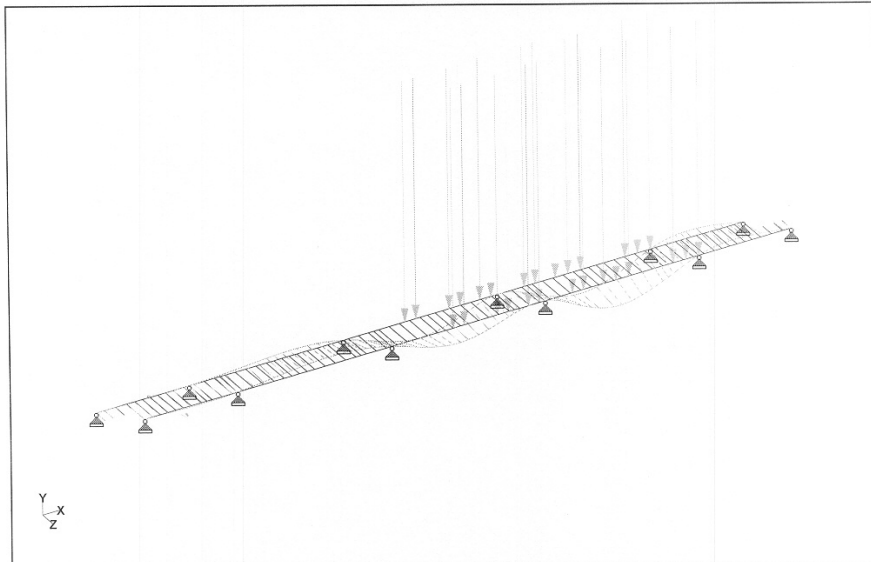


|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>30</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 24.698       | 0.000        | 198.380     | 0.000       | 1.28E 3     |
|     |      | 151  | 0.000        | -24.698      | 0.000        | -198.380    | 0.000       | -992.098    |

|                                                                                                                                                                               |                                    |                                    |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>            | Sheet No<br><b>31</b>              | Rev |
|                                                                                                                                                                               | Part                               |                                    |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                                |                                    |     |
|                                                                                                                                                                               | By <b>CARLOS ROD</b>               | Date <b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | File <b>23VI04 final 34 45.std</b> | Date/Time <b>03-Oct-2002 16:46</b> |     |



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### Node Displacements

| L/C         | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|-------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 2:LOAD GENE | 6    | 0.000     | -0.037    | 0.000     | 0.037             | 0.00001     | 0.00000     | -0.00000    |
|             | 21   | 0.000     | 0.375     | 0.000     | 0.375             | -0.00002    | 0.00000     | 0.00003     |
|             | 39   | 0.000     | -1.636    | 0.000     | 1.636             | -0.00007    | 0.00000     | 0.00000     |
|             | 57   | 0.000     | -1.887    | 0.000     | 1.887             | -0.00000    | 0.00000     | -0.00005    |
|             | 72   | 0.000     | 0.573     | 0.000     | 0.573             | 0.00003     | 0.00000     | -0.00002    |
|             | 84   | 0.000     | -0.105    | 0.000     | 0.105             | 0.00001     | 0.00000     | -0.00001    |
|             | 99   | 0.000     | 0.601     | 0.000     | 0.601             | -0.00004    | 0.00000     | 0.00003     |
|             | 117  | 0.000     | -1.229    | 0.000     | 1.229             | -0.00005    | 0.00000     | 0.00006     |
|             | 135  | 0.000     | -2.096    | 0.000     | 2.096             | 0.00005     | 0.00000     | 0.00001     |
|             | 150  | 0.000     | 0.434     | 0.000     | 0.434             | 0.00003     | 0.00000     | -0.00003    |

|                                                                                                                                |                                                |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>                        | Sheet No<br><b>32</b>              | Rev |
|                                                                                                                                | Part                                           |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                                            |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b> Date <b>23-Sep-02</b> Chd |                                    |     |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 34 45.std</b>             | Date/Time <b>03-Oct-2002 16:46</b> |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

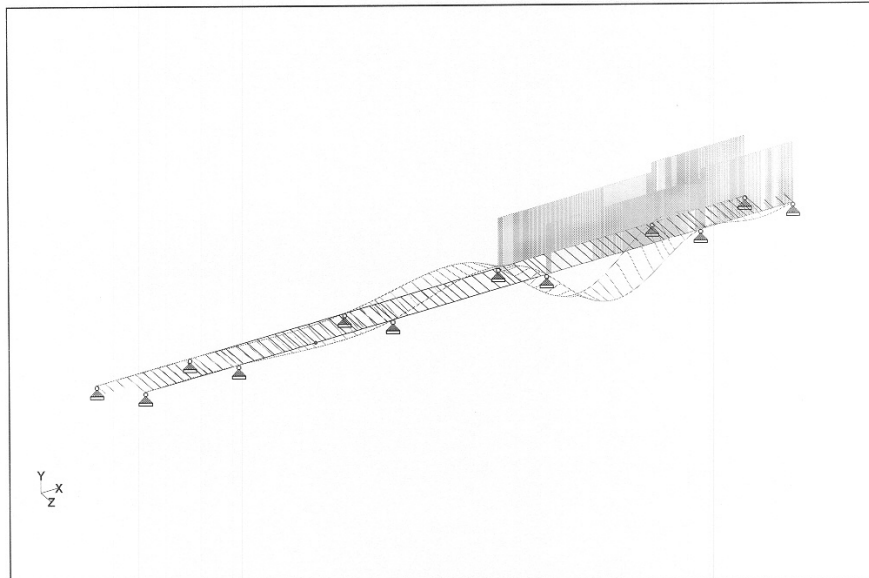
| L/C         | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|             |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 2:LOAD GENE | 5    | 5    | 0.000        | 1.273        | 0.000        | -17.650     | 0.000       | -29.898     |
|             |      | 6    | 0.000        | -1.273       | 0.000        | 17.650      | 0.000       | 44.878      |
|             | 6    | 6    | 0.000        | 1.343        | 0.000        | -20.066     | 0.000       | -45.172     |
|             |      | 7    | 0.000        | -1.343       | 0.000        | 20.066      | 0.000       | 61.474      |
|             | 20   | 20   | 0.000        | -4.197       | 0.000        | 97.764      | 0.000       | 72.228      |
|             |      | 21   | 0.000        | 4.197        | 0.000        | -97.764     | 0.000       | -141.162    |
|             | 21   | 21   | 0.000        | -4.594       | 0.000        | 107.229     | 0.000       | 141.777     |
|             |      | 22   | 0.000        | 4.594        | 0.000        | -107.229    | 0.000       | -197.530    |
|             | 38   | 38   | 0.000        | 10.260       | 0.000        | -189.665    | 0.000       | -1.37E 3    |
|             |      | 39   | 0.000        | 9.740        | 0.000        | 189.665     | 0.000       | 1.41E 3     |
|             | 39   | 39   | 0.000        | -8.828       | 0.000        | -214.467    | 0.000       | -1.42E 3    |
|             |      | 40   | 0.000        | 8.828        | 0.000        | 214.467     | 0.000       | 1.31E 3     |
|             | 56   | 56   | 0.000        | 21.961       | 0.000        | -231.292    | 0.000       | -1.46E 3    |
|             |      | 57   | 0.000        | -2.361       | 0.000        | 231.292     | 0.000       | 1.65E 3     |
|             | 57   | 57   | 0.000        | 3.908        | 0.000        | -271.065    | 0.000       | -1.66E 3    |
|             |      | 58   | 0.000        | 15.692       | 0.000        | 271.065     | 0.000       | 1.69E 3     |
|             | 71   | 71   | 0.000        | 8.522        | 0.000        | 280.098     | 0.000       | 893.229     |
|             |      | 72   | 0.000        | -8.522       | 0.000        | -280.098    | 0.000       | -751.157    |
|             | 72   | 72   | 0.000        | 8.612        | 0.000        | 281.949     | 0.000       | 753.893     |
|             |      | 73   | 0.000        | -8.612       | 0.000        | -281.949    | 0.000       | -649.379    |
|             | 82   | 83   | 0.000        | 1.862        | 0.000        | -27.715     | 0.000       | -109.578    |
|             |      | 84   | 0.000        | -1.862       | 0.000        | 27.715      | 0.000       | 132.177     |
|             | 83   | 84   | 0.000        | 2.020        | 0.000        | -23.253     | 0.000       | -131.860    |
|             |      | 85   | 0.000        | -2.020       | 0.000        | 23.253      | 0.000       | 165.543     |
|             | 97   | 98   | 0.000        | -3.880       | 0.000        | 139.211     | 0.000       | 262.737     |
|             |      | 99   | 0.000        | 3.880        | 0.000        | -139.211    | 0.000       | -309.824    |
|             | 98   | 99   | 0.000        | -3.543       | 0.000        | 147.982     | 0.000       | 309.045     |
|             |      | 100  | 0.000        | 3.543        | 0.000        | -147.982    | 0.000       | -367.237    |
|             | 115  | 116  | 0.000        | -1.046       | 0.000        | -187.072    | 0.000       | -1.33E 3    |
|             |      | 117  | 0.000        | 21.046       | 0.000        | 187.072     | 0.000       | 1.18E 3     |
|             | 116  | 117  | 0.000        | -19.852      | 0.000        | -154.909    | 0.000       | -1.18E 3    |
|             |      | 118  | 0.000        | 19.852       | 0.000        | 154.909     | 0.000       | 854.118     |
|             | 133  | 134  | 0.000        | 9.054        | 0.000        | -331.626    | 0.000       | -1.84E 3    |
|             |      | 135  | 0.000        | 10.546       | 0.000        | 331.626     | 0.000       | 1.77E 3     |
|             | 134  | 135  | 0.000        | -9.238       | 0.000        | -299.112    | 0.000       | -1.77E 3    |
|             |      | 136  | 0.000        | 28.838       | 0.000        | 299.112     | 0.000       | 1.52E 3     |
|             | 147  | 149  | 0.000        | 13.066       | 0.000        | 160.604     | 0.000       | 680.406     |
|             |      | 150  | 0.000        | -13.066      | 0.000        | -160.604    | 0.000       | -521.902    |

|                                                                                                                                |                                |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>        | Sheet No<br><b>33</b>          | Rev |
|                                                                                                                                | Part                           |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                            |                                |     |
|                                                                                                                                | By<br>CARLOS ROD               | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                               | File<br>23VI04 final 34 45.std | Date/Time<br>03-Oct-2002 16:46 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 12.054       | 0.000        | 130.645     | 0.000       | 520.459     |
|     |      | 151  | 0.000        | -12.054      | 0.000        | -130.645    | 0.000       | -378.605    |

|                                                                                                                                |                                 |                                       |     |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>         | Sheet No<br><b>34</b>                 | Rev |
|                                                                                                                                | Part                            |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                           | Ref                             |                                       |     |
|                                                                                                                                | By<br><b>CARLOS ROD</b>         | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                        | File<br><b>23VI04 final.std</b> | Date/Time<br><b>03-Oct-2002 16:29</b> |     |



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### Node Displacements

| L/C            | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|----------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 5:TREN B V 4 : | 5    | 0.000     | 0.028     | 0.000     | 0.028             | -0.00000    | 0.00000     | 0.00000     |
|                | 21   | 0.000     | -0.248    | 0.000     | 0.248             | 0.00001     | 0.00000     | -0.00002    |
|                | 39   | 0.000     | 1.291     | 0.000     | 1.291             | -0.00004    | 0.00000     | 0.00009     |
|                | 57   | 0.000     | -4.074    | 0.000     | 4.074             | -0.00009    | 0.00000     | 0.00002     |
|                | 72   | 0.000     | -0.015    | 0.000     | 0.015             | 0.00006     | 0.00000     | -0.00008    |
|                | 84   | 0.000     | 0.072     | 0.000     | 0.072             | -0.00000    | 0.00000     | 0.00000     |
|                | 99   | 0.000     | -0.439    | 0.000     | 0.439             | 0.00002     | 0.00000     | -0.00002    |
|                | 117  | 0.000     | 1.780     | 0.000     | 1.780             | -0.00010    | 0.00000     | 0.00008     |
|                | 135  | 0.000     | -3.716    | 0.000     | 3.716             | -0.00002    | 0.00000     | 0.00009     |
|                | 150  | 0.000     | -0.260    | 0.000     | 0.260             | 0.00003     | 0.00000     | -0.00007    |

|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>35</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
| Client<br>G.I.F.                                                                                                                                                              | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
|                                                                                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

| L/C            | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|----------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|                |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 5:TREN B V 4 : | 5    | 5    | 0.000        | -0.852       | 0.000        | 7.069       | 0.000       | 32.553      |
|                |      | 6    | 0.000        | 0.852        | 0.000        | -7.069      | 0.000       | -42.583     |
|                | 6    | 6    | 0.000        | -0.876       | 0.000        | 7.815       | 0.000       | 43.022      |
|                |      | 7    | 0.000        | 0.876        | 0.000        | -7.815      | 0.000       | -53.648     |
|                | 20   | 20   | 0.000        | 2.743        | 0.000        | -59.711     | 0.000       | -70.891     |
|                |      | 21   | 0.000        | -2.743       | 0.000        | 59.711      | 0.000       | 115.956     |
|                | 21   | 21   | 0.000        | 2.865        | 0.000        | -62.780     | 0.000       | -117.186    |
|                |      | 22   | 0.000        | -2.865       | 0.000        | 62.780      | 0.000       | 151.959     |
|                | 38   | 38   | 0.000        | -12.909      | 0.000        | 259.171     | 0.000       | 360.287     |
|                |      | 39   | 0.000        | 12.909       | 0.000        | -259.171    | 0.000       | -572.326    |
|                | 39   | 39   | 0.000        | -13.871      | 0.000        | 282.645     | 0.000       | 576.250     |
|                |      | 40   | 0.000        | 13.871       | 0.000        | -282.645    | 0.000       | -744.581    |
|                | 56   | 56   | 0.000        | 15.132       | 0.000        | -503.549    | 0.000       | -3.14E 3    |
|                |      | 57   | 0.000        | 1.618        | 0.000        | 503.549     | 0.000       | 3.25E 3     |
|                | 57   | 57   | 0.000        | -0.621       | 0.000        | -530.121    | 0.000       | -3.27E 3    |
|                |      | 58   | 0.000        | 12.996       | 0.000        | 530.121     | 0.000       | 3.19E 3     |
|                | 71   | 71   | 0.000        | 54.495       | 0.000        | 84.114      | 0.000       | 215.827     |
|                |      | 72   | 0.000        | -34.095      | 0.000        | -84.114     | 0.000       | 522.622     |
|                | 72   | 72   | 0.000        | 35.417       | 0.000        | 49.934      | 0.000       | -519.905    |
|                |      | 73   | 0.000        | -20.567      | 0.000        | -49.934     | 0.000       | 859.610     |
|                | 82   | 83   | 0.000        | -1.435       | 0.000        | 11.866      | 0.000       | 81.332      |
|                |      | 84   | 0.000        | 1.435        | 0.000        | -11.866     | 0.000       | -98.743     |
|                | 83   | 84   | 0.000        | -1.531       | 0.000        | 9.364       | 0.000       | 98.222      |
|                |      | 85   | 0.000        | 1.531        | 0.000        | -9.364      | 0.000       | -123.751    |
|                | 97   | 98   | 0.000        | 3.489        | 0.000        | -62.329     | 0.000       | -169.076    |
|                |      | 99   | 0.000        | -3.489       | 0.000        | 62.329      | 0.000       | 211.417     |
|                | 98   | 99   | 0.000        | 3.596        | 0.000        | -59.612     | 0.000       | -209.789    |
|                |      | 100  | 0.000        | -3.596       | 0.000        | 59.612      | 0.000       | 268.850     |
|                | 115  | 116  | 0.000        | -11.922      | 0.000        | 353.267     | 0.000       | 798.915     |
|                |      | 117  | 0.000        | 11.922       | 0.000        | -353.267    | 0.000       | -943.592    |
|                | 116  | 117  | 0.000        | -11.395      | 0.000        | 366.557     | 0.000       | 937.790     |
|                |      | 118  | 0.000        | 11.395       | 0.000        | -366.557    | 0.000       | -1.12E 3    |
|                | 133  | 134  | 0.000        | -5.047       | 0.000        | -510.655    | 0.000       | -3.11E 3    |
|                |      | 135  | 0.000        | 17.422       | 0.000        | 510.655     | 0.000       | 2.97E 3     |
|                | 134  | 135  | 0.000        | -15.178      | 0.000        | -453.763    | 0.000       | -2.96E 3    |
|                |      | 136  | 0.000        | 31.928       | 0.000        | 453.763     | 0.000       | 2.57E 3     |
|                | 147  | 149  | 0.000        | 47.146       | 0.000        | -15.172     | 0.000       | -435.207    |
|                |      | 150  | 0.000        | -32.302      | 0.000        | 15.172      | 0.000       | 917.088     |

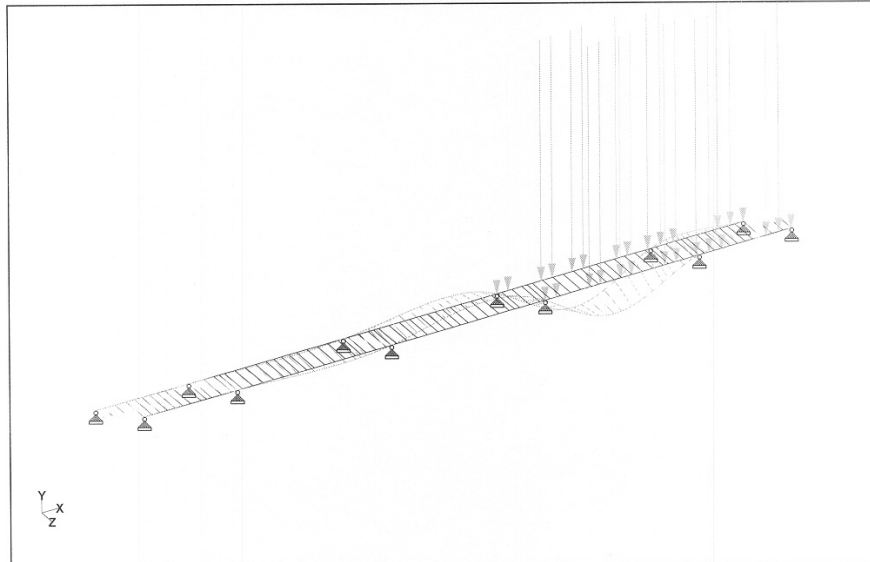
|                                                                                                                                |                         |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b> | Sheet No<br><b>36</b>       | Rev |
|                                                                                                                                | Part                    |                             |     |
| Job Title: PRUEBAS DE CARGA                                                                                                    | Ref                     |                             |     |
|                                                                                                                                | By CARLOS ROD           | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                  | File 23VI04 final.std   | Date/Time 03-Oct-2002 16:29 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 31.969       | 0.000        | -21.697     | 0.000       | -911.900    |
|     |      | 151  | 0.000        | -17.569      | 0.000        | 21.697      | 0.000       | 1.2E 3      |



|                                                                                                                                |                                       |                                       |     |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>               | Sheet No<br><b>37</b>                 | Rev |
|                                                                                                                                | Part                                  |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                           | Ref                                   |                                       |     |
|                                                                                                                                | By<br><b>CARLOS ROD</b>               | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                        | File<br><b>23VI04 final 34 45.std</b> | Date/Time<br><b>03-Oct-2002 16:46</b> |     |



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### Node Displacements

| L/C         | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|-------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 3:LOAD GENE | 6    | 0.000     | 0.013     | 0.000     | 0.013             | -0.00000    | 0.00000     | 0.00000     |
|             | 21   | 0.000     | -0.135    | 0.000     | 0.135             | 0.00001     | 0.00000     | -0.00001    |
|             | 39   | 0.000     | 0.794     | 0.000     | 0.794             | -0.00003    | 0.00000     | 0.00006     |
|             | 57   | 0.000     | -2.907    | 0.000     | 2.907             | -0.00008    | 0.00000     | -0.00000    |
|             | 72   | 0.000     | 0.369     | 0.000     | 0.369             | 0.00005     | 0.00000     | -0.00005    |
|             | 84   | 0.000     | 0.045     | 0.000     | 0.045             | -0.00000    | 0.00000     | 0.00000     |
|             | 99   | 0.000     | -0.291    | 0.000     | 0.291             | 0.00002     | 0.00000     | -0.00002    |
|             | 117  | 0.000     | 1.244     | 0.000     | 1.244             | -0.00008    | 0.00000     | 0.00005     |
|             | 135  | 0.000     | -2.664    | 0.000     | 2.664             | 0.00001     | 0.00000     | 0.00006     |
|             | 150  | 0.000     | 0.118     | 0.000     | 0.118             | 0.00004     | 0.00000     | -0.00005    |



|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>38</b>       | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 34 45.std      | Date/Time 03-Oct-2002 16:46 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

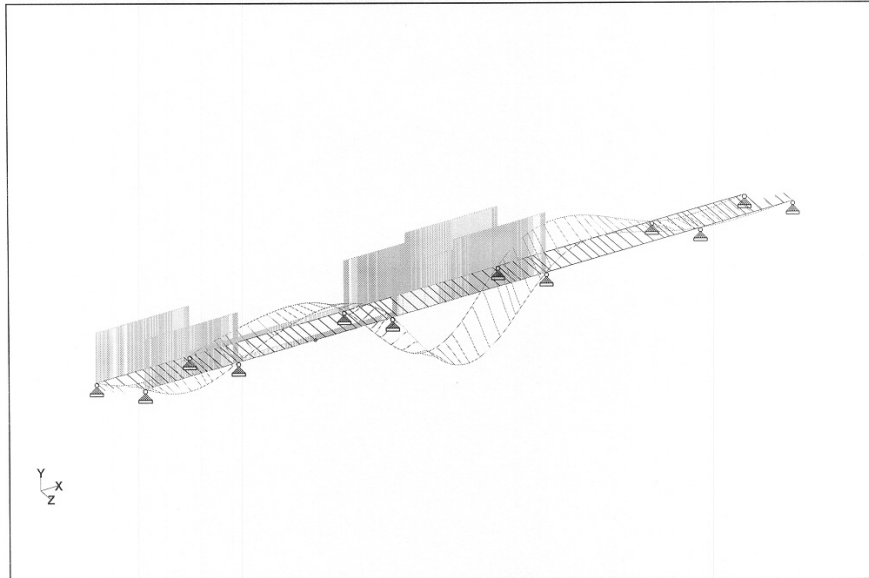
| L/C         | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|             |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 3:LOAD GENE | 5    | 5    | 0.000        | -0.473       | 0.000        | 6.615       | 0.000       | 10.772      |
|             |      | 6    | 0.000        | 0.473        | 0.000        | -6.615      | 0.000       | -16.344     |
|             | 6    | 6    | 0.000        | -0.490       | 0.000        | 7.262       | 0.000       | 16.473      |
|             |      | 7    | 0.000        | 0.490        | 0.000        | -7.262      | 0.000       | -22.419     |
|             | 20   | 20   | 0.000        | 1.634        | 0.000        | -51.249     | 0.000       | -29.533     |
|             |      | 21   | 0.000        | -1.634       | 0.000        | 51.249      | 0.000       | 56.369      |
|             | 21   | 21   | 0.000        | 1.726        | 0.000        | -53.616     | 0.000       | -56.768     |
|             |      | 22   | 0.000        | -1.726       | 0.000        | 53.616      | 0.000       | 77.721      |
|             | 38   | 38   | 0.000        | -8.086       | 0.000        | 208.339     | 0.000       | 179.413     |
|             |      | 39   | 0.000        | 8.086        | 0.000        | -208.339    | 0.000       | -312.231    |
|             | 39   | 39   | 0.000        | -8.800       | 0.000        | 225.969     | 0.000       | 313.574     |
|             |      | 40   | 0.000        | 8.800        | 0.000        | -225.969    | 0.000       | -420.371    |
|             | 56   | 56   | 0.000        | 15.130       | 0.000        | -447.789    | 0.000       | -2.02E 3    |
|             |      | 57   | 0.000        | 4.870        | 0.000        | 447.789     | 0.000       | 2.22E 3     |
|             | 57   | 57   | 0.000        | -3.745       | 0.000        | -477.024    | 0.000       | -2.23E 3    |
|             |      | 58   | 0.000        | 3.745        | 0.000        | 477.024     | 0.000       | 2.18E 3     |
|             | 71   | 71   | 0.000        | 19.146       | 0.000        | 196.527     | 0.000       | 749.717     |
|             |      | 72   | 0.000        | -19.146      | 0.000        | -196.527    | 0.000       | -430.521    |
|             | 72   | 72   | 0.000        | 19.852       | 0.000        | 180.628     | 0.000       | 432.515     |
|             |      | 73   | 0.000        | -19.852      | 0.000        | -180.628    | 0.000       | -191.597    |
|             | 82   | 83   | 0.000        | -0.829       | 0.000        | 9.049       | 0.000       | 45.508      |
|             |      | 84   | 0.000        | 0.829        | 0.000        | -9.049      | 0.000       | -55.573     |
|             | 83   | 84   | 0.000        | -0.925       | 0.000        | 6.519       | 0.000       | 55.447      |
|             |      | 85   | 0.000        | 0.925        | 0.000        | -6.519      | 0.000       | -70.865     |
|             | 97   | 98   | 0.000        | 2.094        | 0.000        | -53.358     | 0.000       | -100.700    |
|             |      | 99   | 0.000        | -2.094       | 0.000        | 53.358      | 0.000       | 126.114     |
|             | 98   | 99   | 0.000        | 2.190        | 0.000        | -50.892     | 0.000       | -125.637    |
|             |      | 100  | 0.000        | -2.190       | 0.000        | 50.892      | 0.000       | 161.614     |
|             | 115  | 116  | 0.000        | -7.563       | 0.000        | 274.016     | 0.000       | 526.981     |
|             |      | 117  | 0.000        | 7.563        | 0.000        | -274.016    | 0.000       | -618.759    |
|             | 116  | 117  | 0.000        | -7.096       | 0.000        | 285.593     | 0.000       | 617.048     |
|             |      | 118  | 0.000        | 7.096        | 0.000        | -285.593    | 0.000       | -733.605    |
|             | 133  | 134  | 0.000        | -0.086       | 0.000        | -480.403    | 0.000       | -2.08E 3    |
|             |      | 135  | 0.000        | 20.086       | 0.000        | 480.403     | 0.000       | 2.04E 3     |
|             | 134  | 135  | 0.000        | -18.078      | 0.000        | -430.298    | 0.000       | -2.03E 3    |
|             |      | 136  | 0.000        | 38.078       | 0.000        | 430.298     | 0.000       | 1.71E 3     |
|             | 147  | 149  | 0.000        | 19.926       | 0.000        | 80.203      | 0.000       | 293.786     |
|             |      | 150  | 0.000        | -19.926      | 0.000        | -80.203     | 0.000       | -52.068     |

|                                                                                                                                                                               |                                |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>        | Sheet No<br><b>39</b>          | Rev |
|                                                                                                                                                                               | Part                           |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                            |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD               | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final 34 45.std | Date/Time<br>03-Oct-2002 16:46 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 19.121       | 0.000        | 58.520      | 0.000       | 52.088      |
|     |      | 151  | 0.000        | -19.121      | 0.000        | -58.520     | 0.000       | 172.925     |

|                                                                                                                                                                               |                                 |                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>         | Sheet No<br><b>40</b>                 | Rev |
|                                                                                                                                                                               | Part                            |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                             |                                       |     |
|                                                                                                                                                                               | By<br><b>CARLOS ROD</b>         | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | File<br><b>23VI04 final.std</b> | Date/Time<br><b>03-Oct-2002 16:29</b> |     |



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### Node Displacements

| L/C            | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|----------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 6:TREN B V 1 : | 5    | 0.000     | -1.110    | 0.000     | 1.110             | 0.00003     | 0.00000     | -0.00005    |
|                | 21   | 0.000     | 1.772     | 0.000     | 1.772             | -0.00003    | 0.00000     | 0.00007     |
|                | 39   | 0.000     | -5.504    | 0.000     | 5.504             | -0.00007    | 0.00000     | -0.00006    |
|                | 57   | 0.000     | 2.325     | 0.000     | 2.325             | 0.00012     | 0.00000     | -0.00011    |
|                | 72   | 0.000     | -0.392    | 0.000     | 0.392             | -0.00000    | 0.00000     | 0.00002     |
|                | 84   | 0.000     | -1.309    | 0.000     | 1.309             | -0.00000    | 0.00000     | 0.00001     |
|                | 99   | 0.000     | 2.382     | 0.000     | 2.382             | -0.00011    | 0.00000     | 0.00007     |
|                | 117  | 0.000     | -5.663    | 0.000     | 5.663             | 0.00018     | 0.00000     | 0.00003     |
|                | 135  | 0.000     | 1.670     | 0.000     | 1.670             | 0.00006     | 0.00000     | -0.00012    |
|                | 150  | 0.000     | -0.227    | 0.000     | 0.227             | -0.00002    | 0.00000     | 0.00001     |

|                                                                                                                                |                          |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>  | Sheet No<br><b>41</b>          | Rev |
|                                                                                                                                | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                      |                                |     |
| Client<br>G.I.F.                                                                                                               | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
|                                                                                                                                | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

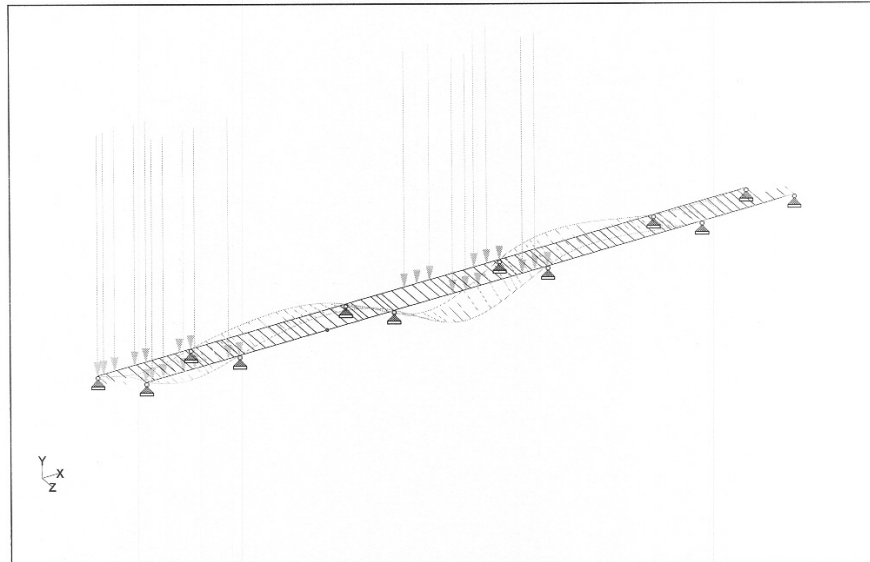
| L/C            | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|----------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|                |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 6:TREN B V 1 : | 5    | 5    | 0.000        | 9.558        | 0.000        | -202.360    | 0.000       | -1.97E 3    |
|                |      | 6    | 0.000        | 2.442        | 0.000        | 202.360     | 0.000       | 2.01E 3     |
|                | 6    | 6    | 0.000        | -1.480       | 0.000        | -232.142    | 0.000       | -2.02E 3    |
|                |      | 7    | 0.000        | 13.855       | 0.000        | 232.142     | 0.000       | 1.93E 3     |
|                | 20   | 20   | 0.000        | -9.663       | 0.000        | 418.323     | 0.000       | 534.618     |
|                |      | 21   | 0.000        | 11.338       | 0.000        | -418.323    | 0.000       | -707.097    |
|                | 21   | 21   | 0.000        | -12.036      | 0.000        | 434.953     | 0.000       | 712.874     |
|                |      | 22   | 0.000        | 13.273       | 0.000        | -434.953    | 0.000       | -866.446    |
|                | 38   | 38   | 0.000        | 32.098       | 0.000        | -783.027    | 0.000       | -3.68E 3    |
|                |      | 39   | 0.000        | -11.997      | 0.000        | 783.027     | 0.000       | 4.04E 3     |
|                | 39   | 39   | 0.000        | 14.606       | 0.000        | -840.701    | 0.000       | -4.06E 3    |
|                |      | 40   | 0.000        | 0.244        | 0.000        | 840.701     | 0.000       | 4.15E 3     |
|                | 56   | 56   | 0.000        | 15.426       | 0.000        | 414.605     | 0.000       | 1.5E 3      |
|                |      | 57   | 0.000        | -15.426      | 0.000        | -414.605    | 0.000       | -1.24E 3    |
|                | 57   | 57   | 0.000        | 16.250       | 0.000        | 395.184     | 0.000       | 1.25E 3     |
|                |      | 58   | 0.000        | -16.250      | 0.000        | -395.184    | 0.000       | -1.05E 3    |
|                | 71   | 71   | 0.000        | -8.088       | 0.000        | -59.008     | 0.000       | -670.709    |
|                |      | 72   | 0.000        | 8.088        | 0.000        | 59.008      | 0.000       | 535.869     |
|                | 72   | 72   | 0.000        | -7.632       | 0.000        | -71.861     | 0.000       | -539.282    |
|                |      | 73   | 0.000        | 7.632        | 0.000        | 71.861      | 0.000       | 446.664     |
|                | 82   | 83   | 0.000        | 6.558        | 0.000        | -357.063    | 0.000       | -2.24E 3    |
|                |      | 84   | 0.000        | 5.817        | 0.000        | 357.063     | 0.000       | 2.24E 3     |
|                | 83   | 84   | 0.000        | -4.088       | 0.000        | -309.007    | 0.000       | -2.23E 3    |
|                |      | 85   | 0.000        | 21.088       | 0.000        | 309.007     | 0.000       | 2.02E 3     |
|                | 97   | 98   | 0.000        | -9.681       | 0.000        | 382.781     | 0.000       | 959.053     |
|                |      | 99   | 0.000        | 10.919       | 0.000        | -382.781    | 0.000       | -1.08E 3    |
|                | 98   | 99   | 0.000        | -10.802      | 0.000        | 385.156     | 0.000       | 1.08E 3     |
|                |      | 100  | 0.000        | 12.477       | 0.000        | -385.156    | 0.000       | -1.27E 3    |
|                | 115  | 116  | 0.000        | 7.533        | 0.000        | -597.977    | 0.000       | -4.23E 3    |
|                |      | 117  | 0.000        | 7.317        | 0.000        | 597.977     | 0.000       | 4.23E 3     |
|                | 116  | 117  | 0.000        | -5.955       | 0.000        | -570.113    | 0.000       | -4.21E 3    |
|                |      | 118  | 0.000        | 26.055       | 0.000        | 570.113     | 0.000       | 3.95E 3     |
|                | 133  | 134  | 0.000        | 19.359       | 0.000        | 369.944     | 0.000       | 962.654     |
|                |      | 135  | 0.000        | -19.359      | 0.000        | -369.944    | 0.000       | -727.722    |
|                | 134  | 135  | 0.000        | 17.929       | 0.000        | 334.683     | 0.000       | 722.847     |
|                |      | 136  | 0.000        | -17.929      | 0.000        | -334.683    | 0.000       | -428.349    |
|                | 147  | 149  | 0.000        | -6.023       | 0.000        | -50.528     | 0.000       | -383.979    |
|                |      | 150  | 0.000        | 6.023        | 0.000        | 50.528      | 0.000       | 310.914     |

|                                                                                                                                |                          |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>  | Sheet No<br><b>42</b>          | Rev |
|                                                                                                                                | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                      |                                |     |
|                                                                                                                                | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | -5.809       | 0.000        | -43.527     | 0.000       | -308.525    |
|     |      | 151  | 0.000        | 5.809        | 0.000        | 43.527      | 0.000       | 240.166     |

|                                                                                                                                                                               |                                       |                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licenced to GEOCISA</small> | Job No<br><b>23VI04</b>               | Sheet No<br><b>43</b>                 | Rev |
|                                                                                                                                                                               | Part                                  |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                                   |                                       |     |
|                                                                                                                                                                               | By<br><b>CARLOS ROD</b>               | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | File<br><b>23VI04 final 13 24.std</b> | Date/Time<br><b>03-Oct-2002 16:47</b> |     |



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### Node Displacements

| L/C         | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|-------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 2:LOAD GENE | 6    | 0.000     | -0.752    | 0.000     | 0.752             | 0.00002     | 0.00000     | 0.00001     |
|             | 21   | 0.000     | 0.980     | 0.000     | 0.980             | -0.00000    | 0.00000     | 0.00002     |
|             | 39   | 0.000     | -2.498    | 0.000     | 2.498             | -0.00004    | 0.00000     | -0.00003    |
|             | 57   | 0.000     | 1.042     | 0.000     | 1.042             | 0.00007     | 0.00000     | -0.00005    |
|             | 72   | 0.000     | -0.171    | 0.000     | 0.171             | -0.00001    | 0.00000     | 0.00001     |
|             | 84   | 0.000     | -0.847    | 0.000     | 0.847             | 0.00001     | 0.00000     | 0.00002     |
|             | 99   | 0.000     | 1.250     | 0.000     | 1.250             | -0.00007    | 0.00000     | 0.00002     |
|             | 117  | 0.000     | -2.458    | 0.000     | 2.458             | 0.00003     | 0.00000     | 0.00003     |
|             | 135  | 0.000     | 0.657     | 0.000     | 0.657             | 0.00002     | 0.00000     | -0.00005    |
|             | 150  | 0.000     | -0.075    | 0.000     | 0.075             | -0.00001    | 0.00000     | 0.00001     |



|                                                                                                                                                                               |                                       |                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>               | Sheet No<br><b>44</b>                 | Rev |
|                                                                                                                                                                               | Part                                  |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                                   |                                       |     |
|                                                                                                                                                                               | By<br><b>CARLOS ROD</b>               | Date<br><b>23-Sep-02</b>              | Chd |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | File<br><b>23VI04 final 13 24.std</b> | Date/Time<br><b>03-Oct-2002 16:47</b> |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

| L/C         | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|             |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 2:LOAD GENE | 5    | 5    | 0.000        | -0.620       | 0.000        | -206.445    | 0.000       | -1.3E 3     |
|             |      | 6    | 0.000        | 0.620        | 0.000        | 206.445     | 0.000       | 1.29E 3     |
|             | 6    | 6    | 0.000        | 0.285        | 0.000        | -236.930    | 0.000       | -1.3E 3     |
|             |      | 7    | 0.000        | 19.715       | 0.000        | 236.930     | 0.000       | 1.12E 3     |
|             | 20   | 20   | 0.000        | -3.678       | 0.000        | 261.991     | 0.000       | 372.016     |
|             |      | 21   | 0.000        | 3.678        | 0.000        | -261.991    | 0.000       | -432.433    |
|             | 21   | 21   | 0.000        | -3.943       | 0.000        | 266.963     | 0.000       | 434.070     |
|             |      | 22   | 0.000        | 3.943        | 0.000        | -266.963    | 0.000       | -481.923    |
|             | 38   | 38   | 0.000        | 20.164       | 0.000        | -424.714    | 0.000       | -1.72E 3    |
|             |      | 39   | 0.000        | -0.564       | 0.000        | 424.714     | 0.000       | 1.88E 3     |
|             | 39   | 39   | 0.000        | 2.019        | 0.000        | -463.029    | 0.000       | -1.88E 3    |
|             |      | 40   | 0.000        | 17.581       | 0.000        | 463.029     | 0.000       | 1.9E 3      |
|             | 56   | 56   | 0.000        | 6.110        | 0.000        | 222.837     | 0.000       | 620.065     |
|             |      | 57   | 0.000        | -6.110       | 0.000        | -222.837    | 0.000       | -519.693    |
|             | 57   | 57   | 0.000        | 6.527        | 0.000        | 211.868     | 0.000       | 521.108     |
|             |      | 58   | 0.000        | -6.527       | 0.000        | -211.868    | 0.000       | -441.897    |
|             | 71   | 71   | 0.000        | -3.273       | 0.000        | -33.451     | 0.000       | -268.786    |
|             |      | 72   | 0.000        | 3.273        | 0.000        | 33.451      | 0.000       | 214.219     |
|             | 72   | 72   | 0.000        | -3.005       | 0.000        | -41.646     | 0.000       | -214.807    |
|             |      | 73   | 0.000        | 3.005        | 0.000        | 41.646      | 0.000       | 178.343     |
|             | 82   | 83   | 0.000        | -6.010       | 0.000        | -316.273    | 0.000       | -1.48E 3    |
|             |      | 84   | 0.000        | 6.010        | 0.000        | 316.273     | 0.000       | 1.41E 3     |
|             | 83   | 84   | 0.000        | -4.282       | 0.000        | -266.586    | 0.000       | -1.41E 3    |
|             |      | 85   | 0.000        | 24.282       | 0.000        | 266.586     | 0.000       | 1.06E 3     |
|             | 97   | 98   | 0.000        | -2.265       | 0.000        | 258.993     | 0.000       | 552.096     |
|             |      | 99   | 0.000        | 2.265        | 0.000        | -258.993    | 0.000       | -579.579    |
|             | 98   | 99   | 0.000        | -2.310       | 0.000        | 259.044     | 0.000       | 577.923     |
|             |      | 100  | 0.000        | 2.310        | 0.000        | -259.044    | 0.000       | -615.866    |
|             | 115  | 116  | 0.000        | 8.534        | 0.000        | -466.394    | 0.000       | -1.95E 3    |
|             |      | 117  | 0.000        | 11.066       | 0.000        | 466.394     | 0.000       | 1.88E 3     |
|             | 116  | 117  | 0.000        | -9.859       | 0.000        | -434.119    | 0.000       | -1.87E 3    |
|             |      | 118  | 0.000        | 29.459       | 0.000        | 434.119     | 0.000       | 1.62E 3     |
|             | 133  | 134  | 0.000        | 7.896        | 0.000        | 176.687     | 0.000       | 348.192     |
|             |      | 135  | 0.000        | -7.896       | 0.000        | -176.687    | 0.000       | -252.374    |
|             | 134  | 135  | 0.000        | 7.225        | 0.000        | 160.993     | 0.000       | 251.305     |
|             |      | 136  | 0.000        | -7.225       | 0.000        | -160.993    | 0.000       | -132.622    |
|             | 147  | 149  | 0.000        | -2.439       | 0.000        | -34.568     | 0.000       | -121.371    |
|             |      | 150  | 0.000        | 2.439        | 0.000        | 34.568      | 0.000       | 91.783      |

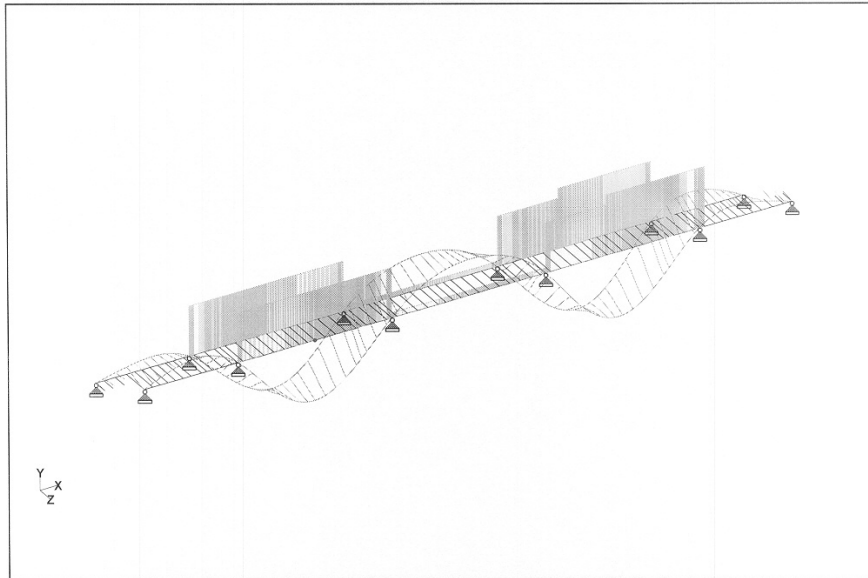
|                                                                                                                                |                                |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>        | Sheet No<br><b>45</b>          | Rev |
|                                                                                                                                | Part                           |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                            |                                |     |
|                                                                                                                                | By<br>CARLOS ROD               | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                               | File<br>23VI04 final 13 24.std | Date/Time<br>03-Oct-2002 16:47 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | -2.305       | 0.000        | -29.642     | 0.000       | -91.291     |
|     |      | 151  | 0.000        | 2.305        | 0.000        | 29.642      | 0.000       | 64.165      |



|                                                                                                                                                                |                          |                                |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br>Software licensed to GEOCISA | Job No<br><b>23VI04</b>  | Sheet No<br><b>46</b>          | Rev |
|                                                                                                                                                                | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                  | Ref                      |                                |     |
|                                                                                                                                                                | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |



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### Node Displacements

| L/C          | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|--------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 7:TREN B V 2 | 5    | 0.000     | 0.846     | 0.000     | 0.846             | -0.00008    | 0.00000     | 0.00009     |
|              | 21   | 0.000     | -4.792    | 0.000     | 4.792             | -0.00003    | 0.00000     | -0.00007    |
|              | 39   | 0.000     | 3.035     | 0.000     | 3.035             | 0.00003     | 0.00000     | 0.00001     |
|              | 57   | 0.000     | -5.572    | 0.000     | 5.572             | -0.00016    | 0.00000     | -0.00003    |
|              | 72   | 0.000     | 1.476     | 0.000     | 1.476             | 0.00001     | 0.00000     | -0.00006    |
|              | 84   | 0.000     | 1.354     | 0.000     | 1.354             | -0.00009    | 0.00000     | 0.00006     |
|              | 99   | 0.000     | -5.020    | 0.000     | 5.020             | 0.00008     | 0.00000     | 0.00000     |
|              | 117  | 0.000     | 3.188     | 0.000     | 3.188             | -0.00005    | 0.00000     | 0.00001     |
|              | 135  | 0.000     | -5.451    | 0.000     | 5.451             | 0.00017     | 0.00000     | 0.00006     |
|              | 150  | 0.000     | 1.180     | 0.000     | 1.180             | 0.00013     | 0.00000     | -0.00007    |

|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>47</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

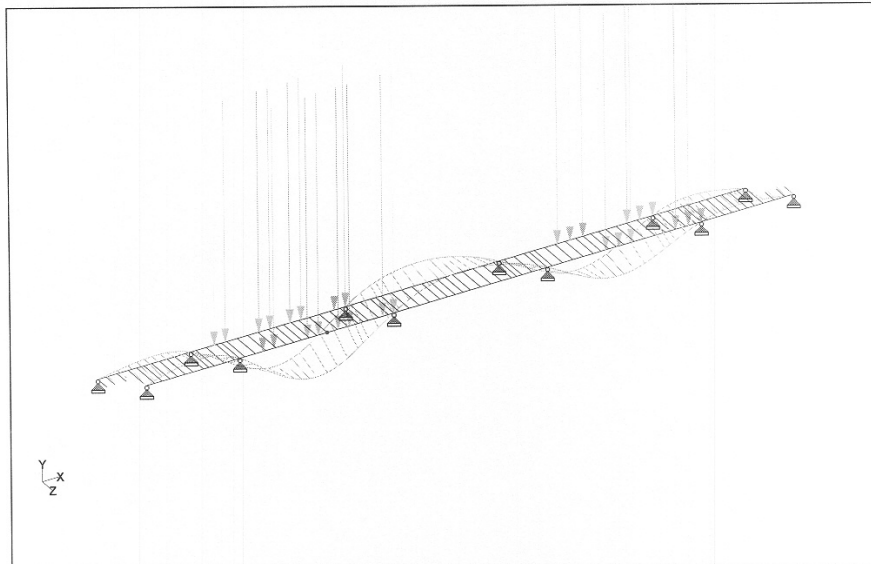
| L/C          | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|--------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|              |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 7:TREN B V 2 | 5    | 5    | 0.000        | -25.451      | 0.000        | 212.146     | 0.000       | 948.813     |
|              |      | 6    | 0.000        | 25.451       | 0.000        | -212.146    | 0.000       | -1.25E 3    |
|              | 6    | 6    | 0.000        | -26.923      | 0.000        | 252.799     | 0.000       | 1.26E 3     |
|              |      | 7    | 0.000        | 26.923       | 0.000        | -252.799    | 0.000       | -1.58E 3    |
|              | 20   | 20   | 0.000        | 28.646       | 0.000        | -673.167    | 0.000       | -3.2E 3     |
|              |      | 21   | 0.000        | -11.896      | 0.000        | 673.167     | 0.000       | 3.53E 3     |
|              | 21   | 21   | 0.000        | 13.907       | 0.000        | -723.803    | 0.000       | -3.55E 3    |
|              |      | 22   | 0.000        | -1.532       | 0.000        | 723.803     | 0.000       | 3.64E 3     |
|              | 38   | 38   | 0.000        | -0.684       | 0.000        | 671.284     | 0.000       | 1.35E 3     |
|              |      | 39   | 0.000        | 2.359        | 0.000        | -671.284    | 0.000       | -1.38E 3    |
|              | 39   | 39   | 0.000        | -2.709       | 0.000        | 681.866     | 0.000       | 1.38E 3     |
|              |      | 40   | 0.000        | 3.946        | 0.000        | -681.866    | 0.000       | -1.43E 3    |
|              | 56   | 56   | 0.000        | 27.060       | 0.000        | -664.467    | 0.000       | -3.82E 3    |
|              |      | 57   | 0.000        | -6.960       | 0.000        | 664.467     | 0.000       | 4.1E 3      |
|              | 57   | 57   | 0.000        | 9.249        | 0.000        | -709.391    | 0.000       | -4.12E 3    |
|              |      | 58   | 0.000        | 5.601        | 0.000        | 709.391     | 0.000       | 4.14E 3     |
|              | 71   | 71   | 0.000        | 26.681       | 0.000        | 454.174     | 0.000       | 2.52E 3     |
|              |      | 72   | 0.000        | -26.681      | 0.000        | -454.174    | 0.000       | -2.08E 3    |
|              | 72   | 72   | 0.000        | 26.426       | 0.000        | 472.495     | 0.000       | 2.09E 3     |
|              |      | 73   | 0.000        | -26.426      | 0.000        | -472.495    | 0.000       | -1.77E 3    |
|              | 82   | 83   | 0.000        | -24.562      | 0.000        | 488.691     | 0.000       | 1.61E 3     |
|              |      | 84   | 0.000        | 24.562       | 0.000        | -488.691    | 0.000       | -1.91E 3    |
|              | 83   | 84   | 0.000        | -24.783      | 0.000        | 480.032     | 0.000       | 1.9E 3      |
|              |      | 85   | 0.000        | 24.783       | 0.000        | -480.032    | 0.000       | -2.31E 3    |
|              | 97   | 98   | 0.000        | 8.595        | 0.000        | -719.657    | 0.000       | -3.65E 3    |
|              |      | 99   | 0.000        | 3.780        | 0.000        | 719.657     | 0.000       | 3.68E 3     |
|              | 98   | 99   | 0.000        | -2.178       | 0.000        | -678.797    | 0.000       | -3.66E 3    |
|              |      | 100  | 0.000        | 18.928       | 0.000        | 678.797     | 0.000       | 3.49E 3     |
|              | 115  | 116  | 0.000        | 0.710        | 0.000        | 593.916     | 0.000       | 1.45E 3     |
|              |      | 117  | 0.000        | 0.528        | 0.000        | -593.916    | 0.000       | -1.44E 3    |
|              | 116  | 117  | 0.000        | -1.003       | 0.000        | 579.203     | 0.000       | 1.43E 3     |
|              |      | 118  | 0.000        | 2.678        | 0.000        | -579.203    | 0.000       | -1.46E 3    |
|              | 133  | 134  | 0.000        | 3.212        | 0.000        | -566.813    | 0.000       | -4.13E 3    |
|              |      | 135  | 0.000        | 11.638       | 0.000        | 566.813     | 0.000       | 4.08E 3     |
|              | 134  | 135  | 0.000        | -9.642       | 0.000        | -529.926    | 0.000       | -4.06E 3    |
|              |      | 136  | 0.000        | 29.742       | 0.000        | 529.926     | 0.000       | 3.73E 3     |
|              | 147  | 149  | 0.000        | 32.034       | 0.000        | 297.452     | 0.000       | 1.97E 3     |
|              |      | 150  | 0.000        | -32.034      | 0.000        | -297.452    | 0.000       | -1.59E 3    |

|                                                                                                                                |                          |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>  | Sheet No<br><b>48</b>          | Rev |
|                                                                                                                                | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                      |                                |     |
|                                                                                                                                | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                               | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 30.189       | 0.000        | 240.561     | 0.000       | 1.58E 3     |
|     |      | 151  | 0.000        | -30.189      | 0.000        | -240.561    | 0.000       | -1.22E 3    |

|                                                                                                                                |                                    |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>            | Sheet No<br><b>49</b>              | Rev |
|                                                                                                                                | Part                               |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                                |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b>               | Date <b>23-Sep-02</b>              | Chd |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 13 24.std</b> | Date/Time <b>03-Oct-2002 16:47</b> |     |



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### Node Displacements

| L/C         | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|-------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 3:LOAD GENE | 6    | 0.000     | 0.528     | 0.000     | 0.528             | -0.00005    | 0.00000     | 0.00004     |
|             | 21   | 0.000     | -3.106    | 0.000     | 3.106             | -0.00003    | 0.00000     | -0.00006    |
|             | 39   | 0.000     | 1.840     | 0.000     | 1.840             | 0.00006     | 0.00000     | -0.00002    |
|             | 57   | 0.000     | -2.594    | 0.000     | 2.594             | -0.00008    | 0.00000     | -0.00001    |
|             | 72   | 0.000     | 0.668     | 0.000     | 0.668             | 0.00003     | 0.00000     | -0.00003    |
|             | 84   | 0.000     | 0.891     | 0.000     | 0.891             | -0.00008    | 0.00000     | 0.00004     |
|             | 99   | 0.000     | -3.285    | 0.000     | 3.285             | 0.00007     | 0.00000     | 0.00001     |
|             | 117  | 0.000     | 1.736     | 0.000     | 1.736             | -0.00003    | 0.00000     | -0.00002    |
|             | 135  | 0.000     | -2.365    | 0.000     | 2.365             | 0.00002     | 0.00000     | 0.00004     |
|             | 150  | 0.000     | 0.459     | 0.000     | 0.459             | 0.00004     | 0.00000     | -0.00003    |

|                                                                                                                                |                                |                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>        | Sheet No<br><b>50</b>          | Rev |
|                                                                                                                                | Part                           |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                  | Ref                            |                                |     |
|                                                                                                                                | By<br>CARLOS ROD               | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                               | File<br>23VI04 final 13 24.std | Date/Time<br>03-Oct-2002 16:47 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

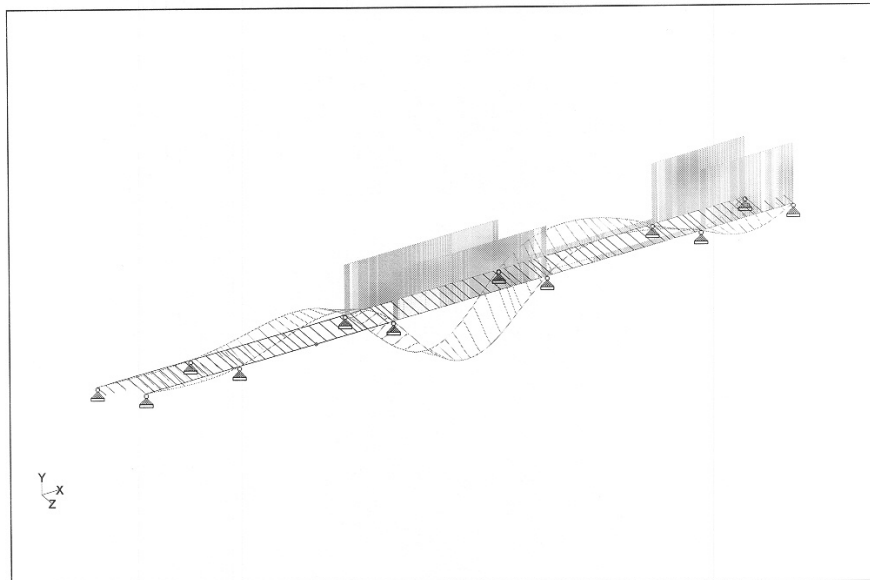
| L/C         | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|             |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 3:LOAD GENE | 5    | 5    | 0.000        | -15.928      | 0.000        | 190.008     | 0.000       | 440.601     |
|             |      | 6    | 0.000        | 15.928       | 0.000        | -190.008    | 0.000       | -628.039    |
|             | 6    | 6    | 0.000        | -17.206      | 0.000        | 226.951     | 0.000       | 630.300     |
|             |      | 7    | 0.000        | 17.206       | 0.000        | -226.951    | 0.000       | -839.102    |
|             | 20   | 20   | 0.000        | 37.396       | 0.000        | -535.871    | 0.000       | -1.94E 3    |
|             |      | 21   | 0.000        | -17.396      | 0.000        | 535.871     | 0.000       | 2.25E 3     |
|             | 21   | 21   | 0.000        | 19.257       | 0.000        | -583.965    | 0.000       | -2.26E 3    |
|             |      | 22   | 0.000        | 0.743        | 0.000        | 583.965     | 0.000       | 2.3E 3      |
|             | 38   | 38   | 0.000        | 1.629        | 0.000        | 447.008     | 0.000       | 886.750     |
|             |      | 39   | 0.000        | -1.629       | 0.000        | -447.008    | 0.000       | -859.994    |
|             | 39   | 39   | 0.000        | 1.653        | 0.000        | 446.279     | 0.000       | 862.758     |
|             |      | 40   | 0.000        | -1.653       | 0.000        | -446.279    | 0.000       | -842.702    |
|             | 56   | 56   | 0.000        | 17.699       | 0.000        | -394.767    | 0.000       | -1.81E 3    |
|             |      | 57   | 0.000        | 1.901        | 0.000        | 394.767     | 0.000       | 1.93E 3     |
|             | 57   | 57   | 0.000        | -0.540       | 0.000        | -428.583    | 0.000       | -1.94E 3    |
|             |      | 58   | 0.000        | 20.140       | 0.000        | 428.583     | 0.000       | 1.92E 3     |
|             | 71   | 71   | 0.000        | 10.685       | 0.000        | 273.531     | 0.000       | 1.04E 3     |
|             |      | 72   | 0.000        | -10.685      | 0.000        | -273.531    | 0.000       | -865.304    |
|             | 72   | 72   | 0.000        | 10.475       | 0.000        | 283.978     | 0.000       | 868.304     |
|             |      | 73   | 0.000        | -10.475      | 0.000        | -283.978    | 0.000       | -741.187    |
|             | 82   | 83   | 0.000        | -14.092      | 0.000        | 405.768     | 0.000       | 992.668     |
|             |      | 84   | 0.000        | 14.092       | 0.000        | -405.768    | 0.000       | -1.16E 3    |
|             | 83   | 84   | 0.000        | -14.167      | 0.000        | 400.354     | 0.000       | 1.16E 3     |
|             |      | 85   | 0.000        | 14.167       | 0.000        | -400.354    | 0.000       | -1.4E 3     |
|             | 97   | 98   | 0.000        | 2.552        | 0.000        | -590.572    | 0.000       | -2.34E 3    |
|             |      | 99   | 0.000        | -2.552       | 0.000        | 590.572     | 0.000       | 2.37E 3     |
|             | 98   | 99   | 0.000        | 3.901        | 0.000        | -554.699    | 0.000       | -2.36E 3    |
|             |      | 100  | 0.000        | 16.099       | 0.000        | 554.699     | 0.000       | 2.15E 3     |
|             | 115  | 116  | 0.000        | 3.933        | 0.000        | 420.110     | 0.000       | 819.157     |
|             |      | 117  | 0.000        | -3.933       | 0.000        | -420.110    | 0.000       | -771.429    |
|             | 116  | 117  | 0.000        | 3.460        | 0.000        | 408.408     | 0.000       | 768.861     |
|             |      | 118  | 0.000        | -3.460       | 0.000        | -408.408    | 0.000       | -712.026    |
|             | 133  | 134  | 0.000        | 6.298        | 0.000        | -464.621    | 0.000       | -1.9E 3     |
|             |      | 135  | 0.000        | 13.302       | 0.000        | 464.621     | 0.000       | 1.81E 3     |
|             | 134  | 135  | 0.000        | -11.748      | 0.000        | -427.149    | 0.000       | -1.8E 3     |
|             |      | 136  | 0.000        | 31.348       | 0.000        | 427.149     | 0.000       | 1.51E 3     |
|             | 147  | 149  | 0.000        | 13.889       | 0.000        | 173.770     | 0.000       | 723.173     |
|             |      | 150  | 0.000        | -13.889      | 0.000        | -173.770    | 0.000       | -554.686    |

|                                                                                                                                |                                  |                             |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>51</b>       | Rev |
|                                                                                                                                | Part                             |                             |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                     | By CARLOS ROD Date 23-Sep-02 Chd |                             |     |
| Client G.I.F.                                                                                                                  | File 23VI04 final 13 24.std      | Date/Time 03-Oct-2002 16:47 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 12.875       | 0.000        | 142.708     | 0.000       | 552.947     |
|     |      | 151  | 0.000        | -12.875      | 0.000        | -142.708    | 0.000       | -401.437    |

|                                                                                                                                |                                 |                                       |     |
|--------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>         | Sheet No<br><b>52</b>                 | Rev |
|                                                                                                                                | Part                            |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                           | Ref                             |                                       |     |
| Client<br><b>G.I.F.</b>                                                                                                        | By<br><b>CARLOS ROD</b>         | Date<br><b>23-Sep-02</b>              | Chd |
|                                                                                                                                | File<br><b>23VI04 final.std</b> | Date/Time<br><b>03-Oct-2002 16:29</b> |     |



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### Node Displacements

| L/C          | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|--------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 7:TREN B V 2 | 5    | 0.000     | 0.846     | 0.000     | 0.846             | -0.00008    | 0.00000     | 0.00009     |
|              | 21   | 0.000     | -4.792    | 0.000     | 4.792             | -0.00003    | 0.00000     | -0.00007    |
|              | 39   | 0.000     | 3.035     | 0.000     | 3.035             | 0.00003     | 0.00000     | 0.00001     |
|              | 57   | 0.000     | -5.572    | 0.000     | 5.572             | -0.00016    | 0.00000     | -0.00003    |
|              | 72   | 0.000     | 1.476     | 0.000     | 1.476             | 0.00001     | 0.00000     | -0.00006    |
|              | 84   | 0.000     | 1.354     | 0.000     | 1.354             | -0.00009    | 0.00000     | 0.00006     |
|              | 99   | 0.000     | -5.020    | 0.000     | 5.020             | 0.00008     | 0.00000     | 0.00000     |
|              | 117  | 0.000     | 3.188     | 0.000     | 3.188             | -0.00005    | 0.00000     | 0.00001     |
|              | 135  | 0.000     | -5.451    | 0.000     | 5.451             | 0.00017     | 0.00000     | 0.00006     |
|              | 150  | 0.000     | 1.180     | 0.000     | 1.180             | 0.00013     | 0.00000     | -0.00007    |



|                                                                                                                                                                               |                          |                                |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>  | Sheet No<br><b>53</b>          | Rev |
|                                                                                                                                                                               | Part                     |                                |     |
| Job Title<br>PRUEBAS DE CARGA                                                                                                                                                 | Ref                      |                                |     |
|                                                                                                                                                                               | By<br>CARLOS ROD         | Date<br>23-Sep-02              | Chd |
| Client<br>G.I.F.                                                                                                                                                              | File<br>23VI04 final.std | Date/Time<br>03-Oct-2002 16:29 |     |

### Beam End Forces

Sign convention is as the action of the joint on the beam.

| L/C          | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|--------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|              |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 7:TREN B V 2 | 5    | 5    | 0.000        | -25.451      | 0.000        | 212.146     | 0.000       | 948.813     |
|              |      | 6    | 0.000        | 25.451       | 0.000        | -212.146    | 0.000       | -1.25E 3    |
|              | 6    | 6    | 0.000        | -26.923      | 0.000        | 252.799     | 0.000       | 1.26E 3     |
|              |      | 7    | 0.000        | 26.923       | 0.000        | -252.799    | 0.000       | -1.58E 3    |
|              | 20   | 20   | 0.000        | 28.646       | 0.000        | -673.167    | 0.000       | -3.2E 3     |
|              |      | 21   | 0.000        | -11.896      | 0.000        | 673.167     | 0.000       | 3.53E 3     |
|              | 21   | 21   | 0.000        | 13.907       | 0.000        | -723.803    | 0.000       | -3.55E 3    |
|              |      | 22   | 0.000        | -1.532       | 0.000        | 723.803     | 0.000       | 3.64E 3     |
|              | 38   | 38   | 0.000        | -0.684       | 0.000        | 671.284     | 0.000       | 1.35E 3     |
|              |      | 39   | 0.000        | 2.359        | 0.000        | -671.284    | 0.000       | -1.38E 3    |
|              | 39   | 39   | 0.000        | -2.709       | 0.000        | 681.866     | 0.000       | 1.38E 3     |
|              |      | 40   | 0.000        | 3.946        | 0.000        | -681.866    | 0.000       | -1.43E 3    |
|              | 56   | 56   | 0.000        | 27.060       | 0.000        | -664.467    | 0.000       | -3.82E 3    |
|              |      | 57   | 0.000        | -6.960       | 0.000        | 664.467     | 0.000       | 4.1E 3      |
|              | 57   | 57   | 0.000        | 9.249        | 0.000        | -709.391    | 0.000       | -4.12E 3    |
|              |      | 58   | 0.000        | 5.601        | 0.000        | 709.391     | 0.000       | 4.14E 3     |
|              | 71   | 71   | 0.000        | 26.681       | 0.000        | 454.174     | 0.000       | 2.52E 3     |
|              |      | 72   | 0.000        | -26.681      | 0.000        | -454.174    | 0.000       | -2.08E 3    |
|              | 72   | 72   | 0.000        | 26.426       | 0.000        | 472.495     | 0.000       | 2.09E 3     |
|              |      | 73   | 0.000        | -26.426      | 0.000        | -472.495    | 0.000       | -1.77E 3    |
|              | 82   | 83   | 0.000        | -24.562      | 0.000        | 488.691     | 0.000       | 1.61E 3     |
|              |      | 84   | 0.000        | 24.562       | 0.000        | -488.691    | 0.000       | -1.91E 3    |
|              | 83   | 84   | 0.000        | -24.783      | 0.000        | 480.032     | 0.000       | 1.9E 3      |
|              |      | 85   | 0.000        | 24.783       | 0.000        | -480.032    | 0.000       | -2.31E 3    |
|              | 97   | 98   | 0.000        | 8.595        | 0.000        | -719.657    | 0.000       | -3.65E 3    |
|              |      | 99   | 0.000        | 3.780        | 0.000        | 719.657     | 0.000       | 3.68E 3     |
|              | 98   | 99   | 0.000        | -2.178       | 0.000        | -678.797    | 0.000       | -3.66E 3    |
|              |      | 100  | 0.000        | 18.928       | 0.000        | 678.797     | 0.000       | 3.49E 3     |
|              | 115  | 116  | 0.000        | 0.710        | 0.000        | 593.916     | 0.000       | 1.45E 3     |
|              |      | 117  | 0.000        | 0.528        | 0.000        | -593.916    | 0.000       | -1.44E 3    |
|              | 116  | 117  | 0.000        | -1.003       | 0.000        | 579.203     | 0.000       | 1.43E 3     |
|              |      | 118  | 0.000        | 2.678        | 0.000        | -579.203    | 0.000       | -1.46E 3    |
|              | 133  | 134  | 0.000        | 3.212        | 0.000        | -566.813    | 0.000       | -4.13E 3    |
|              |      | 135  | 0.000        | 11.638       | 0.000        | 566.813     | 0.000       | 4.08E 3     |
|              | 134  | 135  | 0.000        | -9.642       | 0.000        | -529.926    | 0.000       | -4.06E 3    |
|              |      | 136  | 0.000        | 29.742       | 0.000        | 529.926     | 0.000       | 3.73E 3     |
|              | 147  | 149  | 0.000        | 32.034       | 0.000        | 297.452     | 0.000       | 1.97E 3     |
|              |      | 150  | 0.000        | -32.034      | 0.000        | -297.452    | 0.000       | -1.59E 3    |

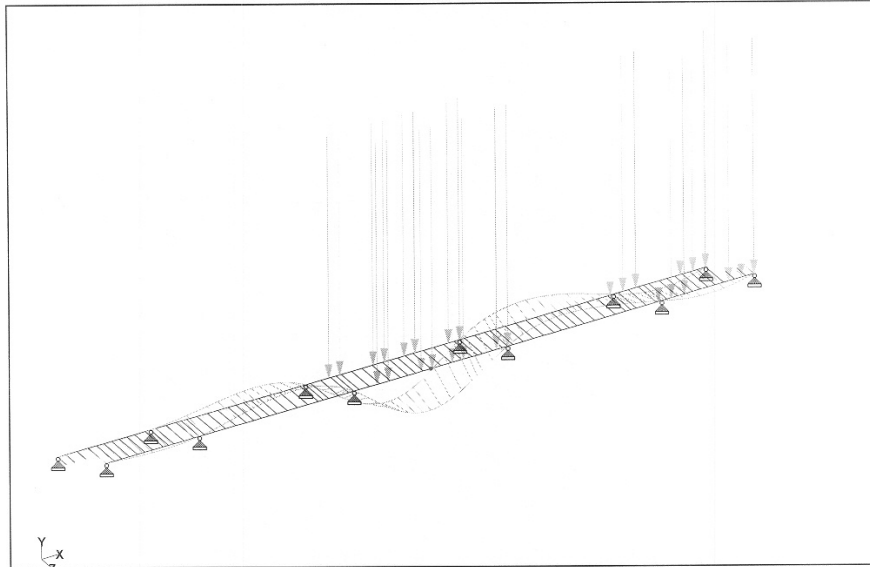


|                                                                                                                   |                                                                                                                                   |                                  |                       |                             |
|-------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------|-----------------------------|
| <br>Software licensed to GEOCISA | <br><b>GEOCISA</b><br>GEOTECNIA Y CEMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>54</b> | Rev                         |
|                                                                                                                   |                                                                                                                                   | Part                             |                       |                             |
| Job Title<br>PRUEBAS DE CARGA                                                                                     |                                                                                                                                   | Ref                              |                       |                             |
|                                                                                                                   |                                                                                                                                   | By CARLOS ROD Date 23-Sep-02 Chd |                       |                             |
| Client<br>G.I.F.                                                                                                  |                                                                                                                                   | File 23VI04 final.std            |                       | Date/Time 03-Oct-2002 16:29 |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 30.189       | 0.000        | 240.561     | 0.000       | 1.58E 3     |
|     |      | 151  | 0.000        | -30.189      | 0.000        | -240.561    | 0.000       | -1.22E 3    |

|                                                                                                                                |                                  |                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A. | Job No<br><b>23VI04</b>          | Sheet No<br><b>55</b>              | Rev |
|                                                                                                                                | Part                             |                                    |     |
| Software licensed to GEOCISA                                                                                                   | Ref                              |                                    |     |
| Job Title <b>PRUEBAS DE CARGA</b>                                                                                              | By <b>CARLOS ROD</b>             | Date <b>23-Sep-02</b>              | Chd |
| Client <b>G.I.F.</b>                                                                                                           | File <b>23VI04 final 3 5.std</b> | Date/Time <b>03-Oct-2002 16:47</b> |     |



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### Node Displacements

| L/C         | Node | X<br>(mm) | Y<br>(mm) | Z<br>(mm) | Resultant<br>(mm) | rX<br>(rad) | rY<br>(rad) | rZ<br>(rad) |
|-------------|------|-----------|-----------|-----------|-------------------|-------------|-------------|-------------|
| 2:LOAD GENE | 6    | 0.000     | -0.082    | 0.000     | 0.082             | 0.00002     | 0.00000     | -0.00001    |
|             | 21   | 0.000     | 0.816     | 0.000     | 0.816             | -0.00004    | 0.00000     | 0.00006     |
|             | 39   | 0.000     | -3.308    | 0.000     | 3.308             | -0.00005    | 0.00000     | -0.00005    |
|             | 57   | 0.000     | 1.584     | 0.000     | 1.584             | 0.00009     | 0.00000     | -0.00004    |
|             | 72   | 0.000     | -0.673    | 0.000     | 0.673             | -0.00001    | 0.00000     | -0.00000    |
|             | 84   | 0.000     | -0.234    | 0.000     | 0.234             | 0.00002     | 0.00000     | -0.00001    |
|             | 99   | 0.000     | 1.368     | 0.000     | 1.368             | -0.00010    | 0.00000     | 0.00006     |
|             | 117  | 0.000     | -3.318    | 0.000     | 3.318             | 0.00005     | 0.00000     | 0.00003     |
|             | 135  | 0.000     | 1.167     | 0.000     | 1.167             | 0.00001     | 0.00000     | -0.00005    |
|             | 150  | 0.000     | -0.547    | 0.000     | 0.547             | -0.00003    | 0.00000     | -0.00000    |

|                                                                                                                                                                               |                                                |                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>                        | Sheet No<br><b>56</b>                 | Rev |
|                                                                                                                                                                               | Part                                           |                                       |     |
| Job Title<br><b>PRUEBAS DE CARGA</b>                                                                                                                                          | Ref                                            |                                       |     |
| Client<br><b>G.I.F.</b>                                                                                                                                                       | By <b>CARLOS ROD</b> Date <b>23-Sep-02</b> Chd |                                       |     |
|                                                                                                                                                                               | File<br><b>23VI04 final 3 5.std</b>            | Date/Time<br><b>03-Oct-2002 16:47</b> |     |

### Beam End Forces

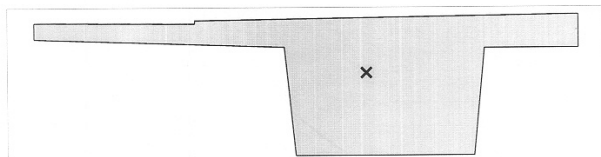
Sign convention is as the action of the joint on the beam.

| L/C         | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-------------|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|             |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
| 2:LOAD GENE | 5    | 5    | 0.000        | 2.796        | 0.000        | -38.656     | 0.000       | -65.391     |
|             |      | 6    | 0.000        | -2.796       | 0.000        | 38.656      | 0.000       | 98.298      |
|             | 6    | 6    | 0.000        | 2.945        | 0.000        | -43.765     | 0.000       | -98.952     |
|             |      | 7    | 0.000        | -2.945       | 0.000        | 43.765      | 0.000       | 134.693     |
|             | 20   | 20   | 0.000        | -9.228       | 0.000        | 222.630     | 0.000       | 164.269     |
|             |      | 21   | 0.000        | 9.228        | 0.000        | -222.630    | 0.000       | -315.842    |
|             | 21   | 21   | 0.000        | -10.021      | 0.000        | 241.842     | 0.000       | 317.335     |
|             |      | 22   | 0.000        | 10.021       | 0.000        | -241.842    | 0.000       | -438.949    |
|             | 38   | 38   | 0.000        | 35.327       | 0.000        | -570.975    | 0.000       | -2.09E 3    |
|             |      | 39   | 0.000        | -15.327      | 0.000        | 570.975     | 0.000       | 2.36E 3     |
|             | 39   | 39   | 0.000        | 17.004       | 0.000        | -615.748    | 0.000       | -2.37E 3    |
|             |      | 40   | 0.000        | 2.996        | 0.000        | 615.748     | 0.000       | 2.38E 3     |
|             | 56   | 56   | 0.000        | 5.419        | 0.000        | 325.891     | 0.000       | 855.210     |
|             |      | 57   | 0.000        | -5.419       | 0.000        | -325.891    | 0.000       | -766.200    |
|             | 57   | 57   | 0.000        | 5.740        | 0.000        | 316.051     | 0.000       | 768.317     |
|             |      | 58   | 0.000        | -5.740       | 0.000        | -316.051    | 0.000       | -698.664    |
|             | 71   | 71   | 0.000        | 1.952        | 0.000        | -195.301    | 0.000       | -880.139    |
|             |      | 72   | 0.000        | -1.952       | 0.000        | 195.301     | 0.000       | 912.683     |
|             | 72   | 72   | 0.000        | 3.182        | 0.000        | -232.515    | 0.000       | -915.145    |
|             |      | 73   | 0.000        | -3.182       | 0.000        | 232.515     | 0.000       | 953.763     |
|             | 82   | 83   | 0.000        | 4.153        | 0.000        | -60.709     | 0.000       | -242.645    |
|             |      | 84   | 0.000        | -4.153       | 0.000        | 60.709      | 0.000       | 293.039     |
|             | 83   | 84   | 0.000        | 4.518        | 0.000        | -50.560     | 0.000       | -292.340    |
|             |      | 85   | 0.000        | -4.518       | 0.000        | 50.560      | 0.000       | 367.660     |
|             | 97   | 98   | 0.000        | -9.024       | 0.000        | 293.151     | 0.000       | 563.579     |
|             |      | 99   | 0.000        | 9.024        | 0.000        | -293.151    | 0.000       | -673.095    |
|             | 98   | 99   | 0.000        | -8.584       | 0.000        | 304.480     | 0.000       | 671.181     |
|             |      | 100  | 0.000        | 8.584        | 0.000        | -304.480    | 0.000       | -812.175    |
|             | 115  | 116  | 0.000        | -0.174       | 0.000        | -623.467    | 0.000       | -2.38E 3    |
|             |      | 117  | 0.000        | 0.174        | 0.000        | 623.467     | 0.000       | 2.38E 3     |
|             | 116  | 117  | 0.000        | 1.257        | 0.000        | -584.641    | 0.000       | -2.37E 3    |
|             |      | 118  | 0.000        | 18.743       | 0.000        | 584.641     | 0.000       | 2.11E 3     |
|             | 133  | 134  | 0.000        | 8.111        | 0.000        | 304.543     | 0.000       | 580.699     |
|             |      | 135  | 0.000        | -8.111       | 0.000        | -304.543    | 0.000       | -482.264    |
|             | 134  | 135  | 0.000        | 7.367        | 0.000        | 288.799     | 0.000       | 480.392     |
|             |      | 136  | 0.000        | -7.367       | 0.000        | -288.799    | 0.000       | -359.383    |
|             | 147  | 149  | 0.000        | -0.484       | 0.000        | -181.165    | 0.000       | -757.500    |
|             |      | 150  | 0.000        | 0.484        | 0.000        | 181.165     | 0.000       | 751.629     |

|                                                                                                                                                                               |                           |                             |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------|-----|
|  <b>GEOCISA</b><br>GEOTECNIA Y CIMENTOS, S.A.<br><small>Software licensed to GEOCISA</small> | Job No<br><b>23VI04</b>   | Sheet No<br><b>57</b>       | Rev |
|                                                                                                                                                                               | Part                      |                             |     |
| Job Title PRUEBAS DE CARGA                                                                                                                                                    |                           | Ref                         |     |
| By CARLOS ROD                                                                                                                                                                 |                           | Date 23-Sep-02              | Chd |
| Client G.I.F.                                                                                                                                                                 | File 23VI04 final 3 5.std | Date/Time 03-Oct-2002 16:47 |     |

**Beam End Forces Cont...**

| L/C | Beam | Node | Axial        | Shear        |              | Torsion     | Bending     |             |
|-----|------|------|--------------|--------------|--------------|-------------|-------------|-------------|
|     |      |      | Fx<br>(Mton) | Fy<br>(Mton) | Fz<br>(Mton) | Mx<br>(kNm) | My<br>(kNm) | Mz<br>(kNm) |
|     | 148  | 150  | 0.000        | 0.165        | 0.000        | -157.518    | 0.000       | -748.843    |
|     |      | 151  | 0.000        | -0.165       | 0.000        | 157.518     | 0.000       | 750.780     |



## Geometric properties of the cross-section

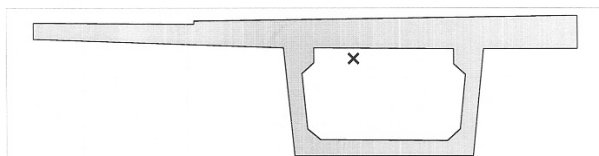
| Parameter         | Value                                                        |                            |
|-------------------|--------------------------------------------------------------|----------------------------|
| A                 | Sectional area                                               | 5.7894189 m <sup>2</sup>   |
| A <sub>v,y</sub>  | Conventional shearing area along Y-axis                      | 2.1819215 m <sup>2</sup>   |
| A <sub>v,z</sub>  | Conventional shearing area along Z-axis                      | 3.4382627 m <sup>2</sup>   |
| $\alpha$          | Angle of principal inertia axes                              | 85.797 deg                 |
| I <sub>y</sub>    | Inertia moment about centroidal Y1-axis parallel with Y-axis | 1.6756928 m <sup>4</sup>   |
| I <sub>z</sub>    | Inertia moment about centroidal Z1-axis parallel with Z-axis | 10.9792171 m <sup>4</sup>  |
| I <sub>t</sub>    | Torsional moment of inertia (St. Venant)                     | 2.62473 m <sup>4</sup>     |
| I <sub>w</sub>    | Sectorial moment of inertia                                  | 0 m <sup>6</sup>           |
| i <sub>y</sub>    | Radius of inertia about Y1-axis                              | 0.5379968 m                |
| i <sub>z</sub>    | Radius of inertia about Z1-axis                              | 1.3771086 m                |
| W <sub>u+</sub>   | Maximum resisting moment about U-axis                        | 2.5637129 m <sup>3</sup>   |
| W <sub>u-</sub>   | Minimum resisting moment about U-axis                        | 4.0804585 m <sup>3</sup>   |
| W <sub>v+</sub>   | Maximum resisting moment about V-axis                        | 1.4313674 m <sup>3</sup>   |
| W <sub>v-</sub>   | Minimum resisting moment about V-axis                        | 1.7117906 m <sup>3</sup>   |
| W <sub>pl,u</sub> | Plastic resisting moment about U-axis                        | 6.0819404 m <sup>3</sup>   |
| W <sub>pl,v</sub> | Plastic resisting moment about V-axis                        | 2.6558977 m <sup>3</sup>   |
| I <sub>u</sub>    | Maximum inertia moment                                       | 11.0297303 m <sup>4</sup>  |
| I <sub>v</sub>    | Minimum inertia moment                                       | 1.6251797 m <sup>4</sup>   |
| i <sub>u</sub>    | Maximum radius of inertia                                    | 1.3802729 m                |
| i <sub>v</sub>    | Minimum radius of inertia                                    | 0.5298259 m                |
| a <sub>u+</sub>   | Radius of gyration along positive direction of Y(U)-axis     | 0.4428273 m                |
| a <sub>u-</sub>   | Radius of gyration along negative direction of Y(U)-axis     | 0.7048131 m                |
| a <sub>v+</sub>   | Radius of gyration along positive direction of Z(V)-axis     | 0.2472385 m                |
| a <sub>v-</sub>   | Radius of gyration along negative direction of Z(V)-axis     | 0.2956757 m                |
| y <sub>M</sub>    | Coordinate of the center of gravity along Y-axis             | 4.6174844 m                |
| z <sub>M</sub>    | Coordinate of the center of gravity along Z-axis             | 1.1718266 m                |
| S <sub>w</sub>    | Sectorial static moment                                      | 0 m <sup>4</sup>           |
| Y <sub>b</sub>    | Y coordinate of the shear center                             | 4.5551061 m                |
| Z <sub>b</sub>    | Z coordinate of the shear center                             | 1.209965 m                 |
| P                 | Perimeter                                                    | 17.2130904 m               |
| P <sub>i</sub>    | Internal perimeter                                           | 0 m                        |
| P <sub>e</sub>    | External perimeter                                           | 17.2130904 m               |
| I <sub>1</sub>    | Moment of inertia I <sub>y</sub> in the user coordinates     | 125.1128303 m <sup>4</sup> |
| I <sub>2</sub>    | Moment of inertia I <sub>z</sub> in the user coordinates     | 18.9291177 m <sup>4</sup>  |
| I <sub>12</sub>   | Moment of inertia I <sub>yz</sub> in the user coordinates    | 30.6385276 m <sup>4</sup>  |



|       |                         |           |                |
|-------|-------------------------|-----------|----------------|
| $I_p$ | Polar moment of inertia | 12.65491  | m <sup>4</sup> |
| $i_p$ | Polar radius of inertia | 1.4784684 | m              |
| $W_p$ | Polar resisting moment  | 0.679726  | m              |

Overall dimensions 7.0014x1.8313 m

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23\23V\04\Croquis\Prueba\Untitled.cns



## Geometric properties of the cross-section

| Parameter         | Value                                                        |                           |
|-------------------|--------------------------------------------------------------|---------------------------|
| A                 | Sectional area                                               | 3.4374667 m <sup>2</sup>  |
| A <sub>v,y</sub>  | Conventional shearing area along Y-axis                      | 0.2483017 m <sup>2</sup>  |
| A <sub>v,z</sub>  | Conventional shearing area along Z-axis                      | 1.9265546 m <sup>2</sup>  |
| $\alpha$          | Angle of principal inertia axes                              | 87.219 deg                |
| I <sub>y</sub>    | Inertia moment about centroidal Y1-axis parallel with Y-axis | 1.1039209 m <sup>4</sup>  |
| I <sub>z</sub>    | Inertia moment about centroidal Z1-axis parallel with Z-axis | 10.0092923 m <sup>4</sup> |
| I <sub>t</sub>    | Torsional moment of inertia (St. Venant)                     | 1.7204912 m <sup>4</sup>  |
| I <sub>w</sub>    | Sectorial moment of inertia                                  | 0 m <sup>6</sup>          |
| i <sub>y</sub>    | Radius of inertia about Y1-axis                              | 0.5666954 m               |
| i <sub>z</sub>    | Radius of inertia about Z1-axis                              | 1.7064063 m               |
| W <sub>u+</sub>   | Maximum resisting moment about U-axis                        | 2.430639 m <sup>3</sup>   |
| W <sub>u-</sub>   | Minimum resisting moment about U-axis                        | 3.481432 m <sup>3</sup>   |
| W <sub>v+</sub>   | Maximum resisting moment about V-axis                        | 0.8357574 m <sup>3</sup>  |
| W <sub>v-</sub>   | Minimum resisting moment about V-axis                        | 1.5441634 m <sup>3</sup>  |
| W <sub>pl,u</sub> | Plastic resisting moment about U-axis                        | 4.8642589 m <sup>3</sup>  |
| W <sub>pl,v</sub> | Plastic resisting moment about V-axis                        | 1.5528716 m <sup>3</sup>  |
| I <sub>u</sub>    | Maximum inertia moment                                       | 10.0303481 m <sup>4</sup> |
| I <sub>v</sub>    | Minimum inertia moment                                       | 1.082865 m <sup>4</sup>   |
| i <sub>u</sub>    | Maximum radius of inertia                                    | 1.7082001 m               |
| i <sub>v</sub>    | Minimum radius of inertia                                    | 0.5612649 m               |
| a <sub>u+</sub>   | Radius of gyration along positive direction of Y(U)-axis     | 0.7071018 m               |
| a <sub>u-</sub>   | Radius of gyration along negative direction of Y(U)-axis     | 1.01279 m                 |
| a <sub>v+</sub>   | Radius of gyration along positive direction of Z(V)-axis     | 0.2431318 m               |
| a <sub>v-</sub>   | Radius of gyration along negative direction of Z(V)-axis     | 0.4492155 m               |
| y <sub>M</sub>    | Coordinate of the center of gravity along Y-axis             | 4.4603628 m               |
| z <sub>M</sub>    | Coordinate of the center of gravity along Z-axis             | 1.3612053 m               |
| S <sub>w</sub>    | Sectorial static moment                                      | 0 m <sup>4</sup>          |
| Y <sub>b</sub>    | Y coordinate of the shear center                             | 4.8474167 m               |
| Z <sub>b</sub>    | Z coordinate of the shear center                             | 1.3697561 m               |
| P                 | Perimeter                                                    | 23.3420844 m              |
| P <sub>i</sub>    | Internal perimeter                                           | 6.128994 m                |
| P <sub>e</sub>    | External perimeter                                           | 17.2130904 m              |
| I <sub>1</sub>    | Moment of inertia I <sub>y</sub> in the user coordinates     | 69.4917571 m <sup>4</sup> |
| I <sub>2</sub>    | Moment of inertia I <sub>z</sub> in the user coordinates     | 16.3785052 m <sup>4</sup> |
| I <sub>12</sub>   | Moment of inertia I <sub>yz</sub> in the user coordinates    | 20.4369381 m <sup>4</sup> |

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 Capital Social: 500.000.000 pes.  
 1º Res. Reg. Merc. Madrid. T. 2.958. G. 1.716. S. 31. F. 158. H. 14.794. C. I. F. A-28208874.

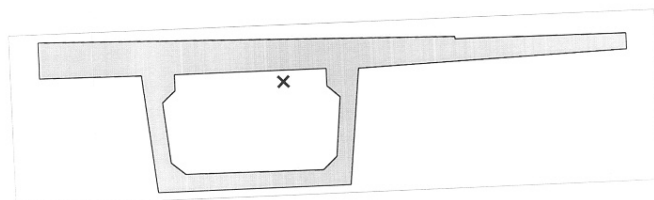


|       |                         |            |                |
|-------|-------------------------|------------|----------------|
| $I_p$ | Polar moment of inertia | 11.1132131 | m <sup>4</sup> |
| $i_p$ | Polar radius of inertia | 1.7980451  | m              |
| $W_p$ | Polar resisting moment  | 0.6501338  | m              |

Overall dimensions 7.0014x1.8313 m

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# Geometric properties of the cross-section

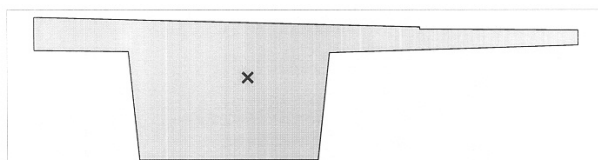
| Parameter         | Value      |                |
|-------------------|------------|----------------|
| A                 | 3.4361789  | m <sup>2</sup> |
| A <sub>v,y</sub>  | 0.2485071  | m <sup>2</sup> |
| A <sub>v,z</sub>  | 1.9251398  | m <sup>2</sup> |
| α                 | -87.699    | deg            |
| I <sub>y</sub>    | 1.0970125  | m <sup>4</sup> |
| I <sub>z</sub>    | 10.0099529 | m <sup>4</sup> |
| I <sub>t</sub>    | 1.7221873  | m <sup>4</sup> |
| I <sub>w</sub>    | 0          | m <sup>6</sup> |
| i <sub>y</sub>    | 0.5650253  | m              |
| i <sub>z</sub>    | 1.7067823  | m              |
| W <sub>u+</sub>   | 2.429419   | m <sup>3</sup> |
| W <sub>u-</sub>   | 3.4819728  | m <sup>3</sup> |
| W <sub>v+</sub>   | 0.8356383  | m <sup>3</sup> |
| W <sub>v-</sub>   | 1.5430812  | m <sup>3</sup> |
| W <sub>pl,u</sub> | 4.8618625  | m <sup>3</sup> |
| W <sub>pl,v</sub> | 1.5525178  | m <sup>3</sup> |
| I <sub>u</sub>    | 10.0243627 | m <sup>4</sup> |
| I <sub>v</sub>    | 1.0826027  | m <sup>4</sup> |
| i <sub>u</sub>    | 1.7080104  | m              |
| i <sub>v</sub>    | 0.5613021  | m              |
| a <sub>u+</sub>   | 0.7070118  | m              |
| a <sub>u-</sub>   | 1.013327   | m              |
| a <sub>v+</sub>   | 0.2431882  | m              |
| a <sub>v-</sub>   | 0.4490689  | m              |
| y <sub>M</sub>    | 3.2372444  | m              |
| z <sub>M</sub>    | 1.358846   | m              |
| S <sub>w</sub>    | 0          | m <sup>4</sup> |
| Y <sub>b</sub>    | 2.7226251  | m              |
| Z <sub>b</sub>    | 1.3708247  | m              |
| P                 | 23.3393069 | m              |
| P <sub>i</sub>    | 6.1290171  | m              |
| P <sub>e</sub>    | 17.2102898 | m              |
| I <sub>1</sub>    | 37.1073131 | m <sup>4</sup> |
| I <sub>2</sub>    | 16.3547285 | m <sup>4</sup> |
| I <sub>12</sub>   | 15.4741306 | m <sup>4</sup> |



|       |                         |            |                |
|-------|-------------------------|------------|----------------|
| $I_p$ | Polar moment of inertia | 11.1069654 | m <sup>4</sup> |
| $i_p$ | Polar radius of inertia | 1.7978764  | m              |
| $W_p$ | Polar resisting moment  | 0.6498922  | m              |

Overall dimensions 7x1.8524 m

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## Geometric properties of the cross-section

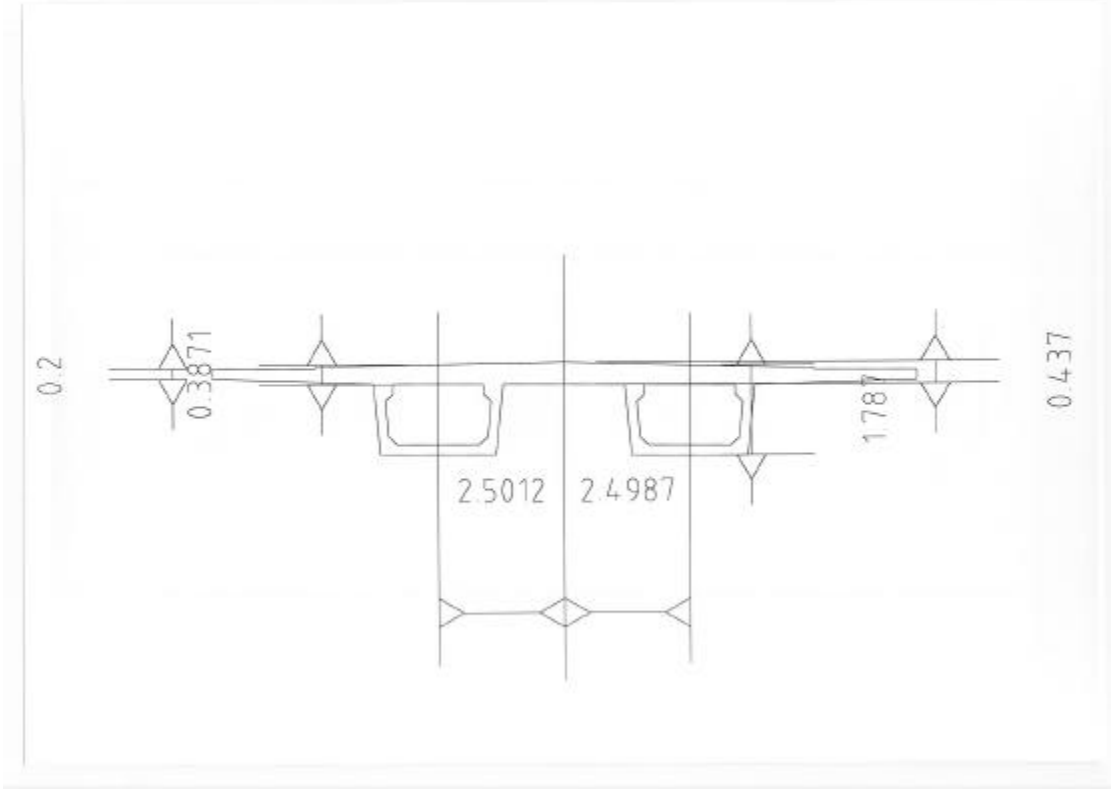
| Parameter         | Value                                                        |                           |
|-------------------|--------------------------------------------------------------|---------------------------|
| A                 | Sectional area                                               | 5.7881253 m <sup>2</sup>  |
| A <sub>v,y</sub>  | Conventional shearing area along Y-axis                      | 2.1858403 m <sup>2</sup>  |
| A <sub>v,z</sub>  | Conventional shearing area along Z-axis                      | 3.4416155 m <sup>2</sup>  |
| $\alpha$          | Angle of principal inertia axes                              | -86.276 deg               |
| I <sub>y</sub>    | Inertia moment about centroidal Y1-axis parallel with Y-axis | 1.6643068 m <sup>4</sup>  |
| I <sub>z</sub>    | Inertia moment about centroidal Z1-axis parallel with Z-axis | 10.9844557 m <sup>4</sup> |
| I <sub>t</sub>    | Torsional moment of inertia (St. Venant)                     | 2.6283516 m <sup>4</sup>  |
| I <sub>w</sub>    | Sectorial moment of inertia                                  | 0 m <sup>6</sup>          |
| i <sub>y</sub>    | Radius of inertia about Y1-axis                              | 0.5362258 m               |
| i <sub>z</sub>    | Radius of inertia about Z1-axis                              | 1.377591 m                |
| W <sub>u+</sub>   | Maximum resisting moment about U-axis                        | 2.5625237 m <sup>3</sup>  |
| W <sub>u-</sub>   | Minimum resisting moment about U-axis                        | 4.0819311 m <sup>3</sup>  |
| W <sub>v+</sub>   | Maximum resisting moment about V-axis                        | 1.4310149 m <sup>3</sup>  |
| W <sub>v-</sub>   | Minimum resisting moment about V-axis                        | 1.7106308 m <sup>3</sup>  |
| W <sub>pl,u</sub> | Plastic resisting moment about U-axis                        | 6.0796132 m <sup>3</sup>  |
| W <sub>pl,v</sub> | Plastic resisting moment about V-axis                        | 2.6551117 m <sup>3</sup>  |
| I <sub>u</sub>    | Maximum inertia moment                                       | 11.0241066 m <sup>4</sup> |
| I <sub>v</sub>    | Minimum inertia moment                                       | 1.624656 m <sup>4</sup>   |
| i <sub>u</sub>    | Maximum radius of inertia                                    | 1.3800752 m               |
| i <sub>v</sub>    | Minimum radius of inertia                                    | 0.5297997 m               |
| a <sub>u+</sub>   | Radius of gyration along positive direction of Y(U)-axis     | 0.4427208 m               |
| a <sub>u-</sub>   | Radius of gyration along negative direction of Y(U)-axis     | 0.7052251 m               |
| a <sub>v+</sub>   | Radius of gyration along positive direction of Z(V)-axis     | 0.2472329 m               |
| a <sub>v-</sub>   | Radius of gyration along negative direction of Z(V)-axis     | 0.2955414 m               |
| y <sub>M</sub>    | Coordinate of the center of gravity along Y-axis             | 3.0783676 m               |
| z <sub>M</sub>    | Coordinate of the center of gravity along Z-axis             | 1.1708148 m               |
| S <sub>w</sub>    | Sectorial static moment                                      | 0 m <sup>4</sup>          |
| Y <sub>b</sub>    | Y coordinate of the shear center                             | 2.4846526 m               |
| Z <sub>b</sub>    | Z coordinate of the shear center                             | 1.2077315 m               |
| P                 | Perimeter                                                    | 17.2103183 m              |
| P <sub>i</sub>    | Internal perimeter                                           | 0 m                       |
| P <sub>e</sub>    | External perimeter                                           | 17.2103183 m              |
| I <sub>1</sub>    | Moment of inertia I <sub>y</sub> in the user coordinates     | 56.5145911 m <sup>4</sup> |
| I <sub>2</sub>    | Moment of inertia I <sub>z</sub> in the user coordinates     | 18.9188603 m <sup>4</sup> |
| I <sub>12</sub>   | Moment of inertia I <sub>yz</sub> in the user coordinates    | 21.4707515 m <sup>4</sup> |

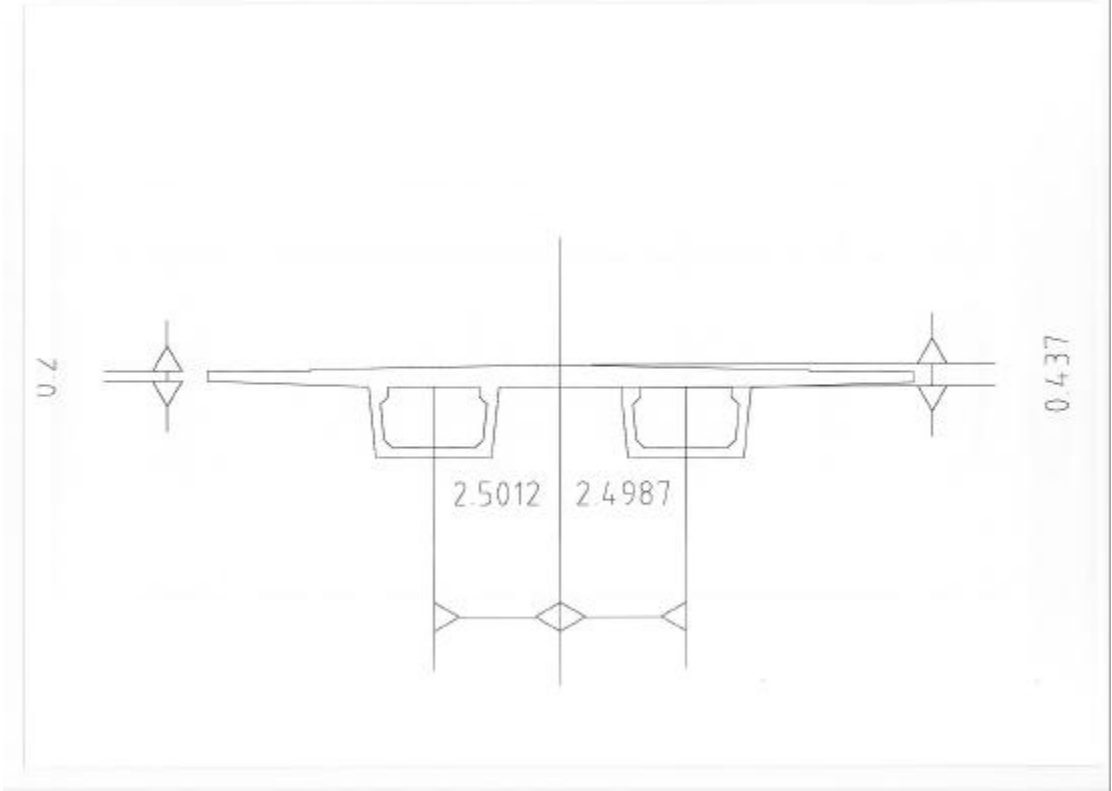


|       |                         |            |                |
|-------|-------------------------|------------|----------------|
| $I_p$ | Polar moment of inertia | 12.6487625 | m <sup>4</sup> |
| $i_p$ | Polar radius of inertia | 1.4782744  | m              |
| $W_p$ | Polar resisting moment  | 0.6794617  | m              |

Overall dimensions 7x1.8524 m

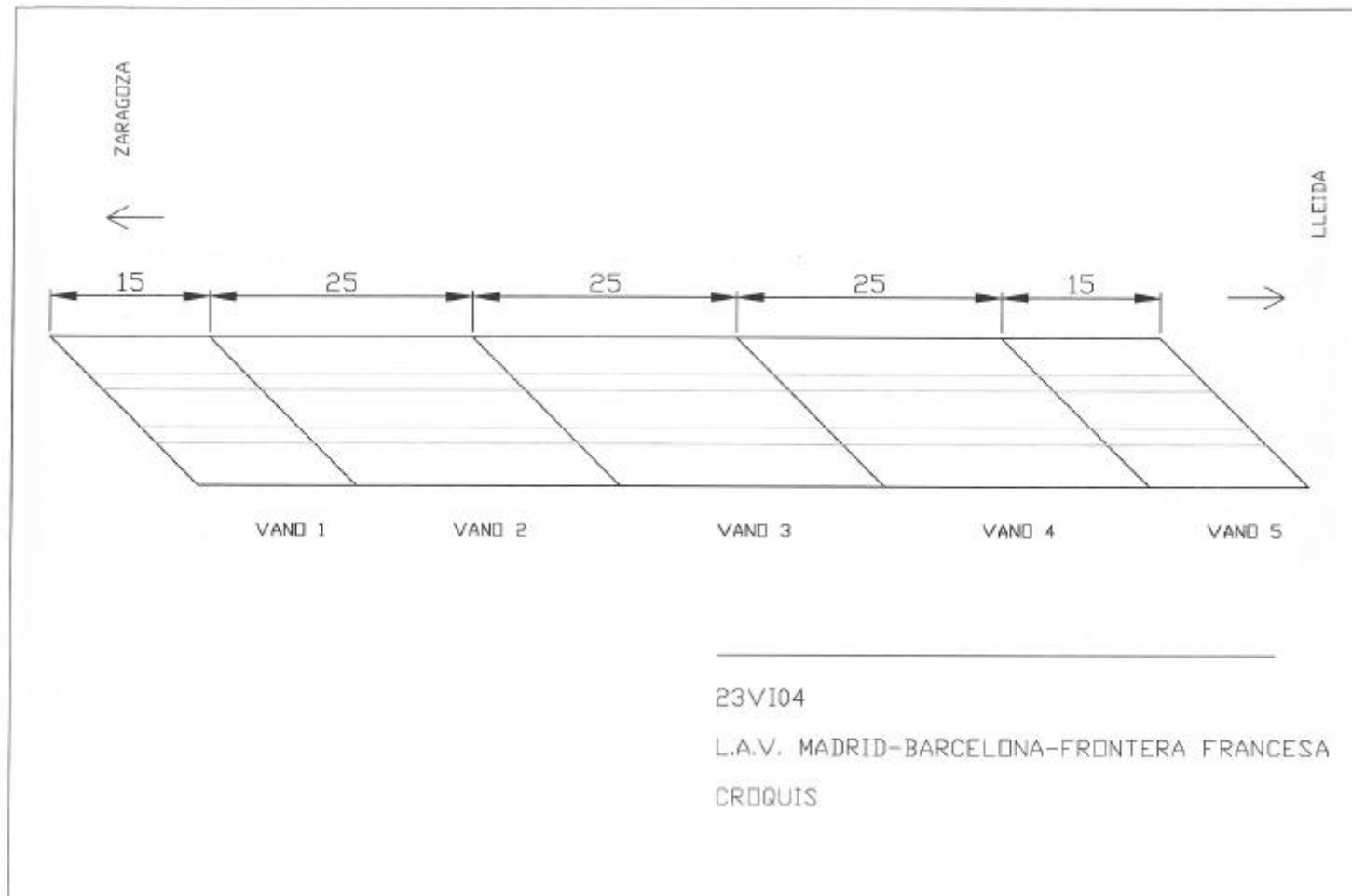
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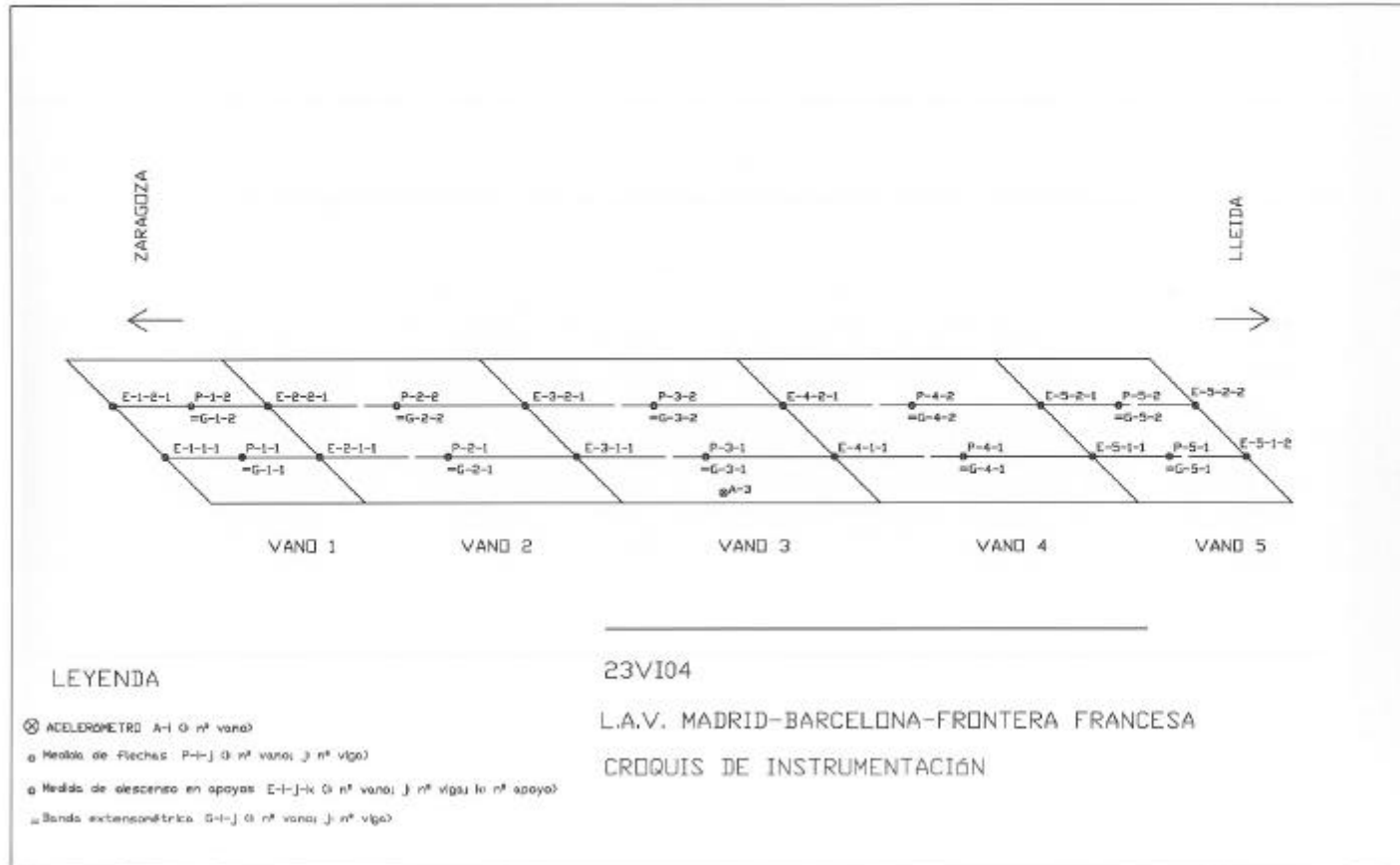


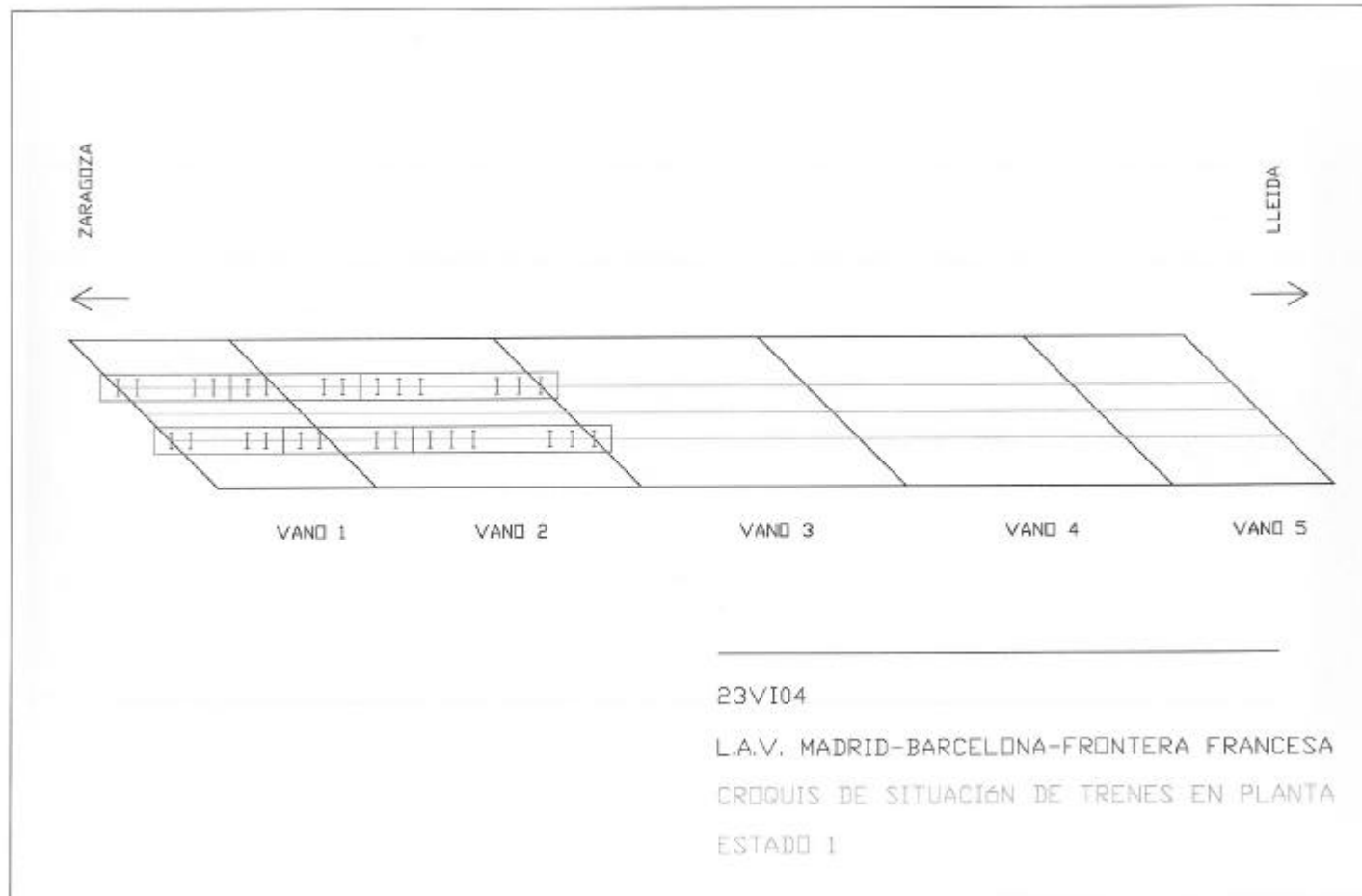
**ANEJO 2C: FIGURAS.**

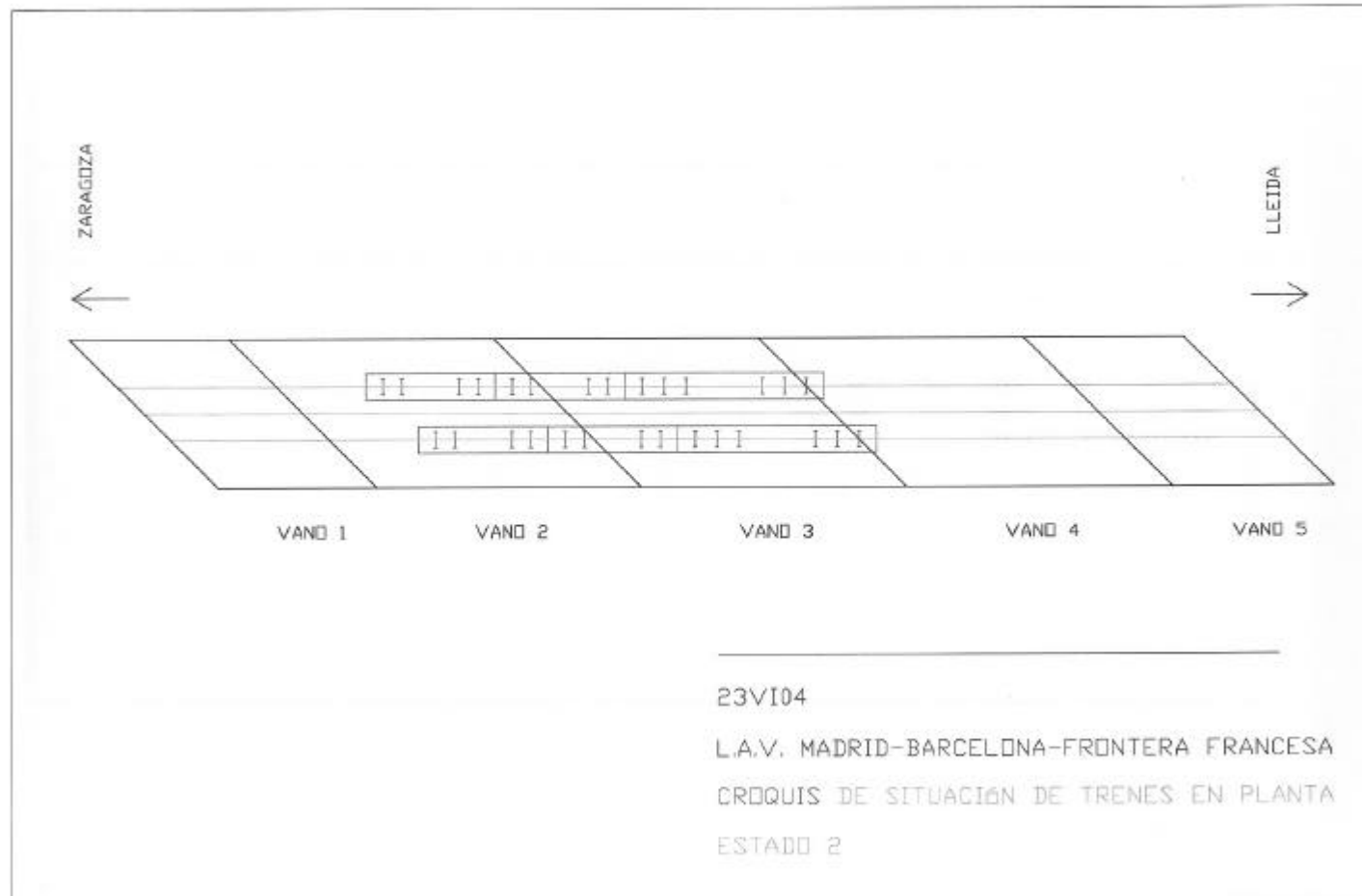
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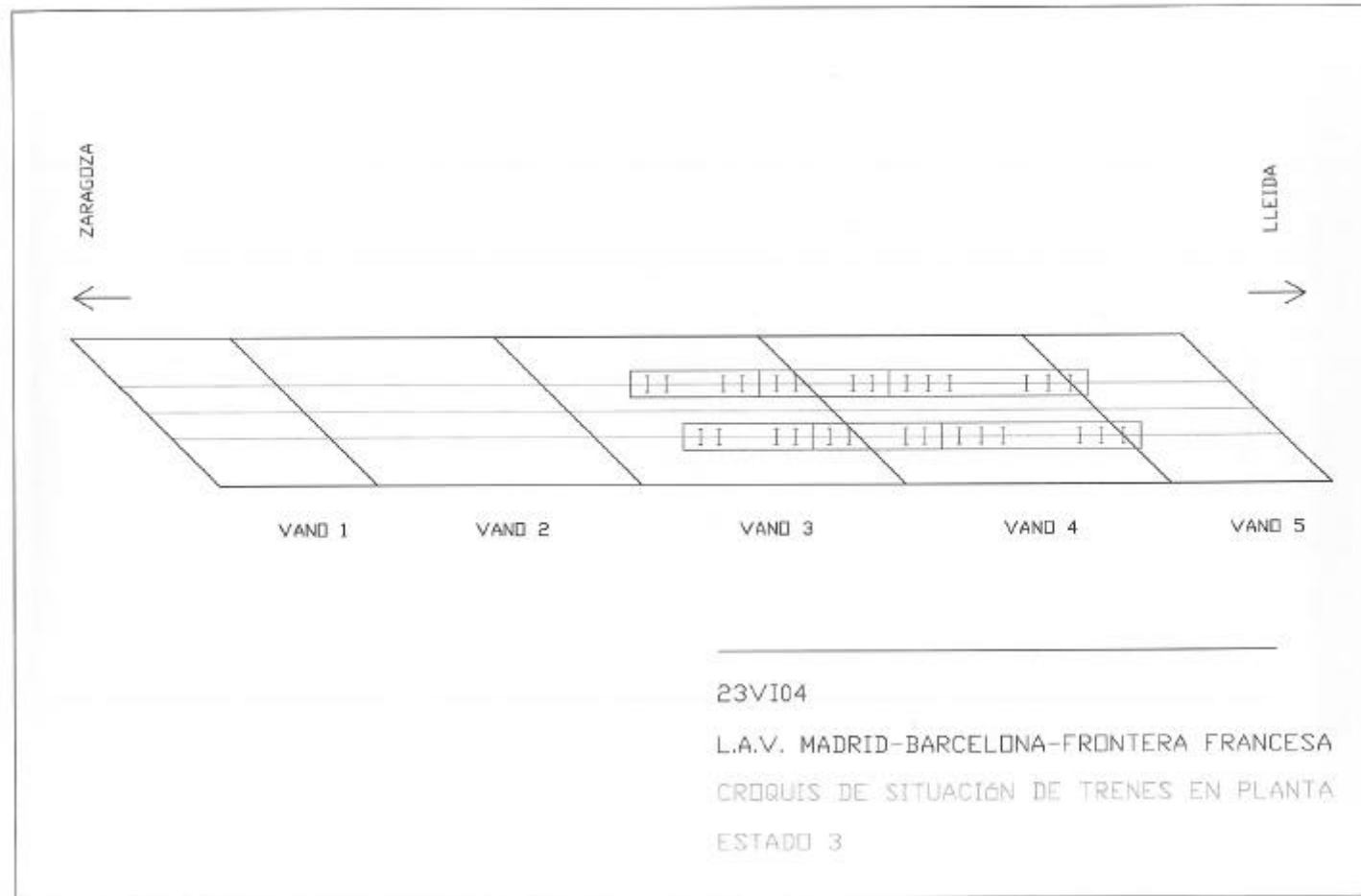


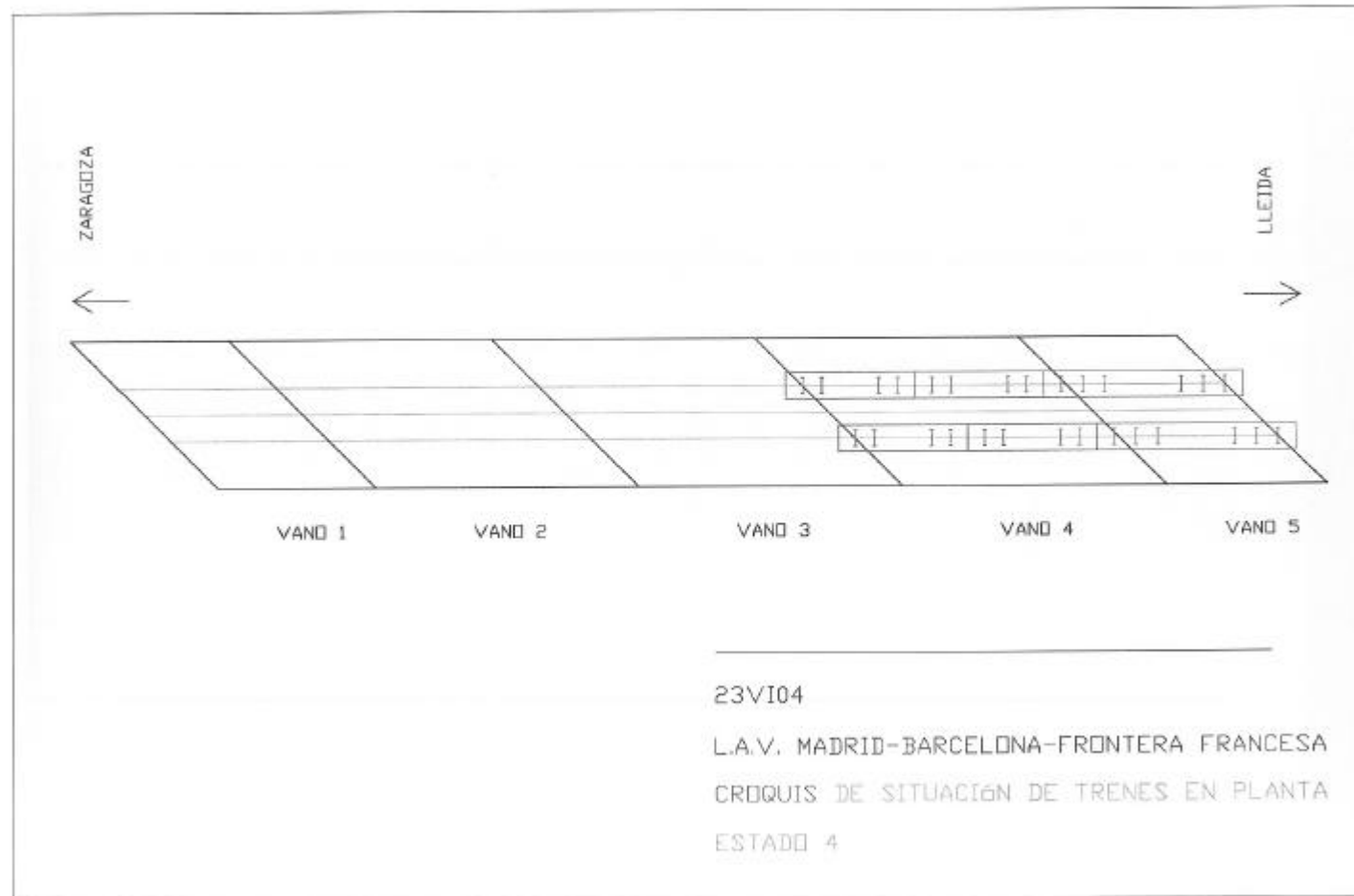


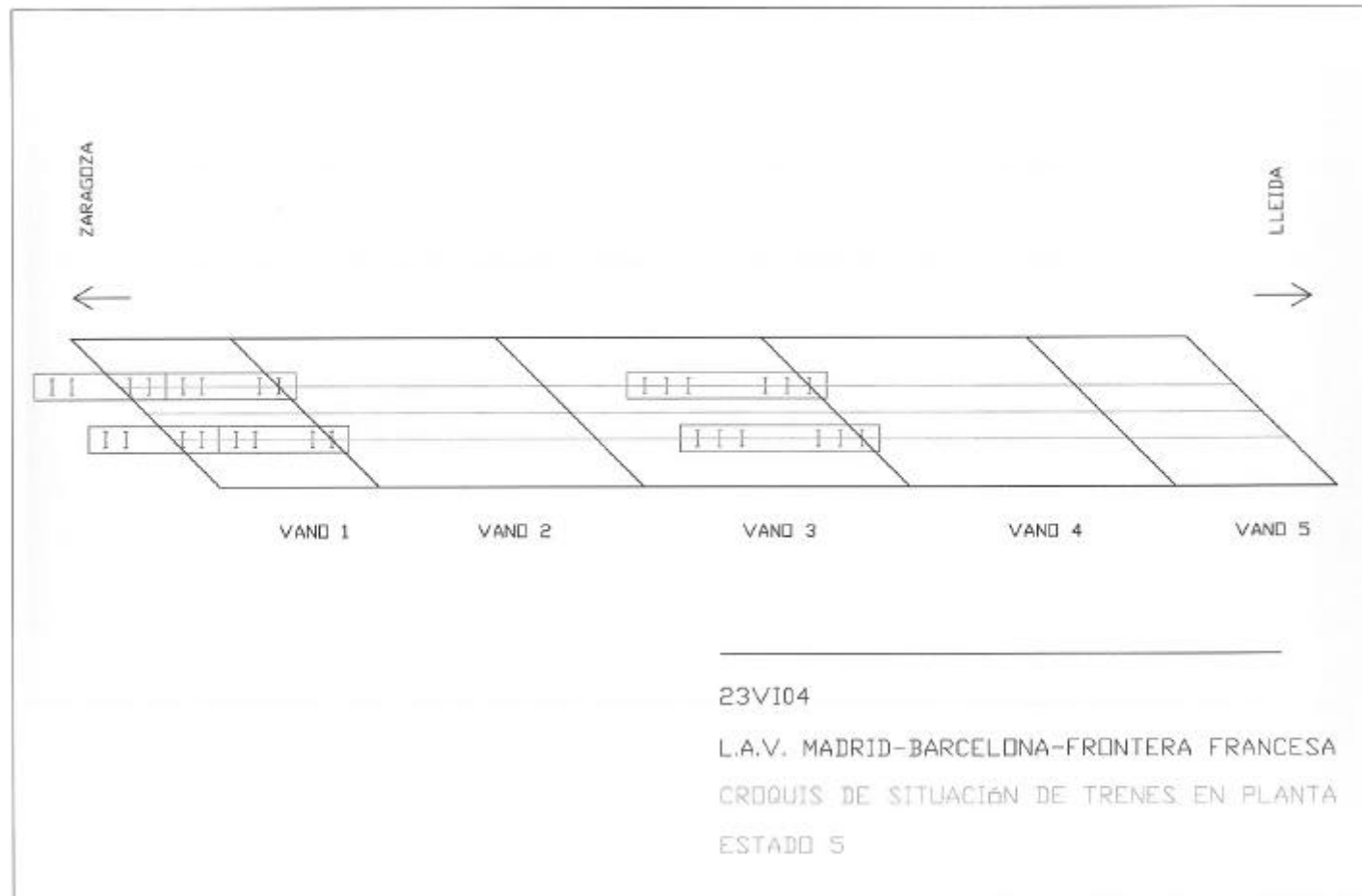


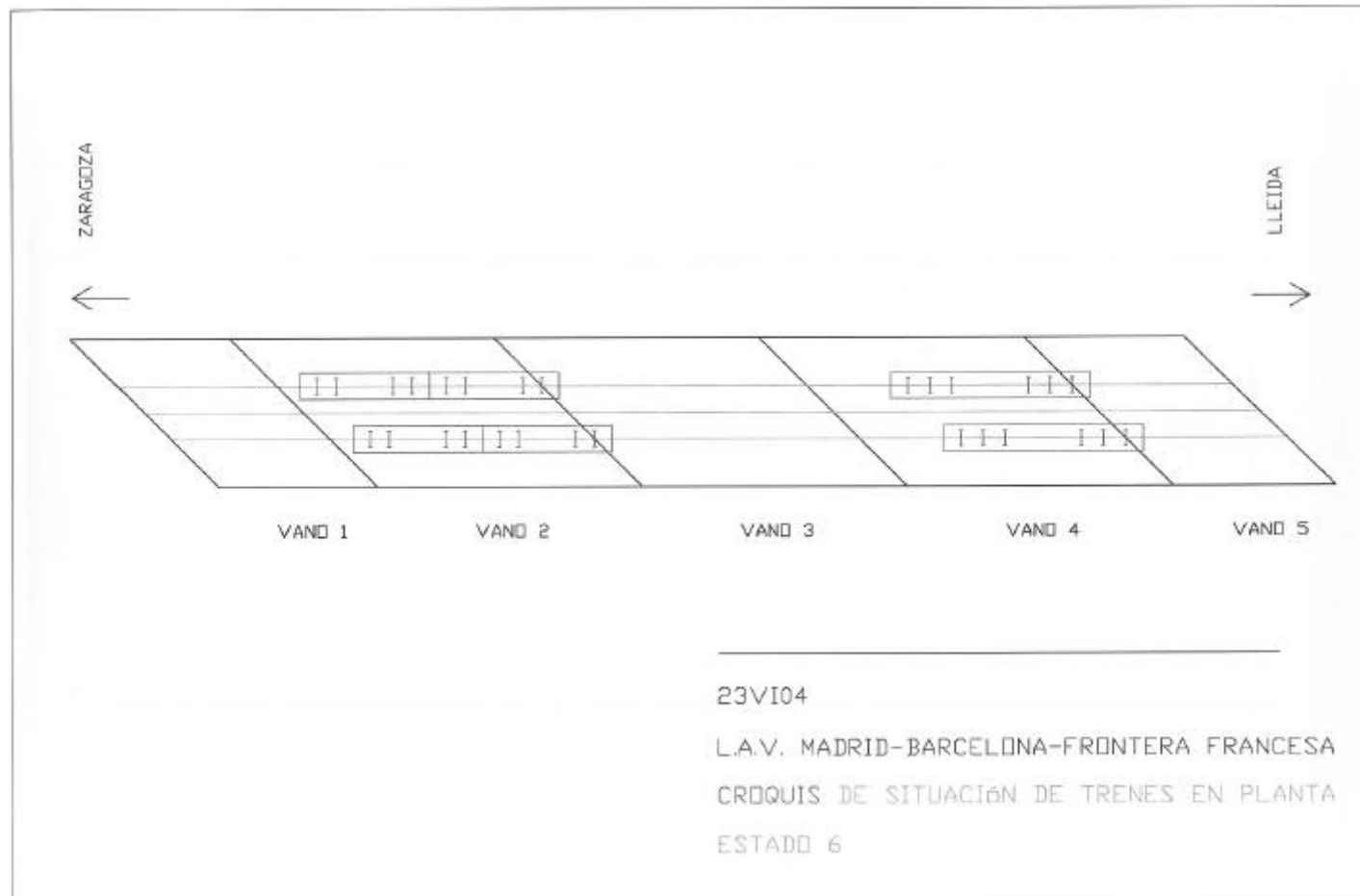


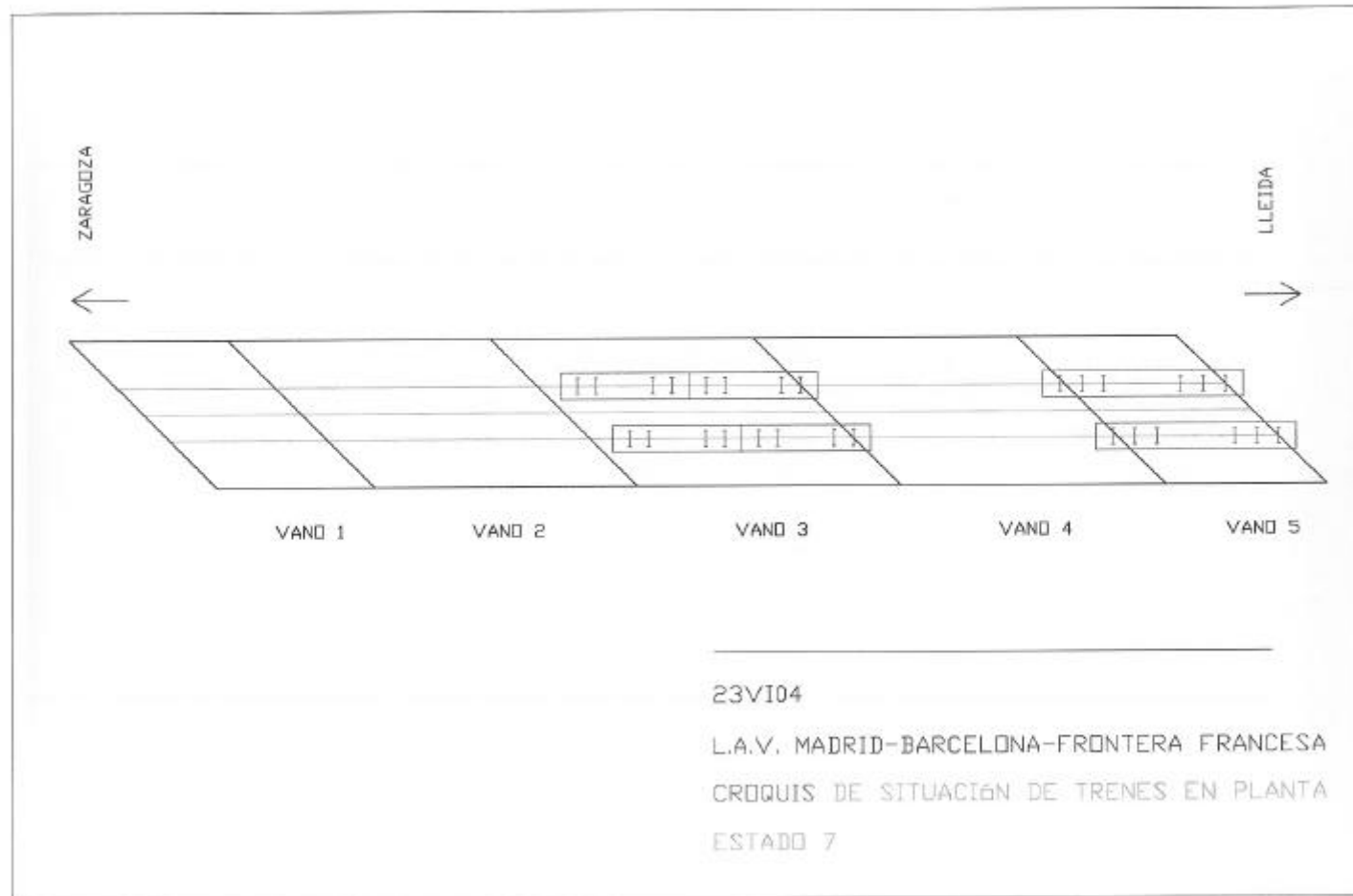




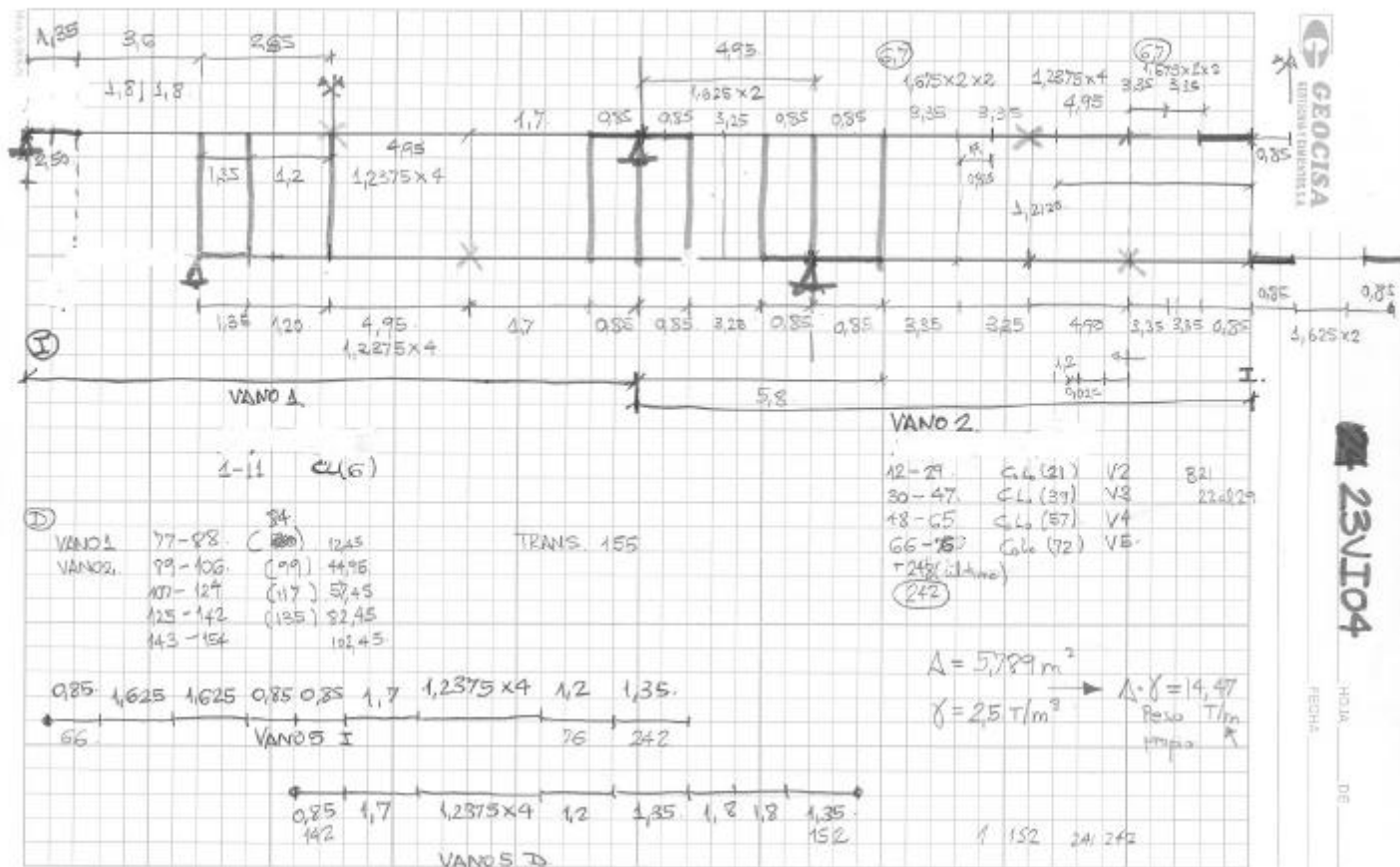


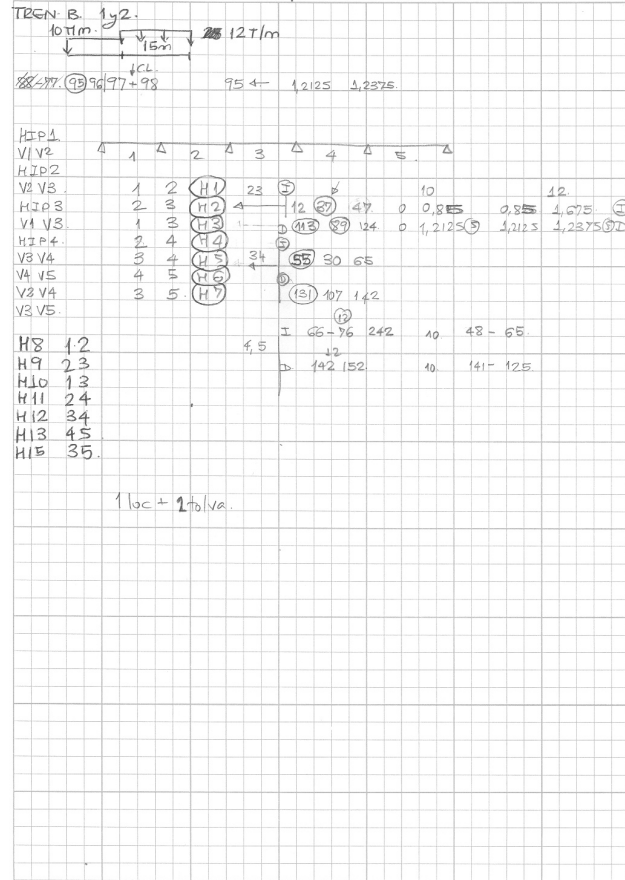






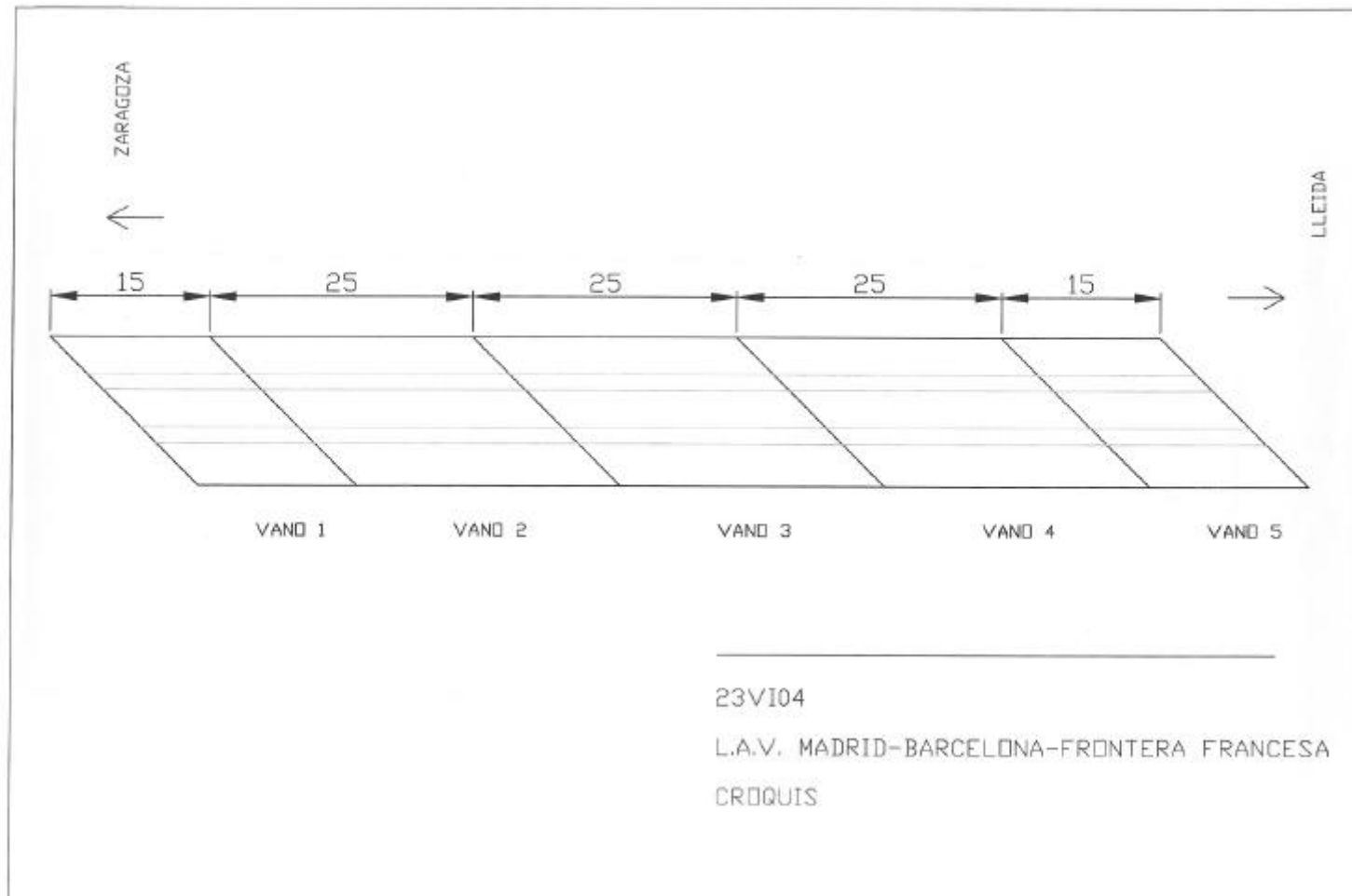


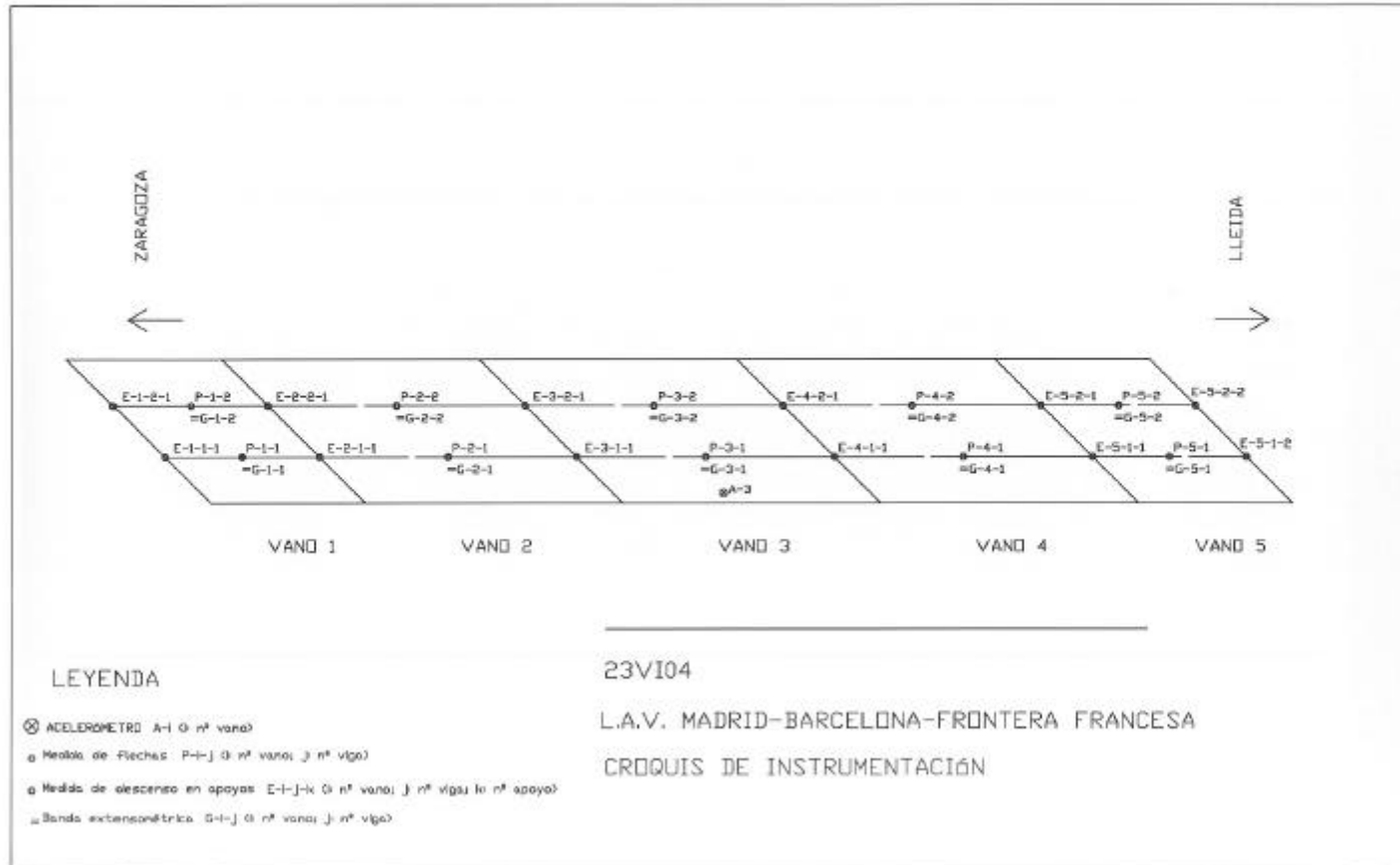


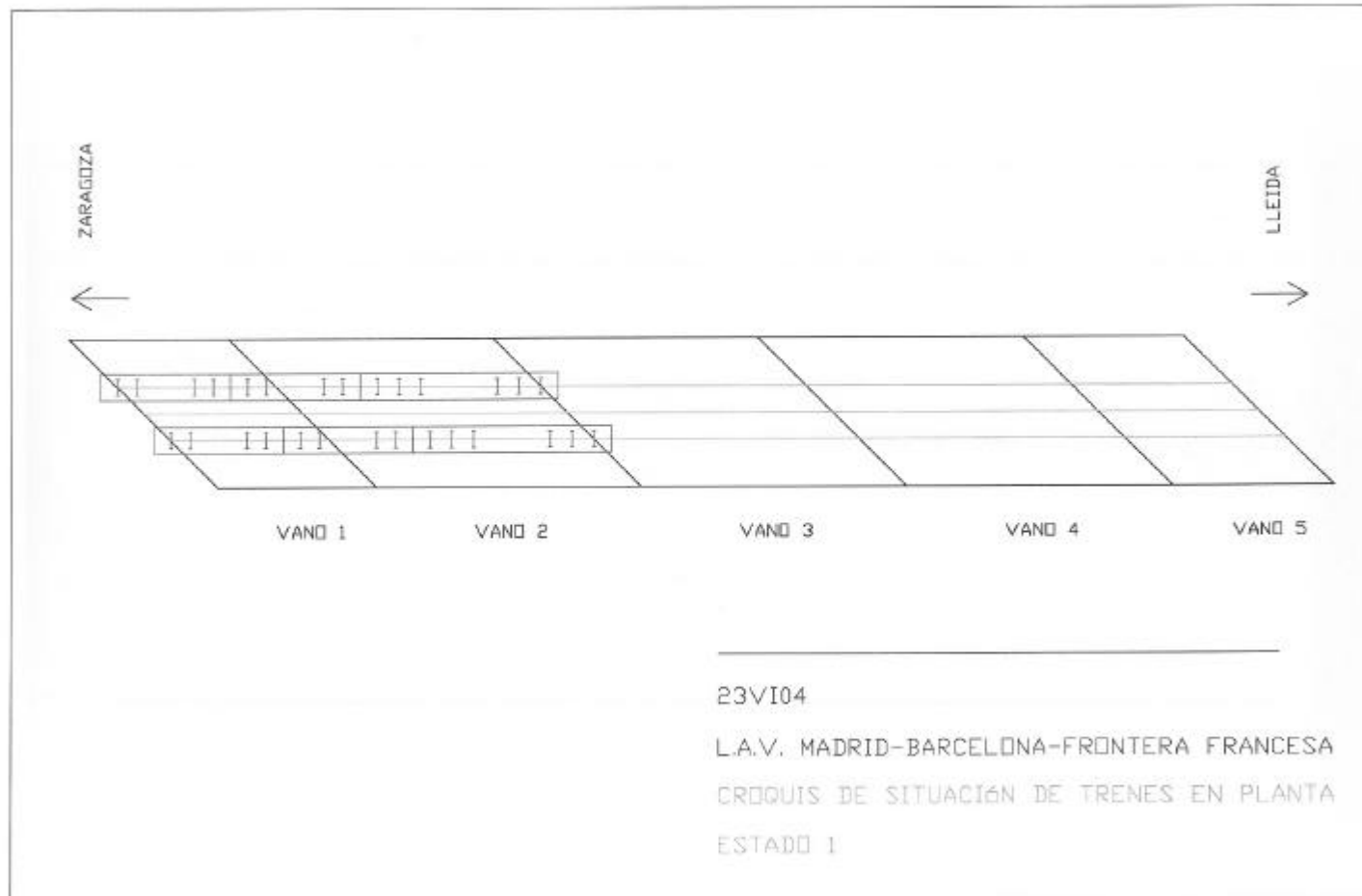


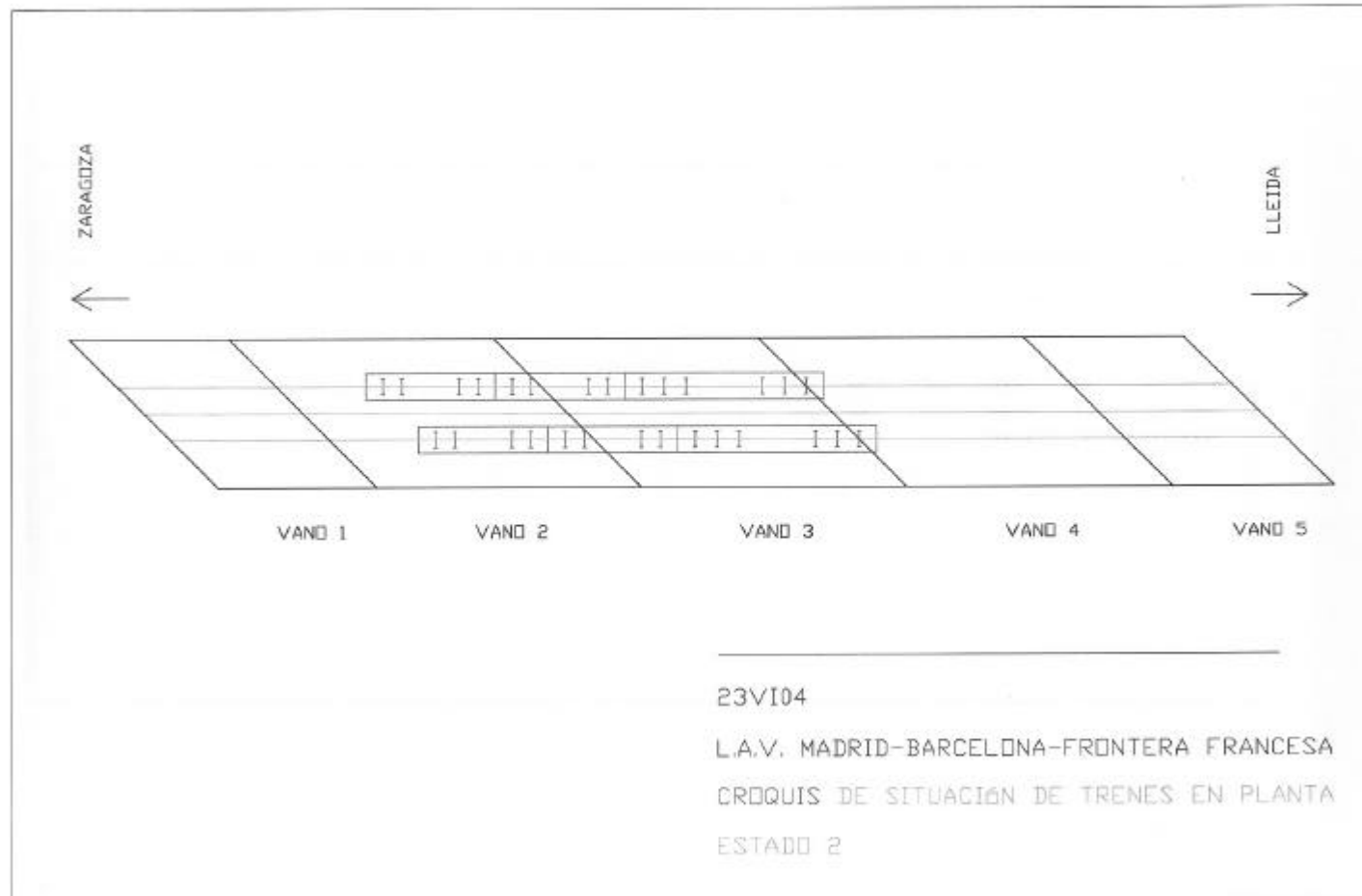
**ANEJO 3: ESQUEMA DE INSTRUMENTACIÓN Y TREN DE CARGAS.**

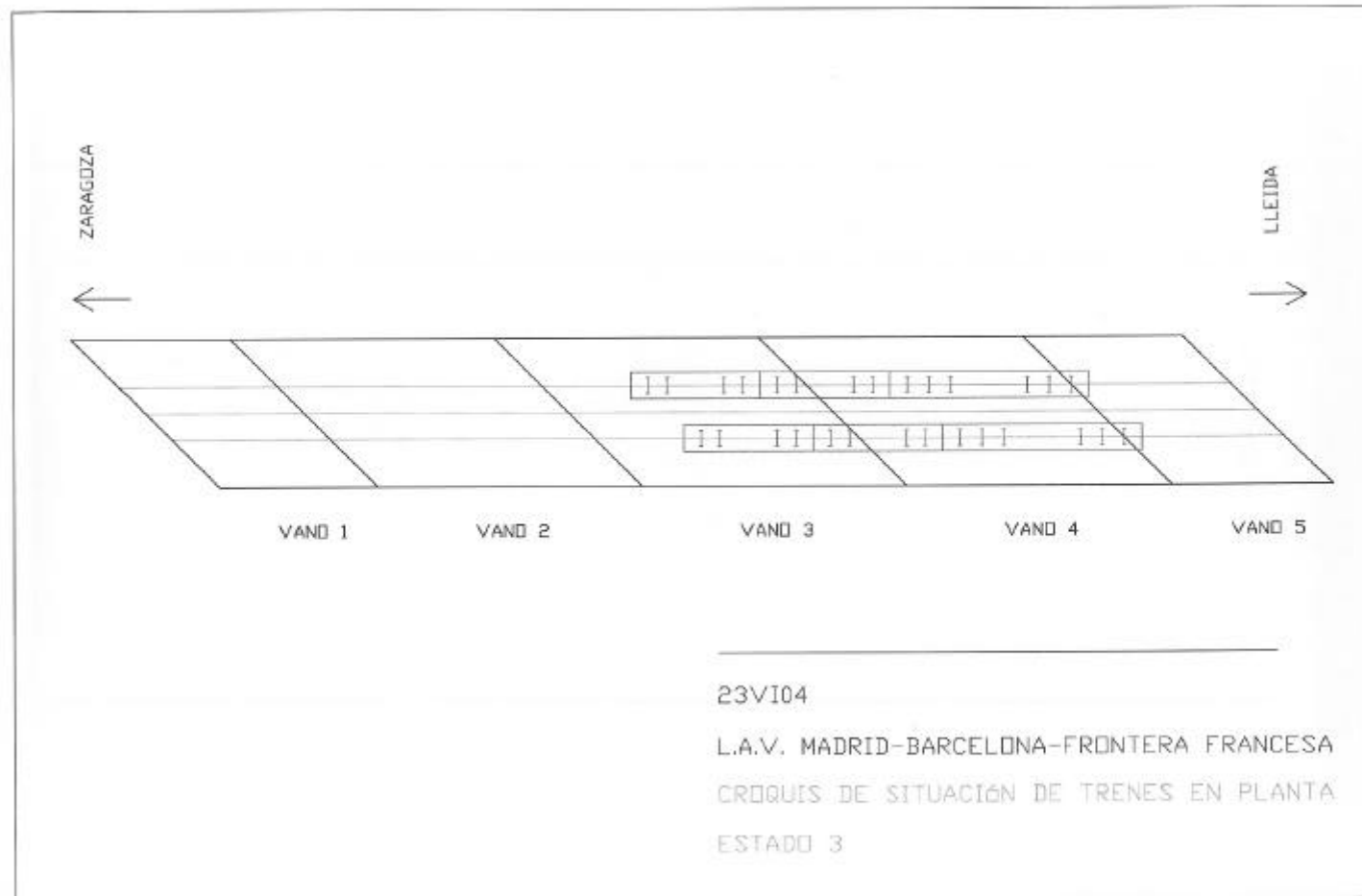
Explorar0071.jpg (1768x1241x16M jpeg)



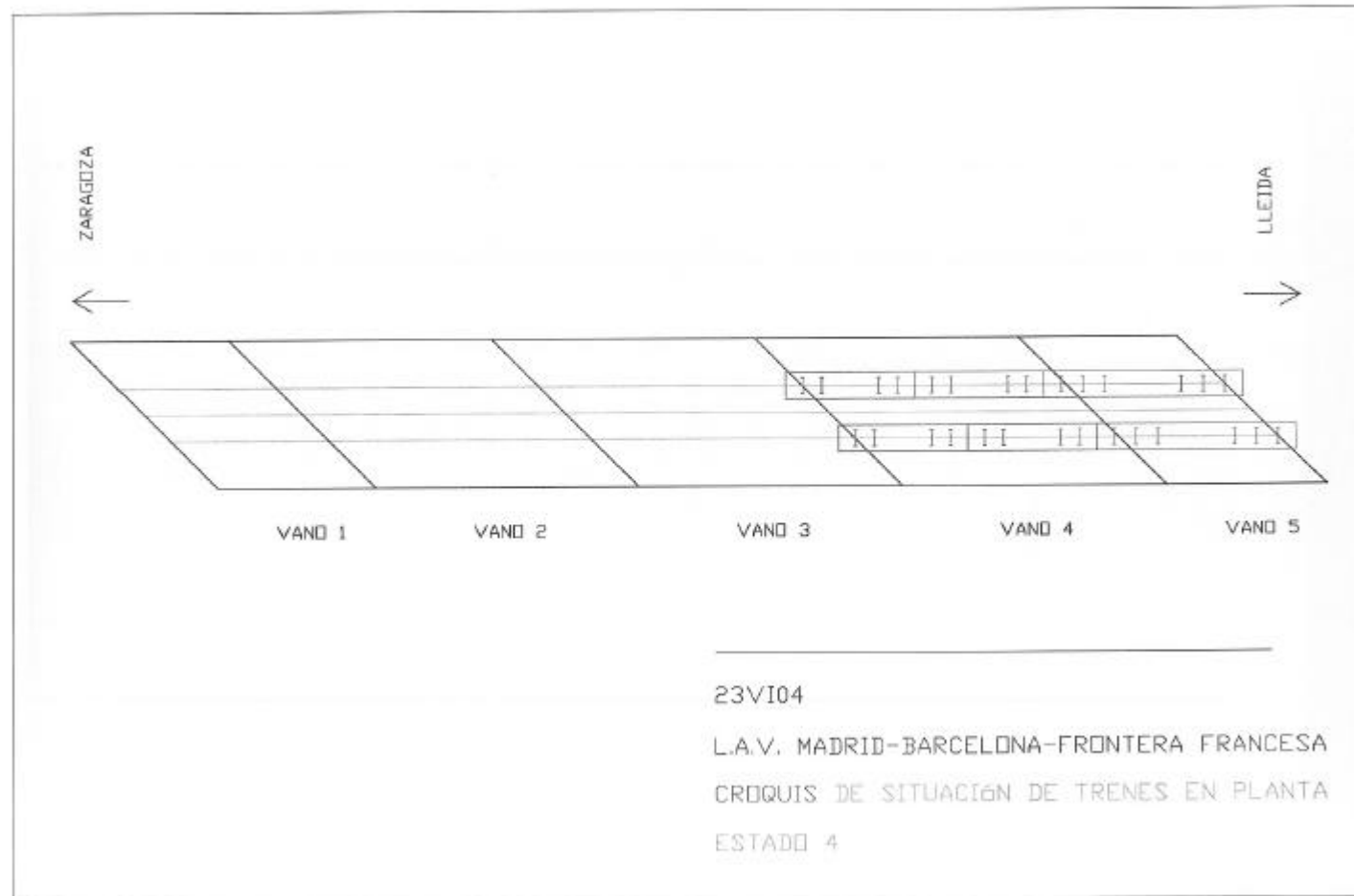


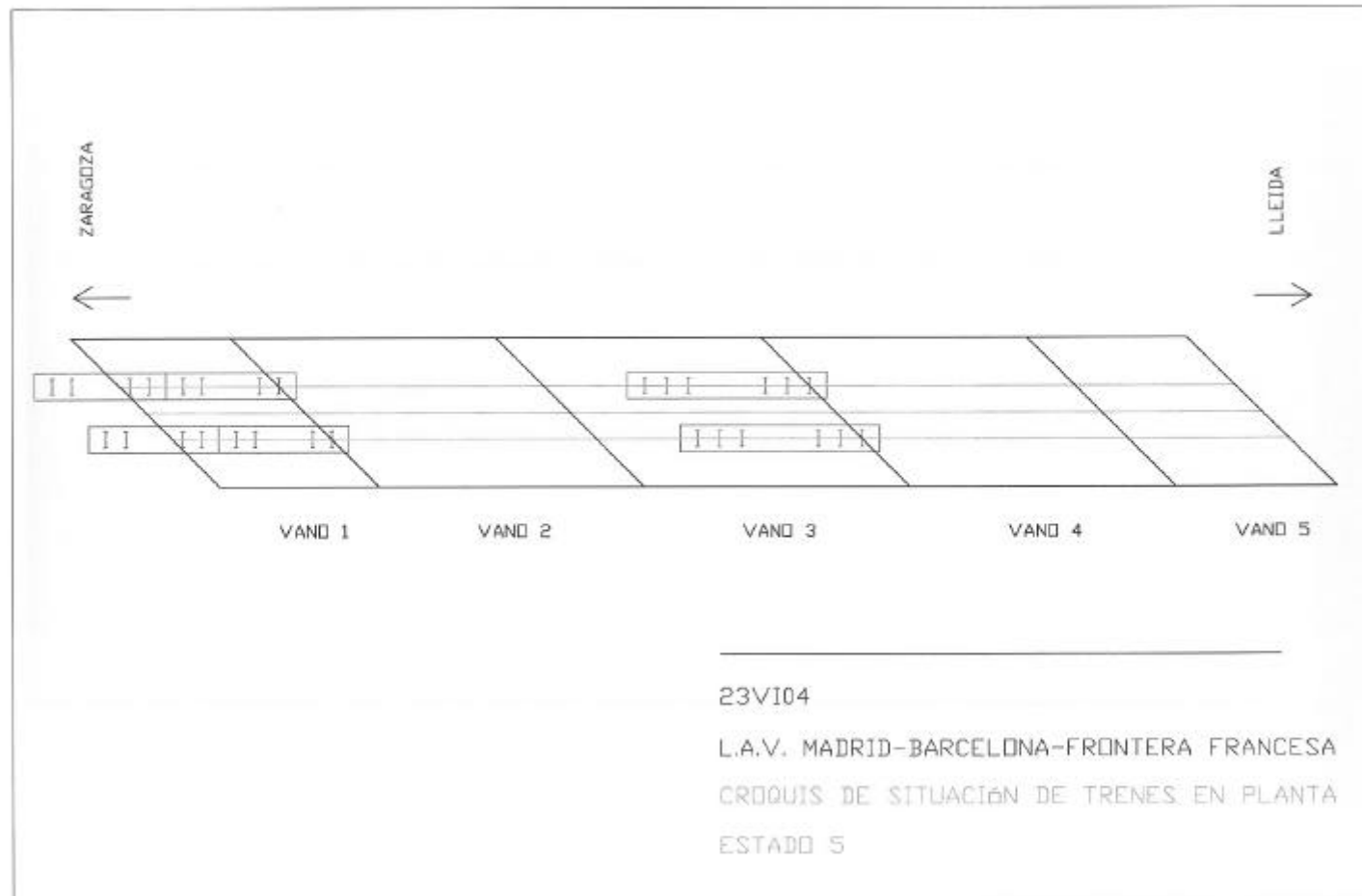


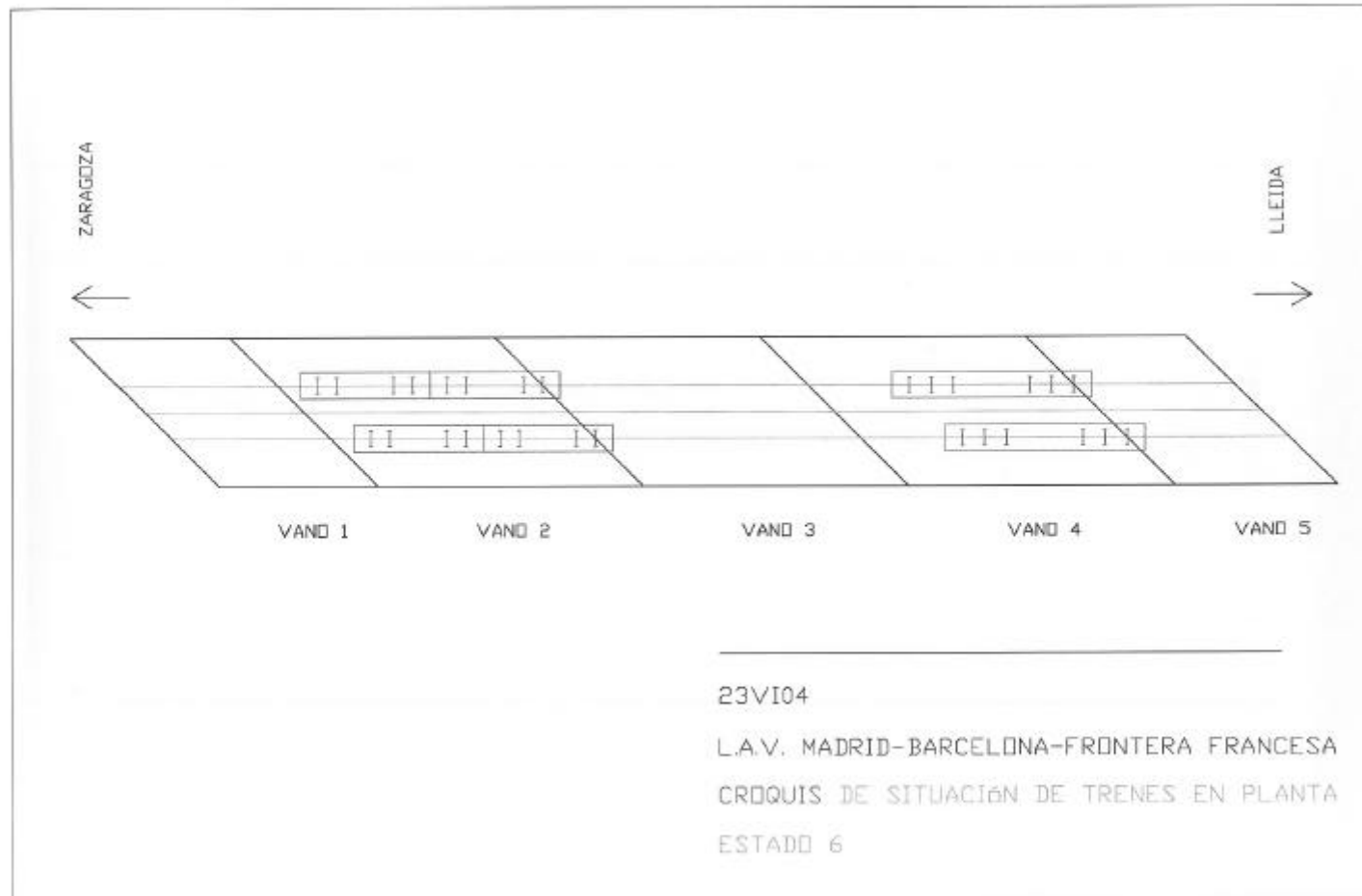


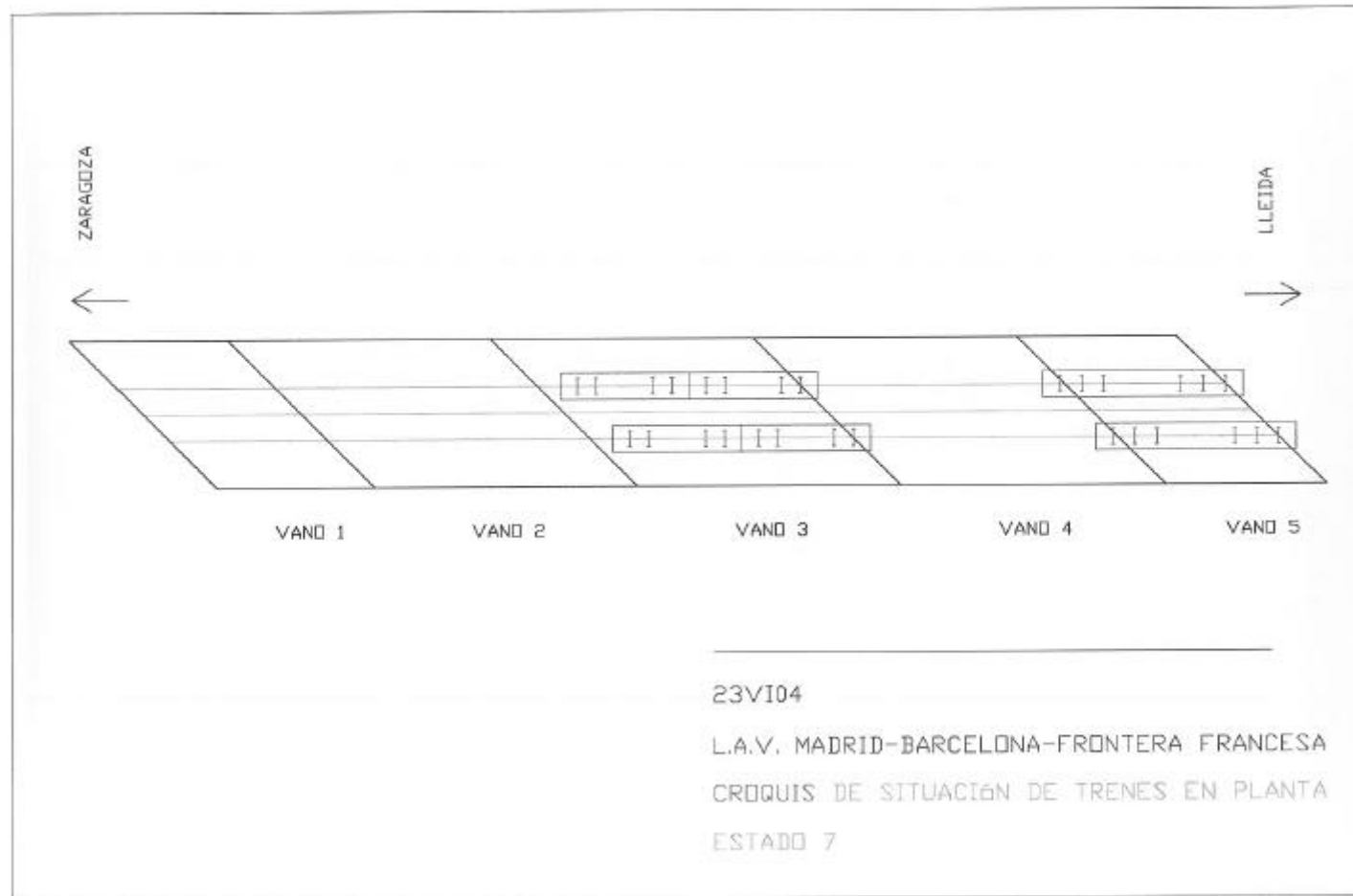


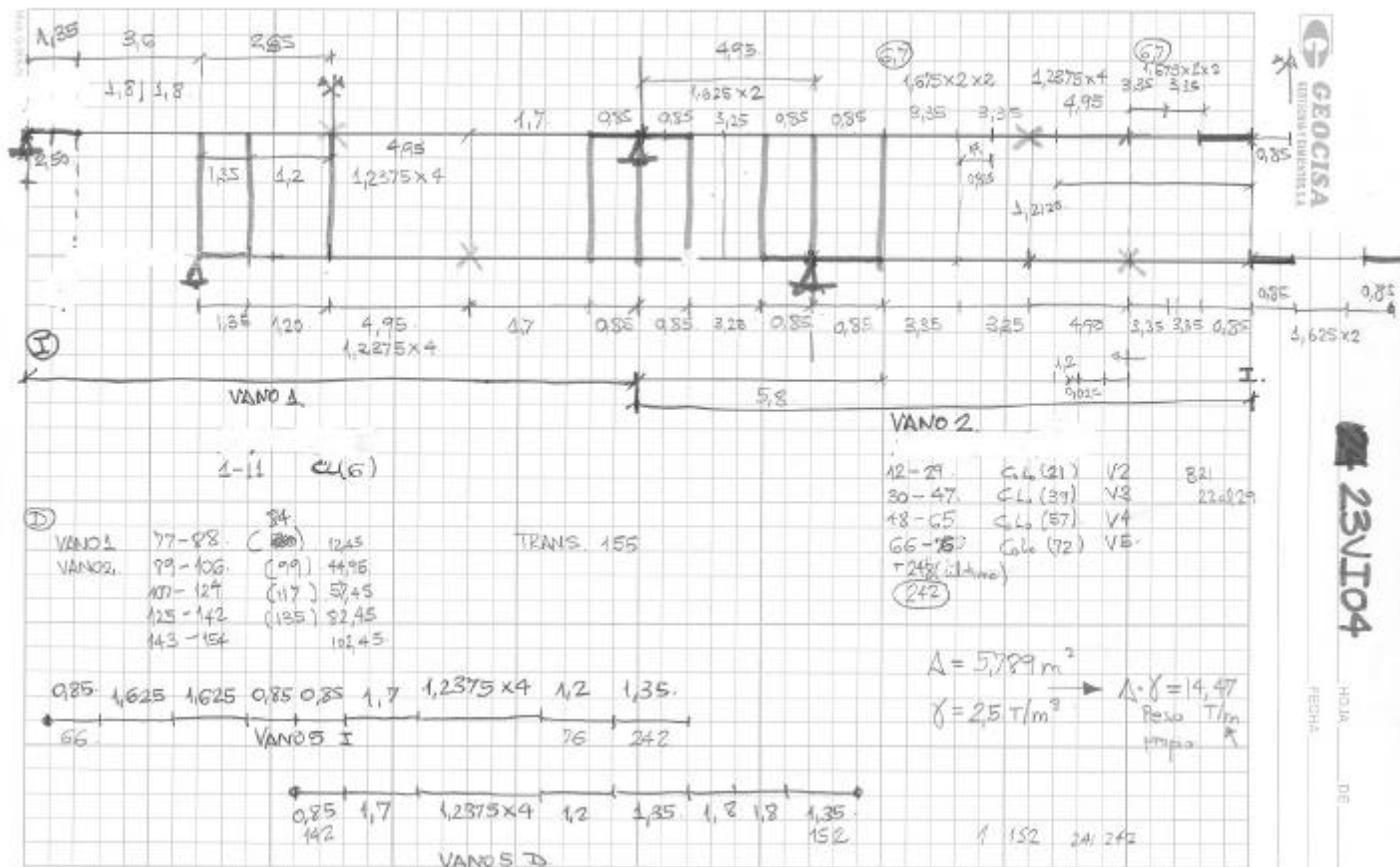














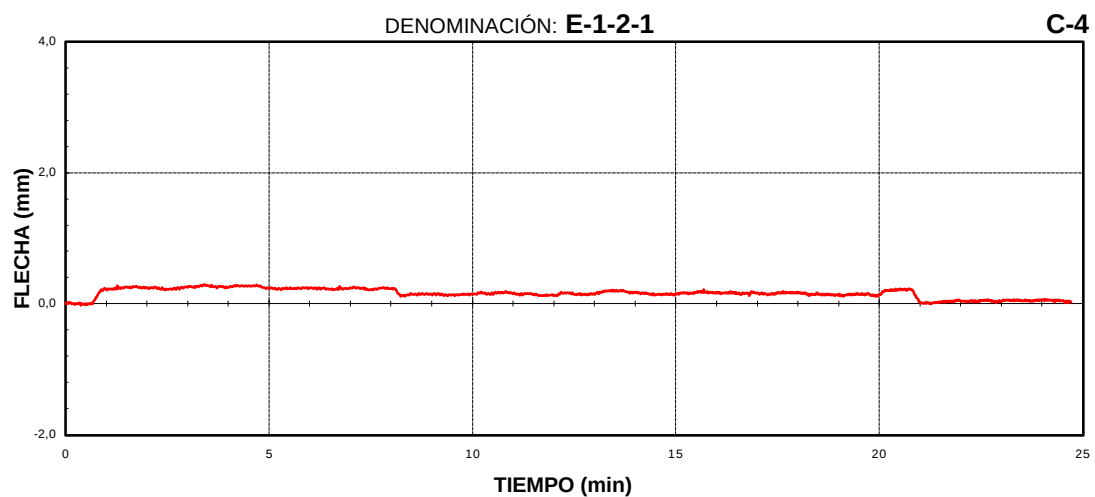
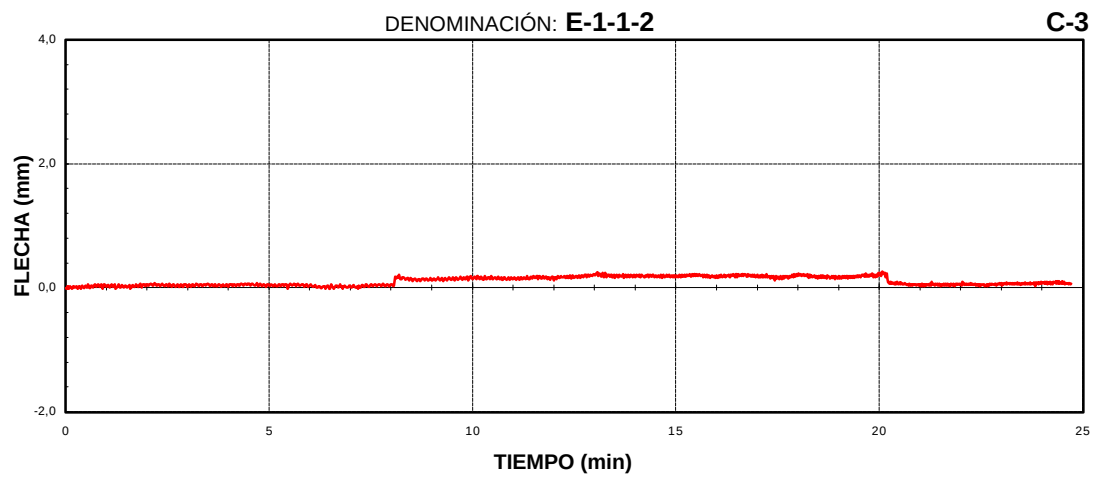
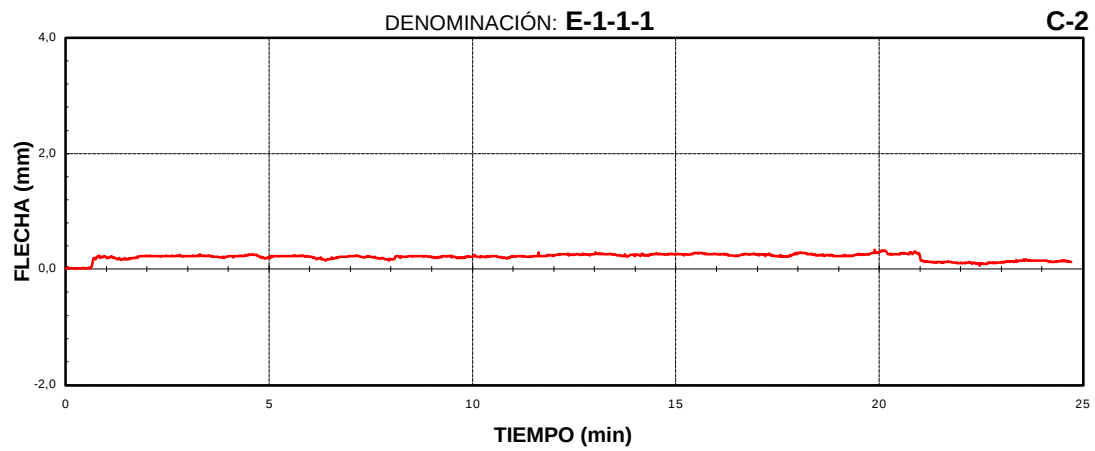
**ANEJO 4: REGISTRO DE MEDIDAS.**

**GIF VIA AVE**  
**23VI04.**  
**ACEQUIA QUINTOS DE EBRO.**

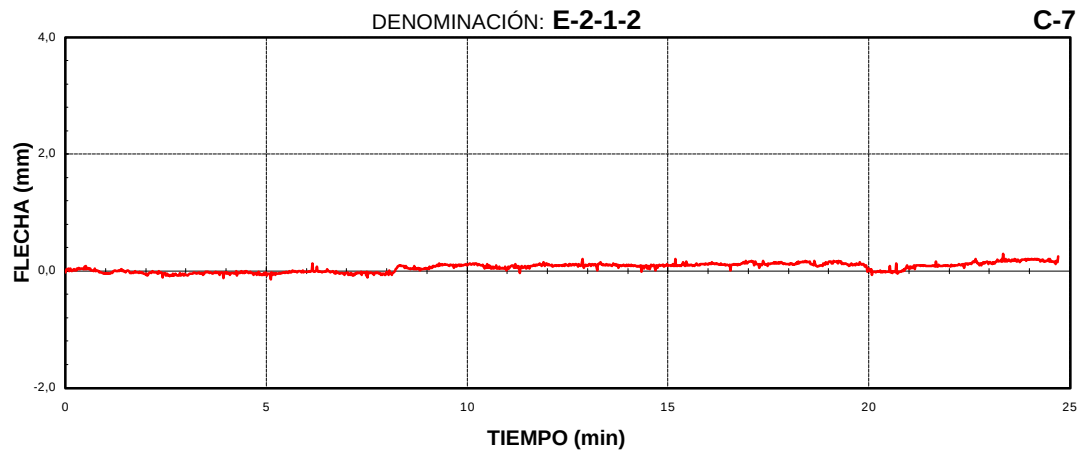
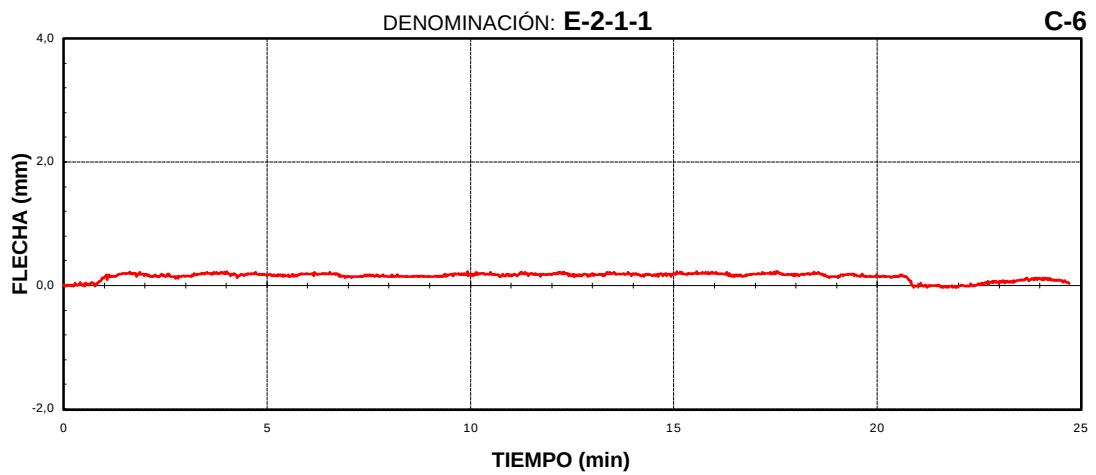
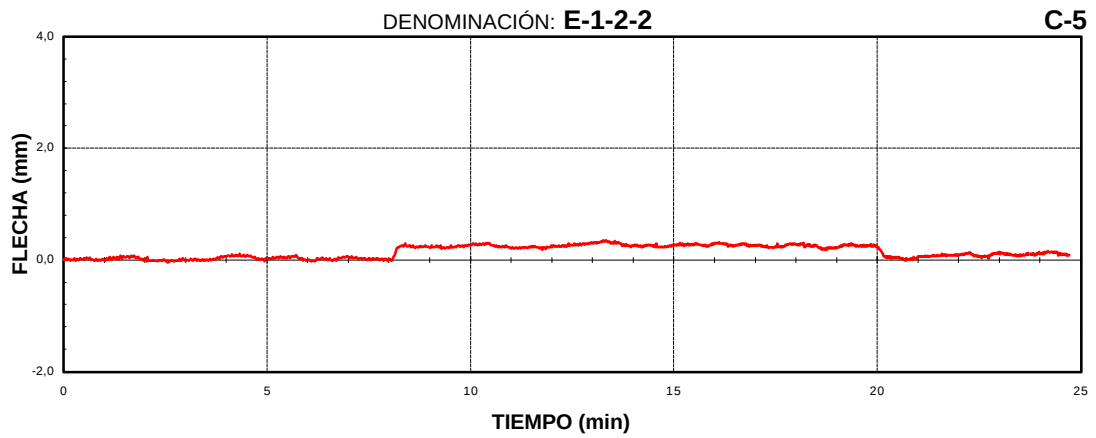
**PRUEBA ESTÁTICA (HIPÓTESIS 1)**



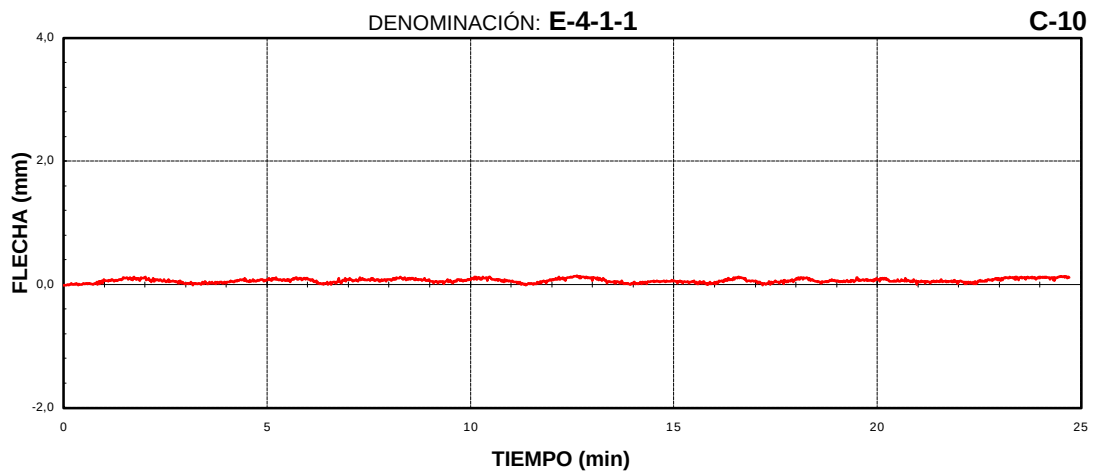
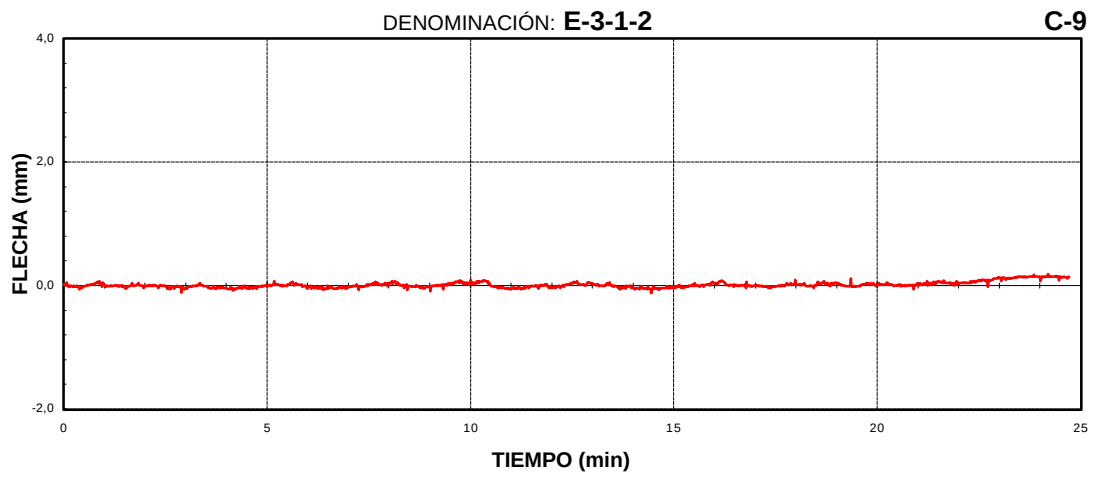
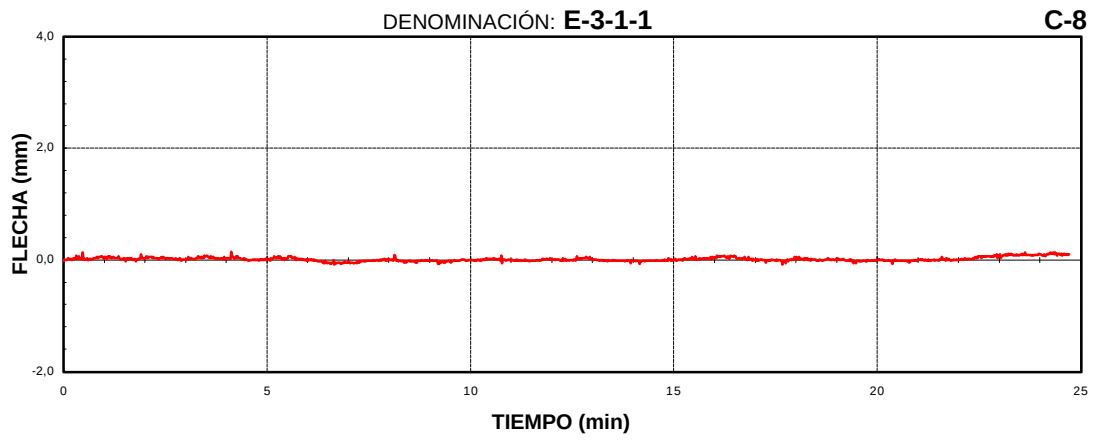
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**23VI04. ACEQUIA QUINTOS DE EBRO.**  
**HIPÓTESIS 1.**



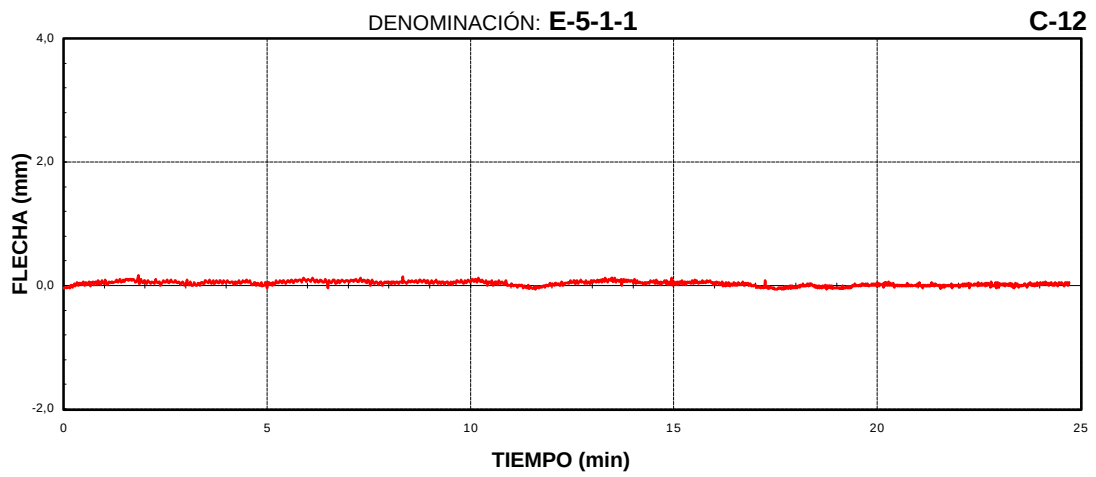
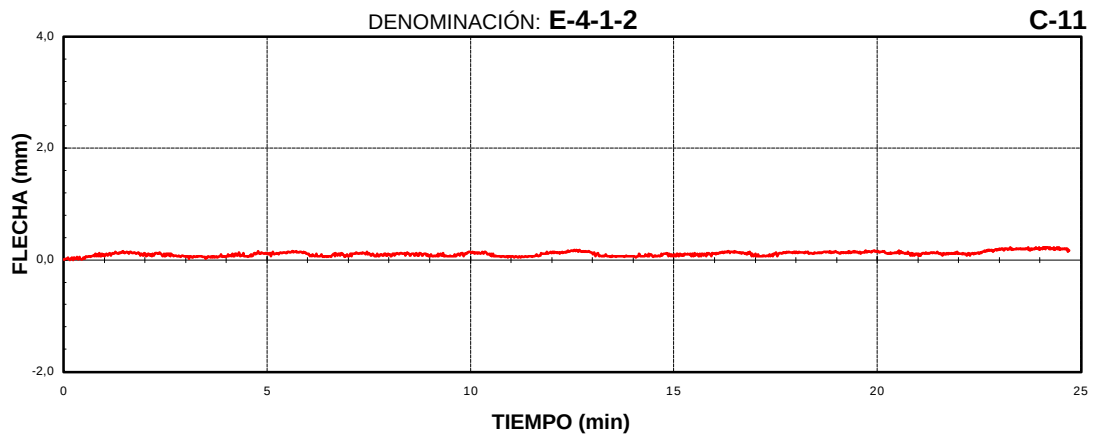
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HIPÓTESIS 1.



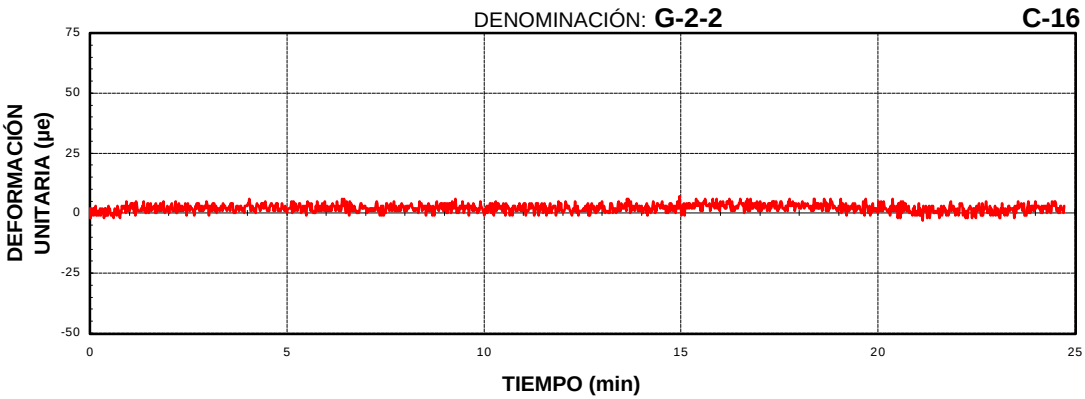
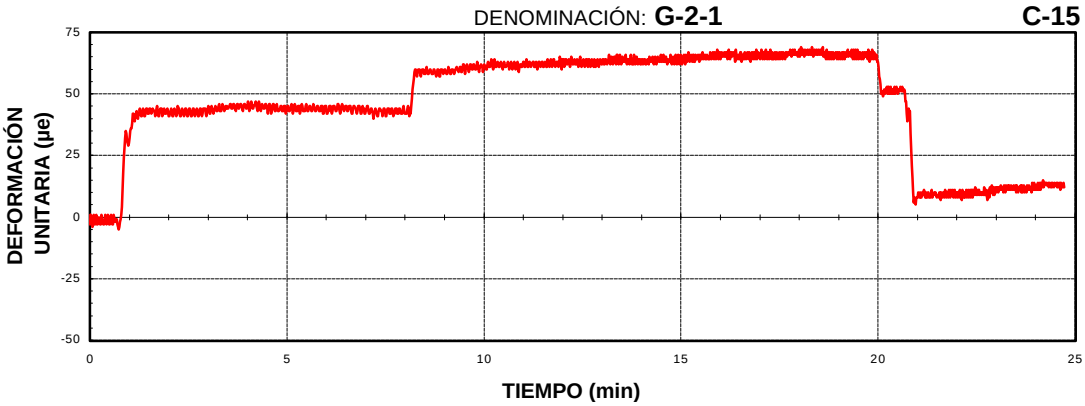
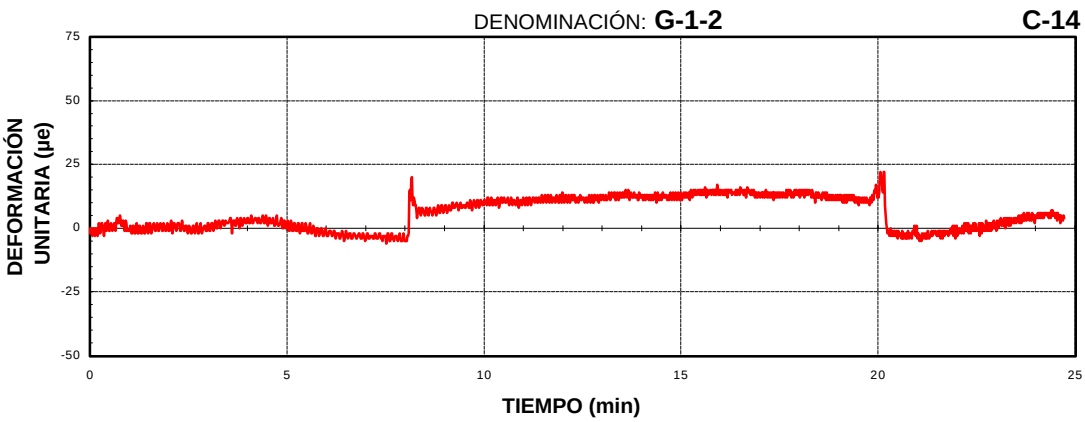
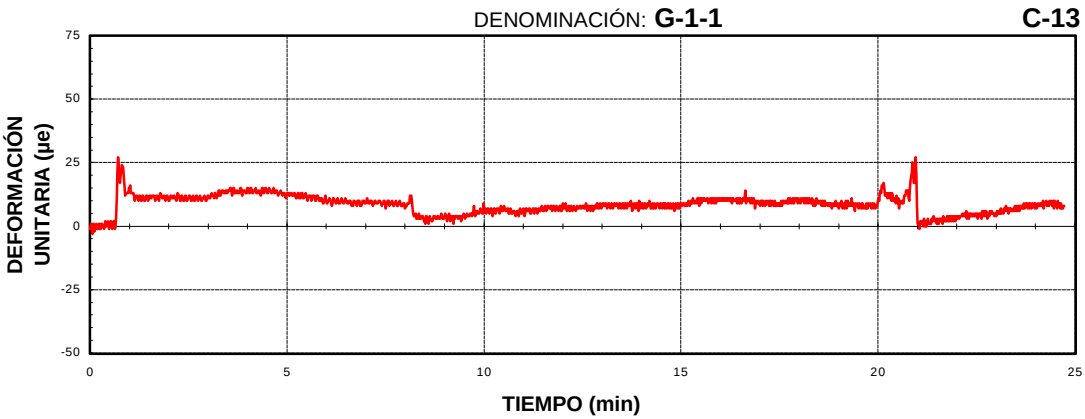
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HIPÓTESIS 1.



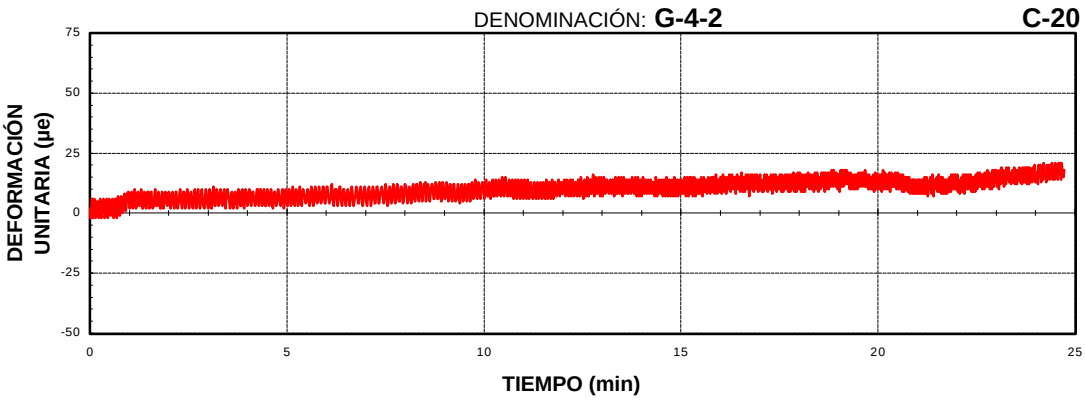
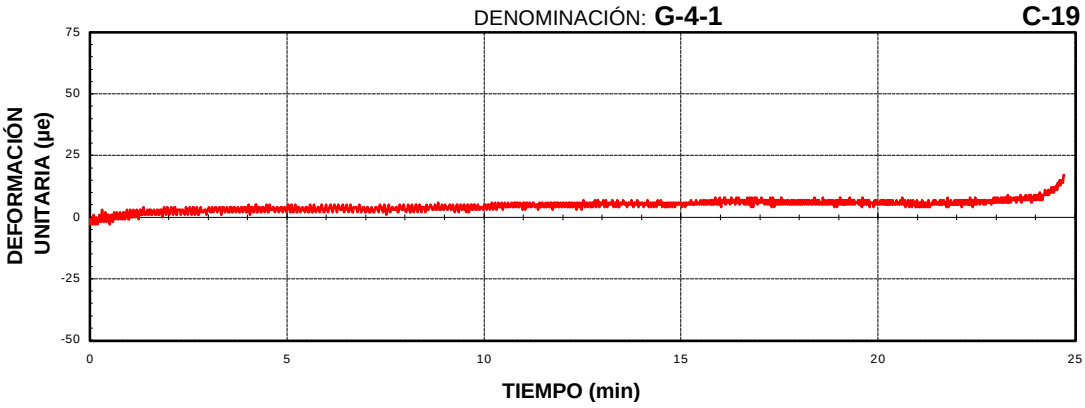
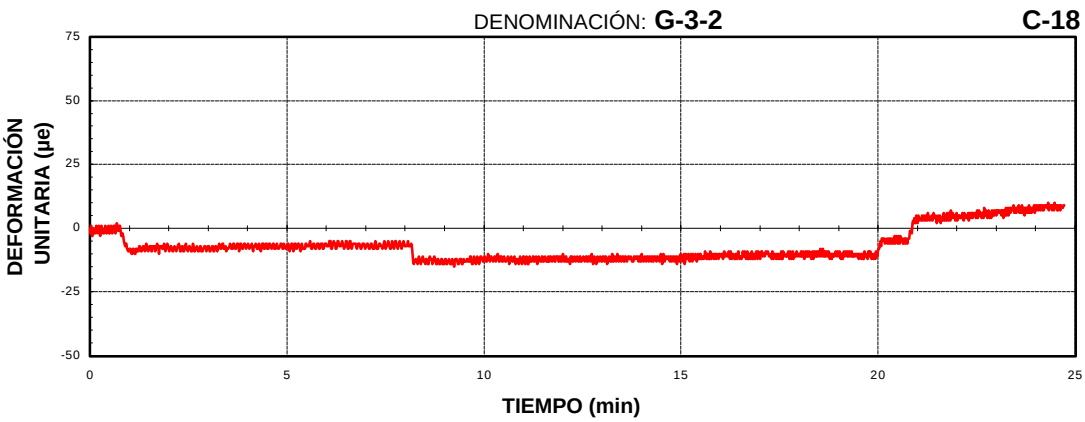
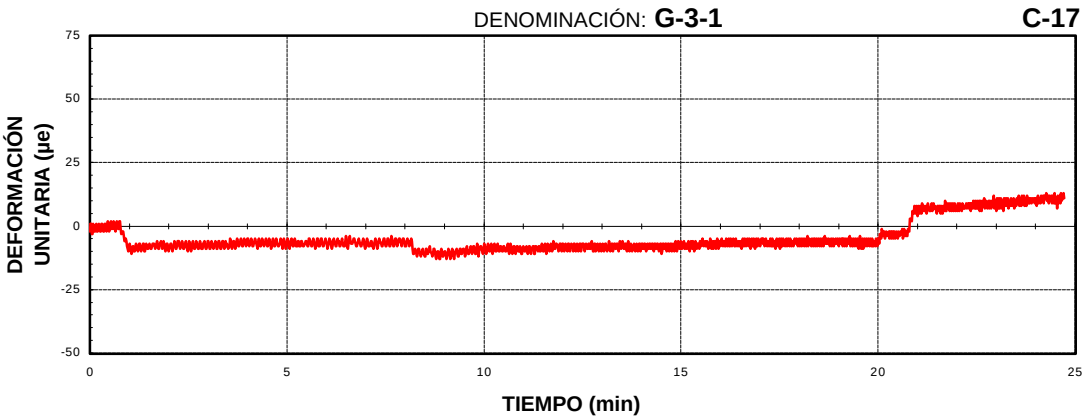
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HIPÓTESIS 1.



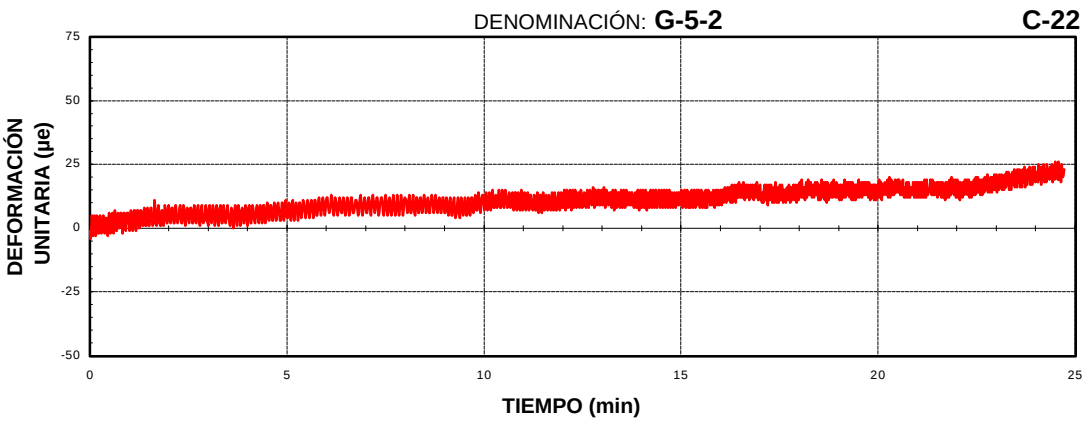
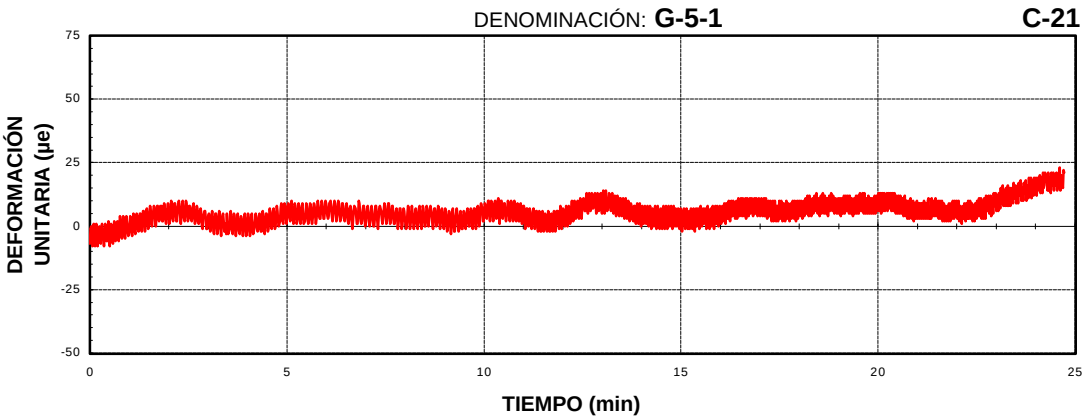
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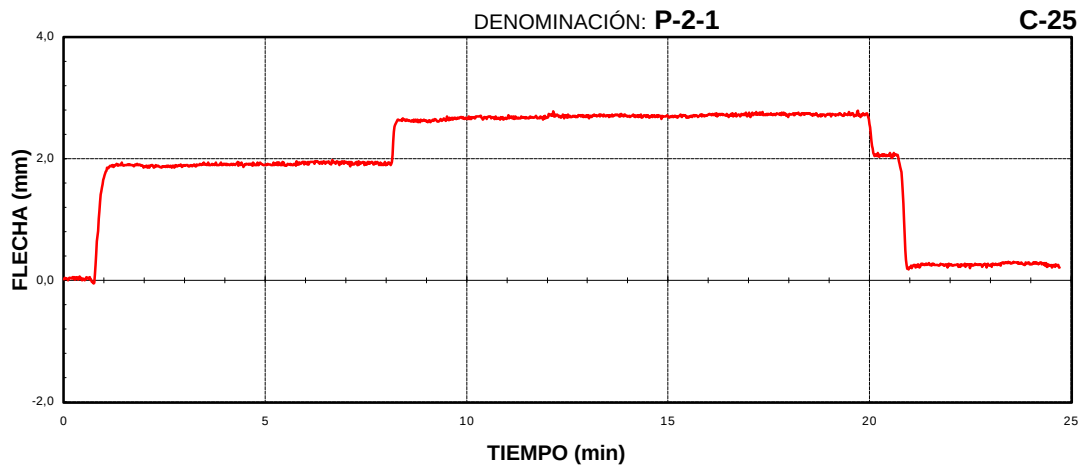
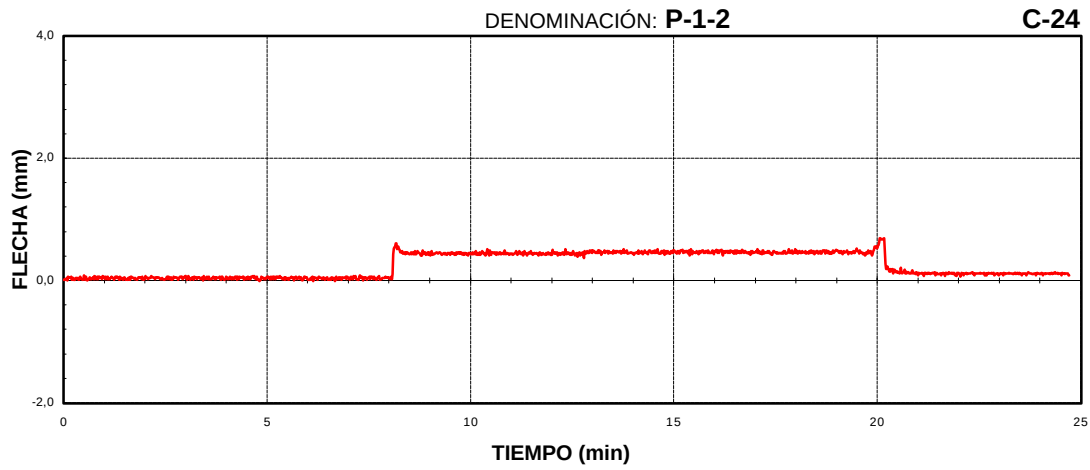
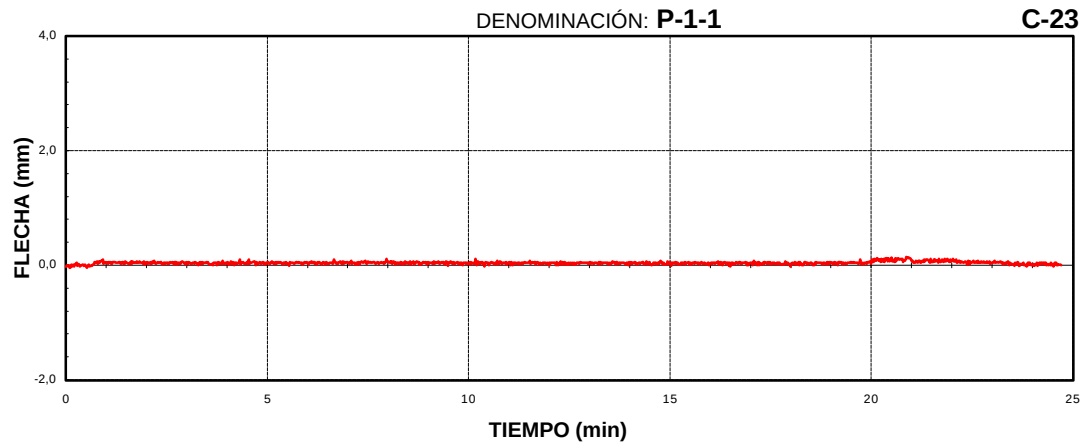
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HIPÓTESIS 1.

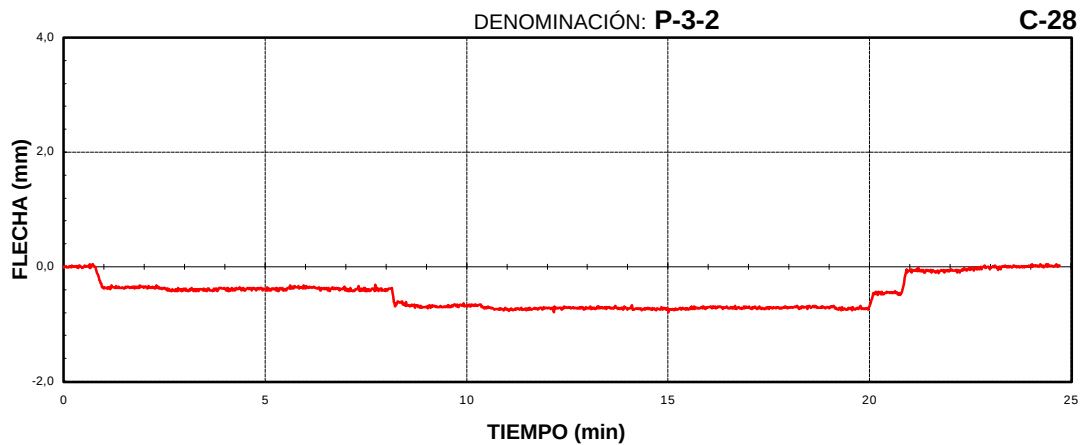
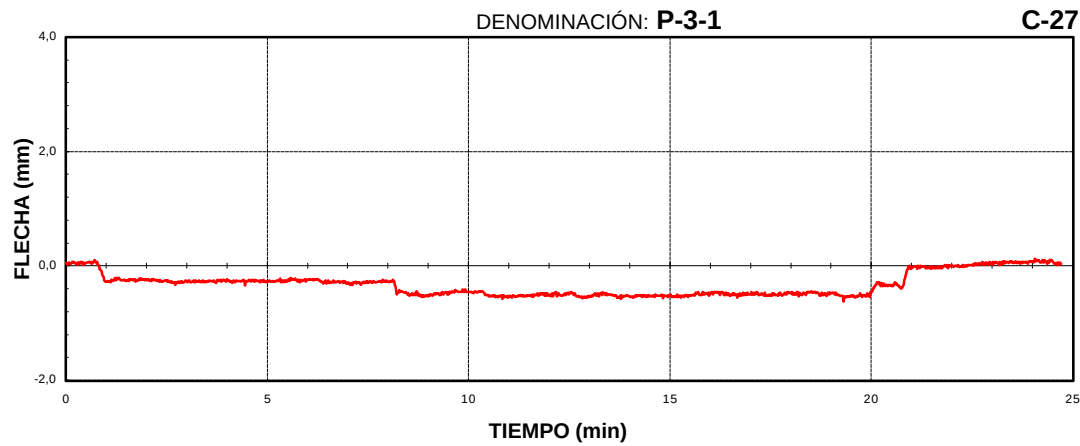
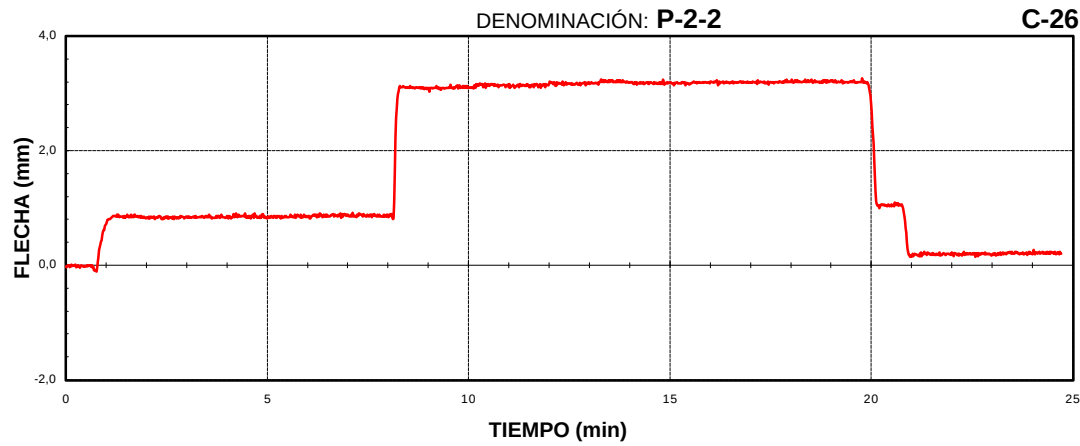


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HIPÓTESIS 1.

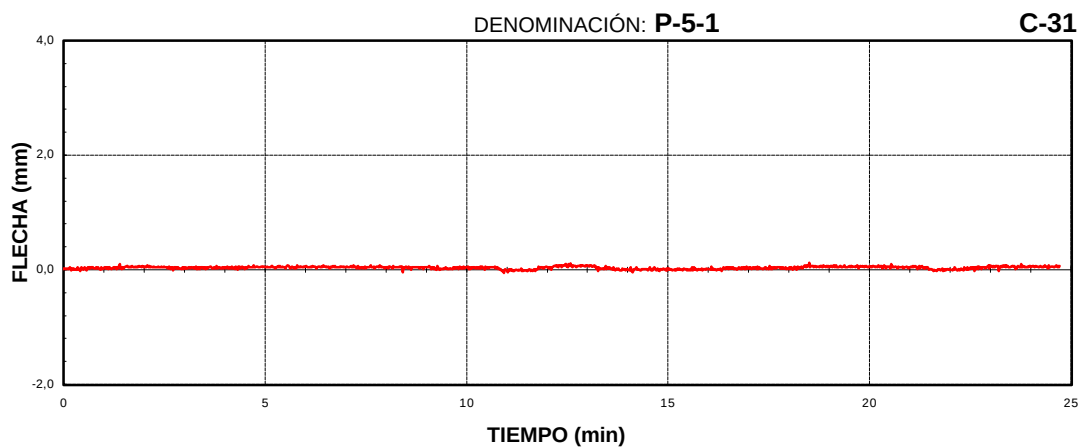
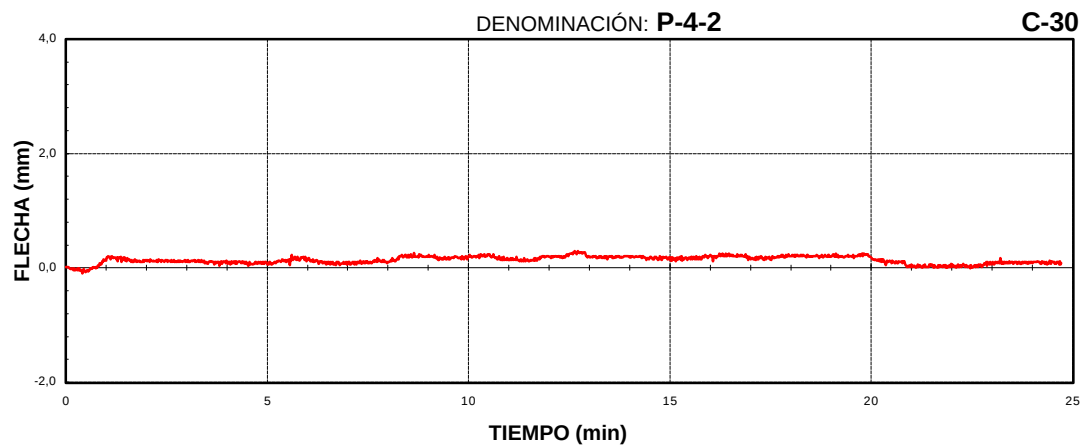
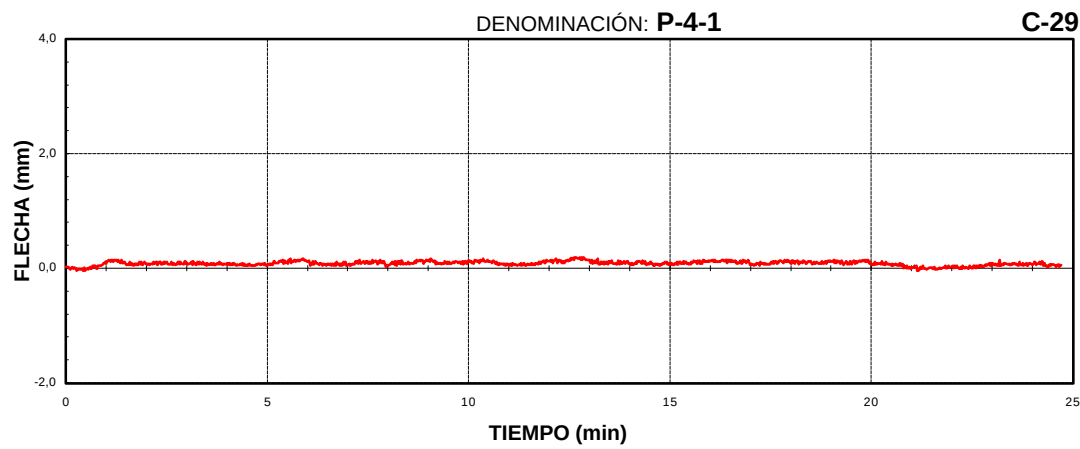




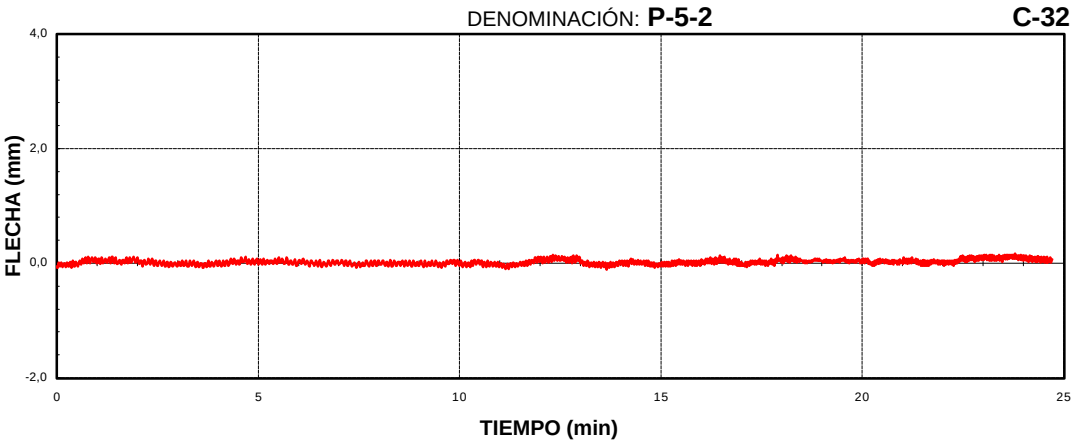
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HIPÓTESIS 1.



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HIPÓTESIS 1.



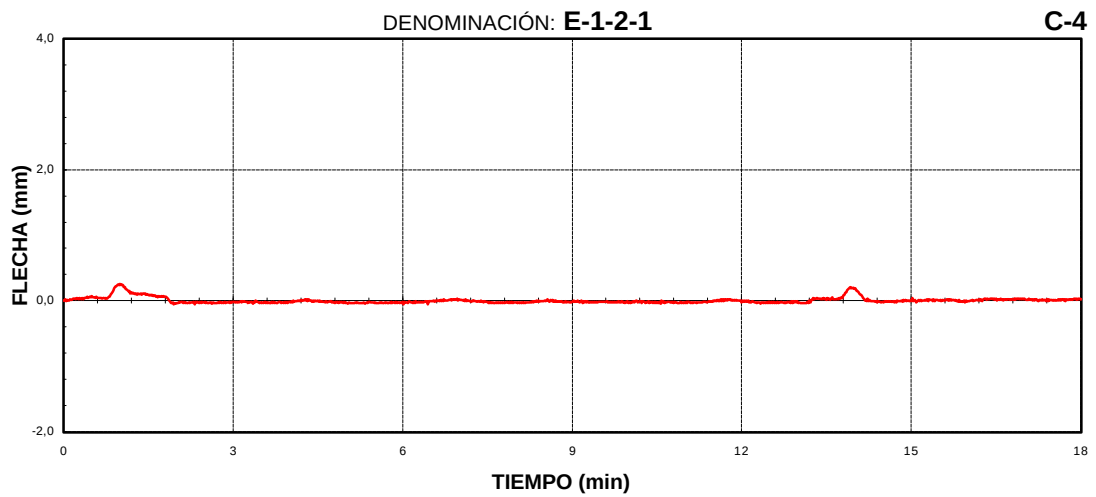
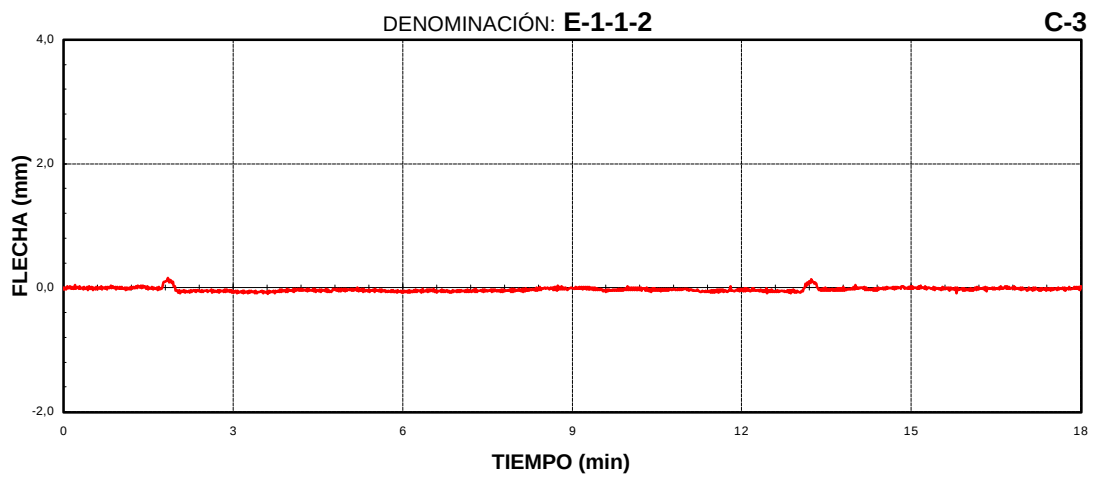
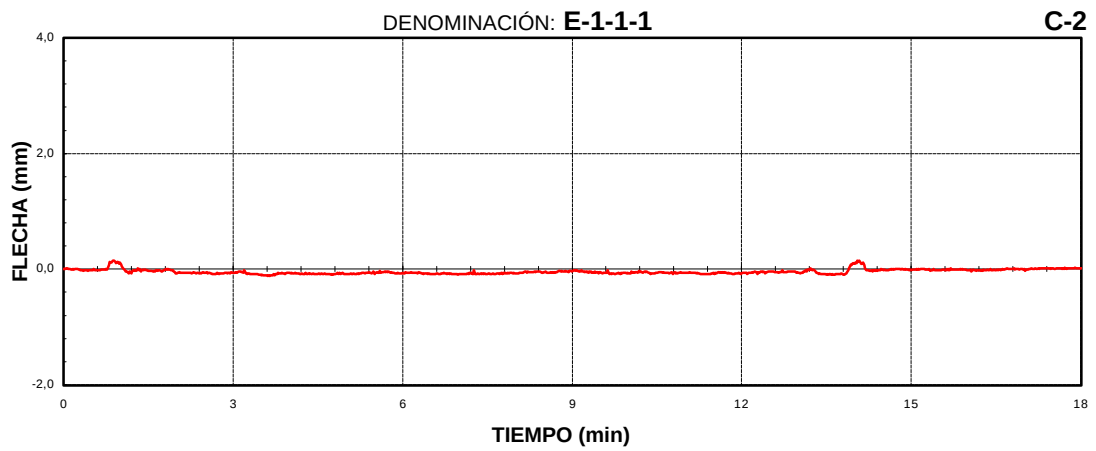
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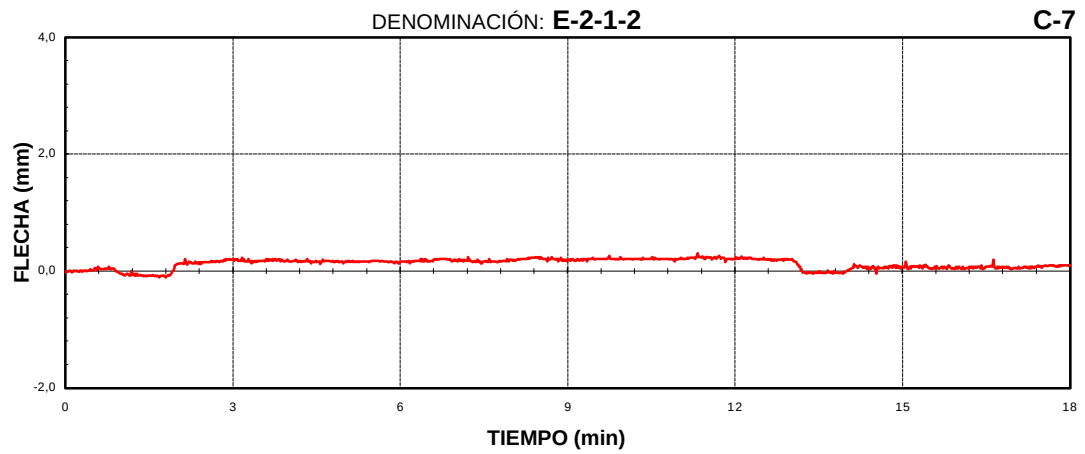
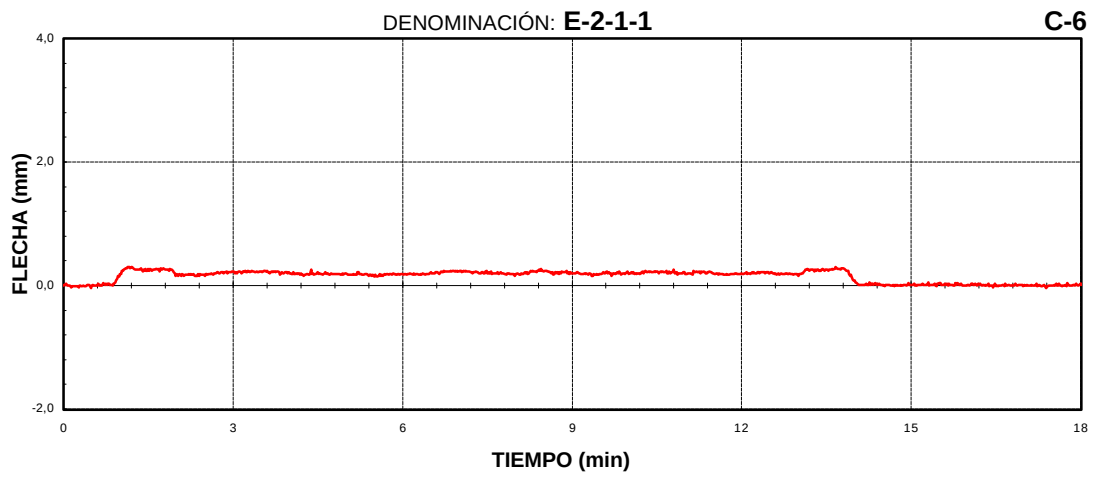
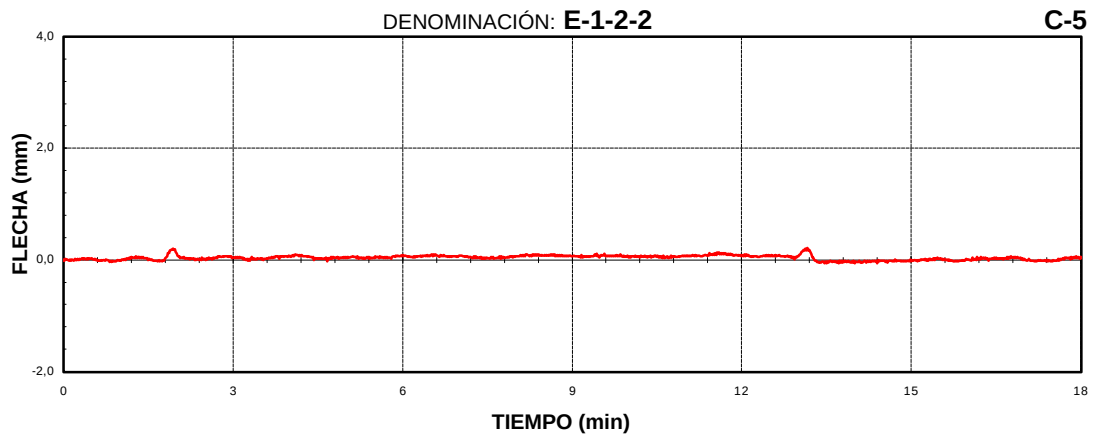
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**ACEQUIA QUINTOS DE EBRO.**

**PRUEBA ESTÁTICA (HIPÓTESIS 2)**

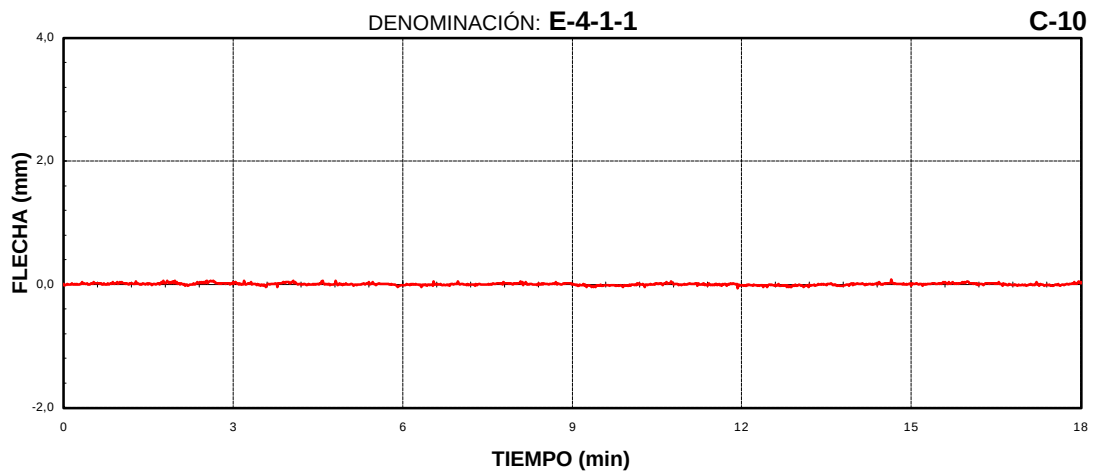
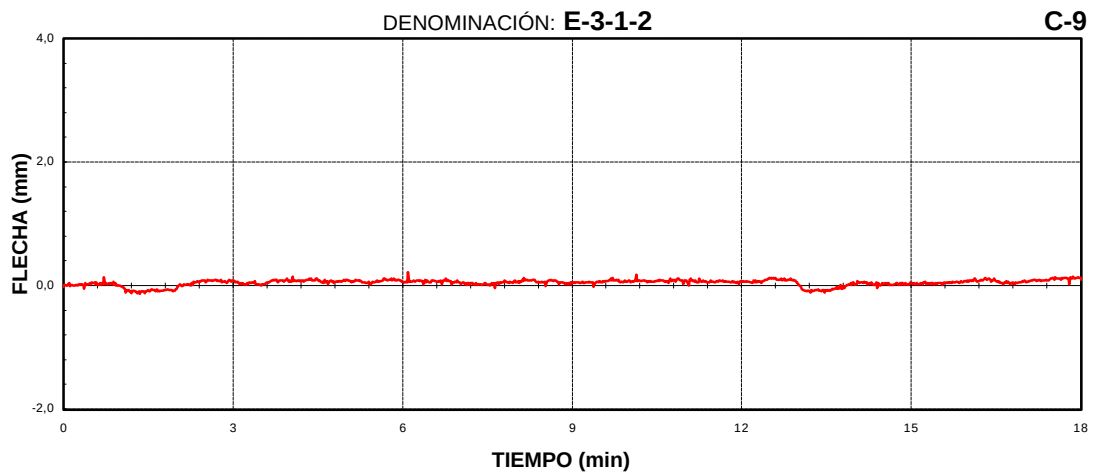
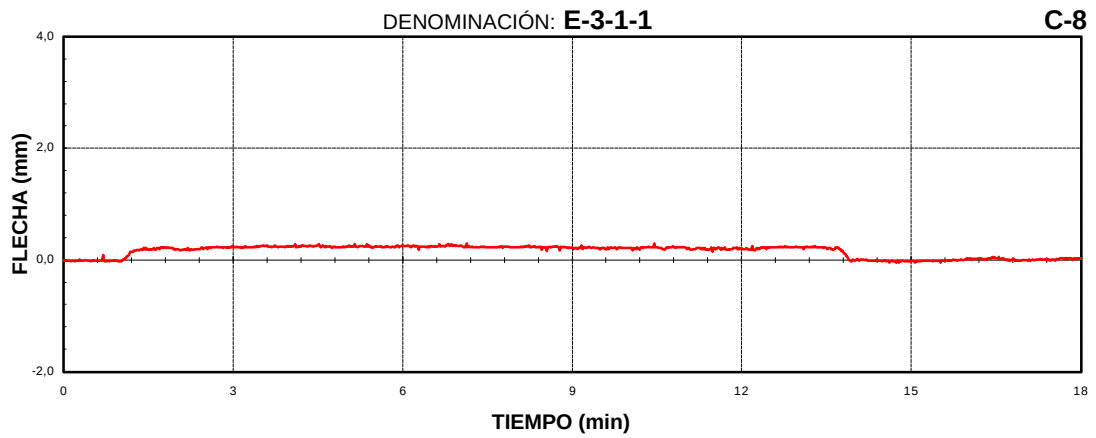
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 2.



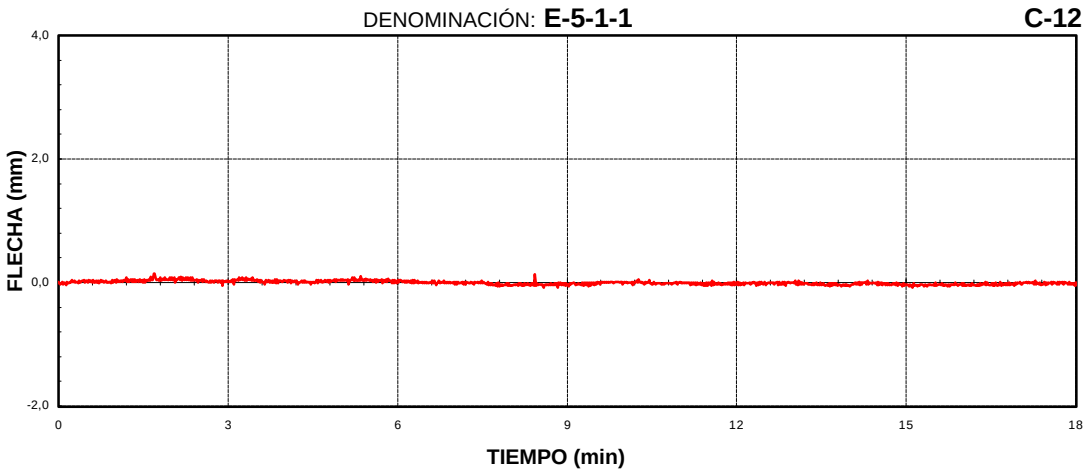
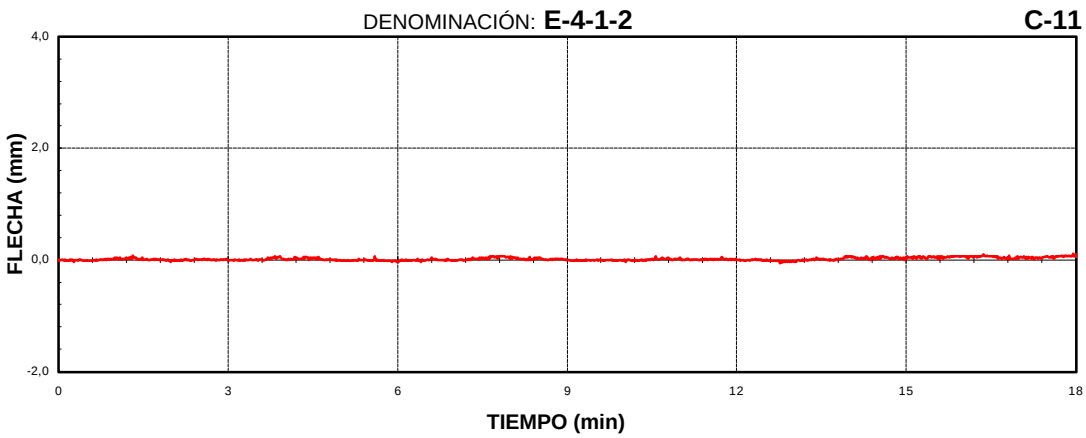
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 2.



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HIPÓTESIS 2.

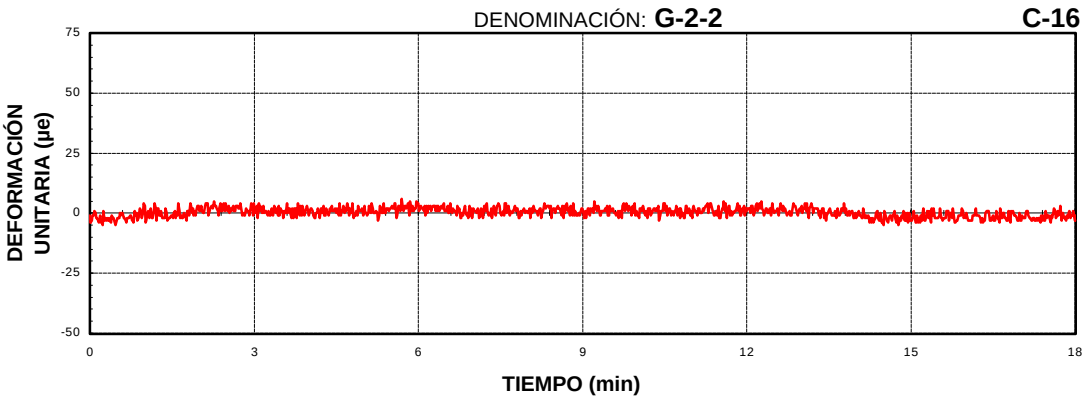
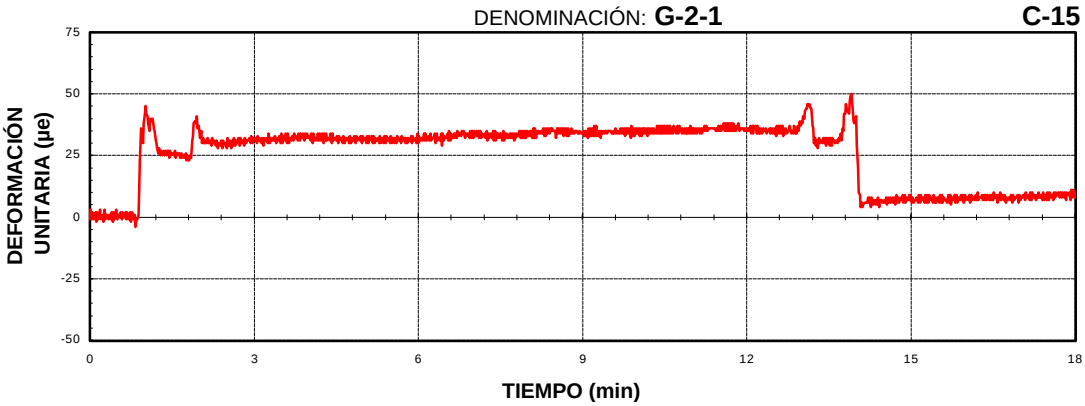
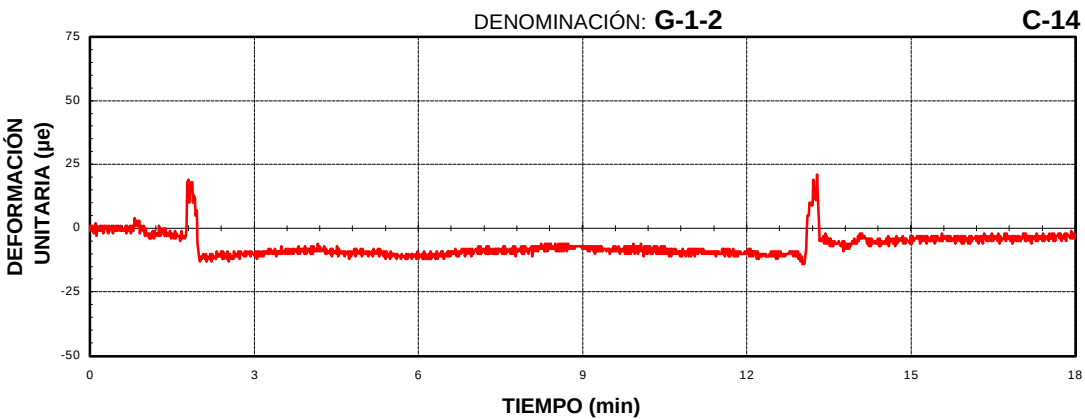
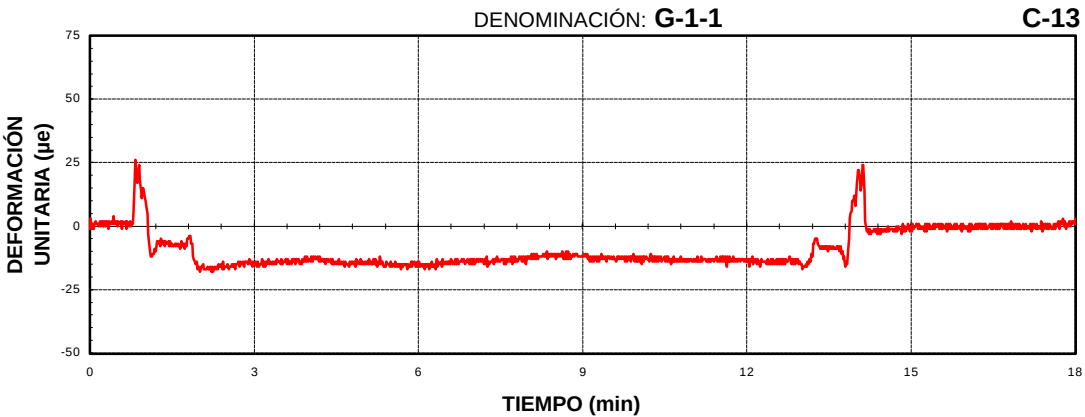


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HIPÓTESIS 2.

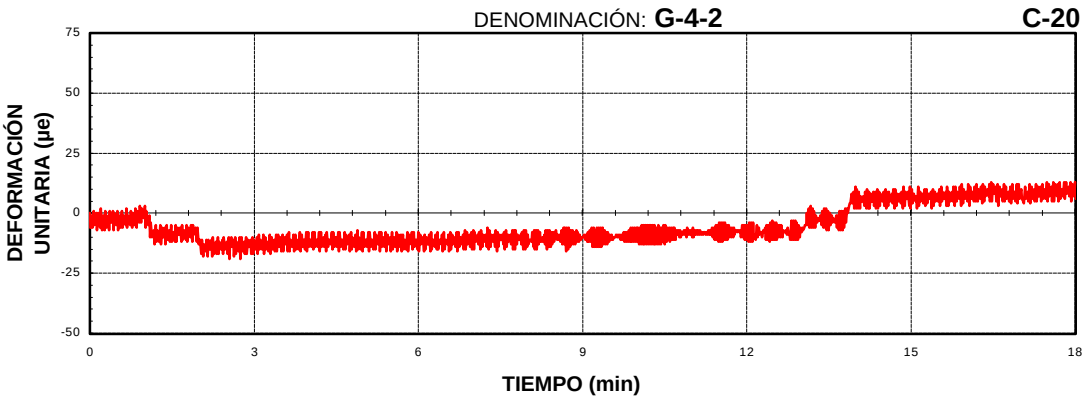
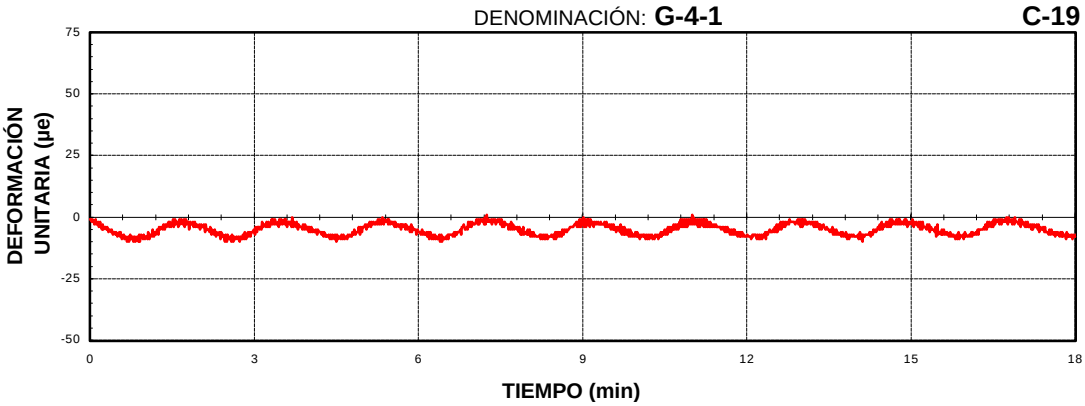
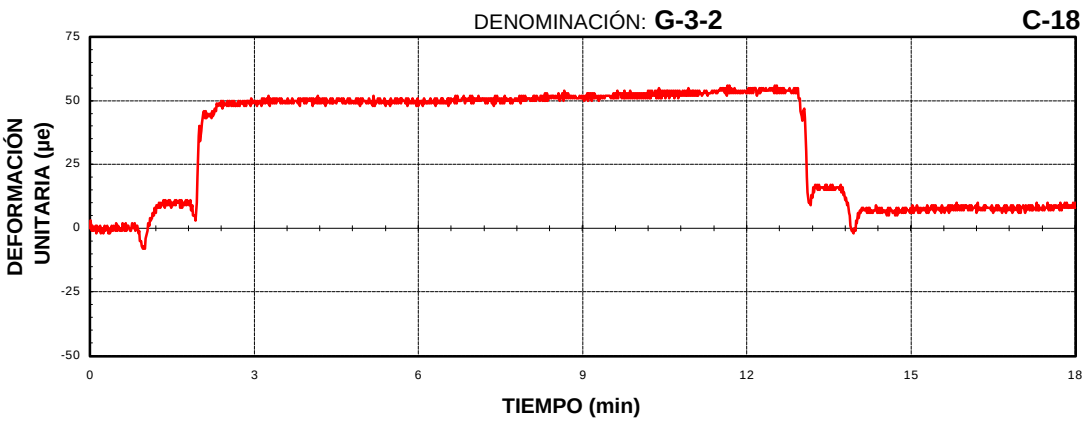
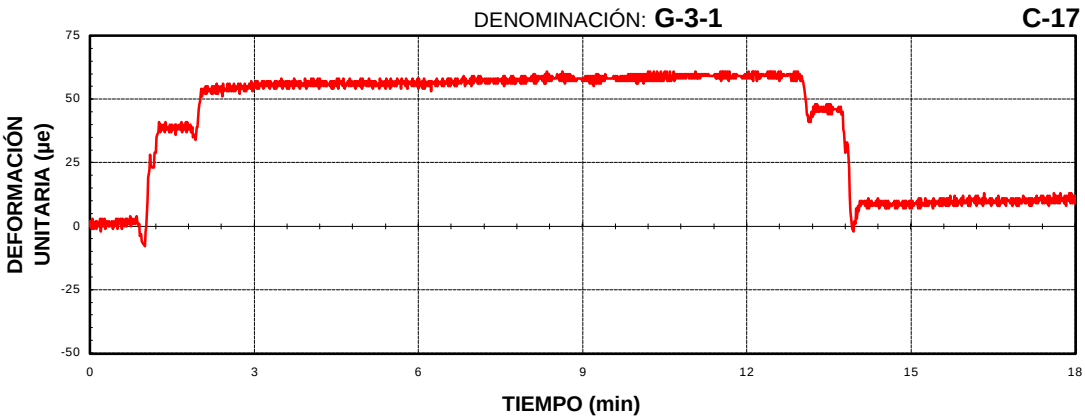




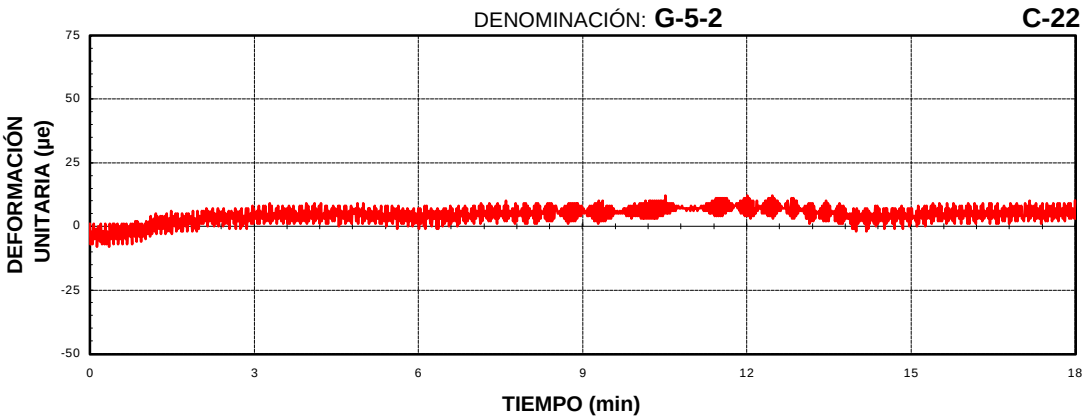
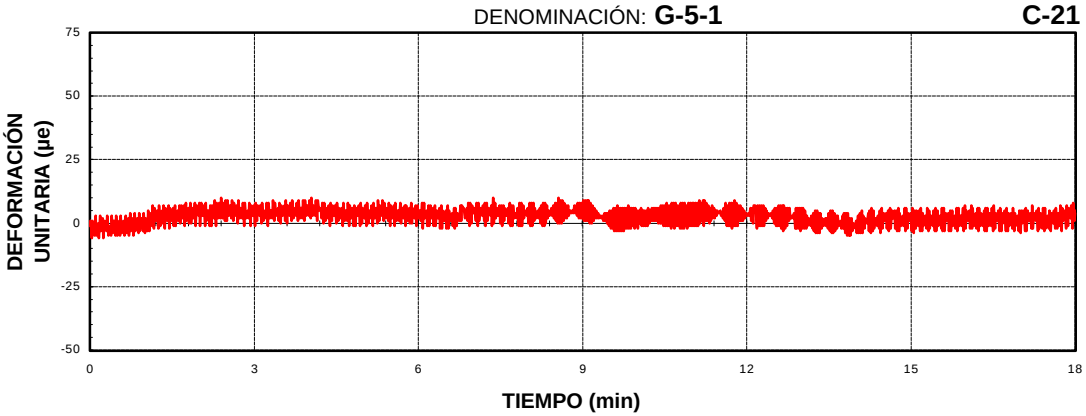
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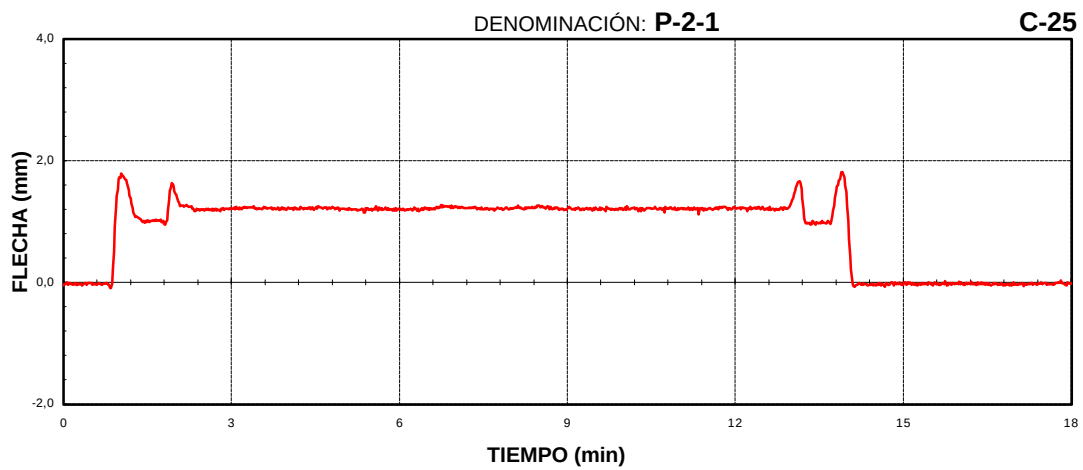
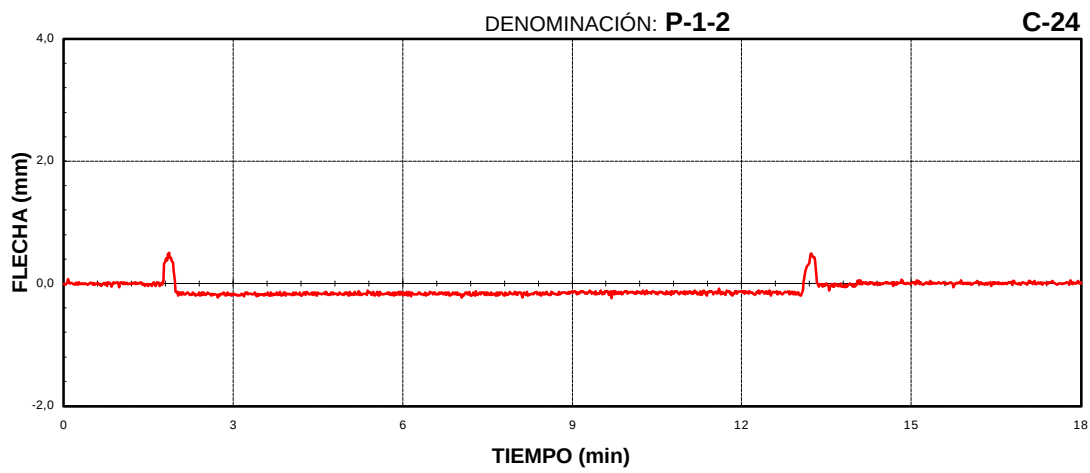
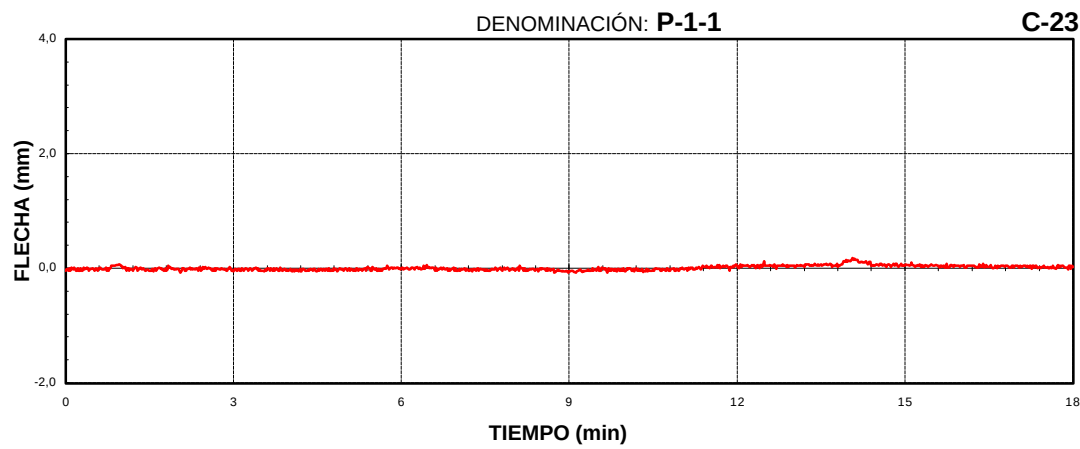
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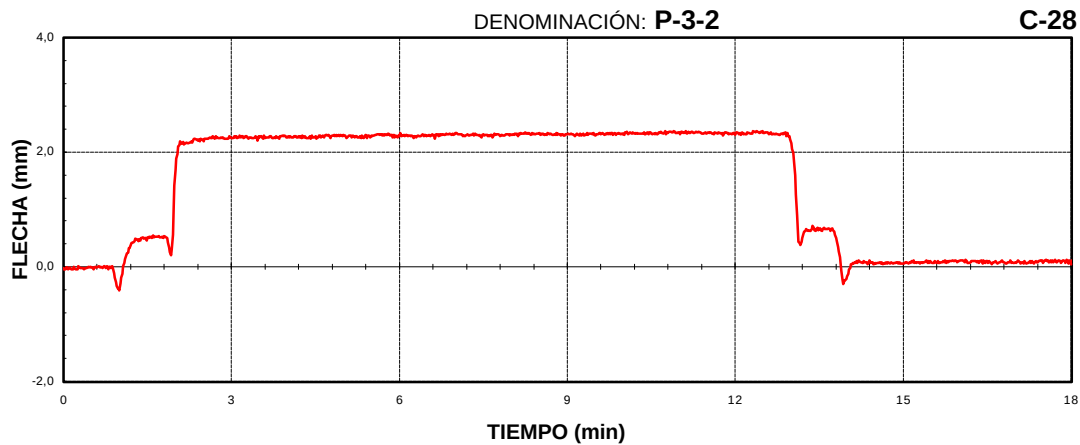
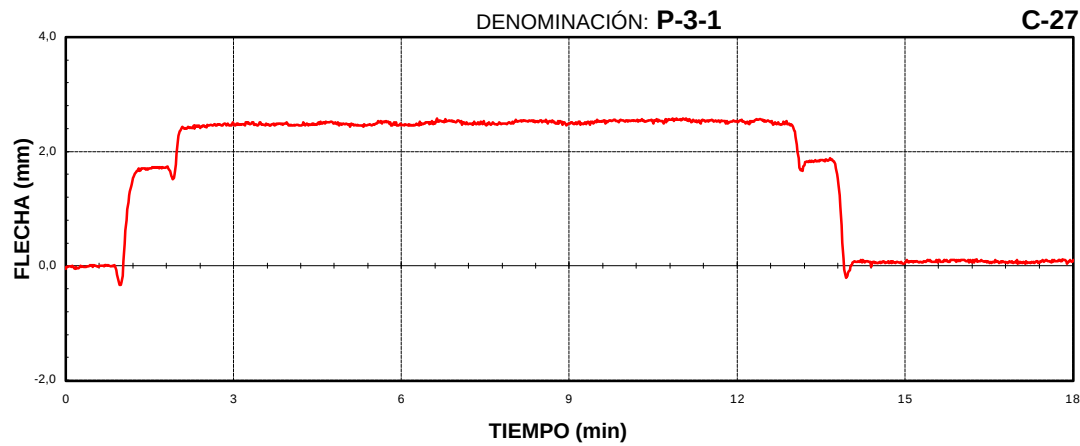
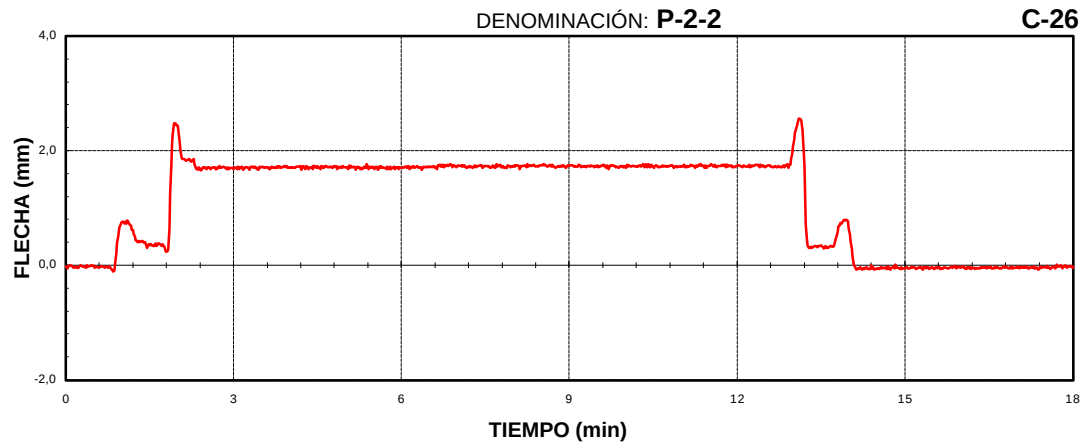
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HIPÓTESIS 2.



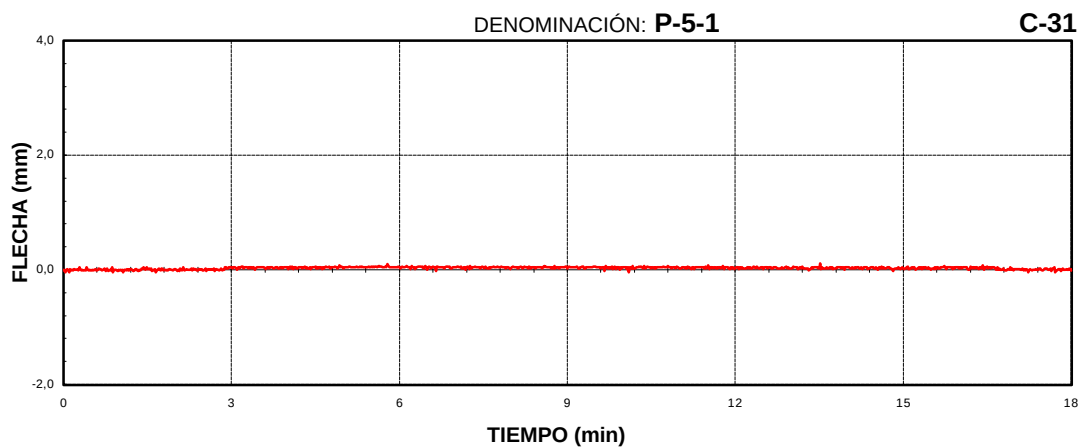
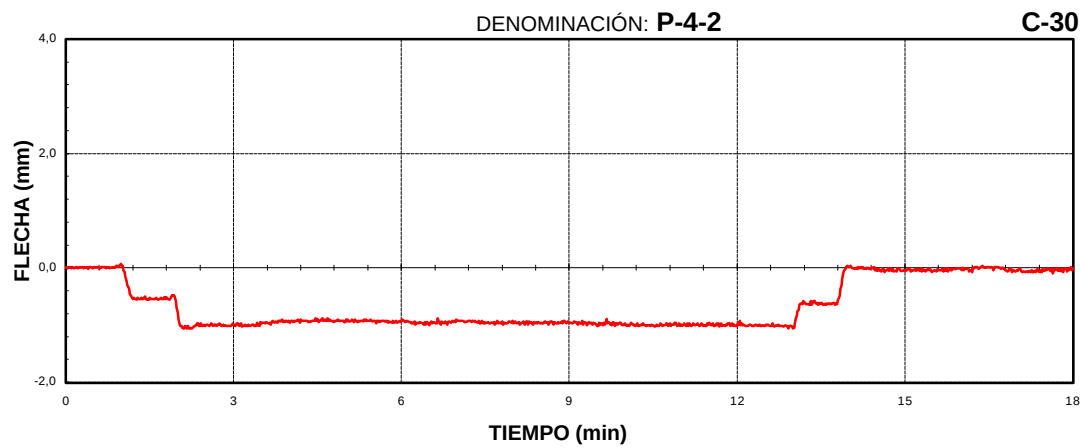
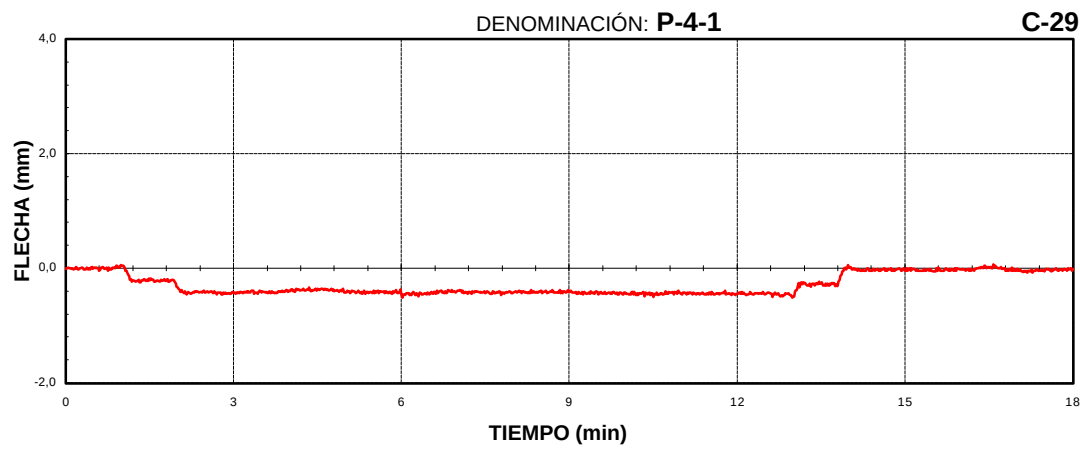
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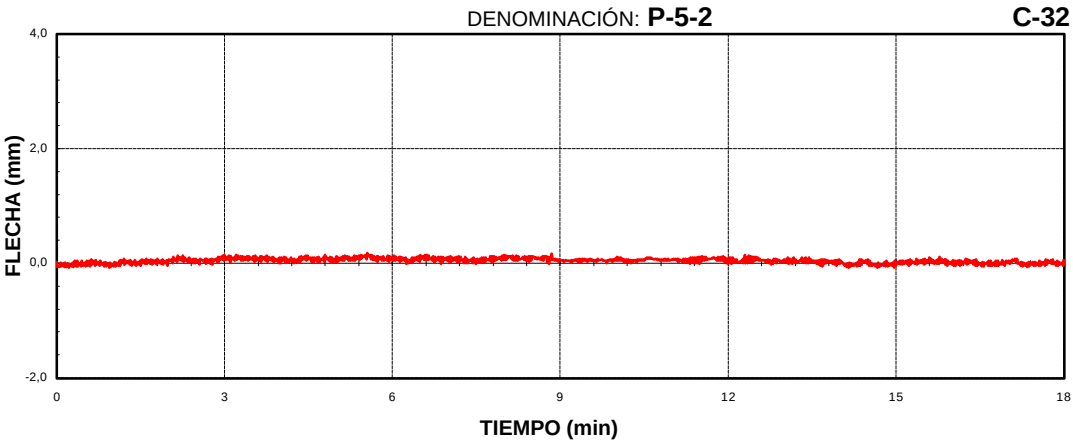
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 2.



GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 2.



GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 2.

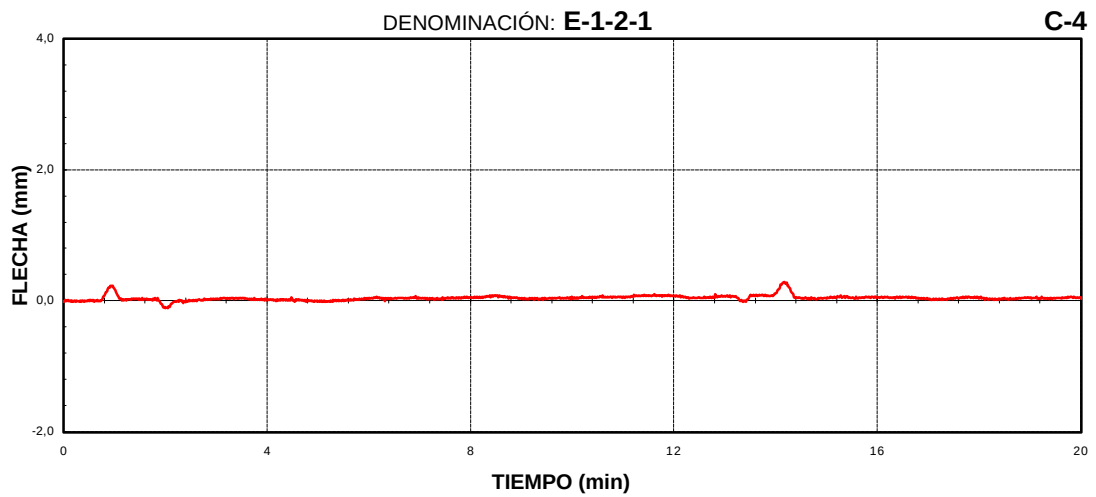
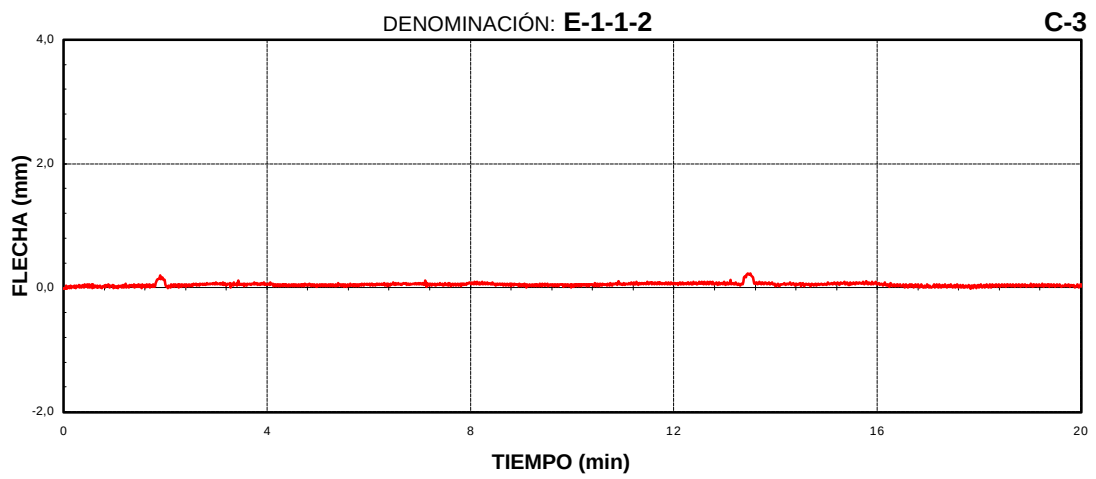
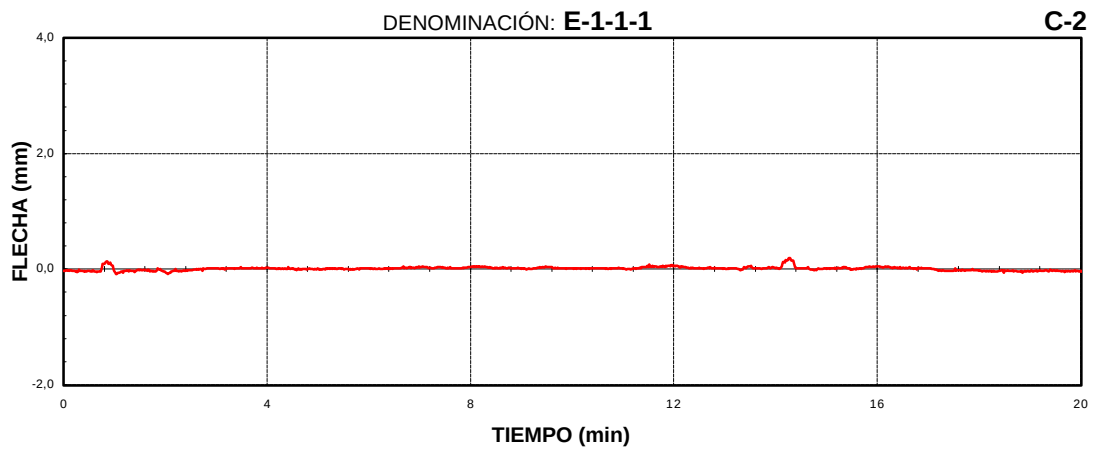


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**ACEQUIA QUINTOS DE EBRO.**

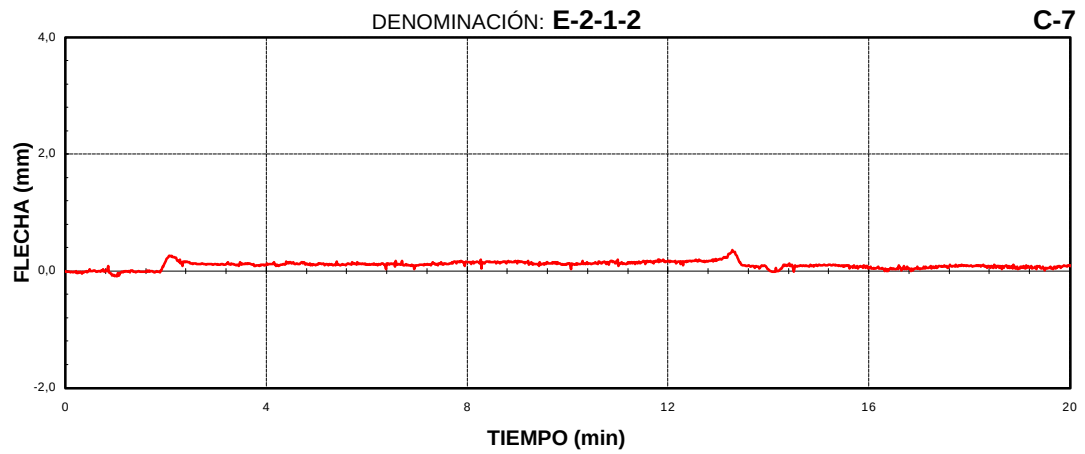
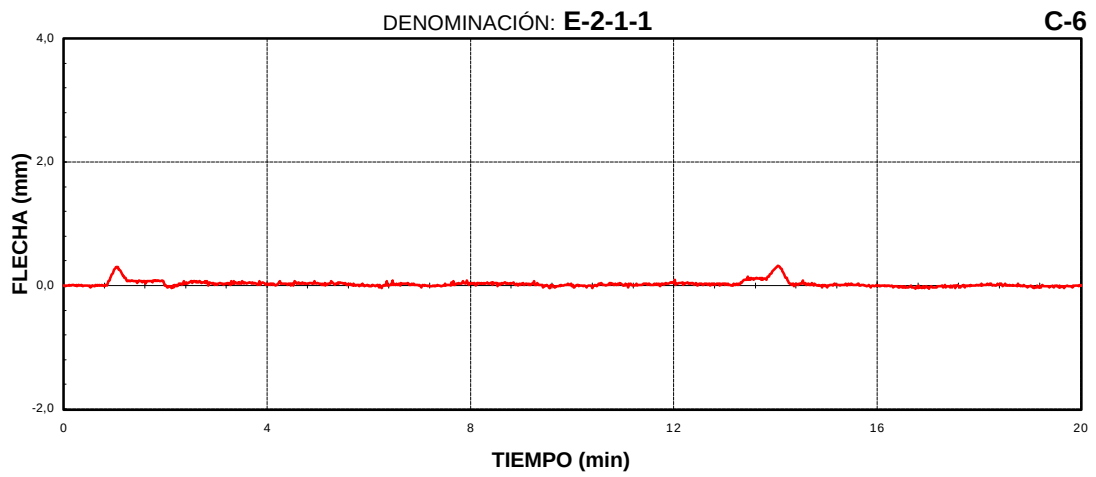
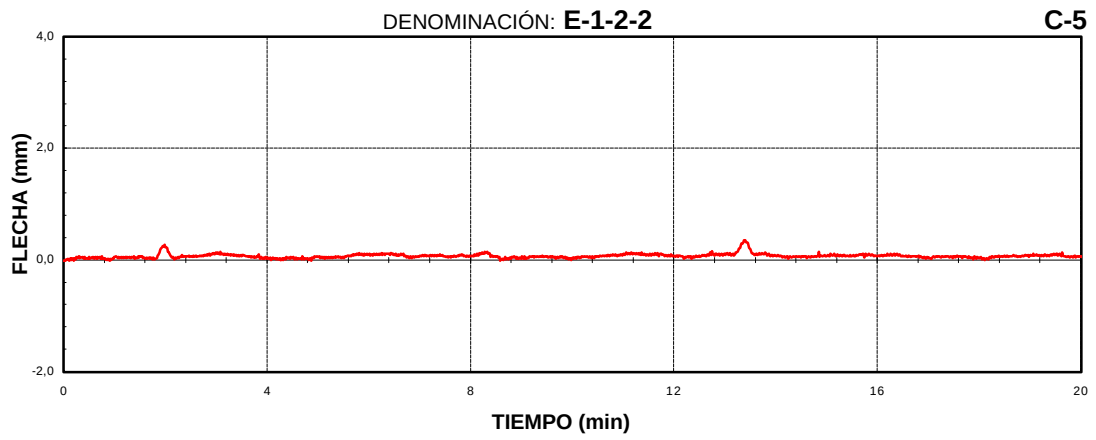
**PRUEBA ESTÁTICA (HIPÓTESIS 3)**



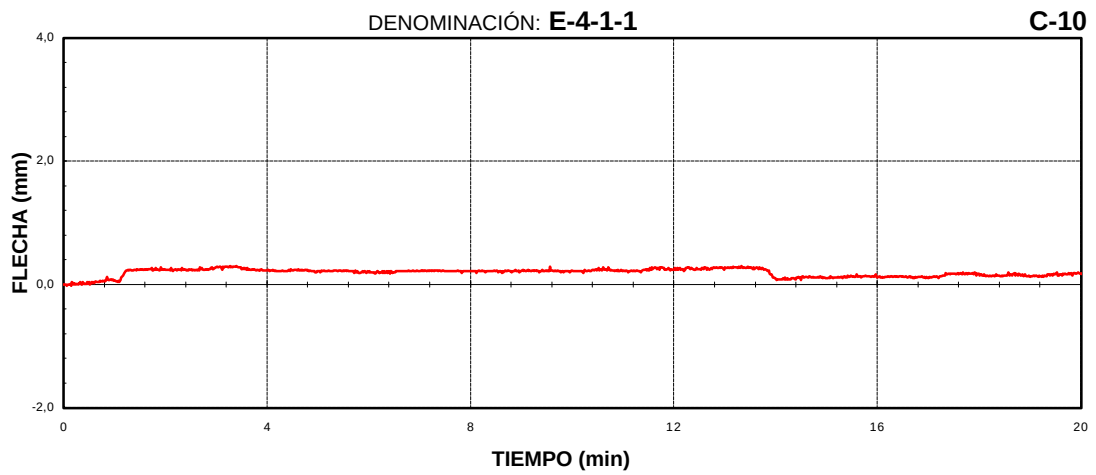
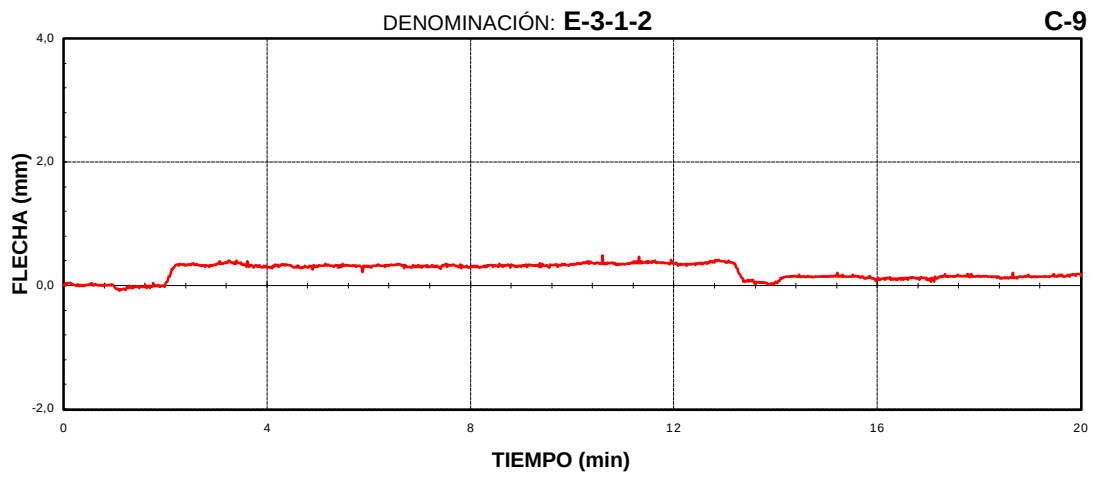
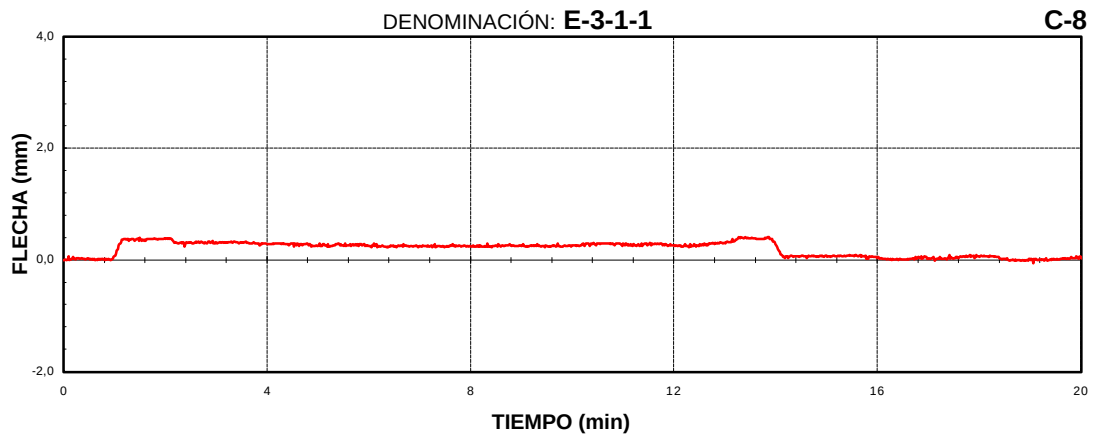
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 3.



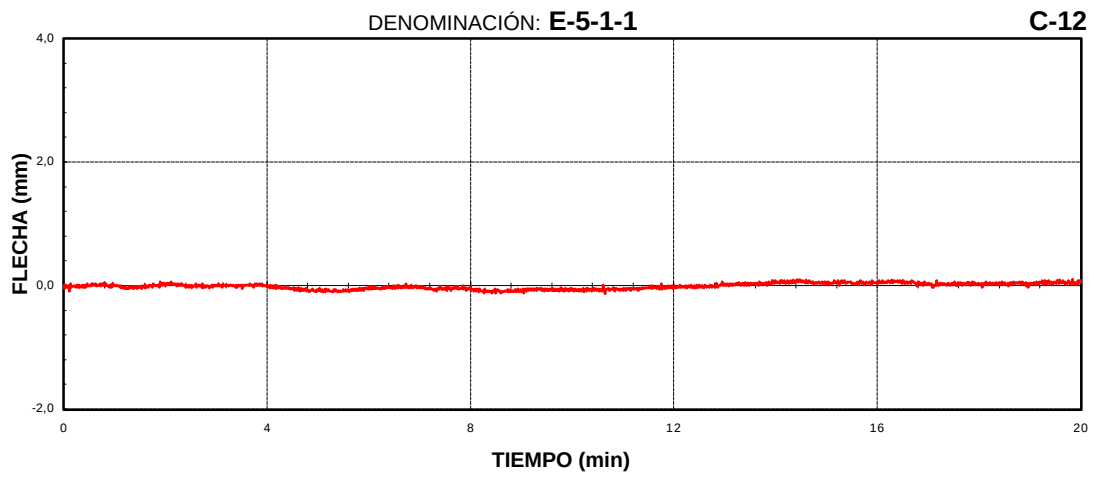
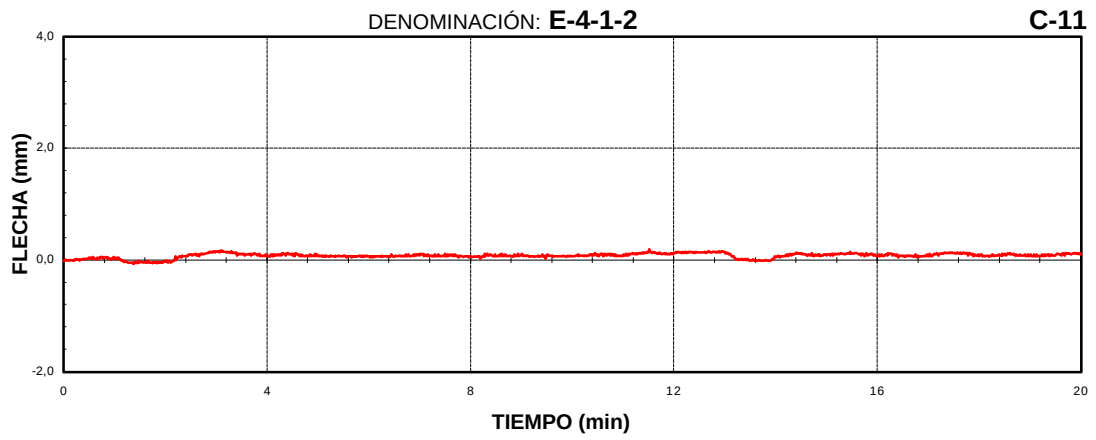
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HIPÓTESIS 3.



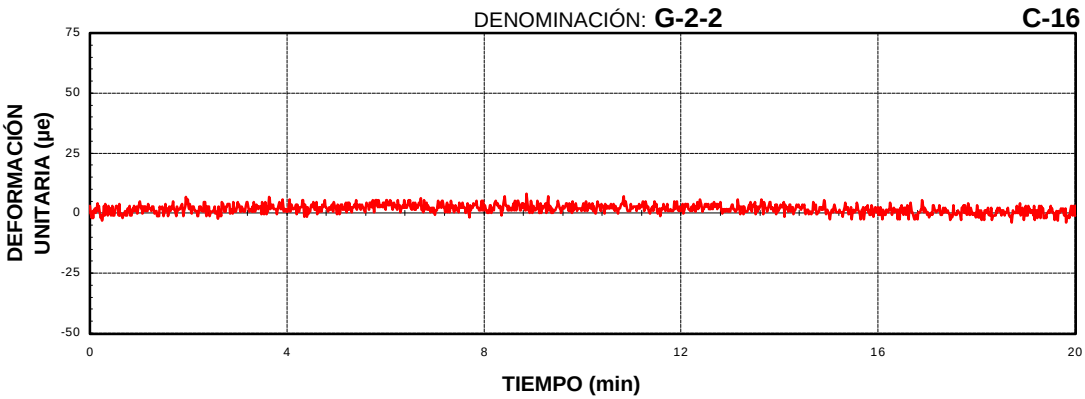
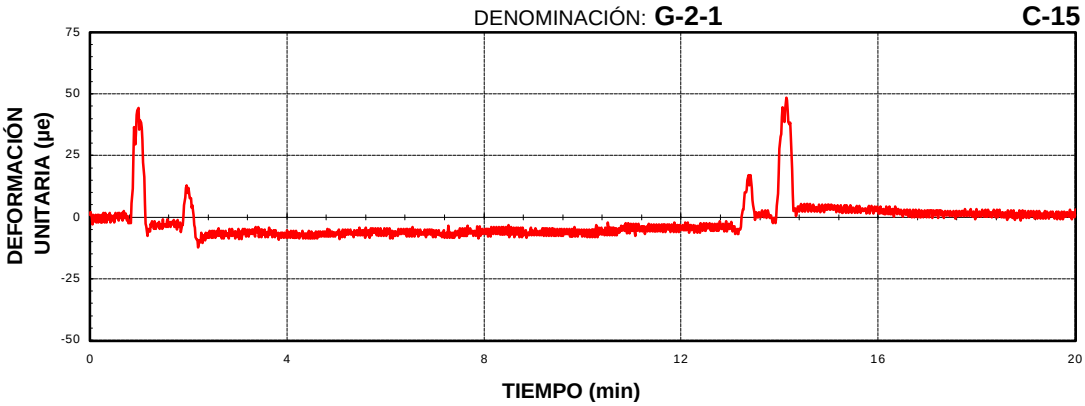
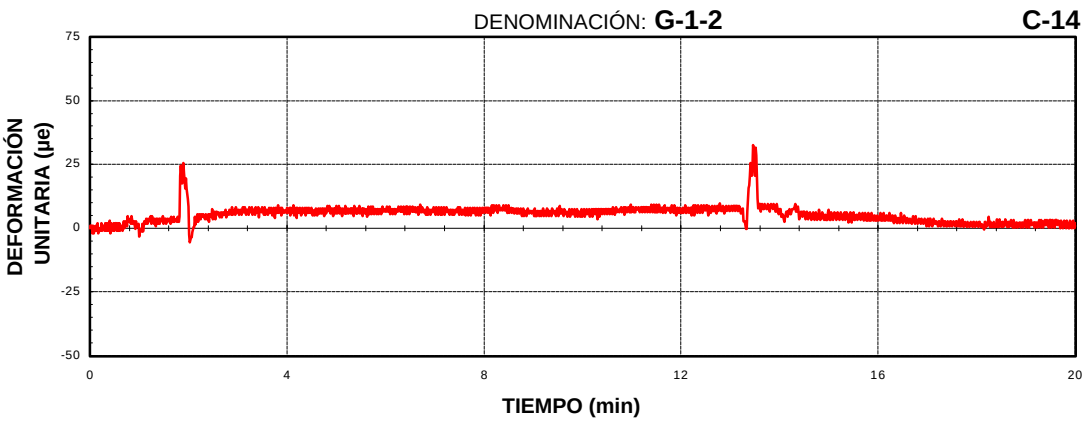
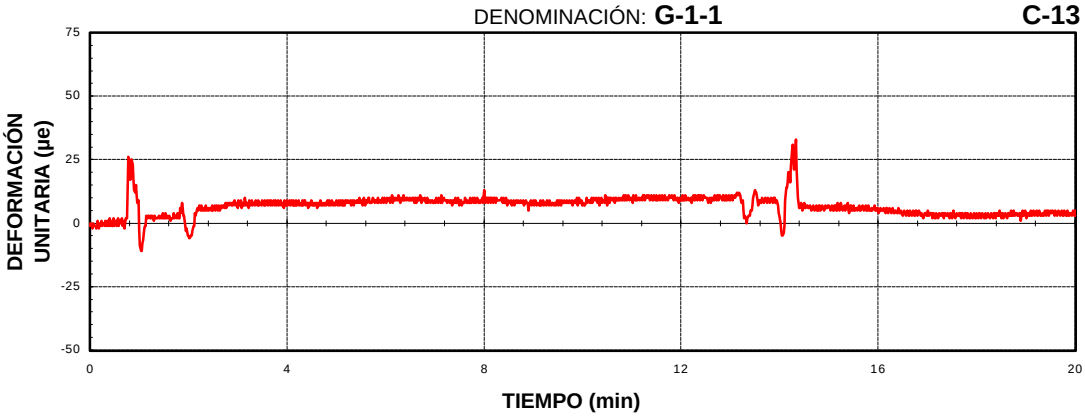
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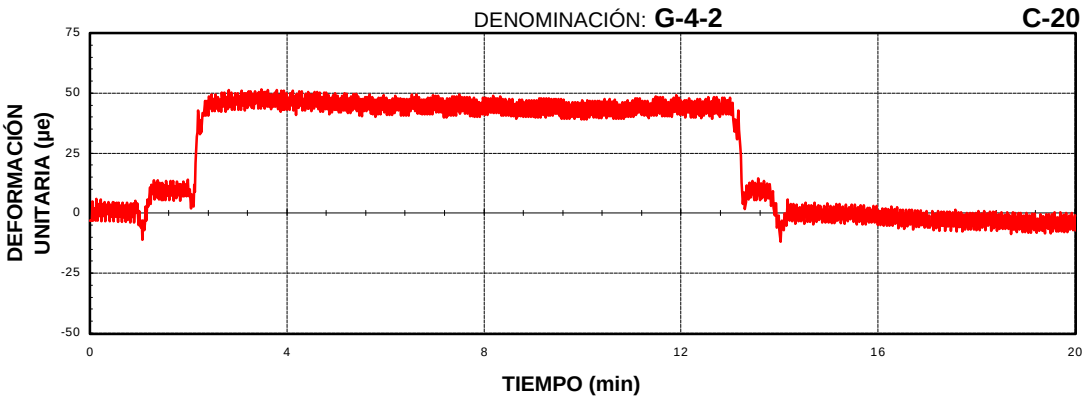
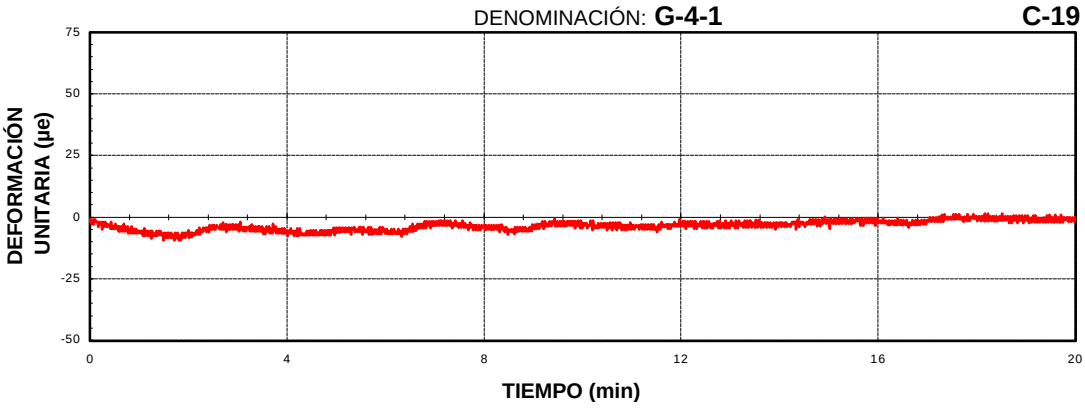
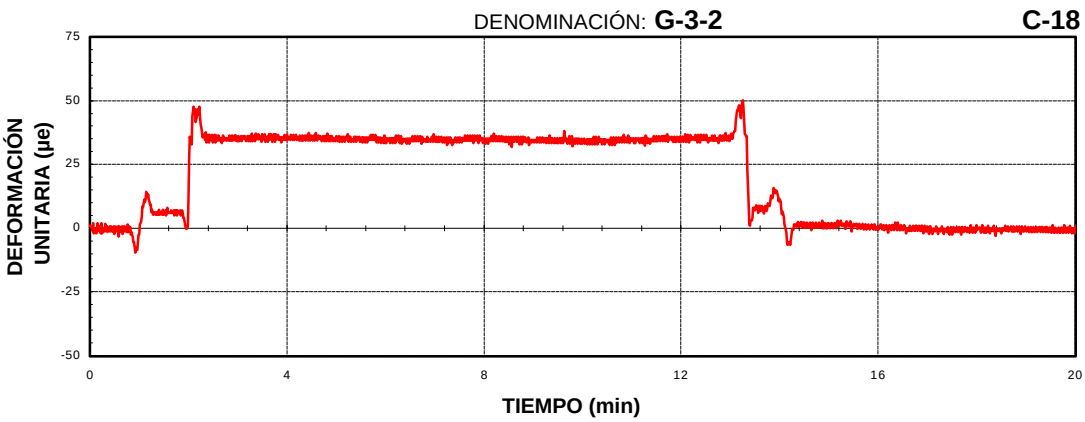
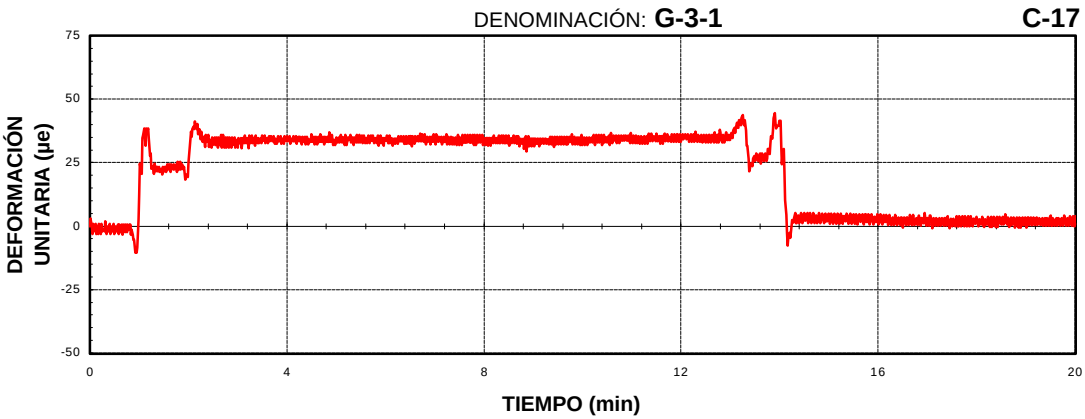
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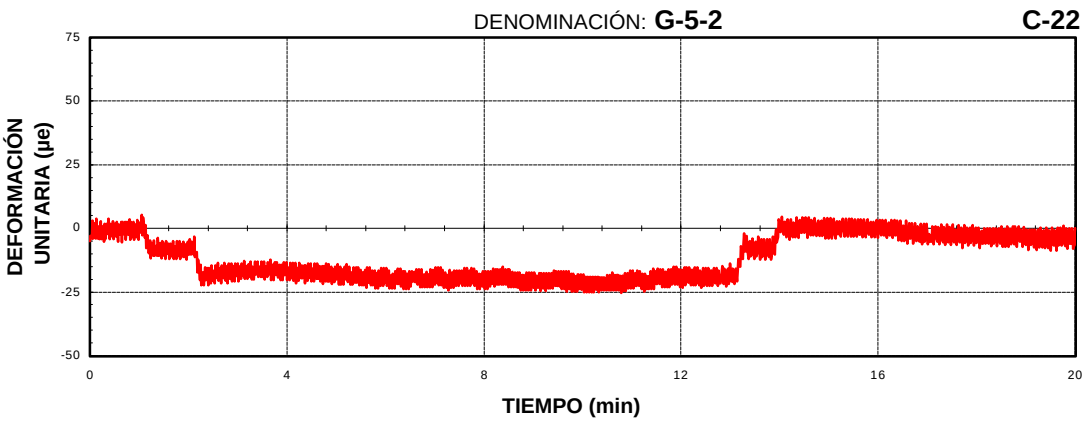
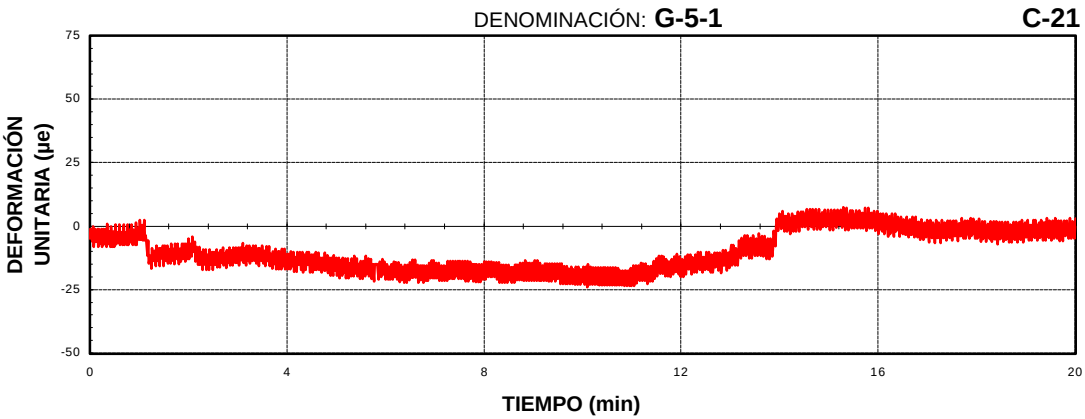
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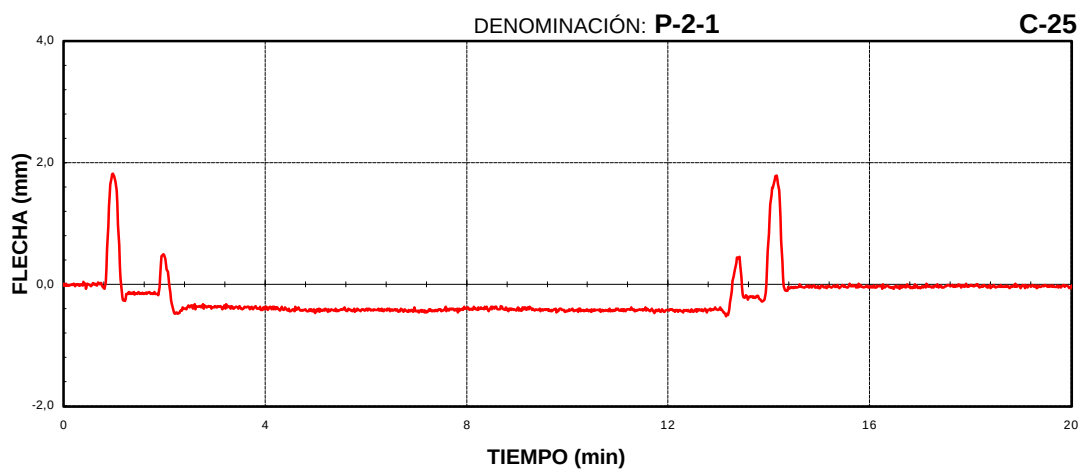
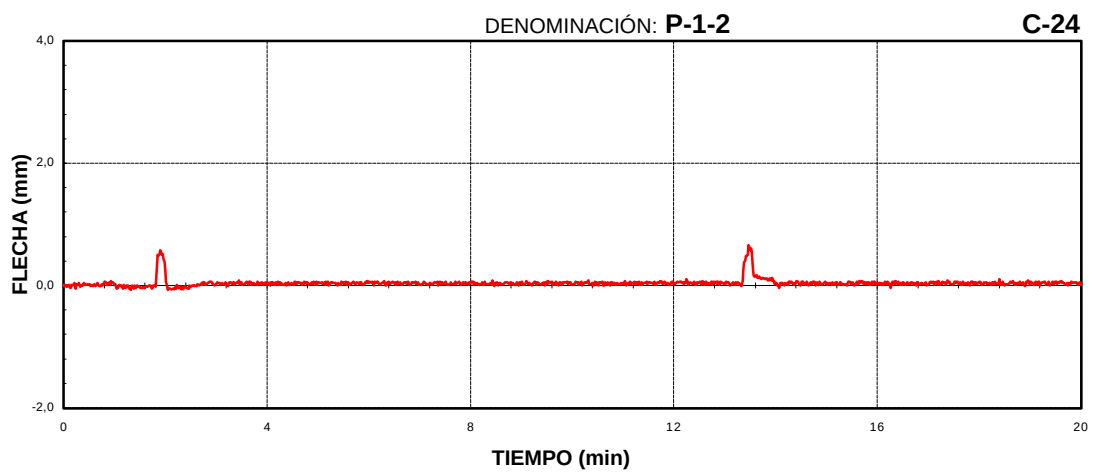
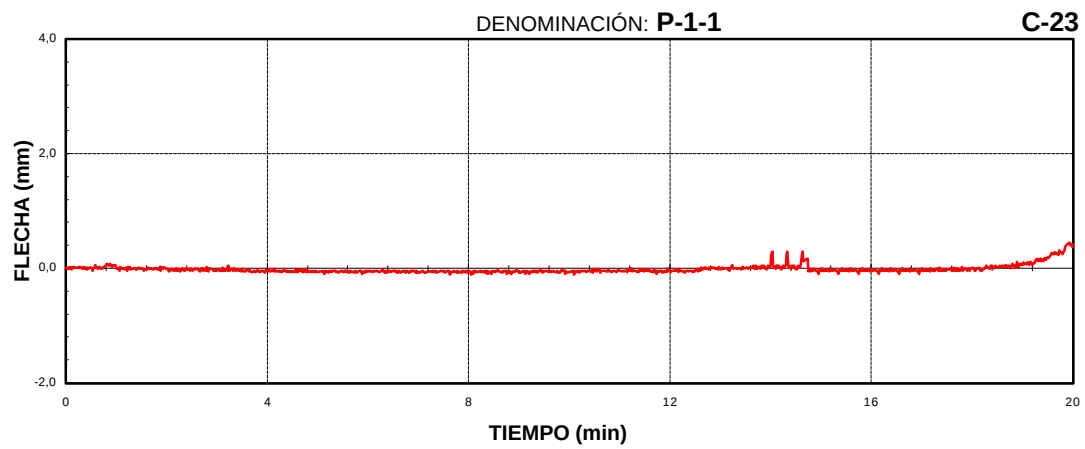
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HIPÓTESIS 3.



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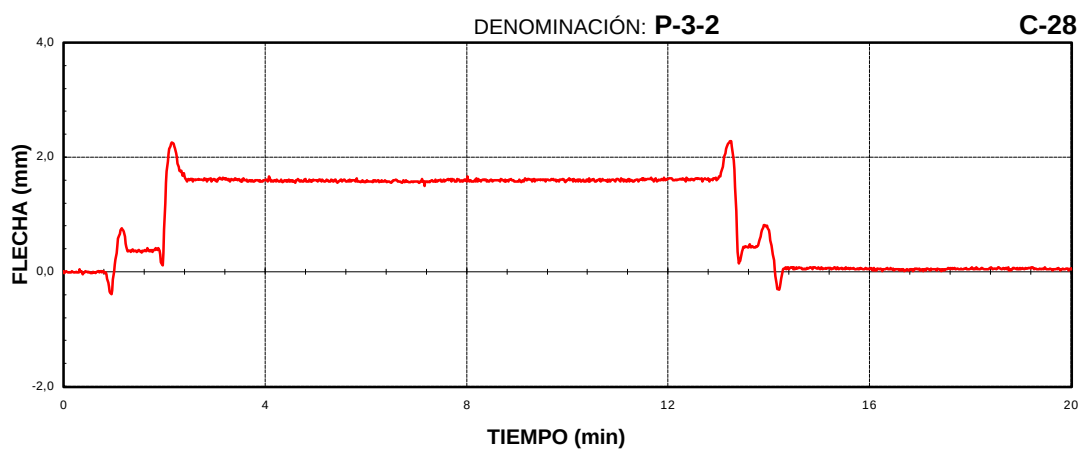
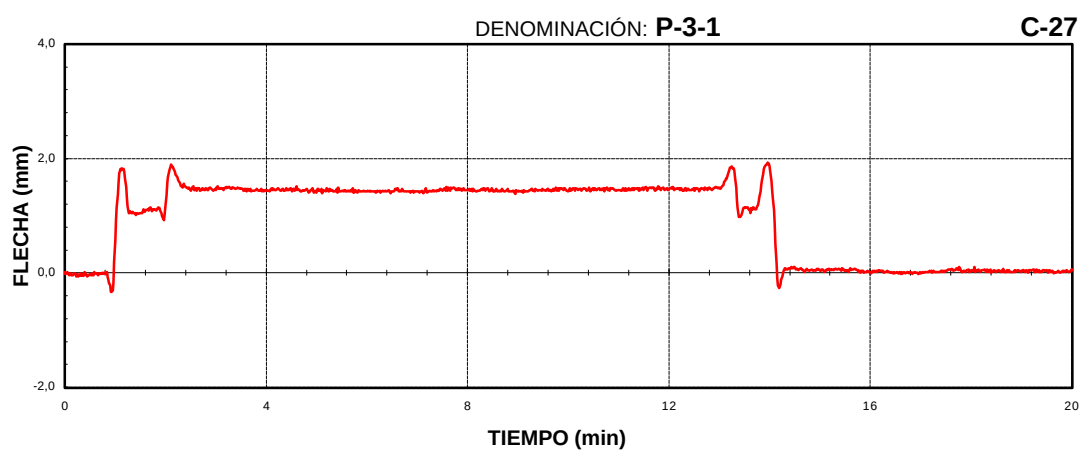
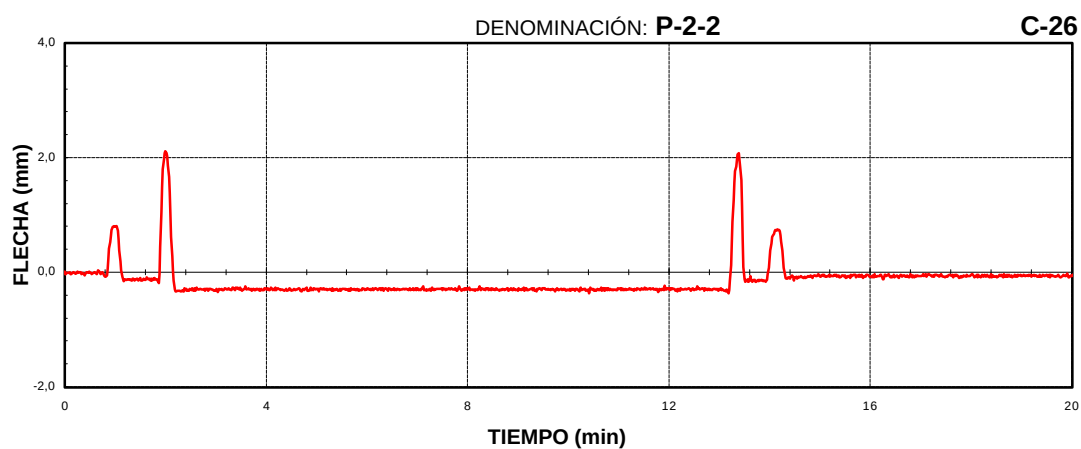


GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 3.

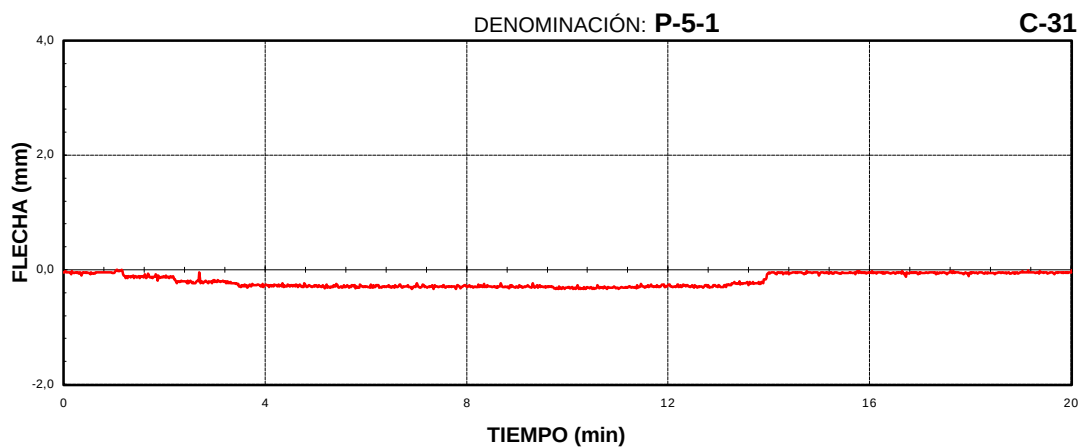
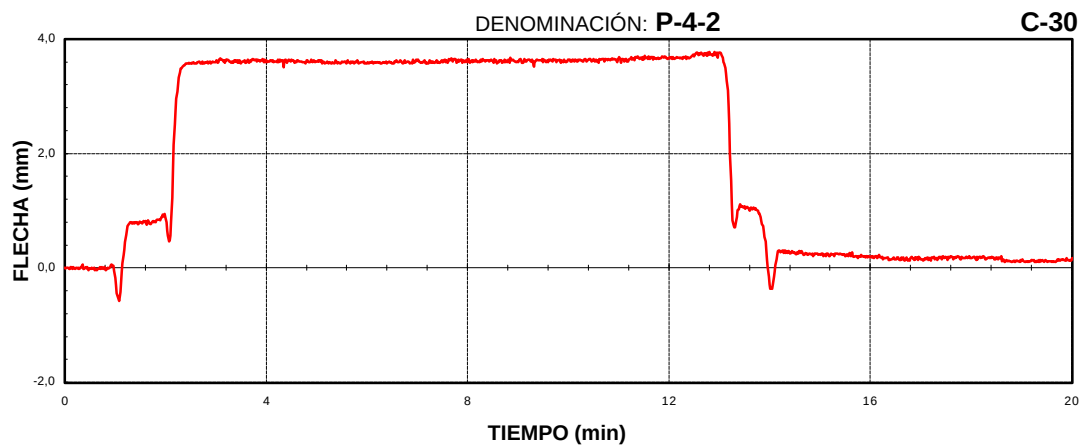
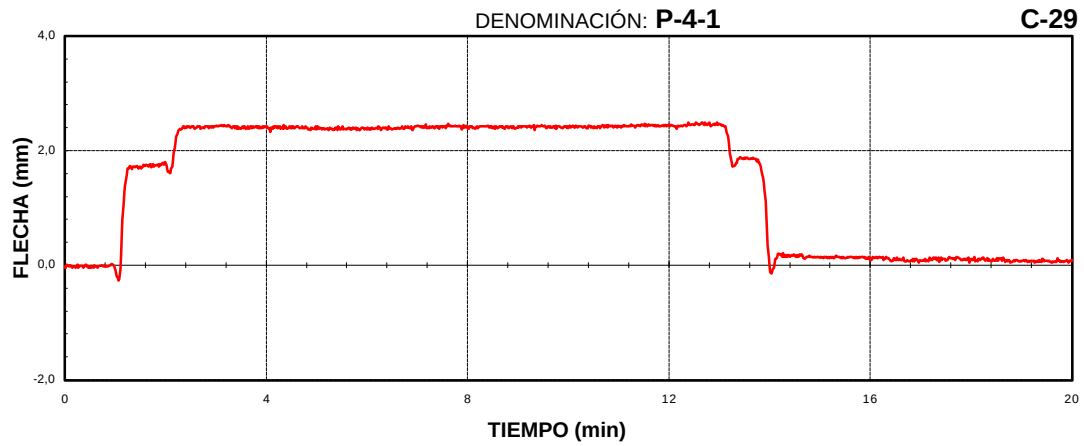




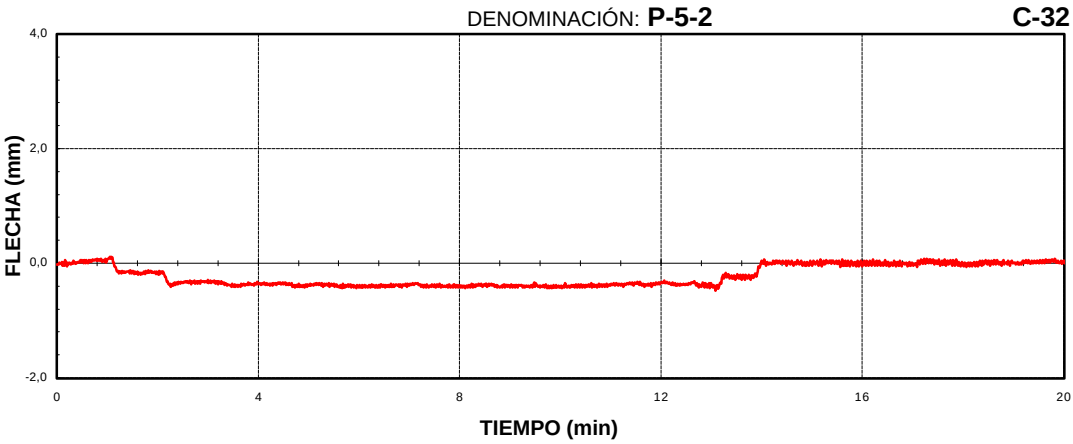
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**HIPÓTESIS 3.**



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**HIPÓTESIS 3.**



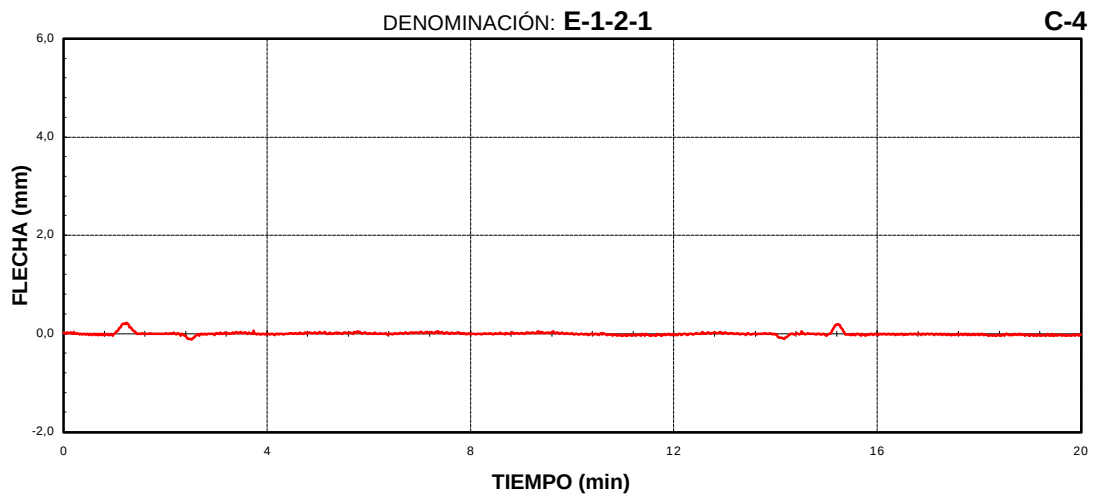
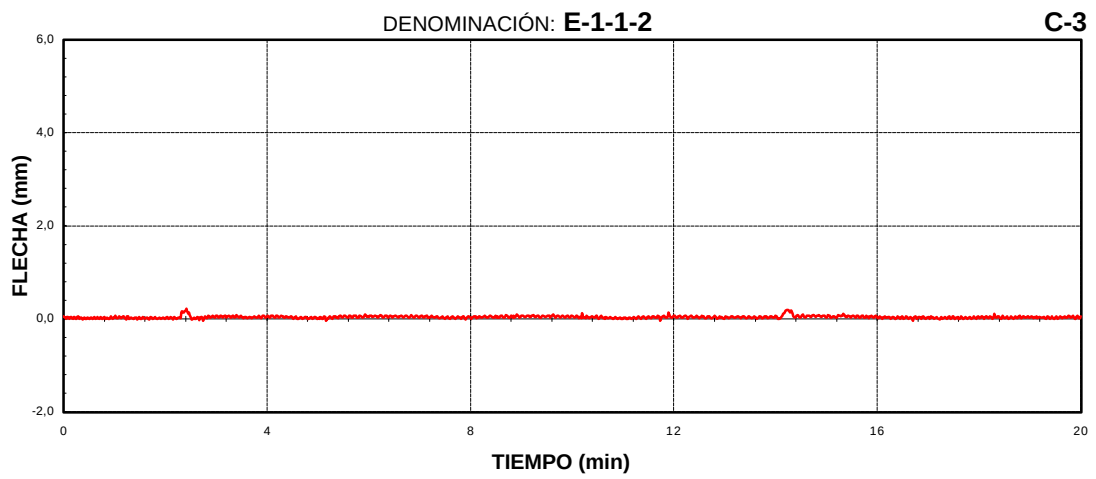
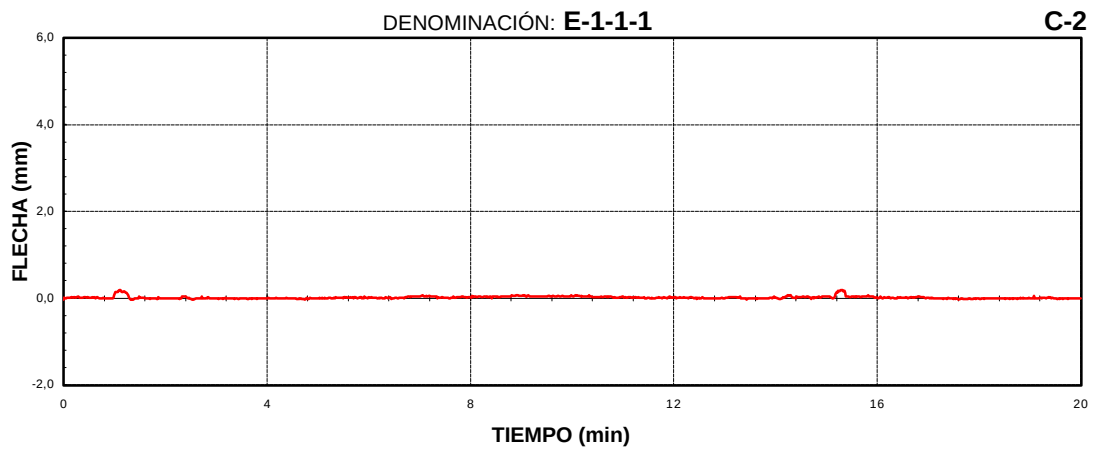
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HIPÓTESIS 3.



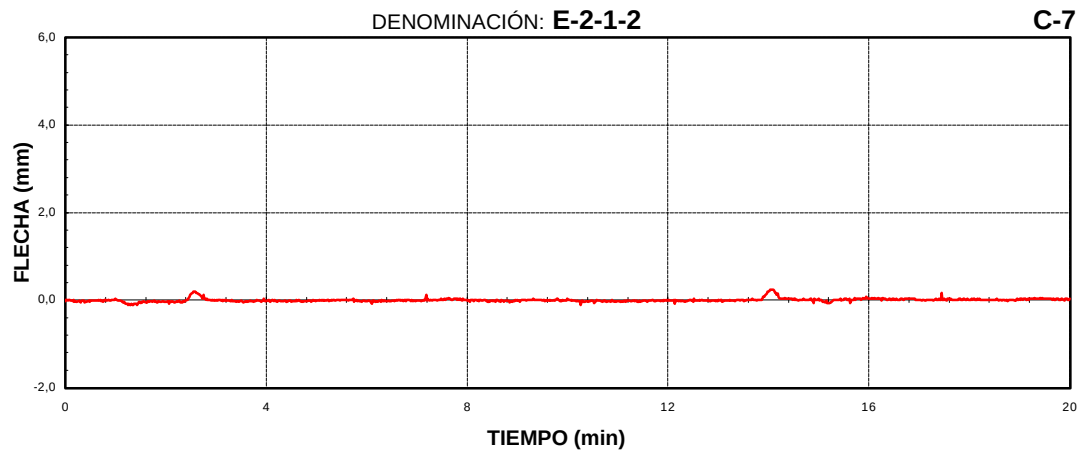
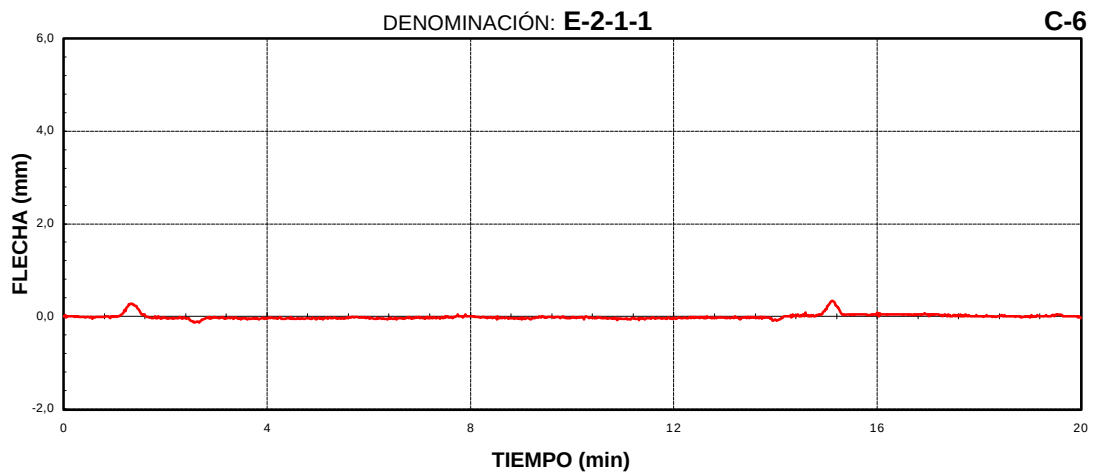
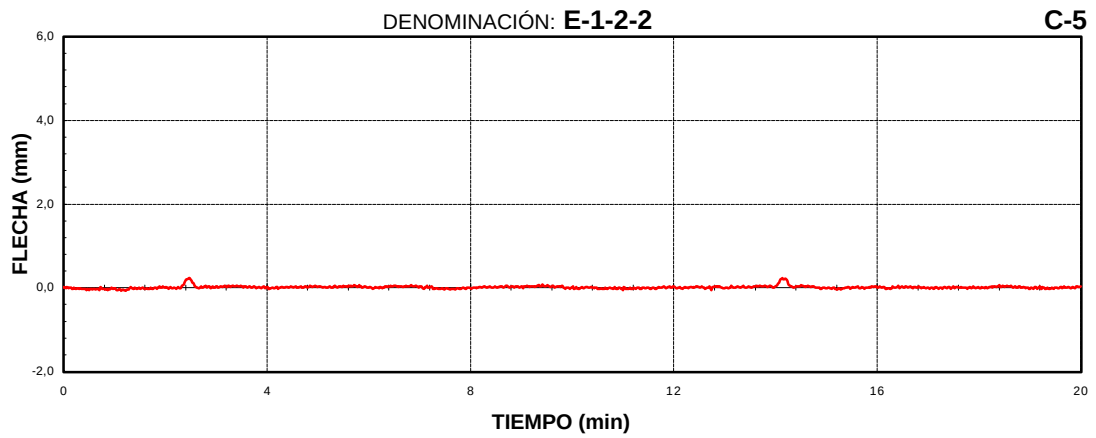
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**PRUEBA ESTÁTICA (HIPÓTESIS 4)**

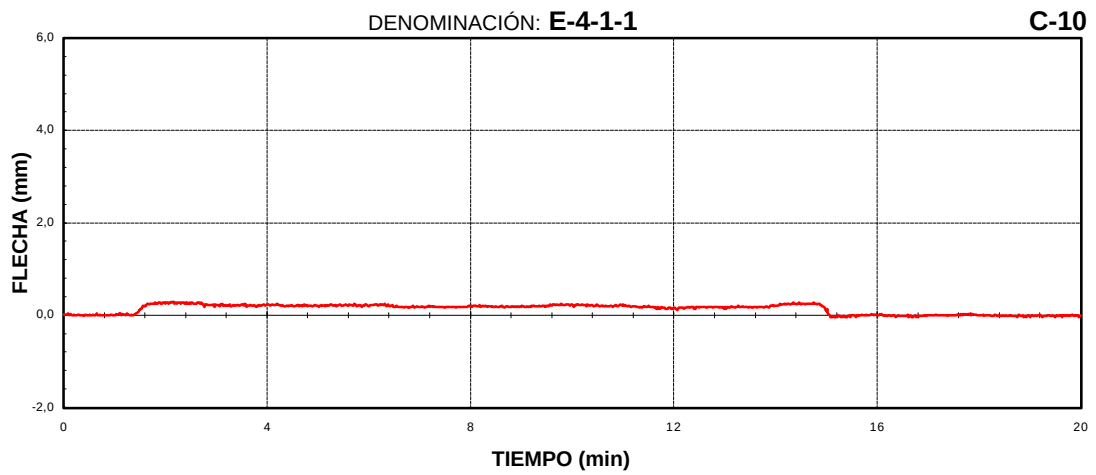
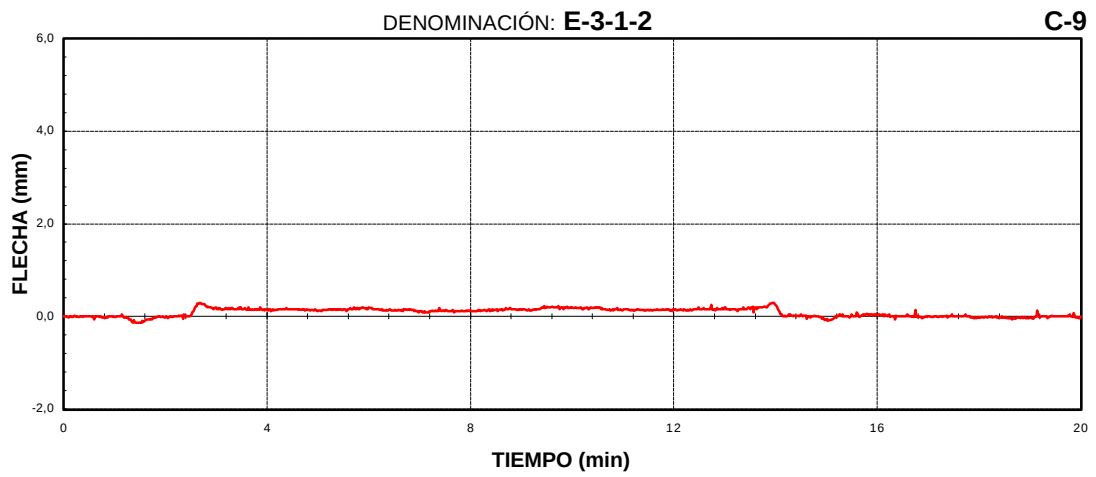
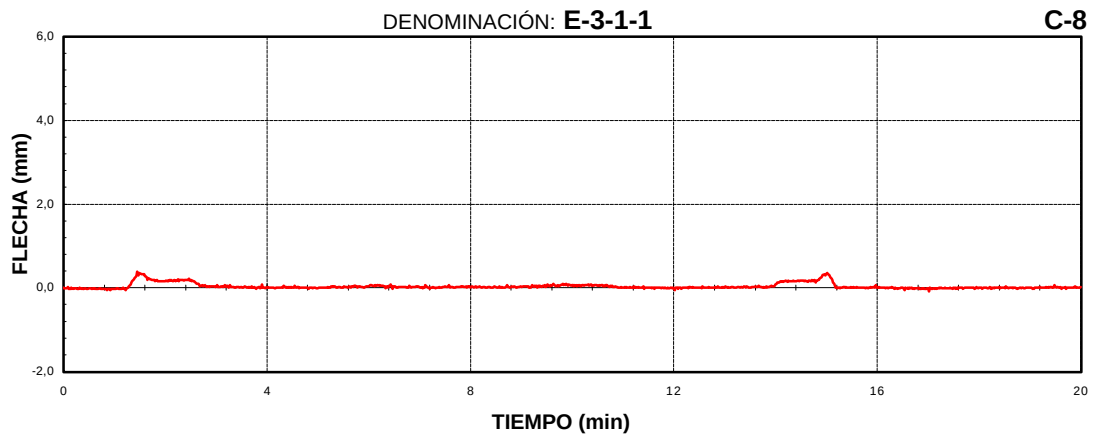
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HIPÓTESIS 4.



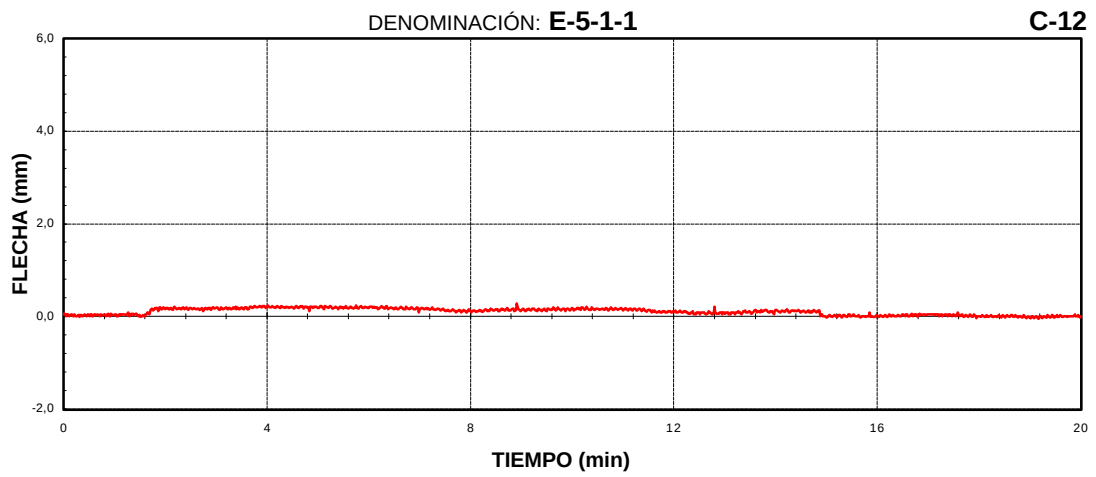
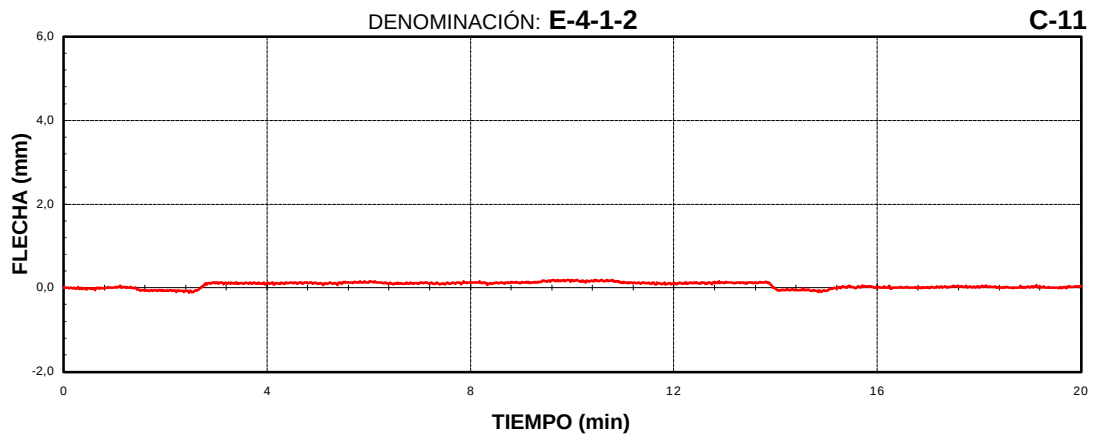
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HIPÓTESIS 4.



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HIPÓTESIS 4.

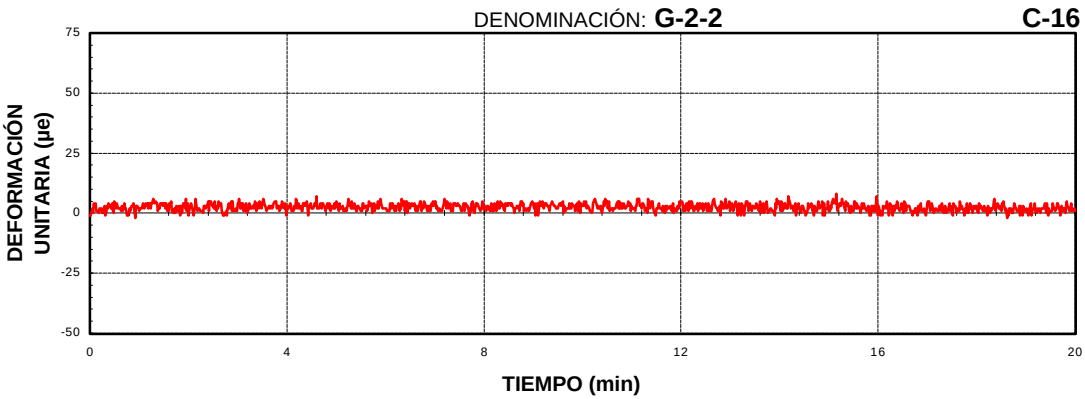
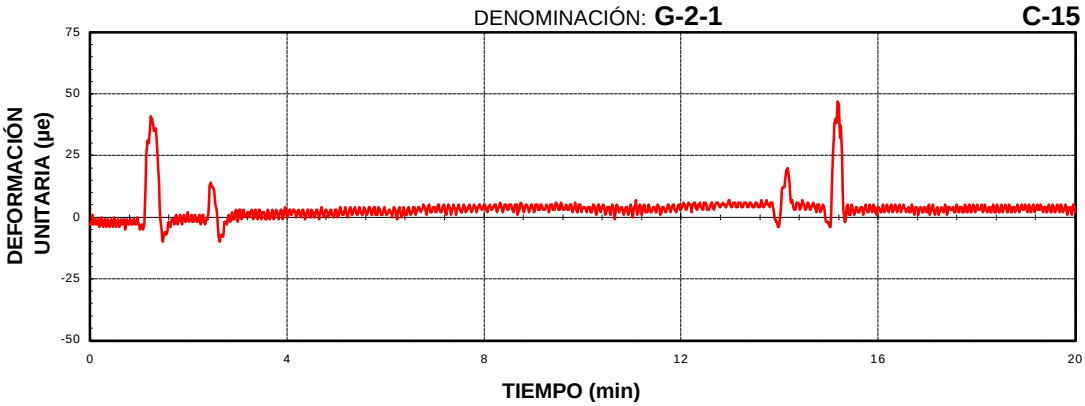
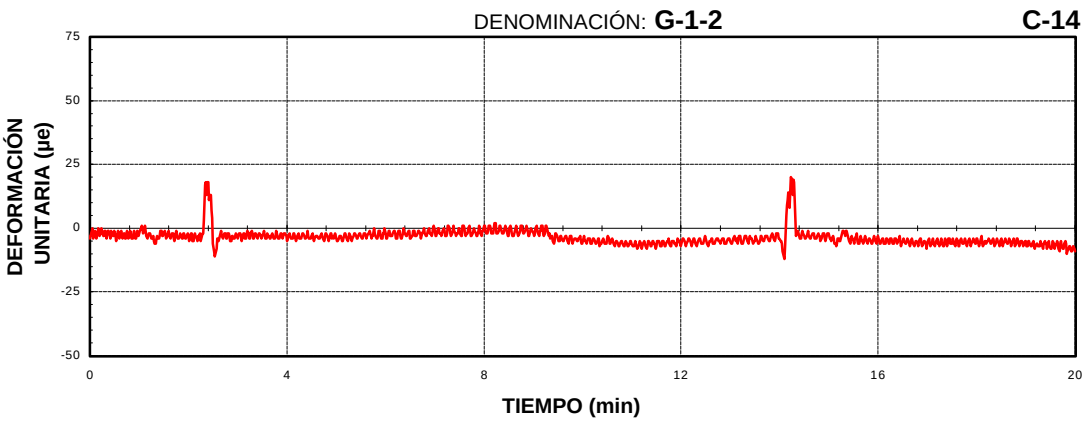
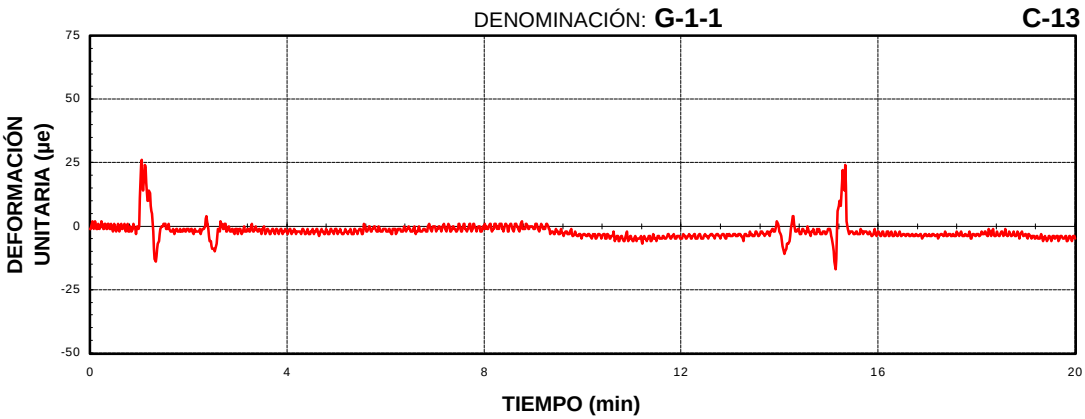


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HIPÓTESIS 4.

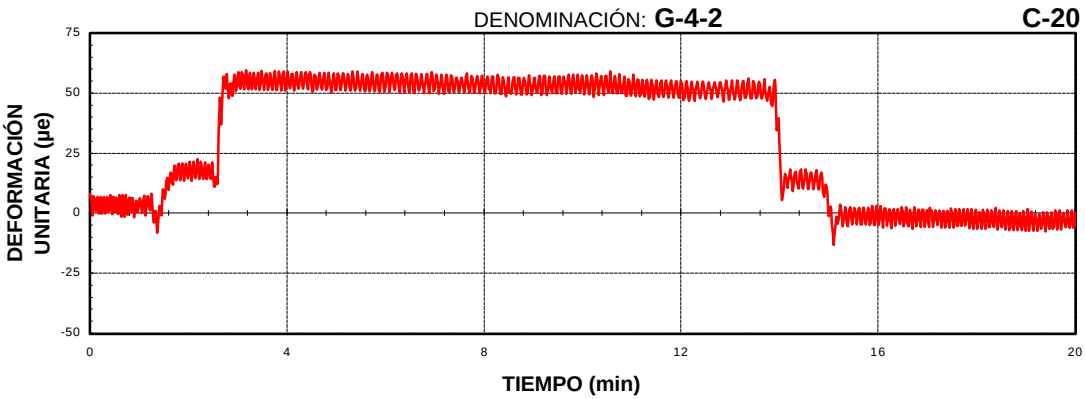
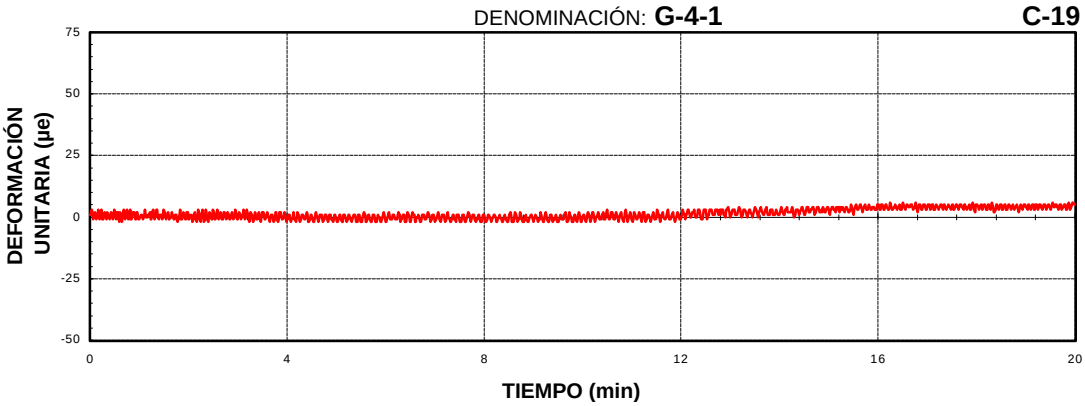
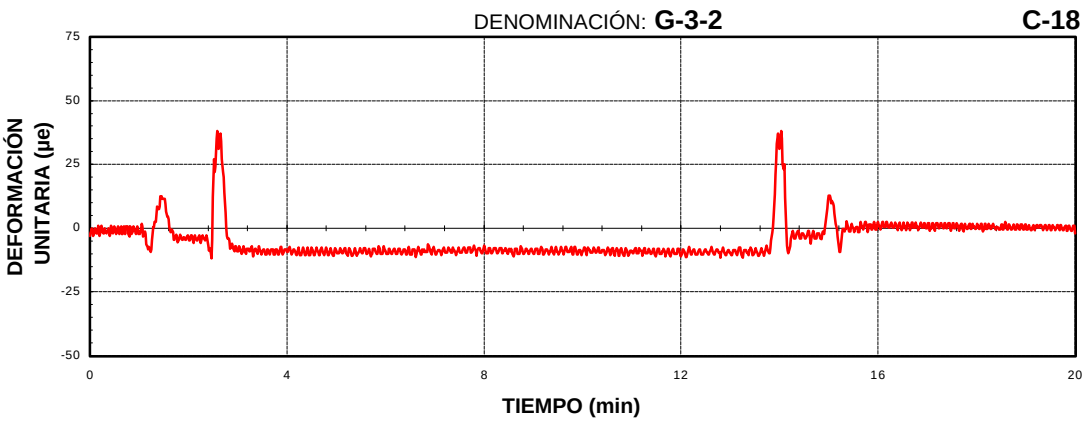
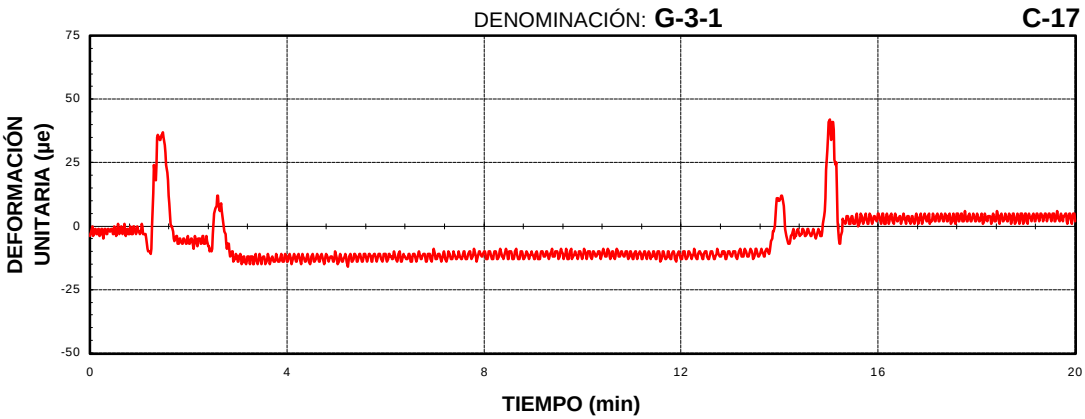




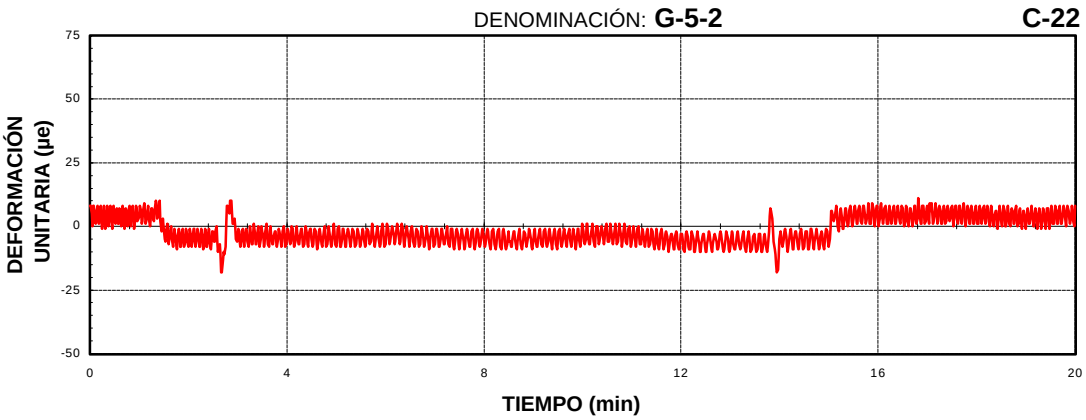
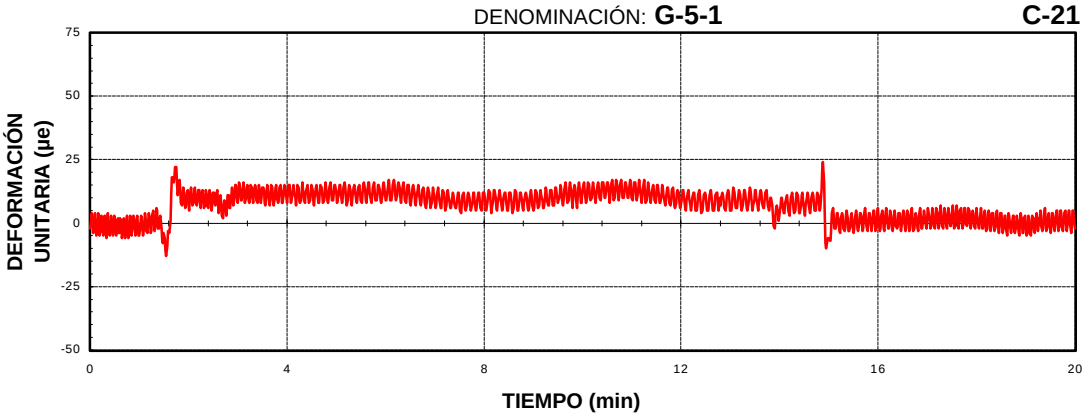
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HIPÓTESIS 4.



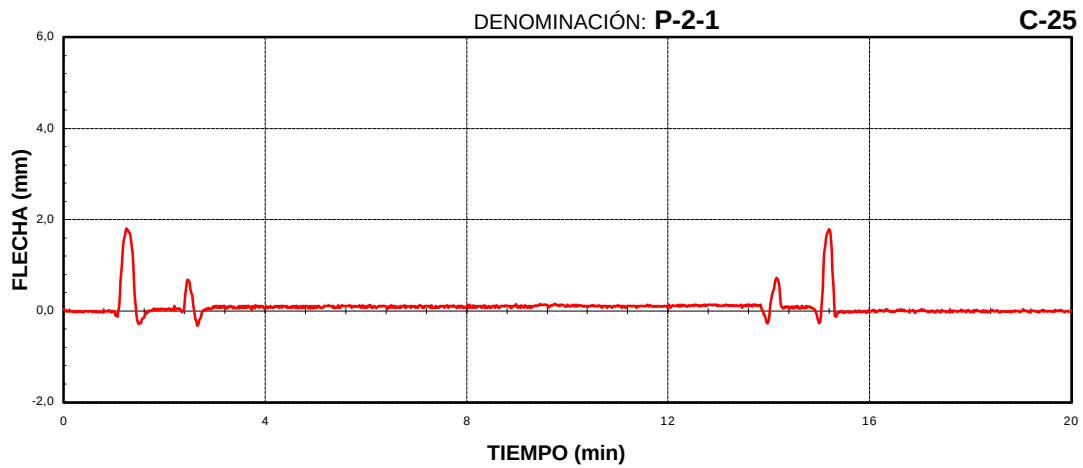
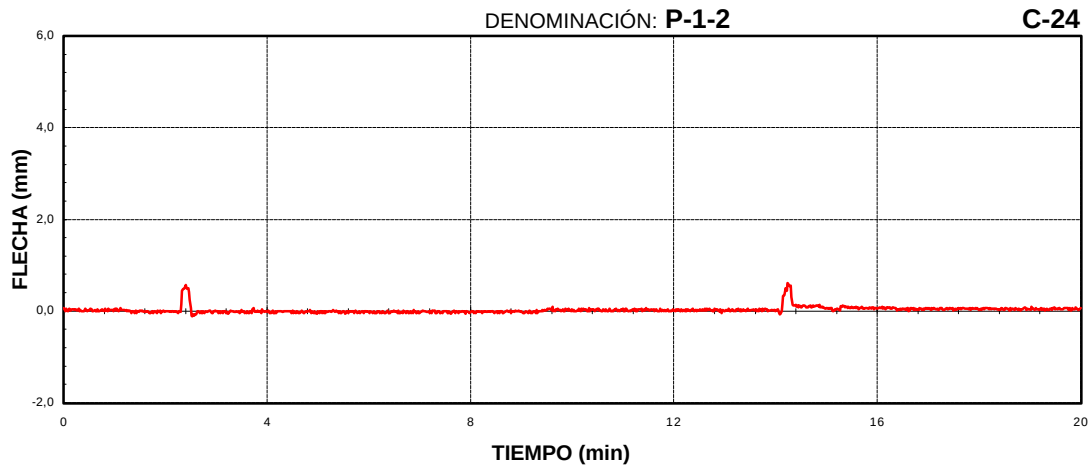
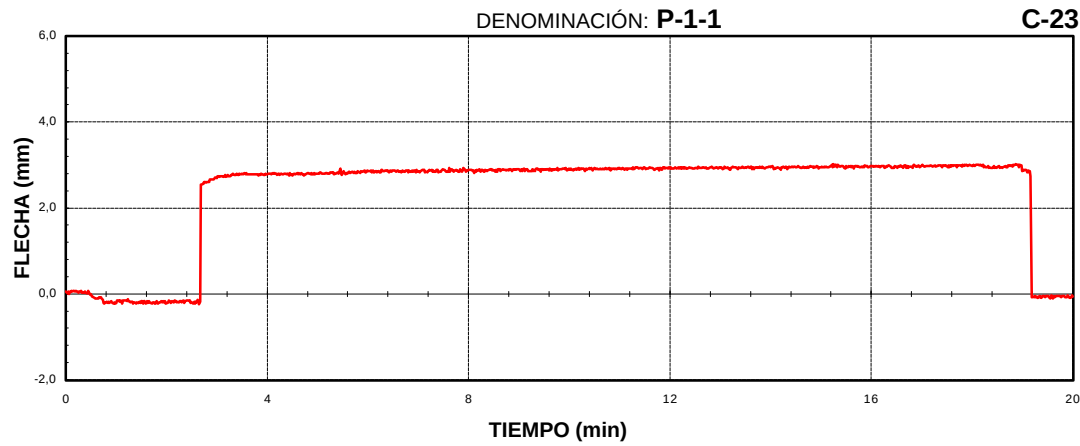
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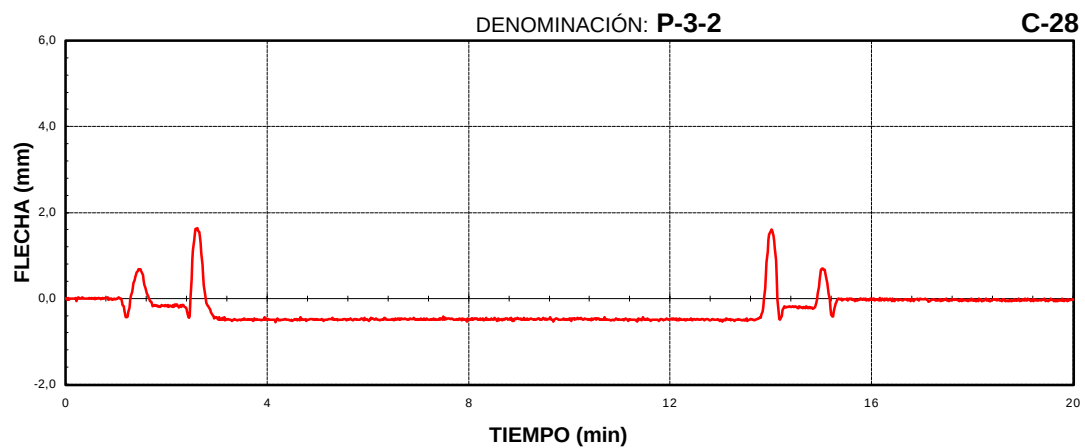
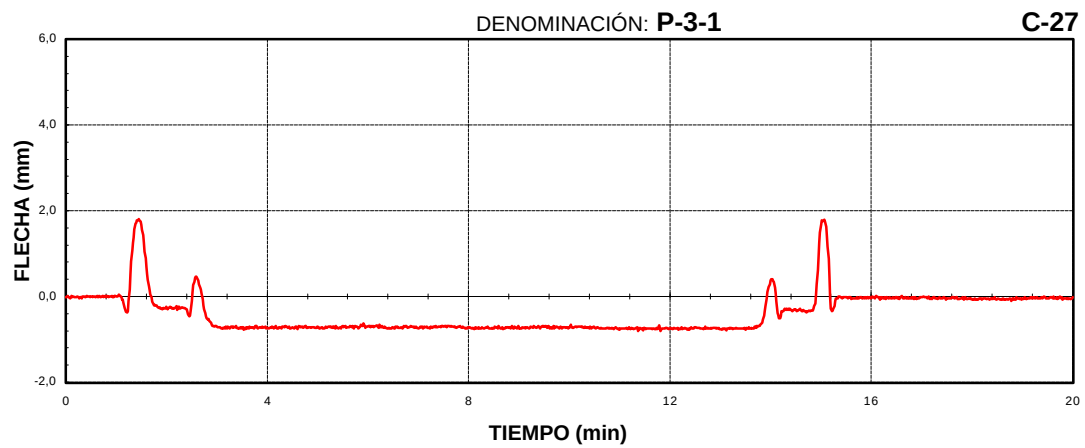
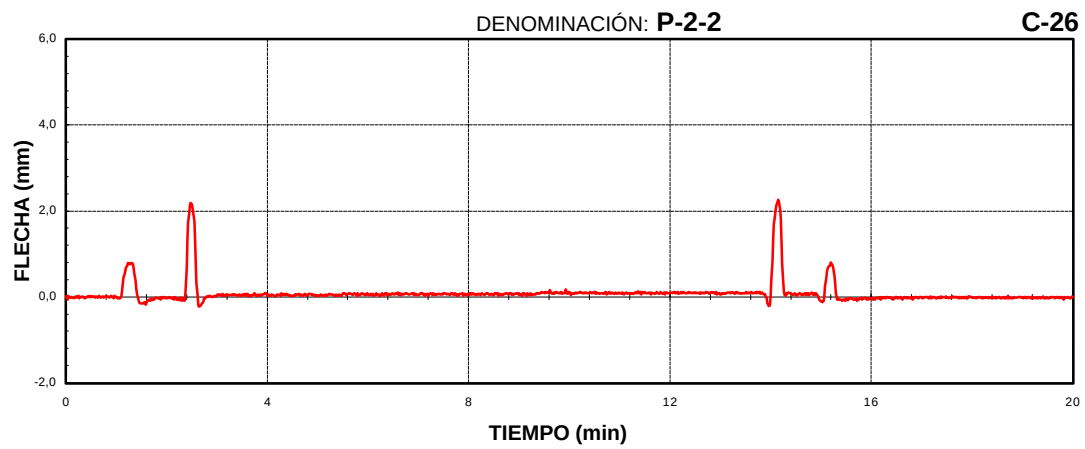
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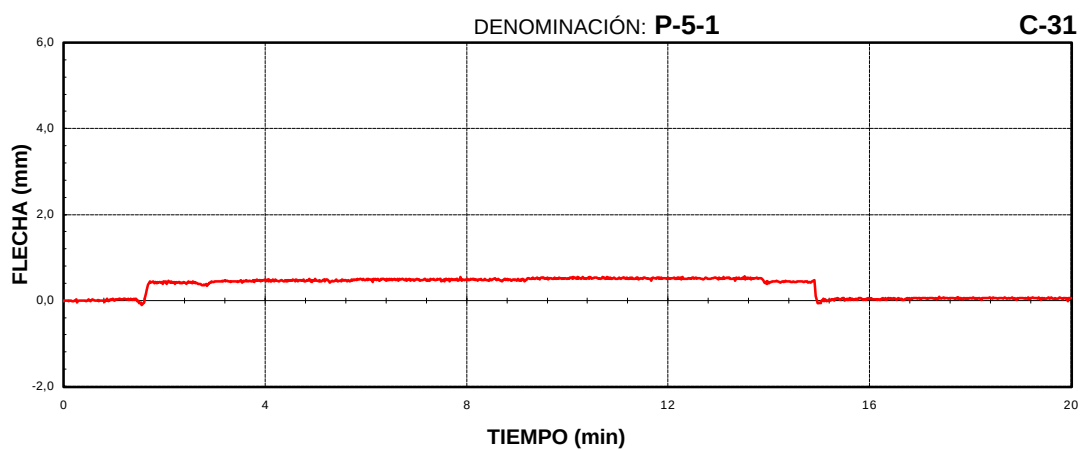
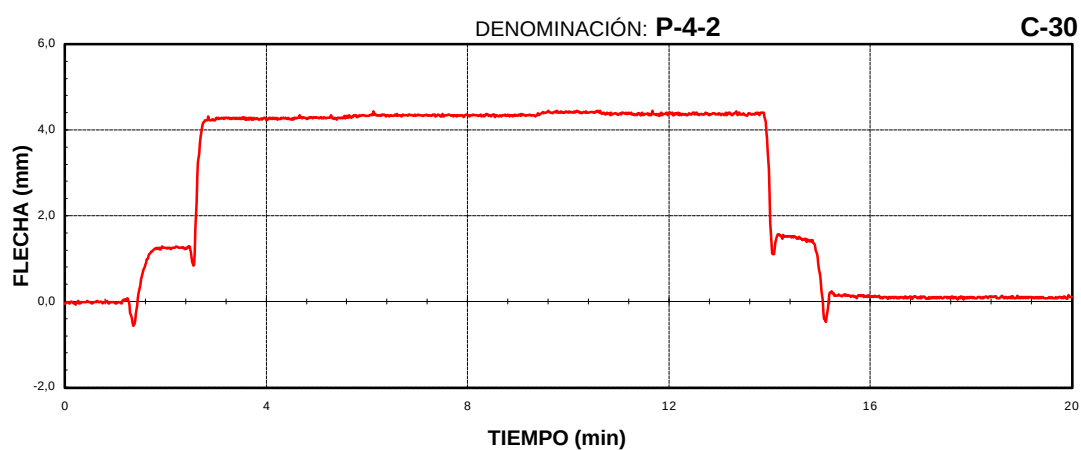
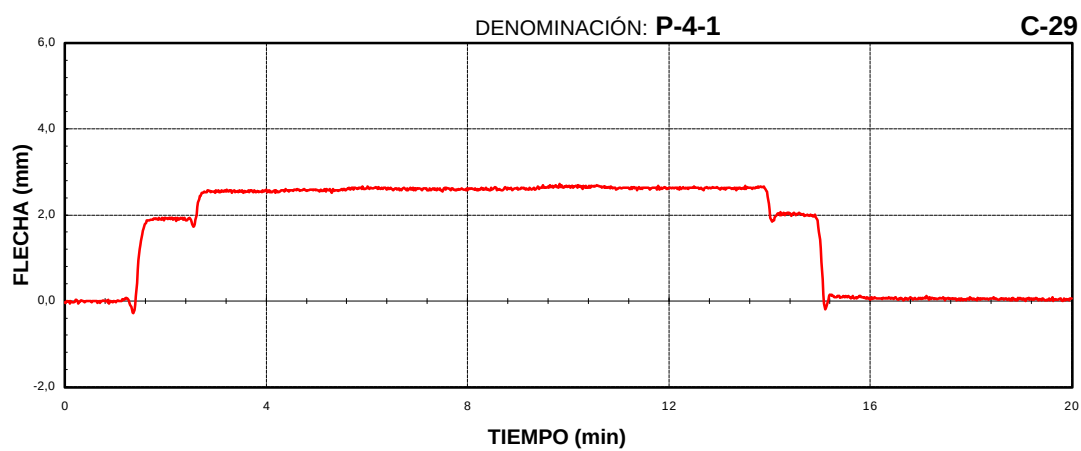
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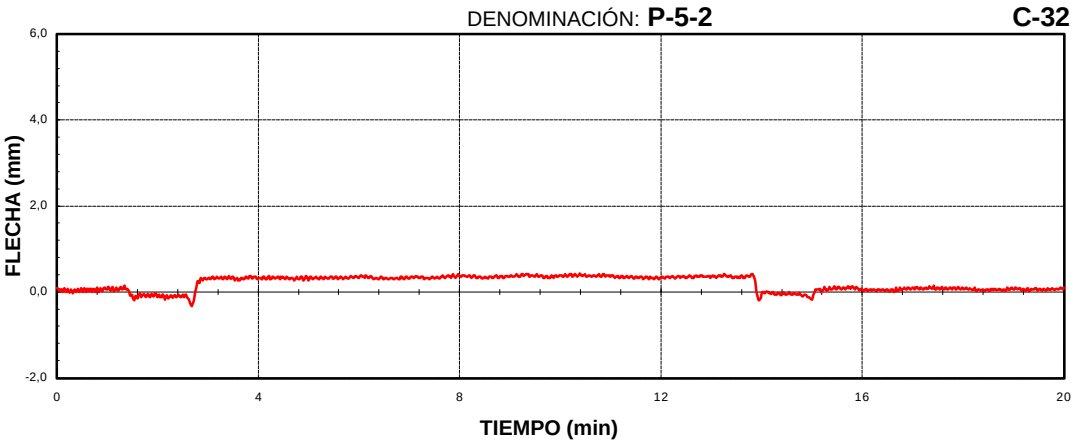
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HIPÓTESIS 4.



GIF VIA AVE  
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HIPÓTESIS 4.

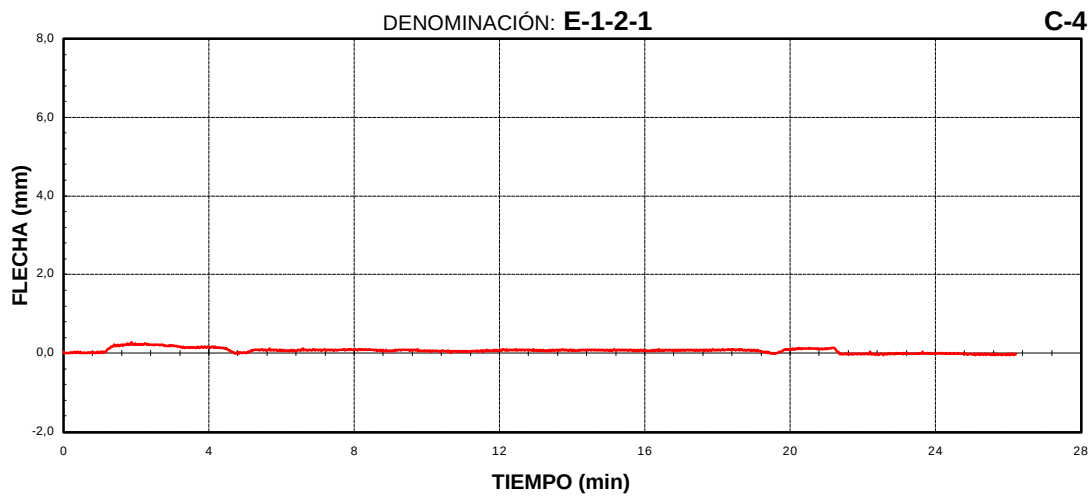
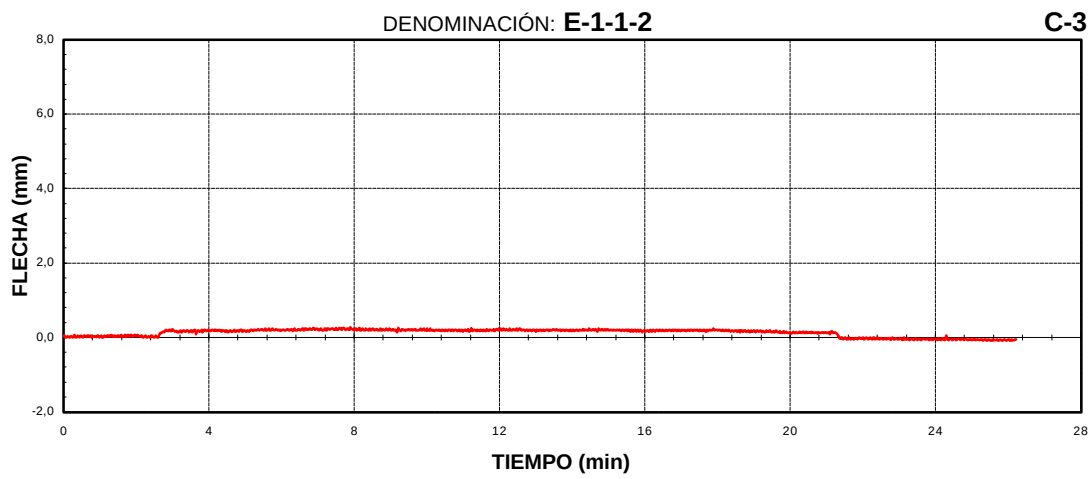
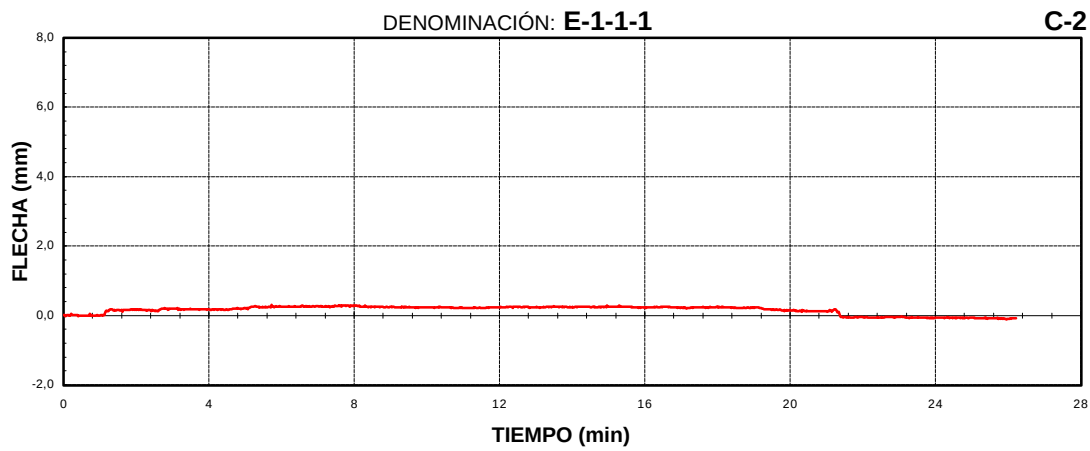


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**ACEQUIA QUINTOS DE EBRO.**

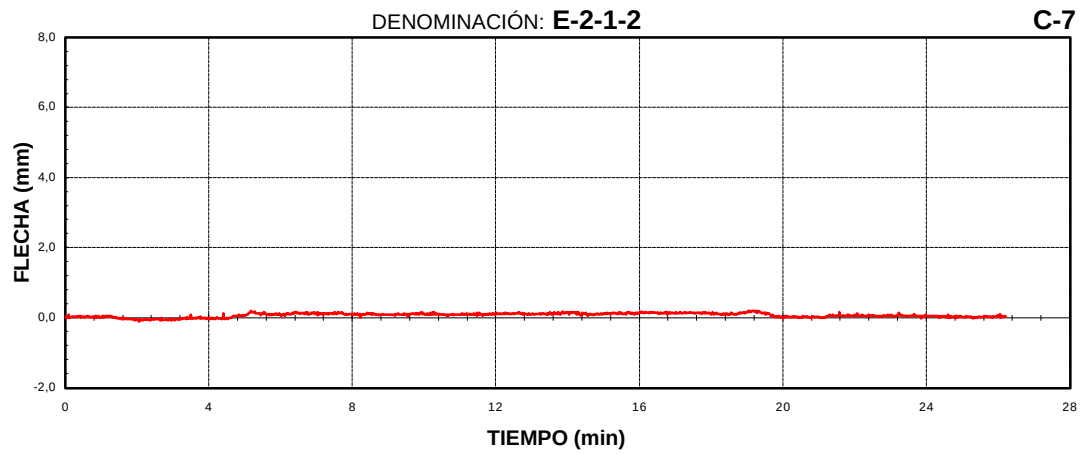
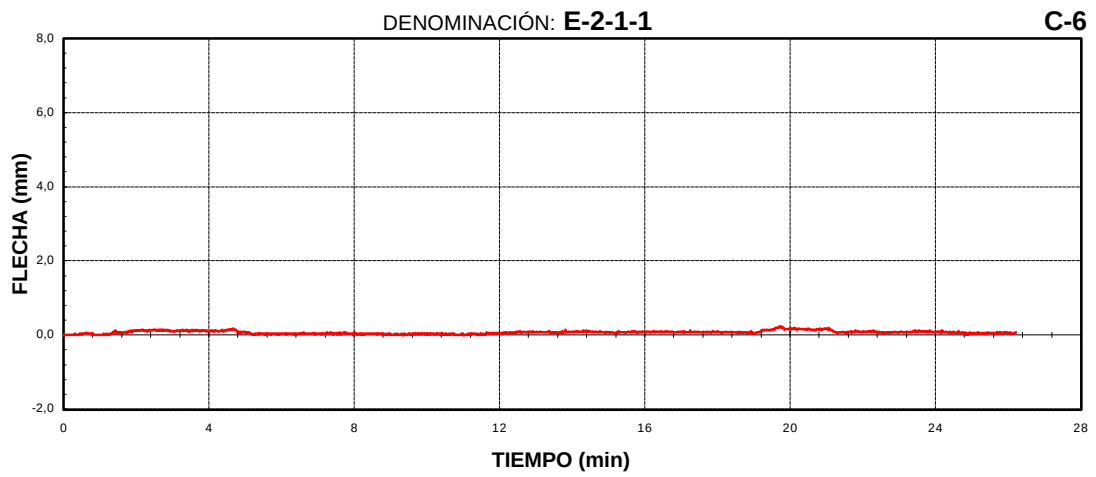
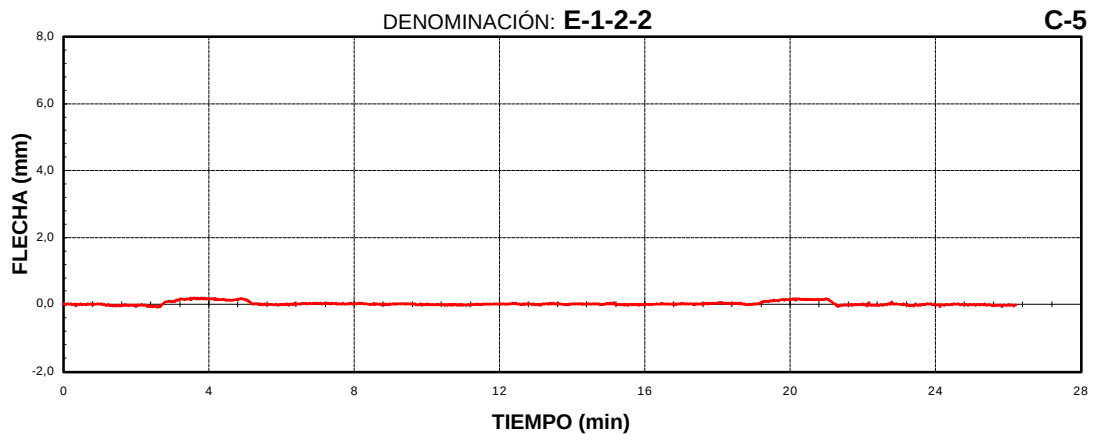
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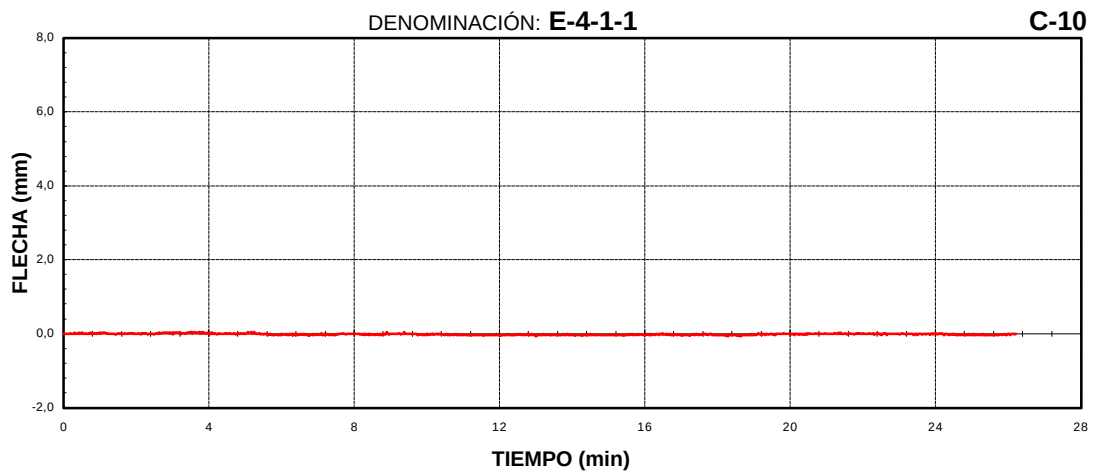
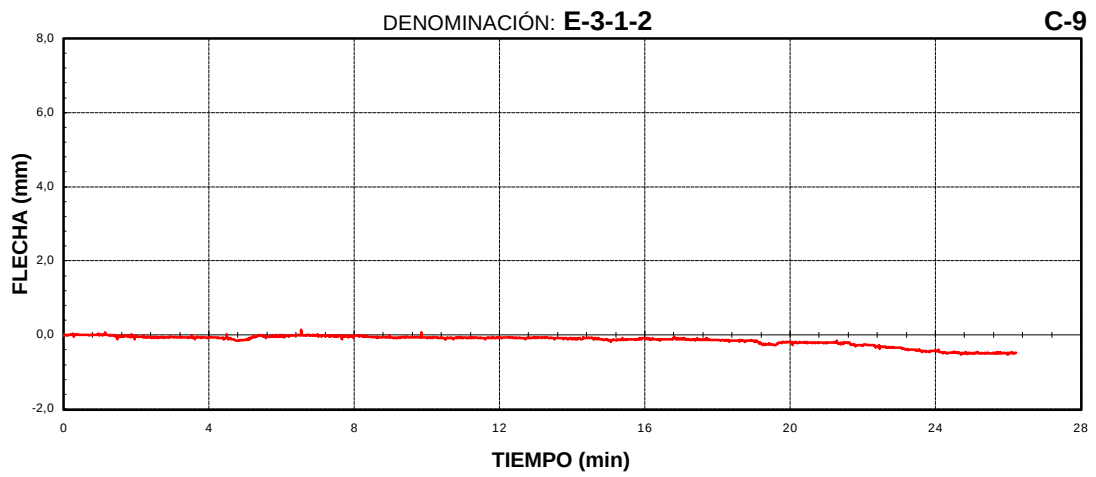
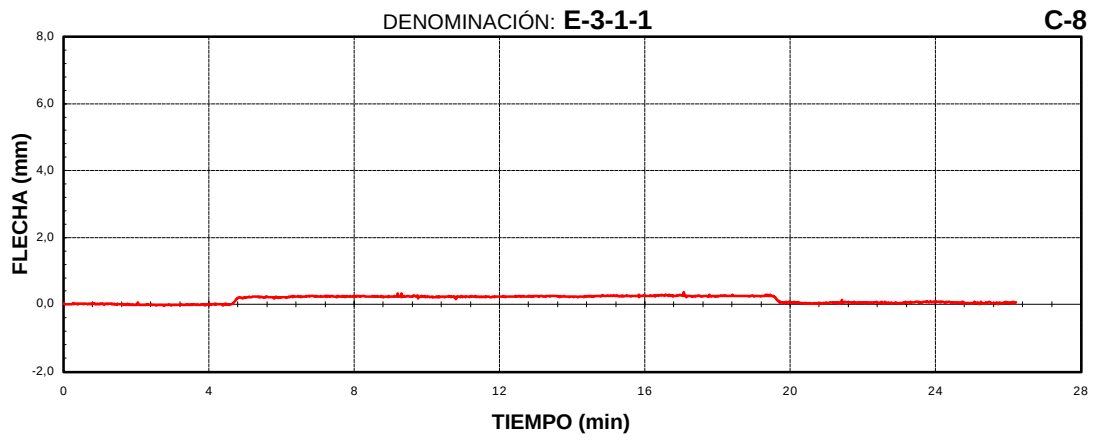
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HIPÓTESIS 5.



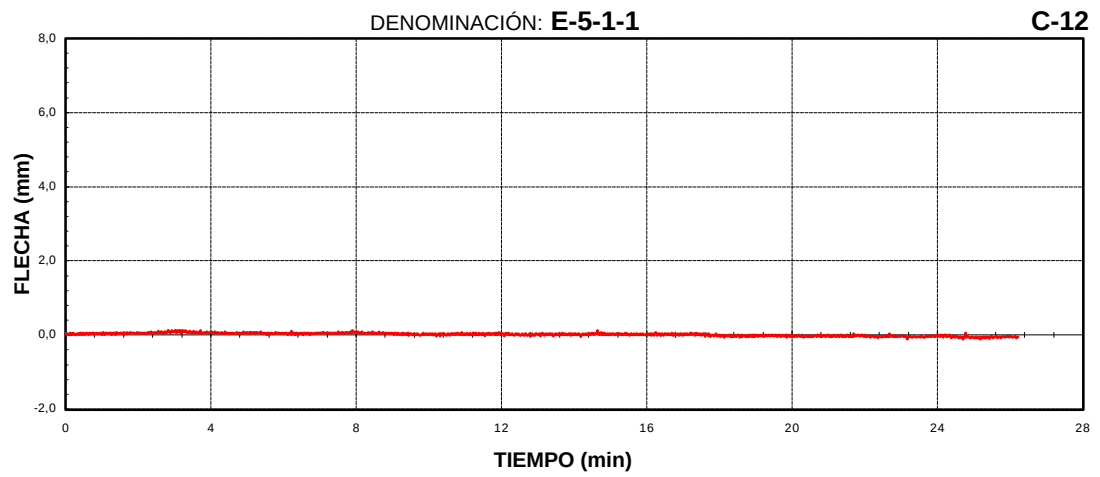
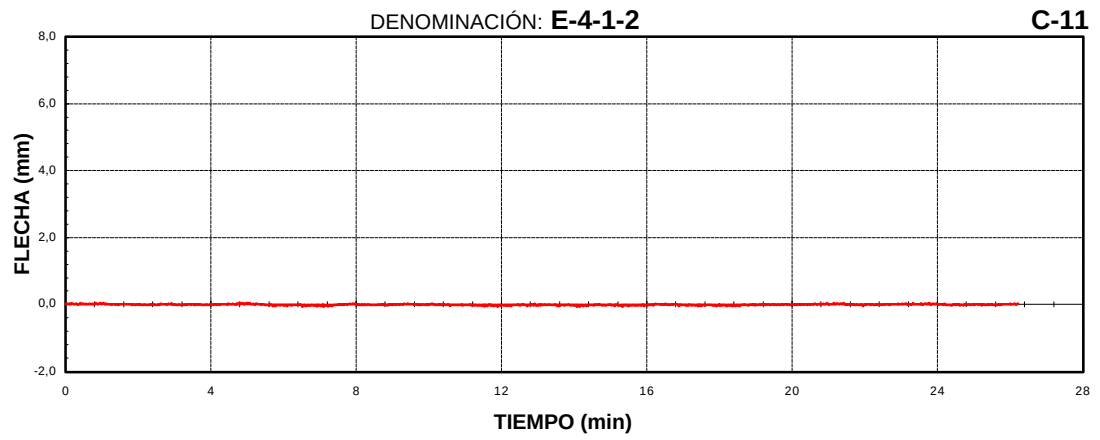
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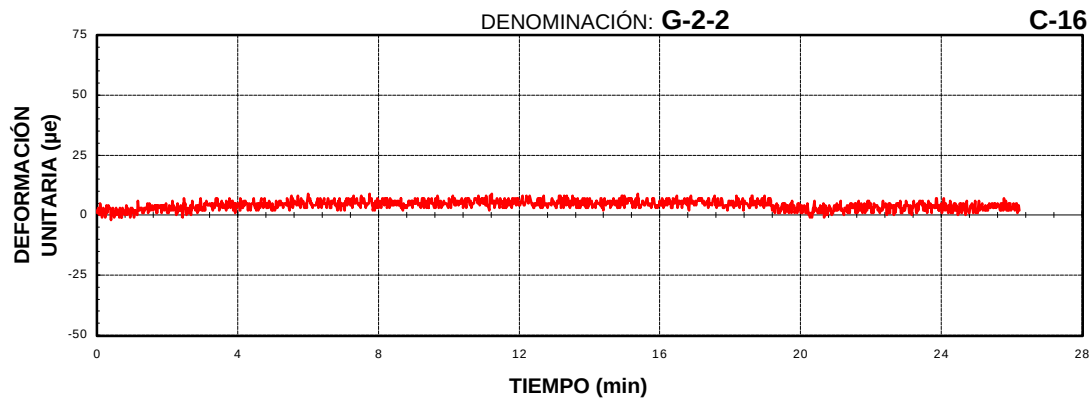
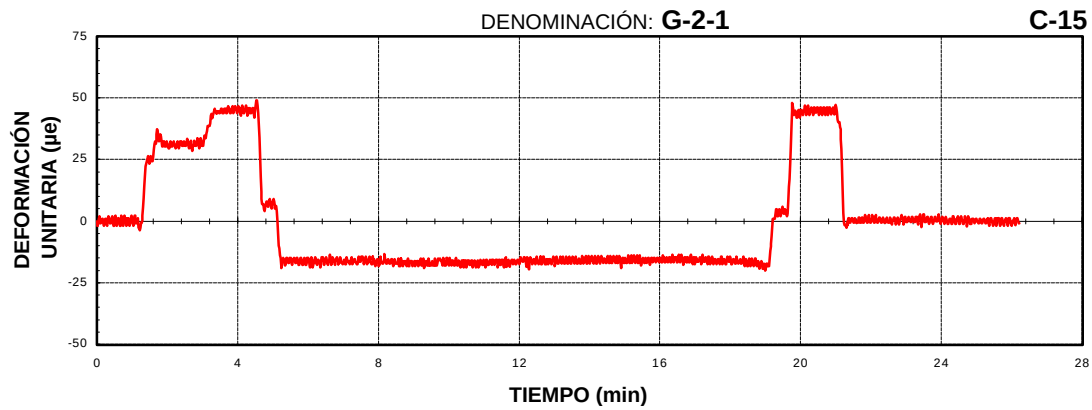
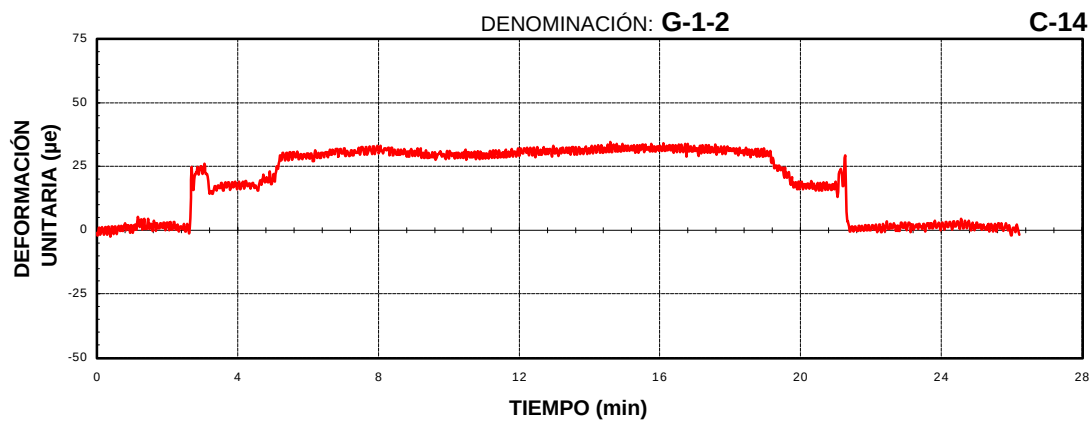
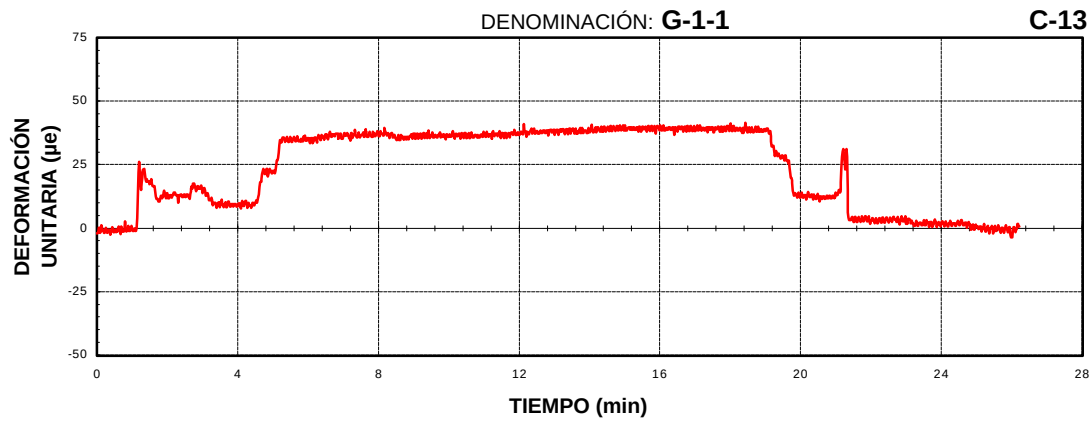
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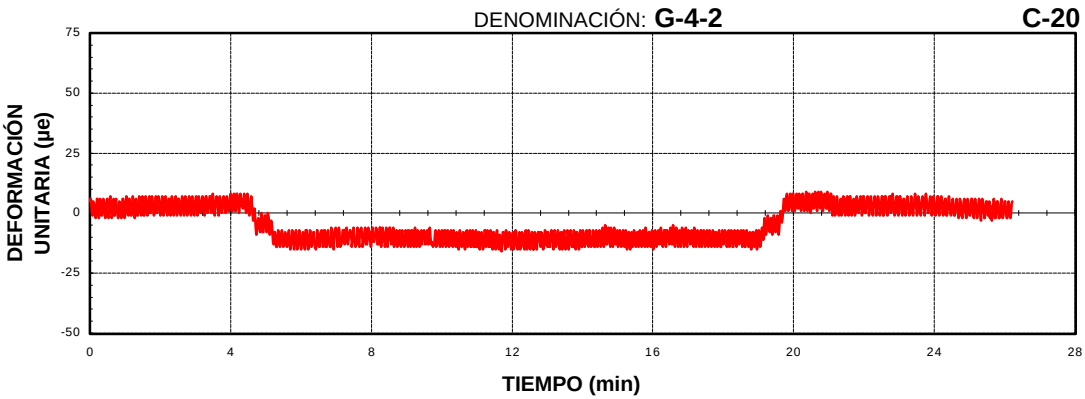
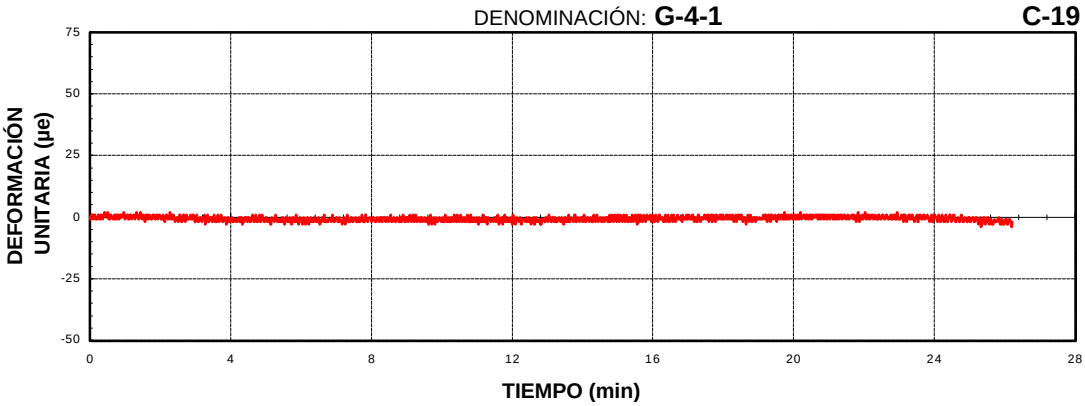
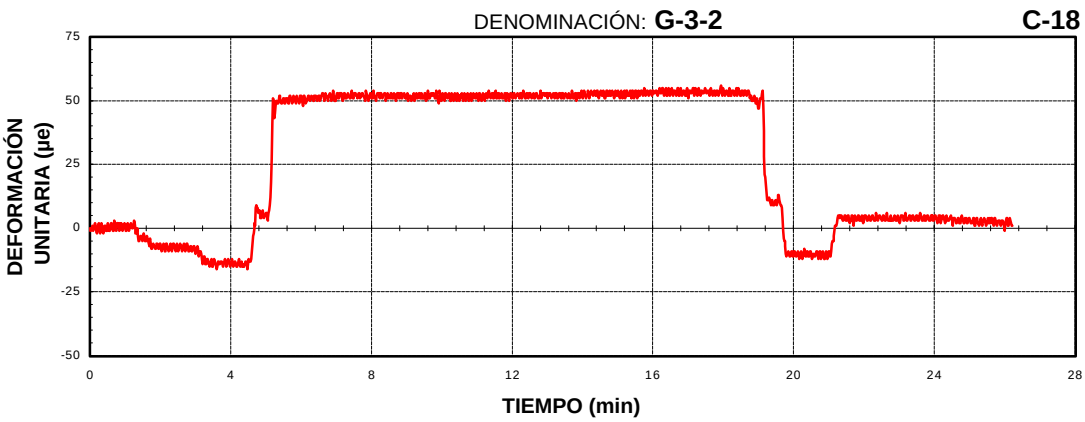
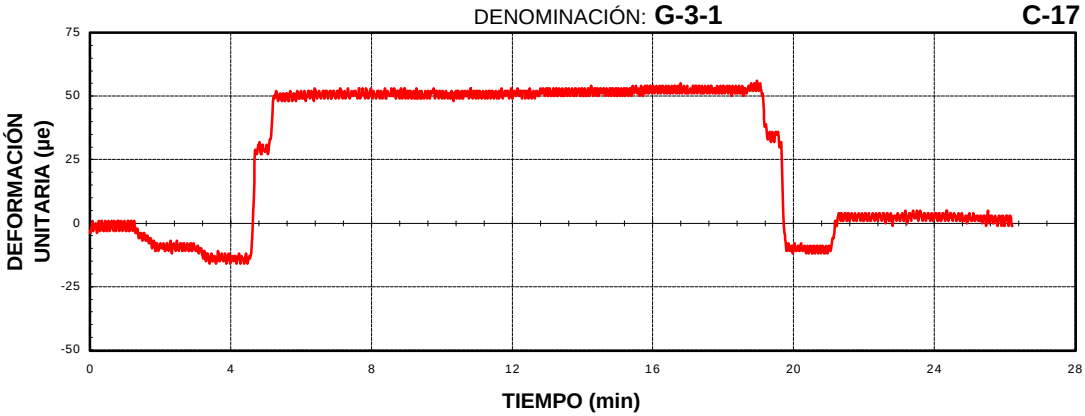
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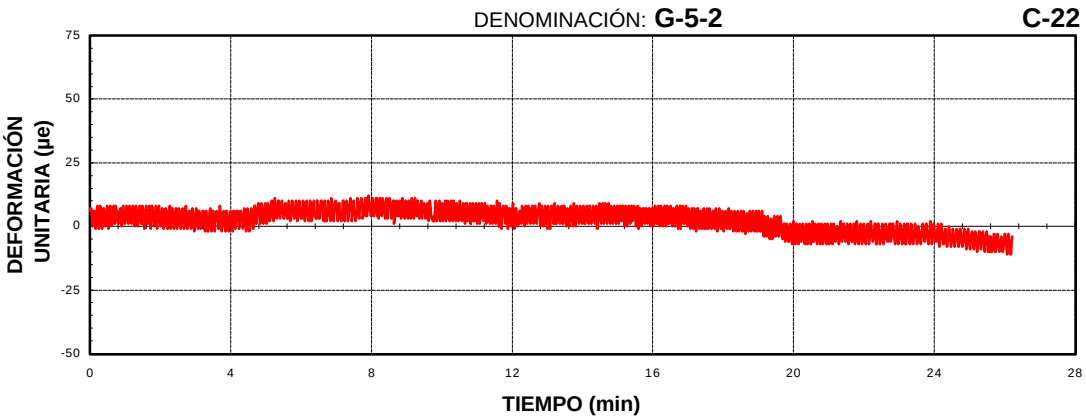
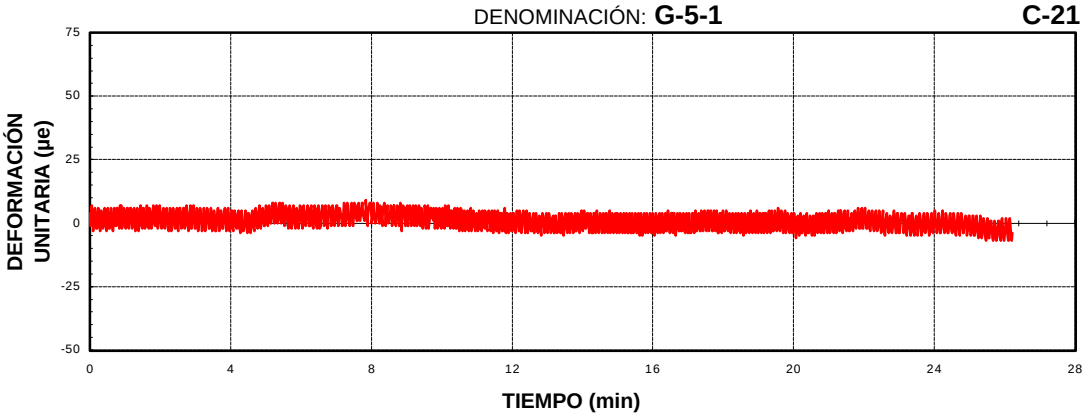
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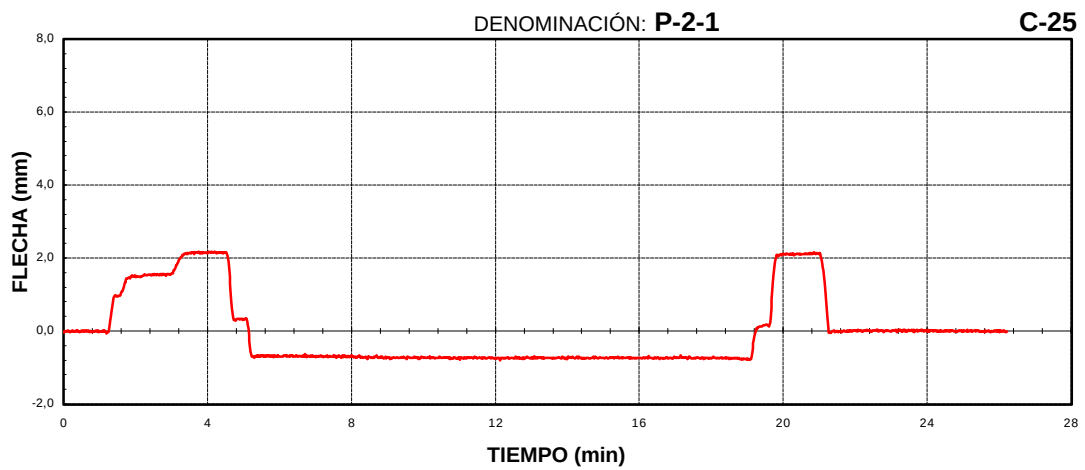
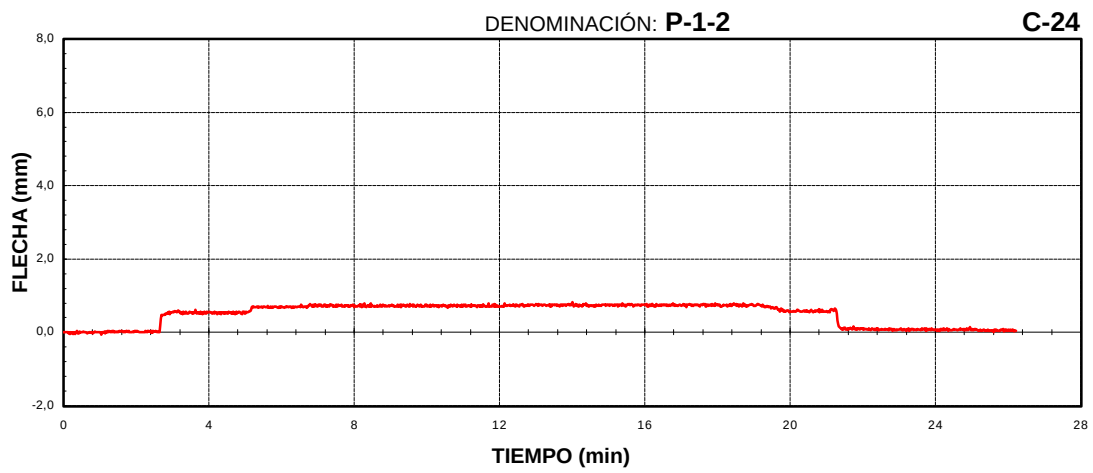
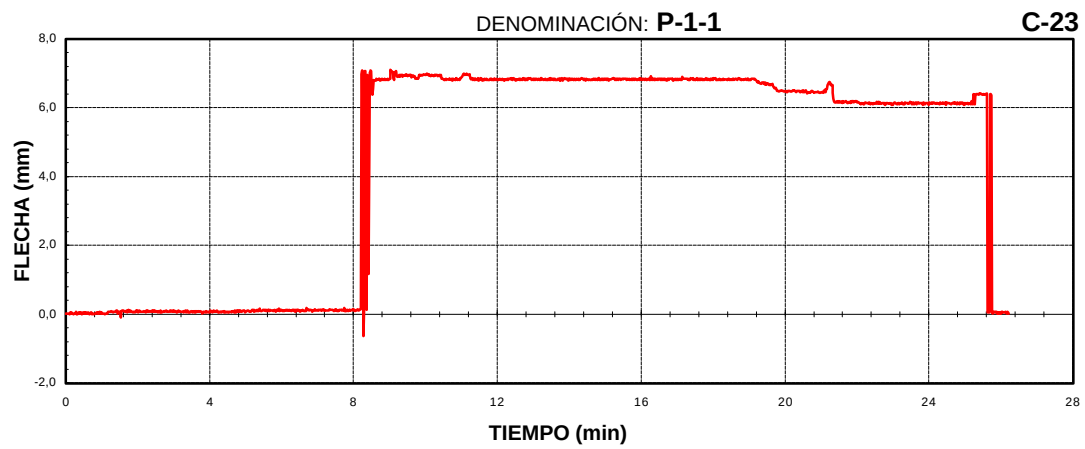
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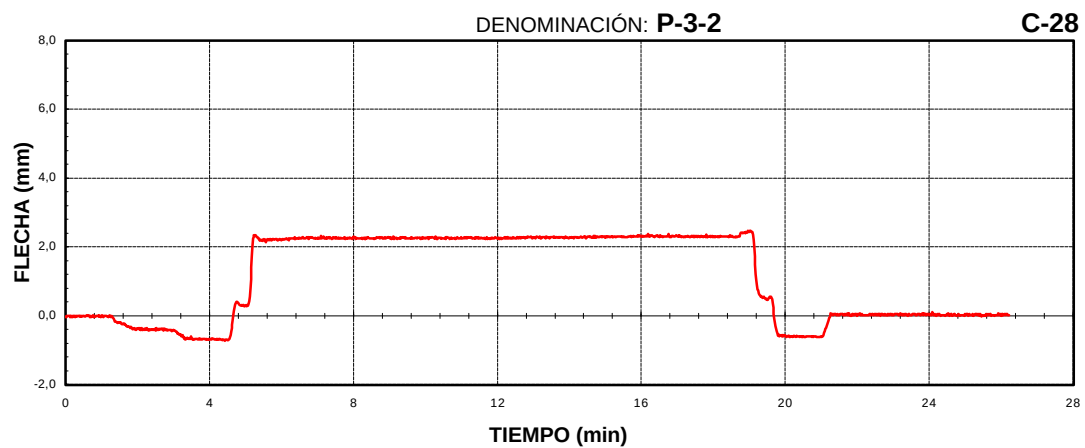
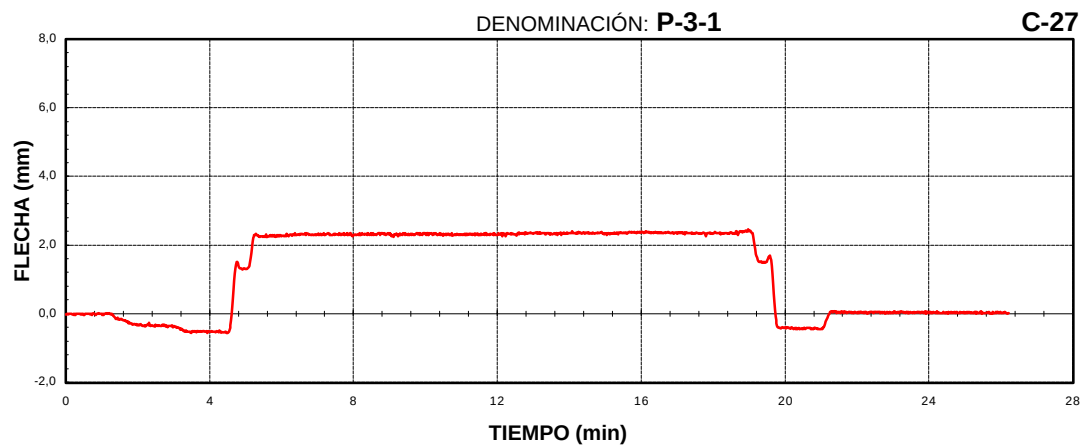
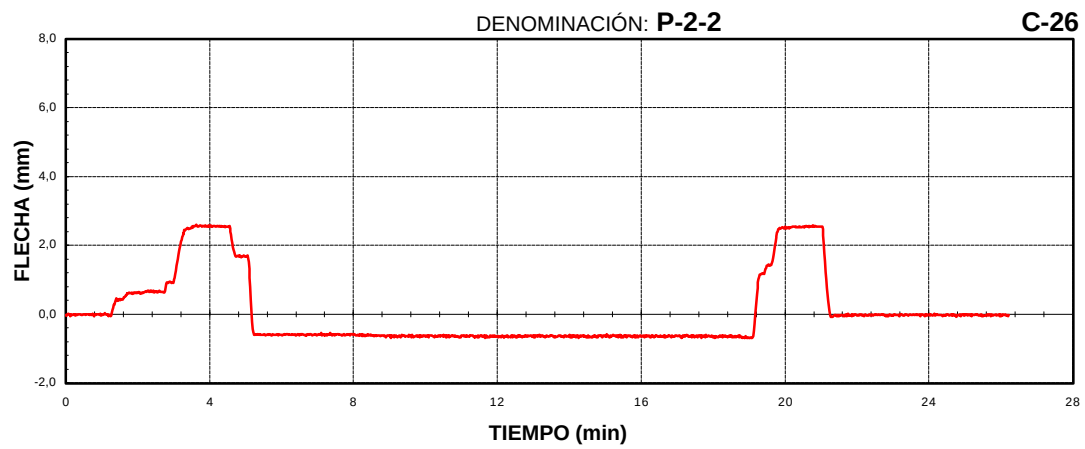


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**HIPÓTESIS 5.**

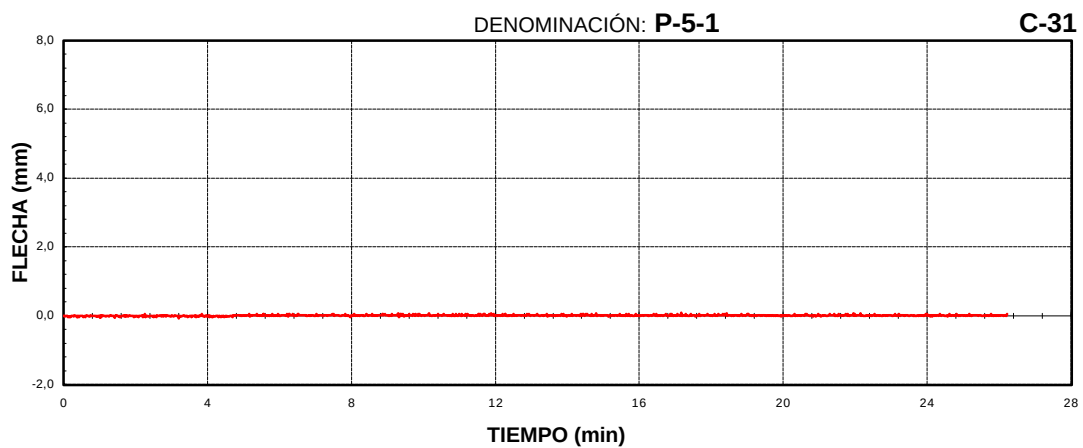
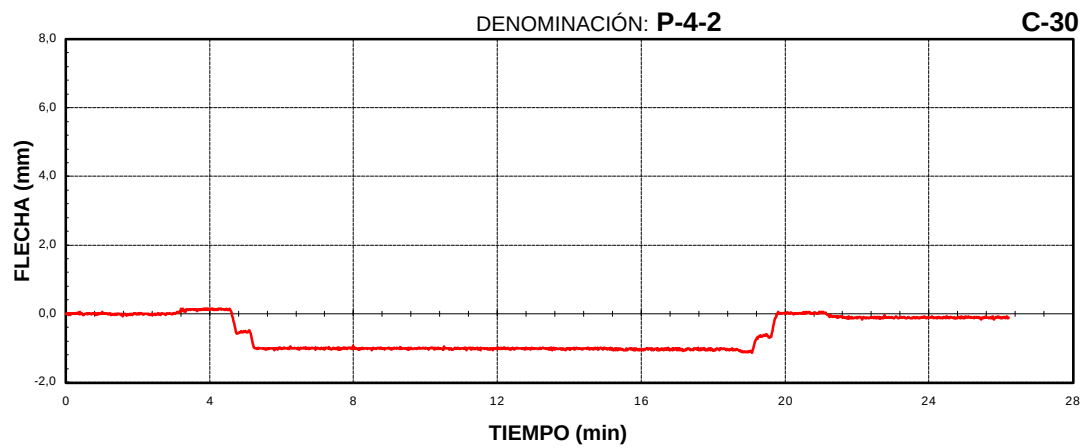
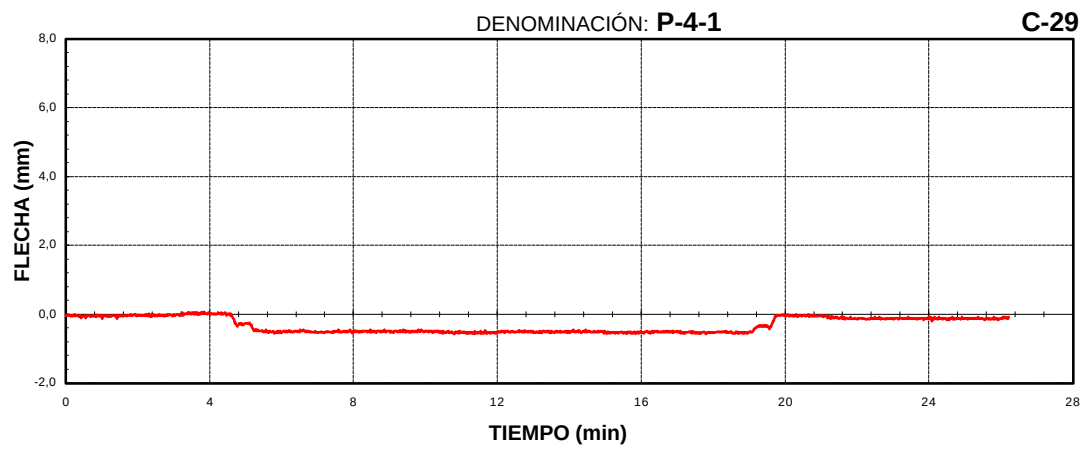




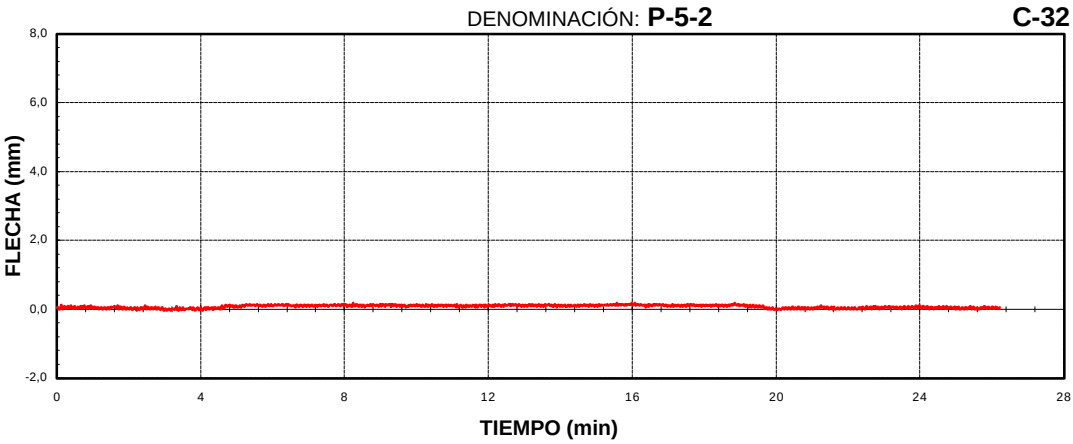
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**HIPÓTESIS 5.**



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**HIPÓTESIS 5.**



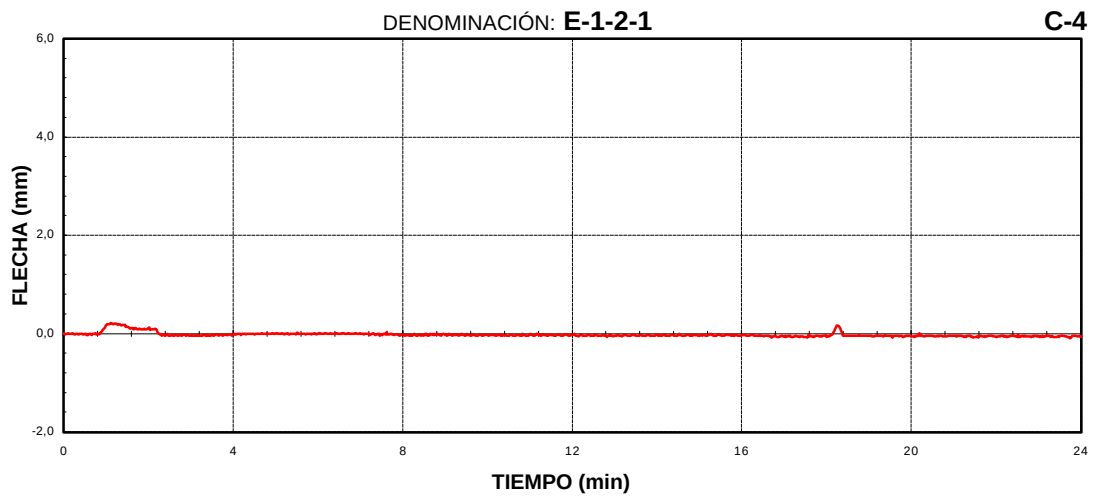
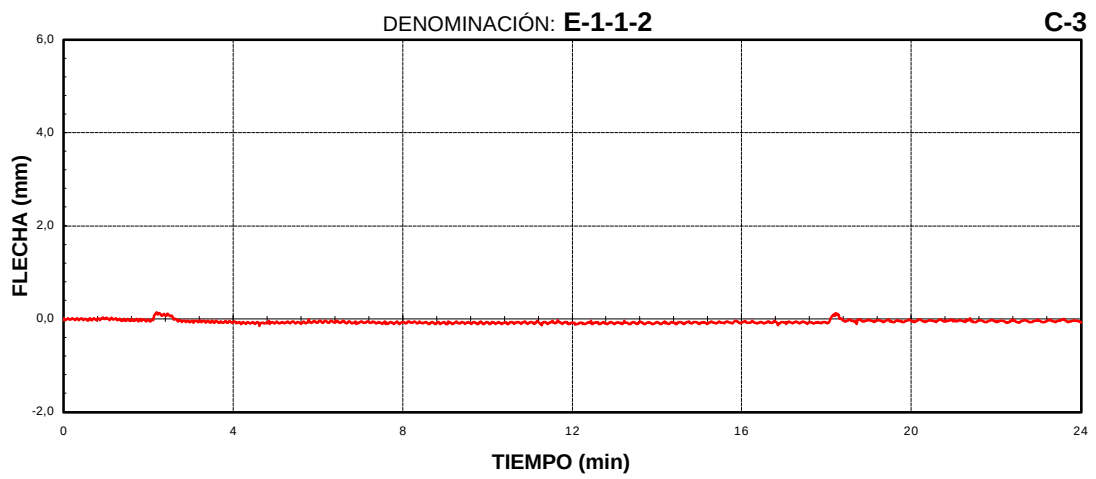
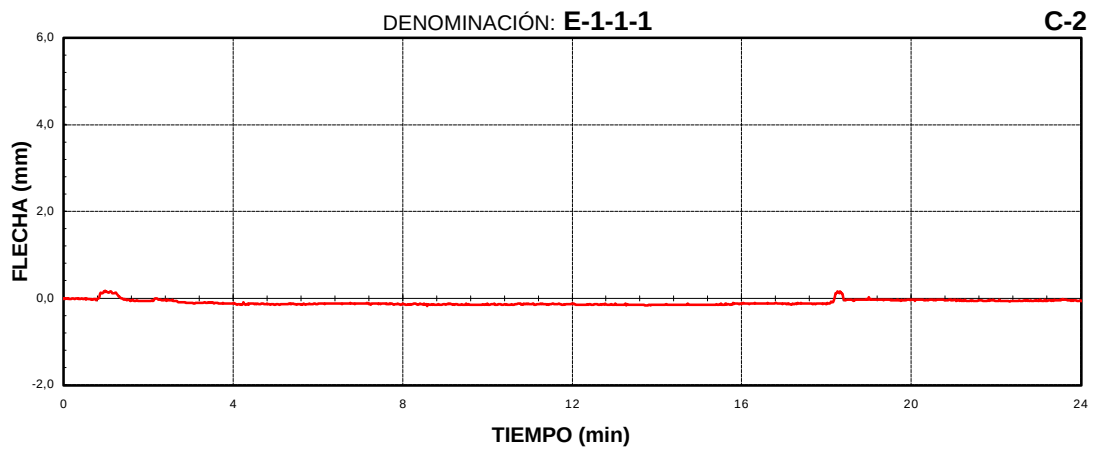
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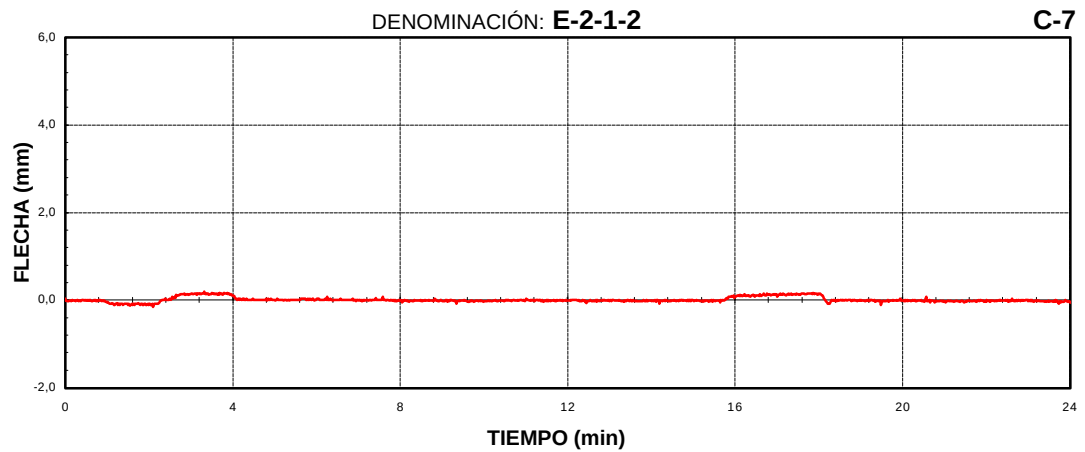
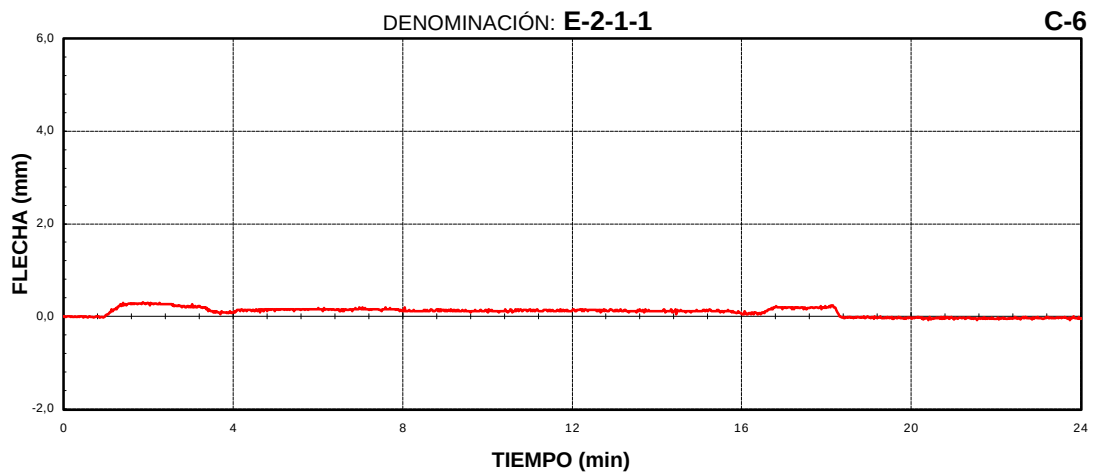
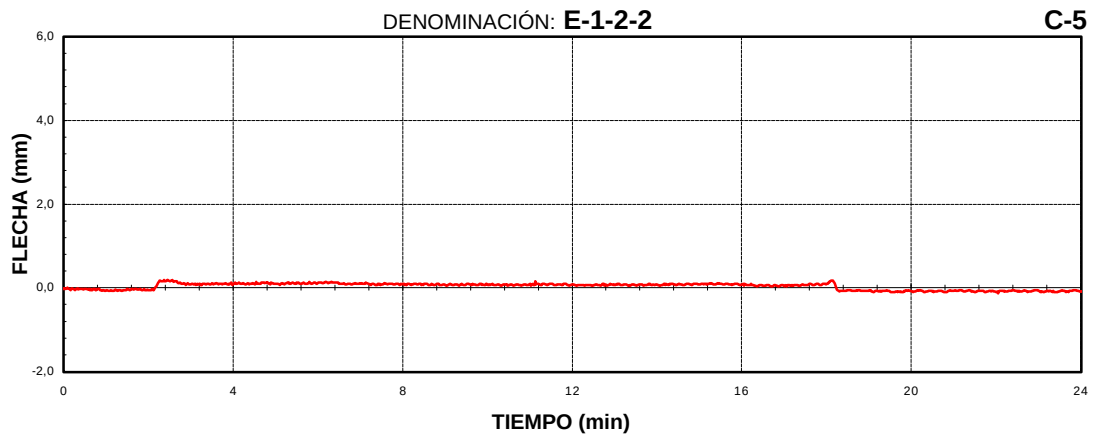
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**ACEQUIA QUINTOS DE EBRO.**

**PRUEBA ESTÁTICA (HIPÓTESIS 6)**

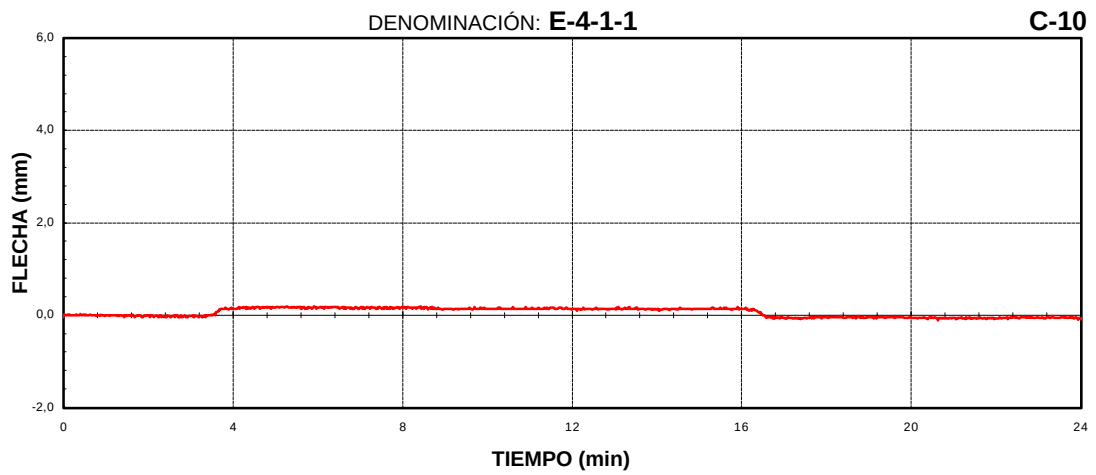
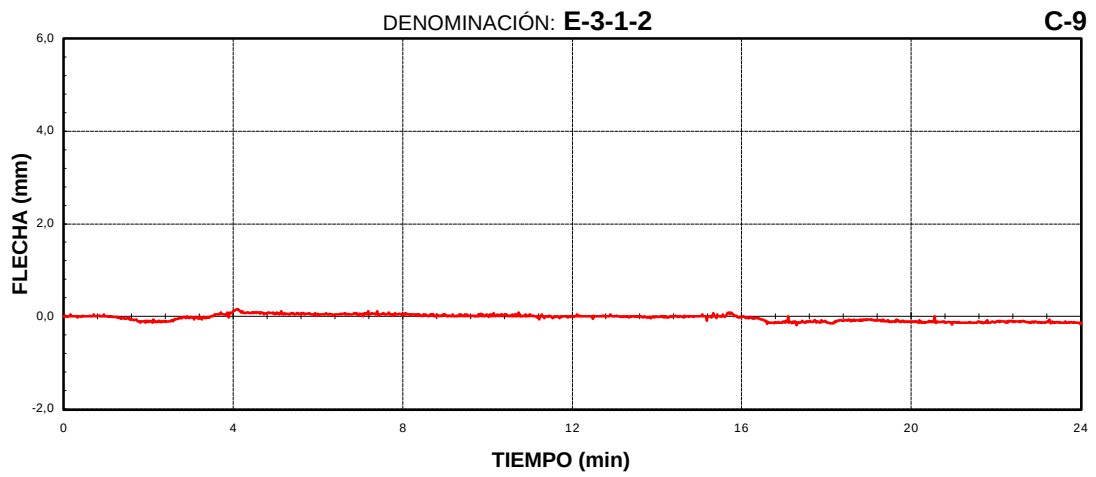
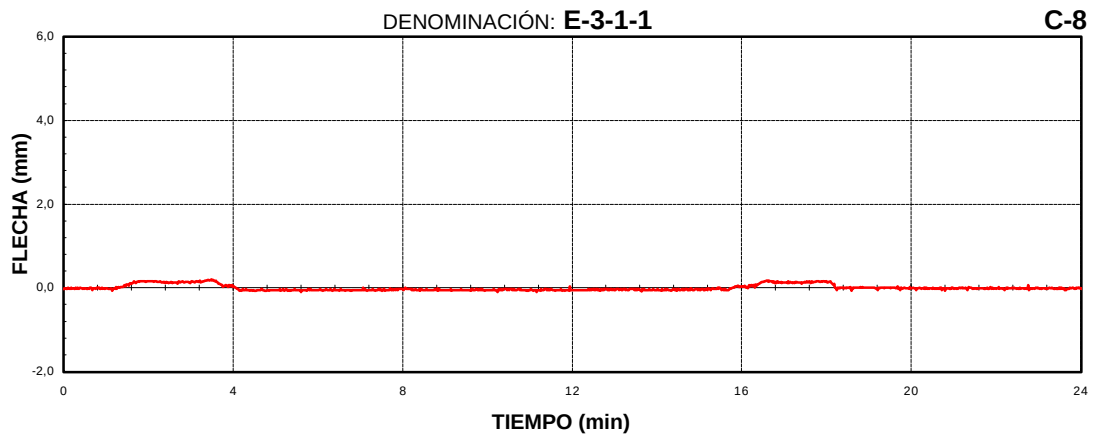
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HIPÓTESIS 6.



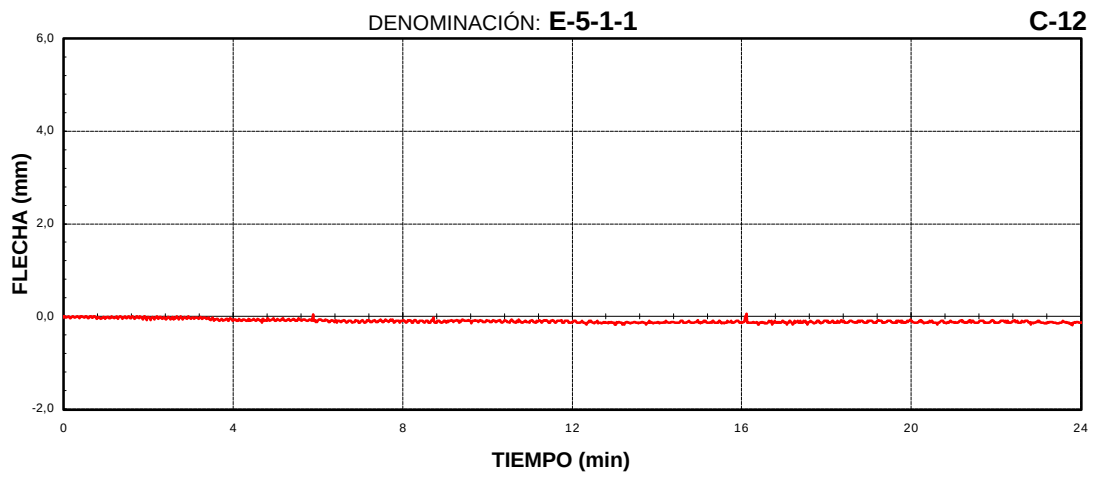
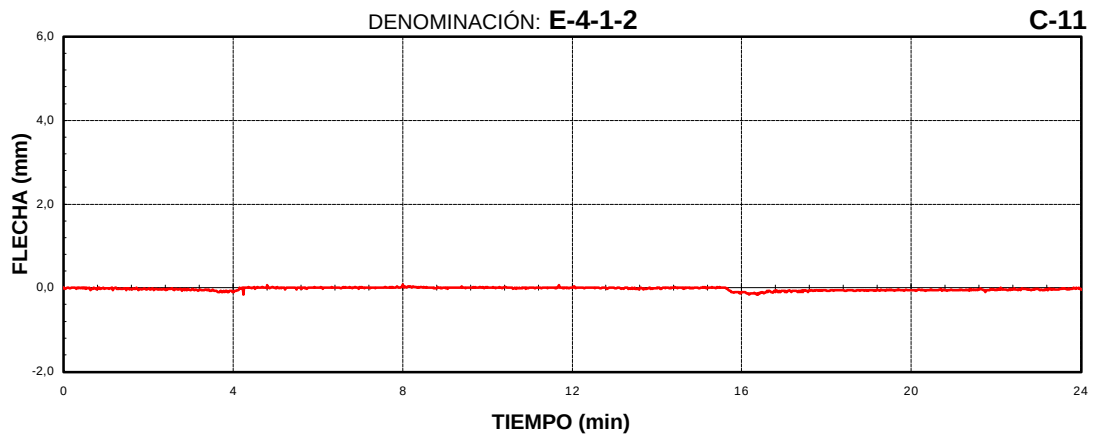
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HIPÓTESIS 6.



GIF VIA AVE  
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HIPÓTESIS 6.

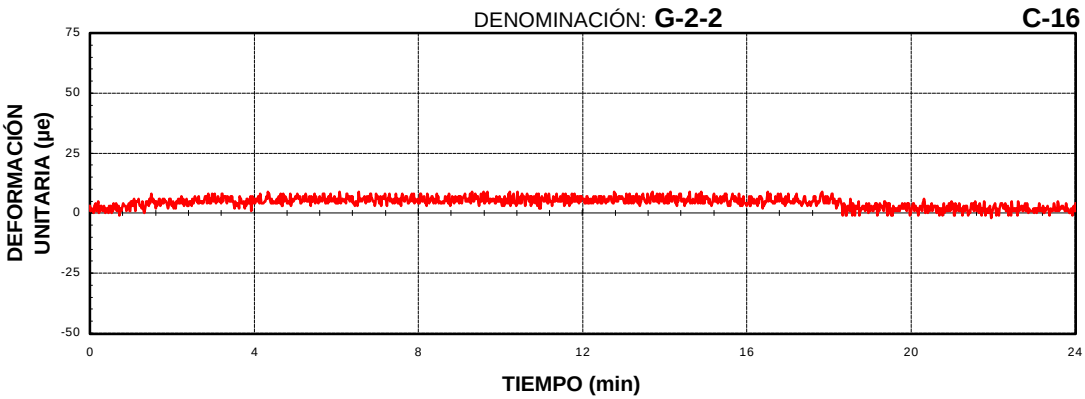
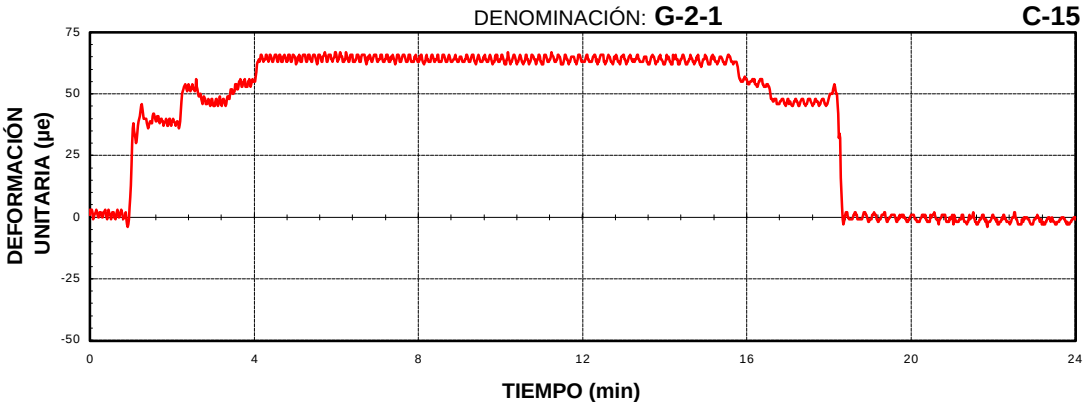
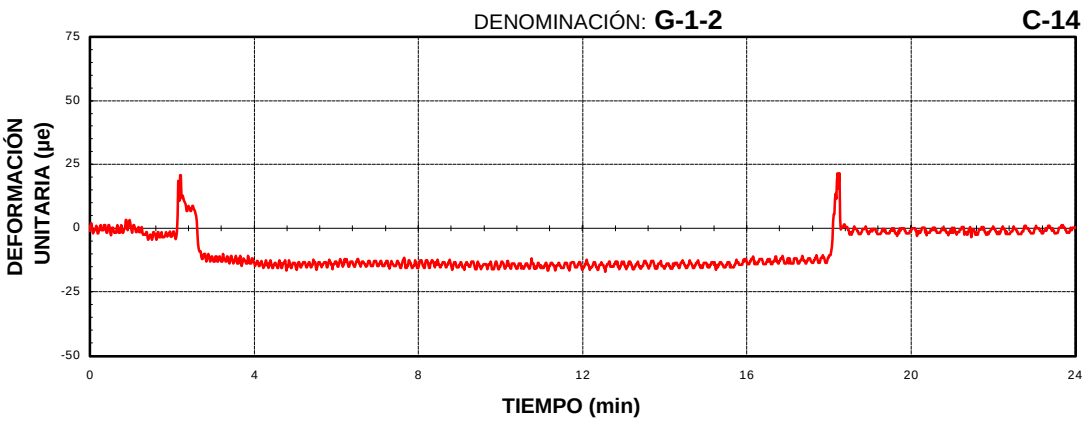
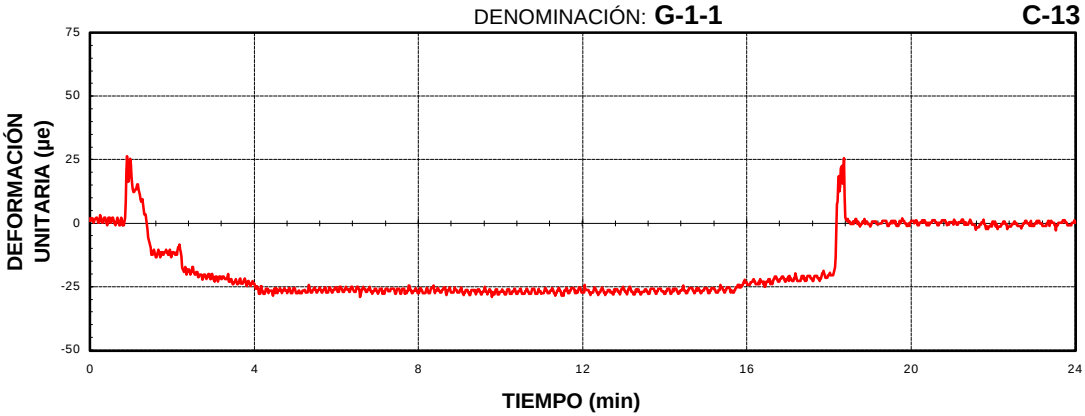


GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 6.

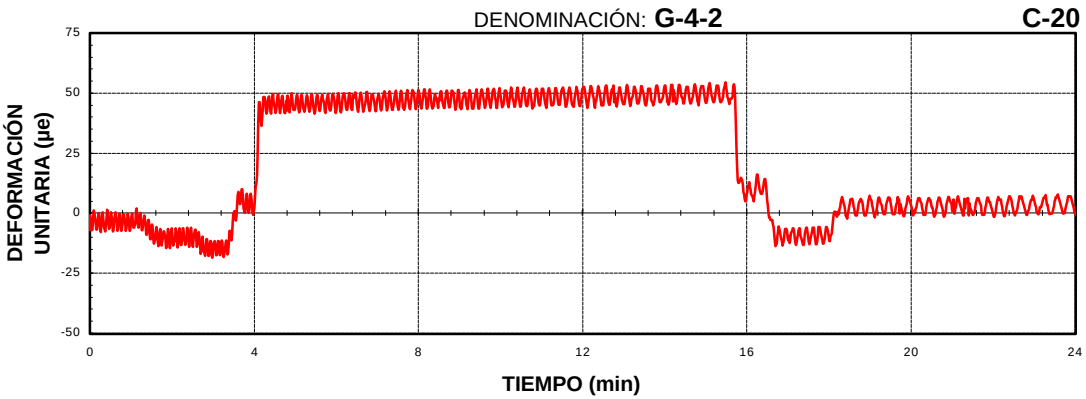
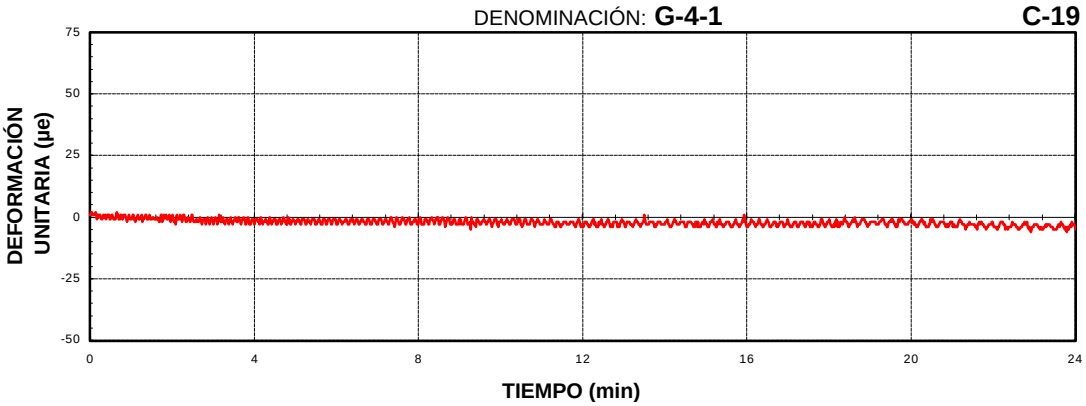
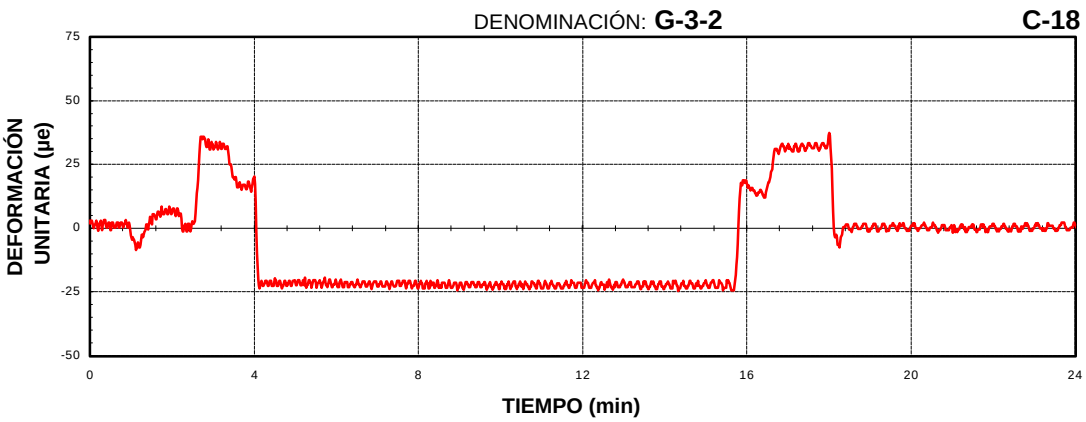
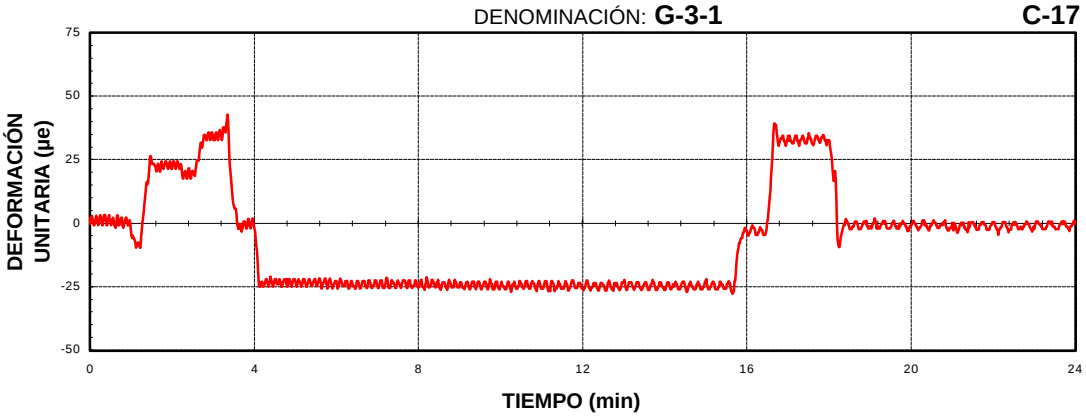




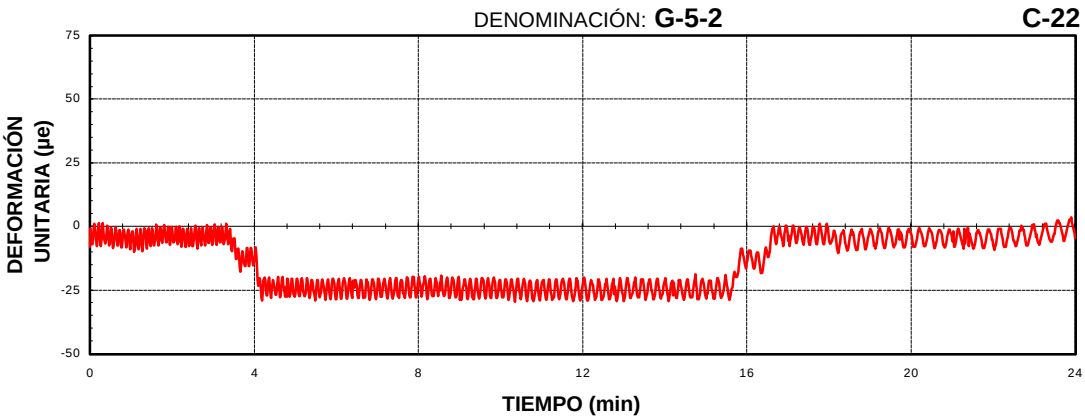
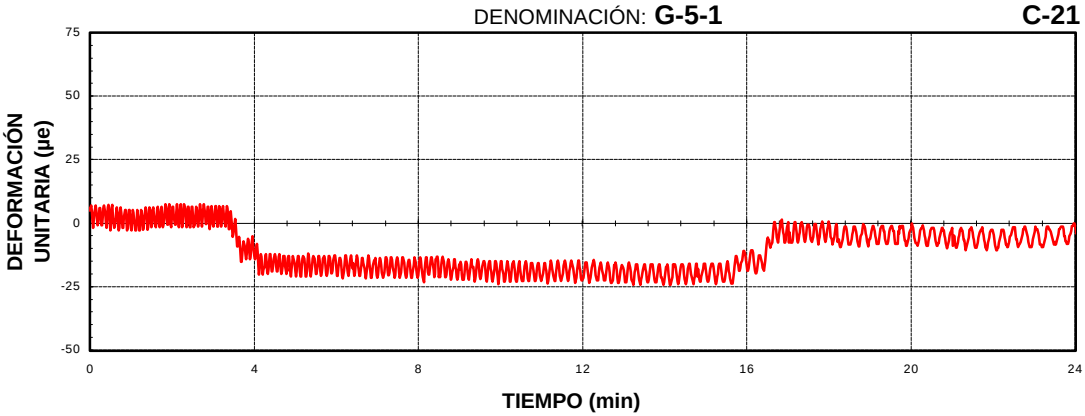
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HIPÓTESIS 6.



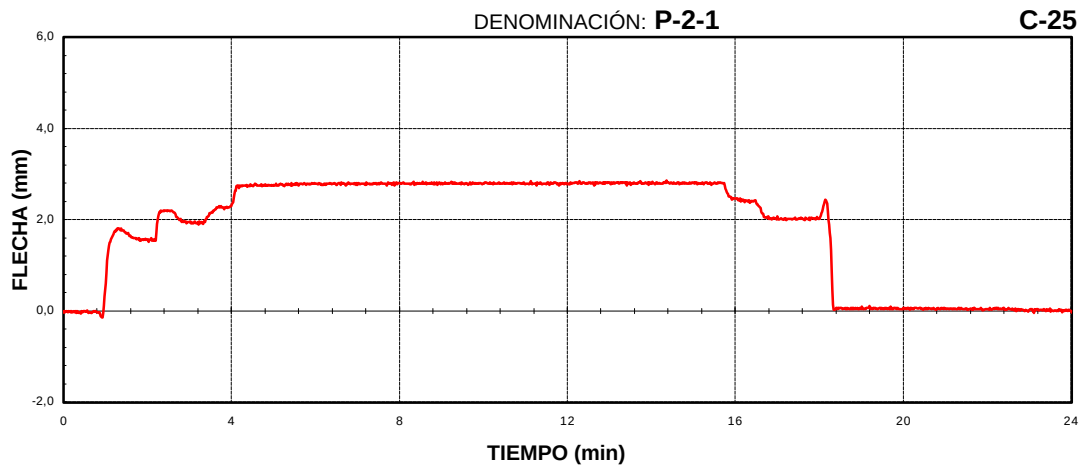
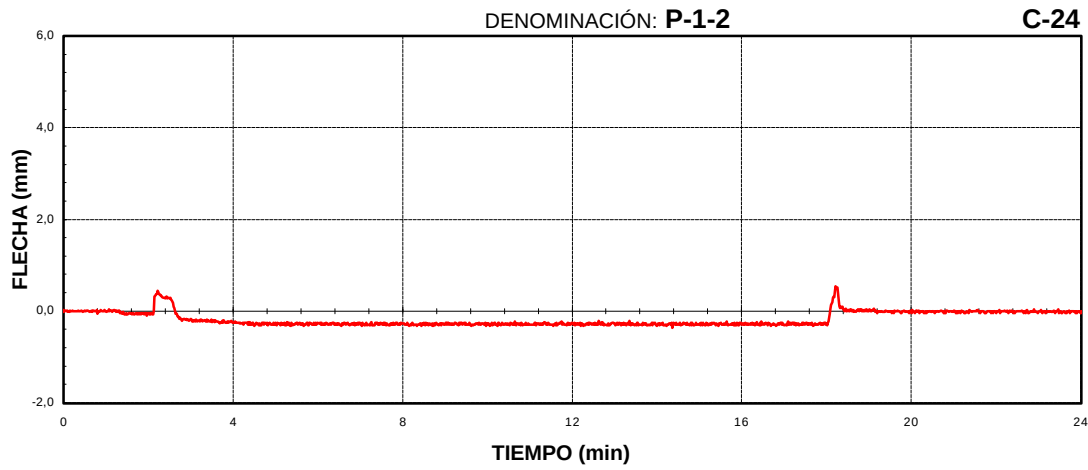
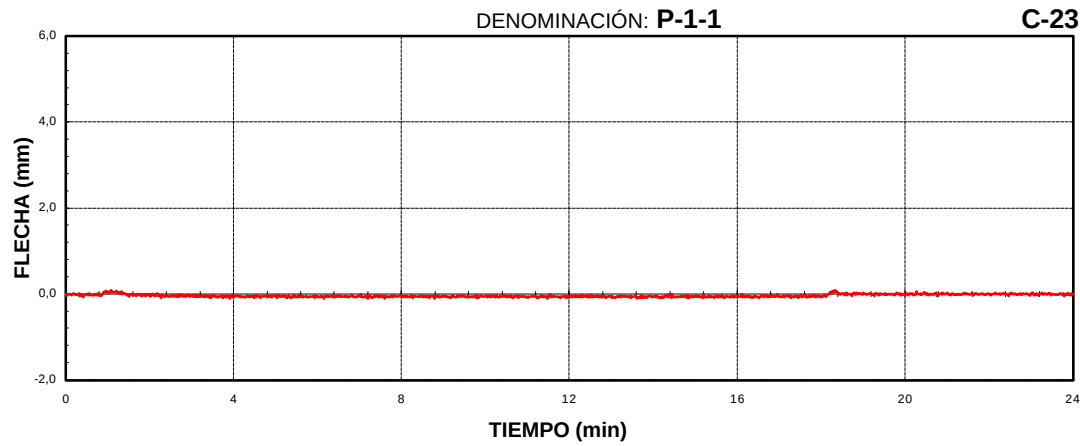
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HIPÓTESIS 6.



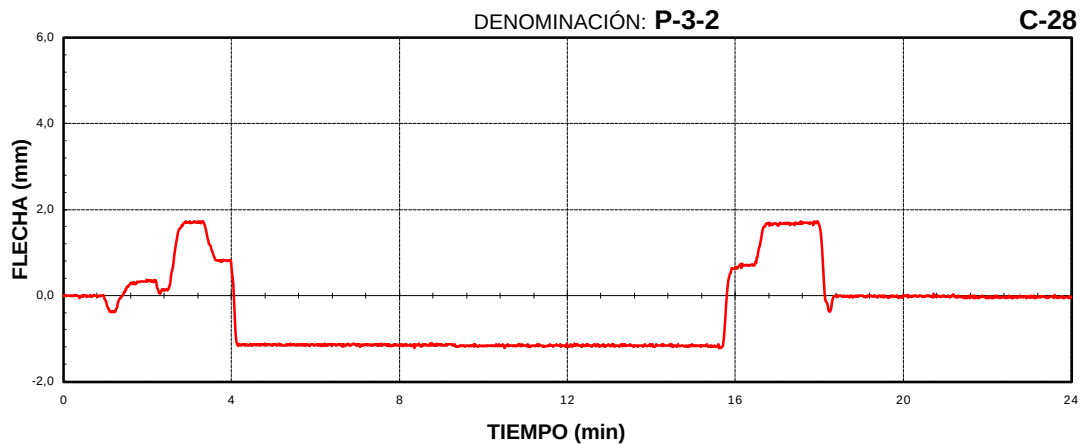
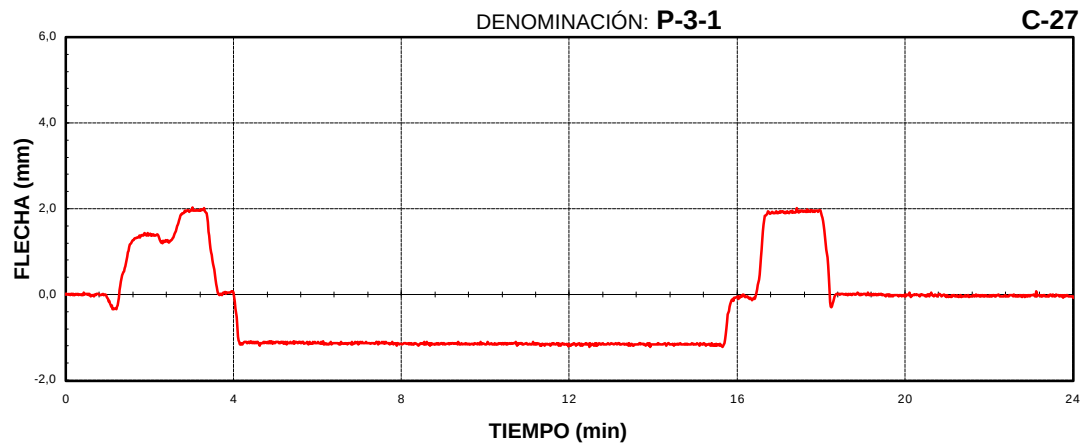
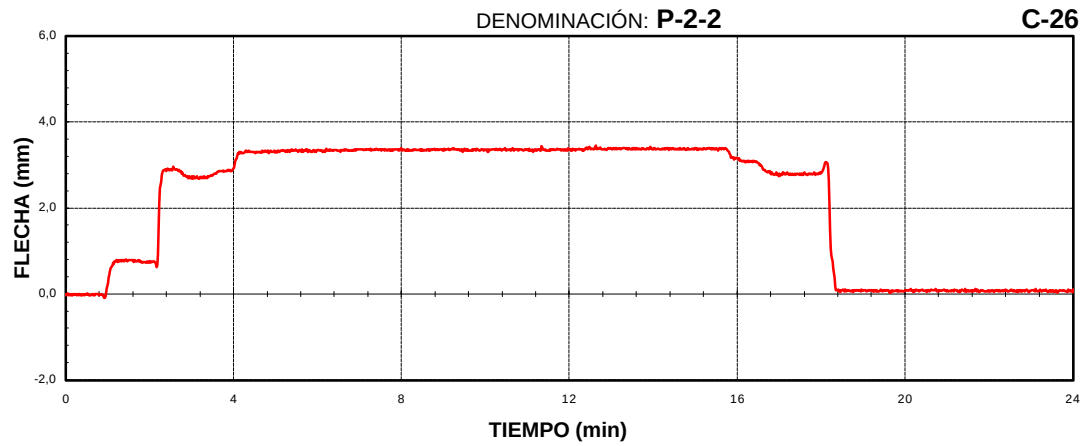
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HIPÓTESIS 6.



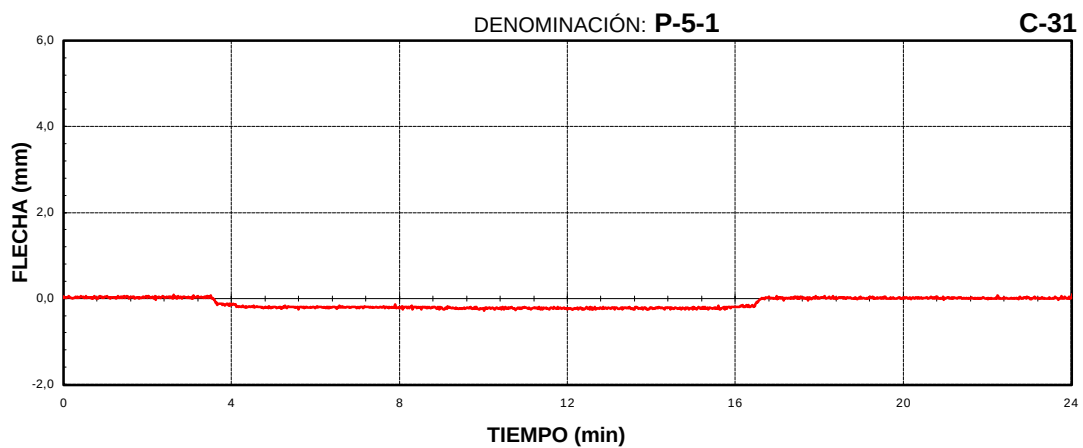
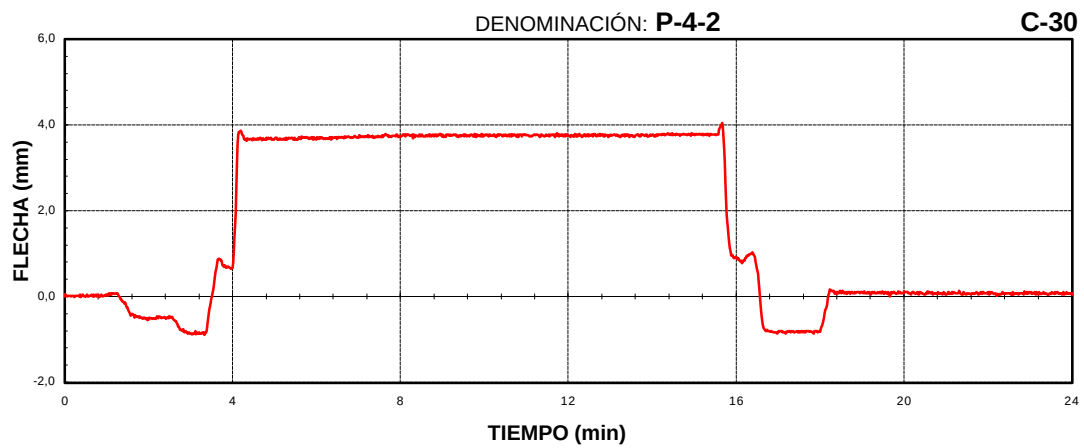
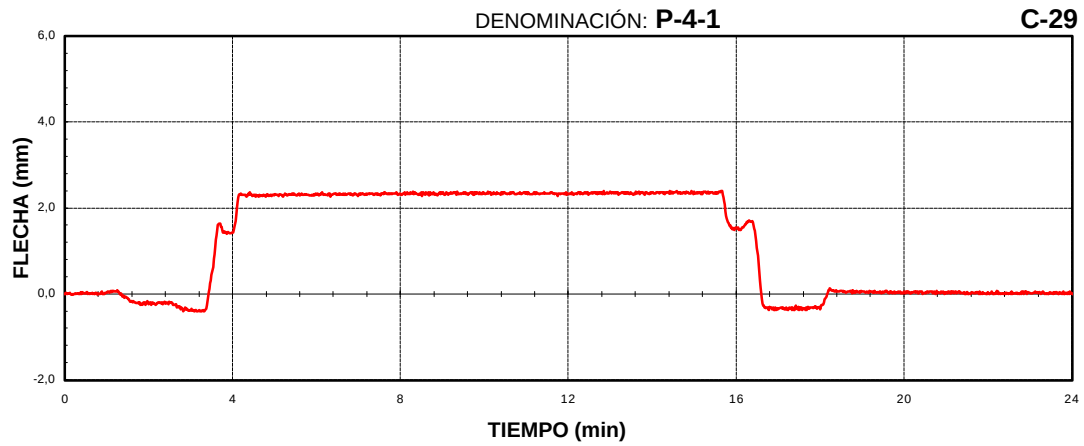
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HIPÓTESIS 6.



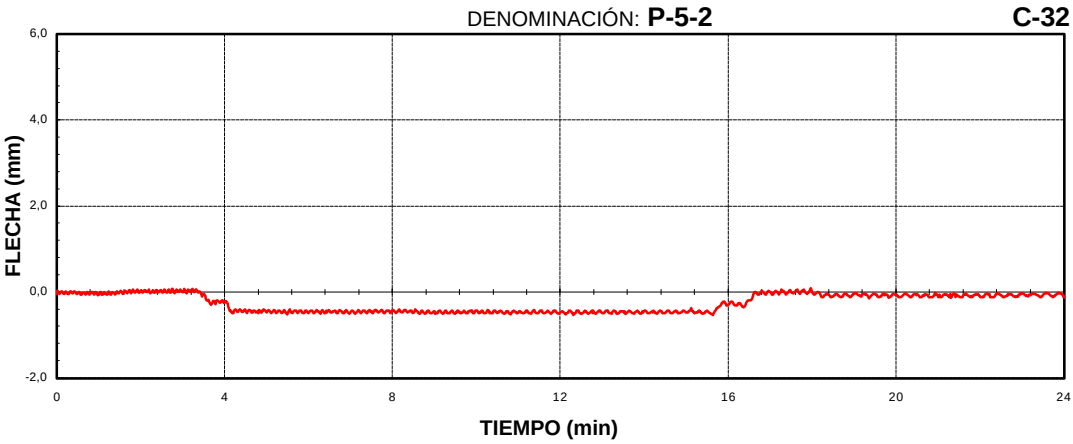
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HIPÓTESIS 6.



**GIF VIA AVE**  
**23VI04. ACEQUIA QUINTOS DE EBRO.**  
**HIPÓTESIS 6.**



GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 6.

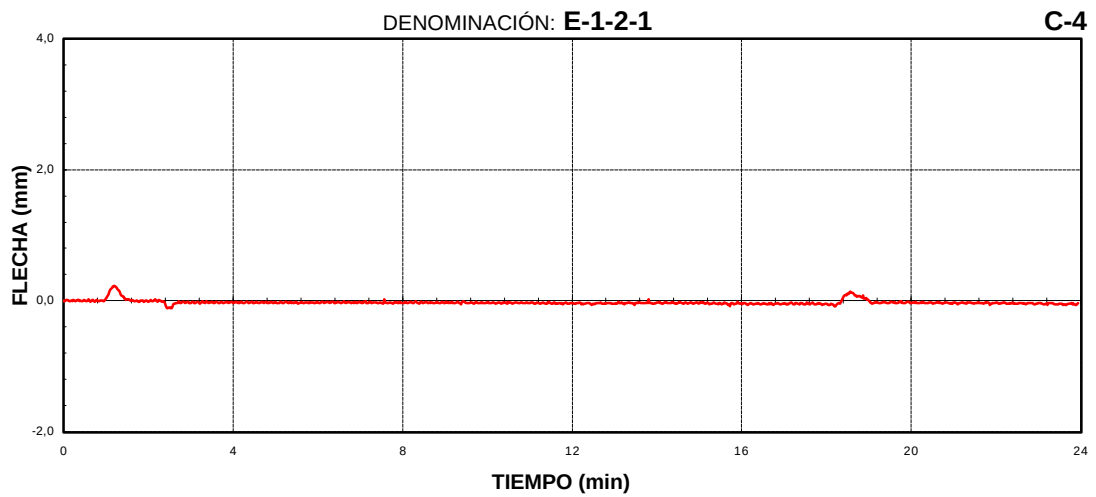
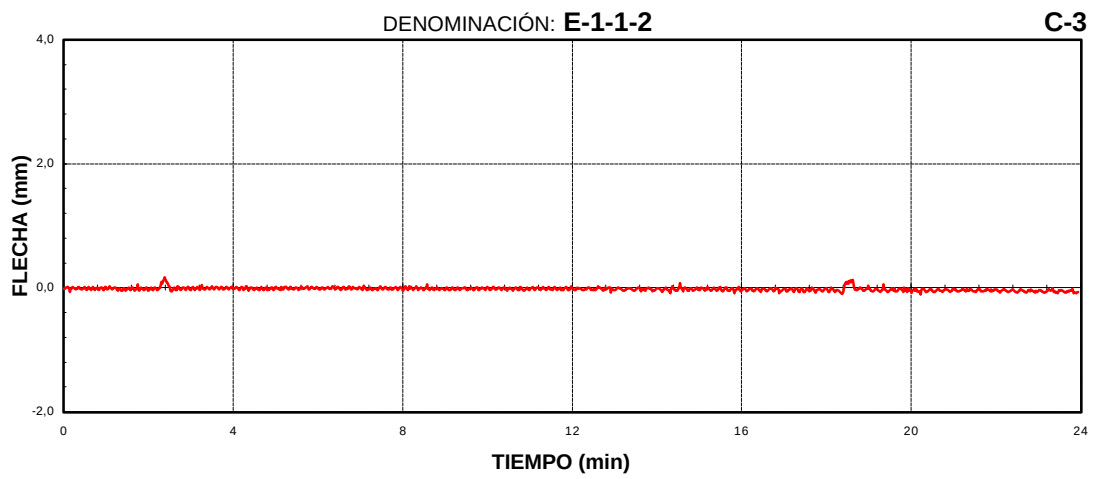
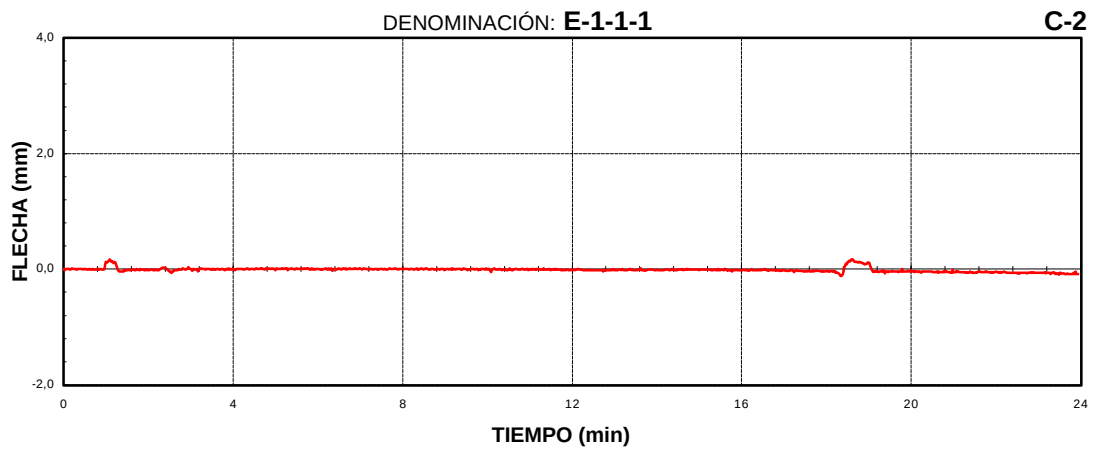


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**23VI04.**  
**ACEQUIA QUINTOS DE EBRO.**

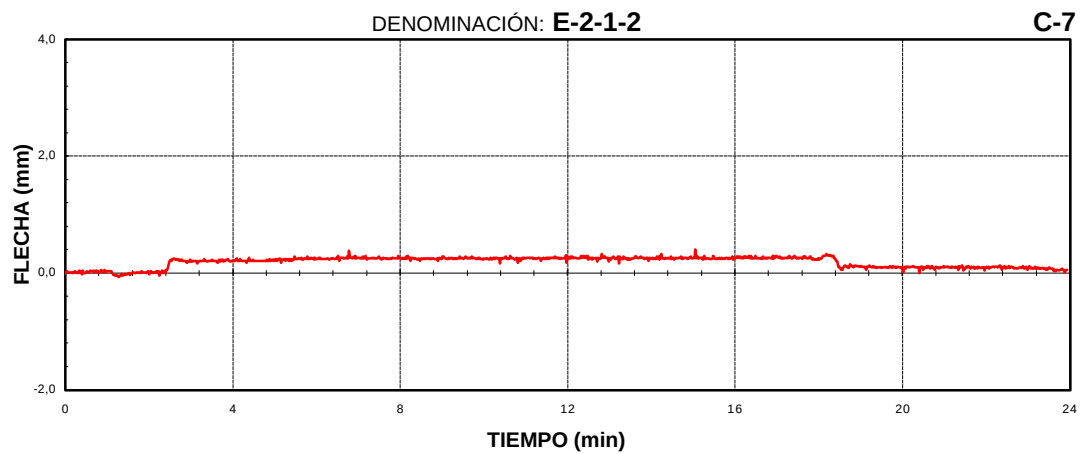
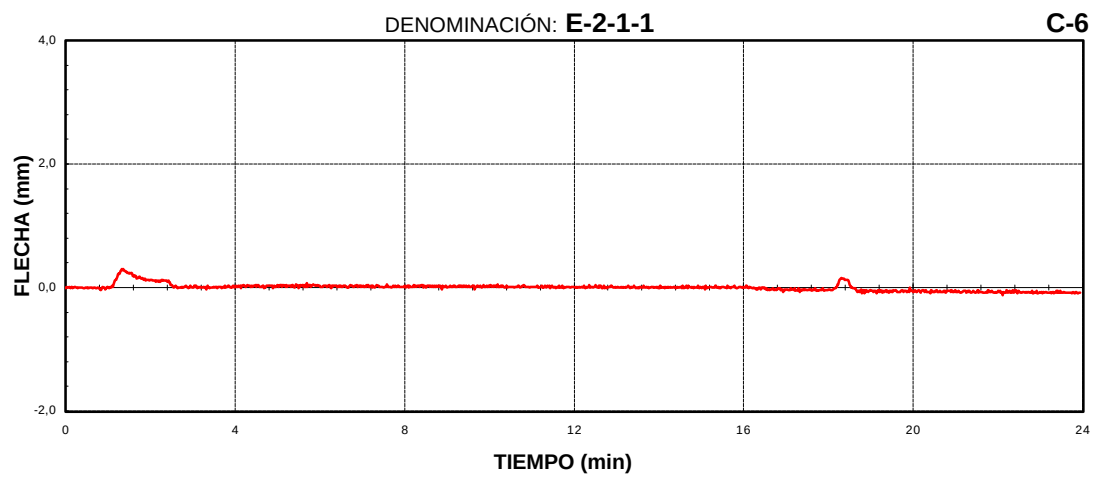
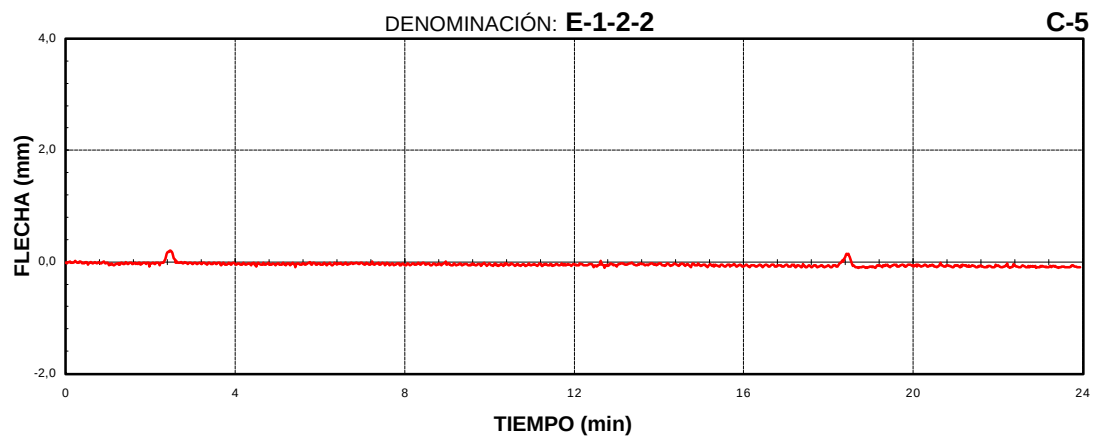
**PRUEBA ESTÁTICA (HIPÓTESIS 7)**



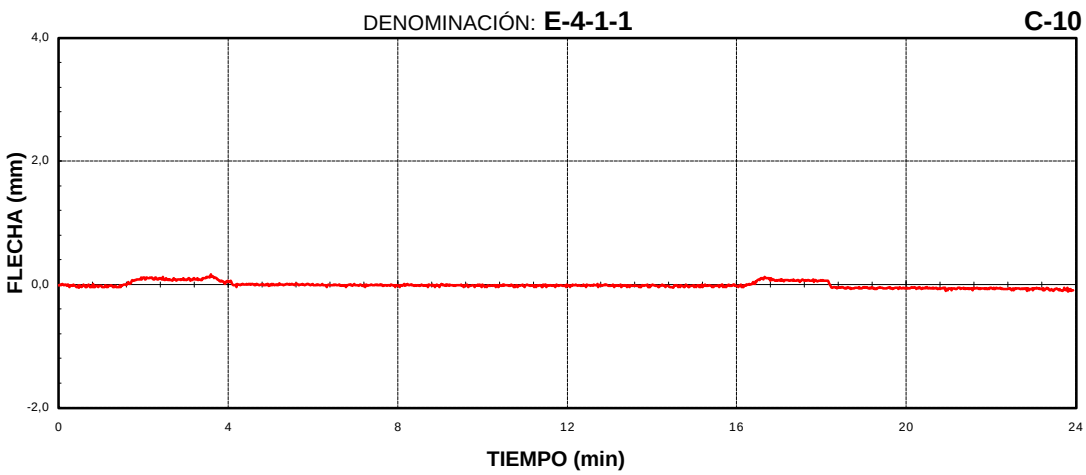
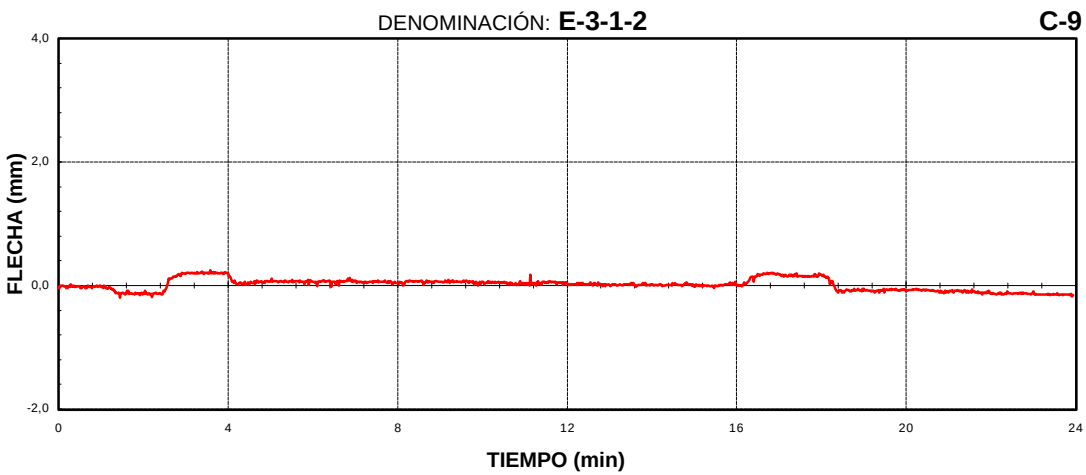
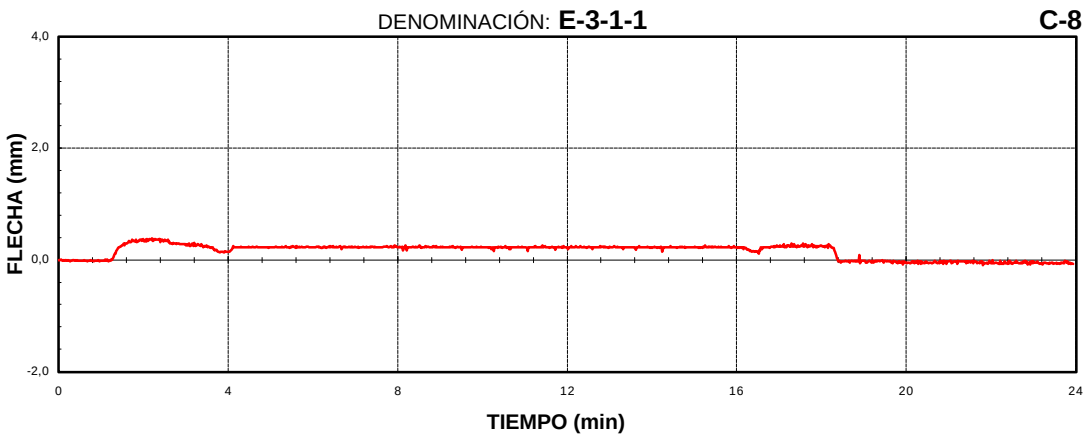
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HIPÓTESIS 7.



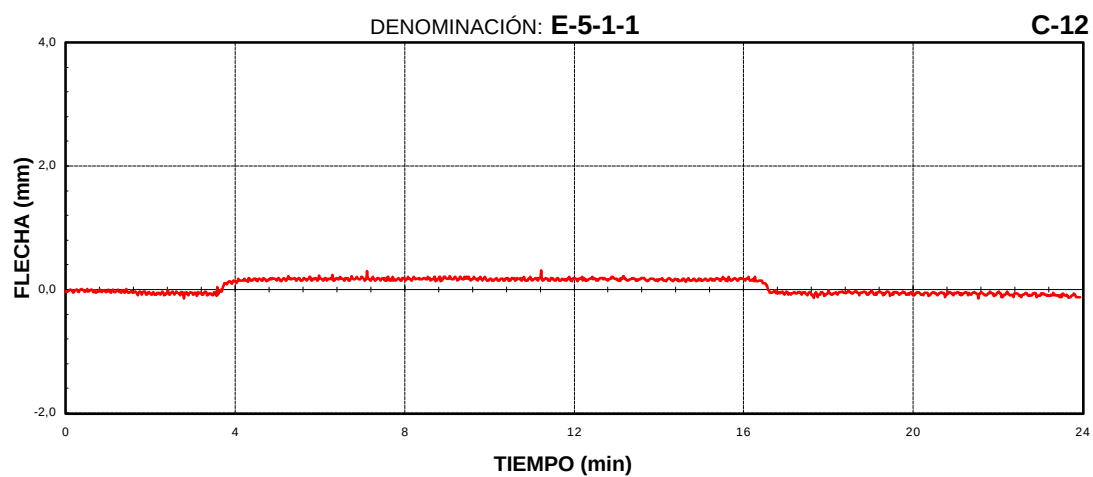
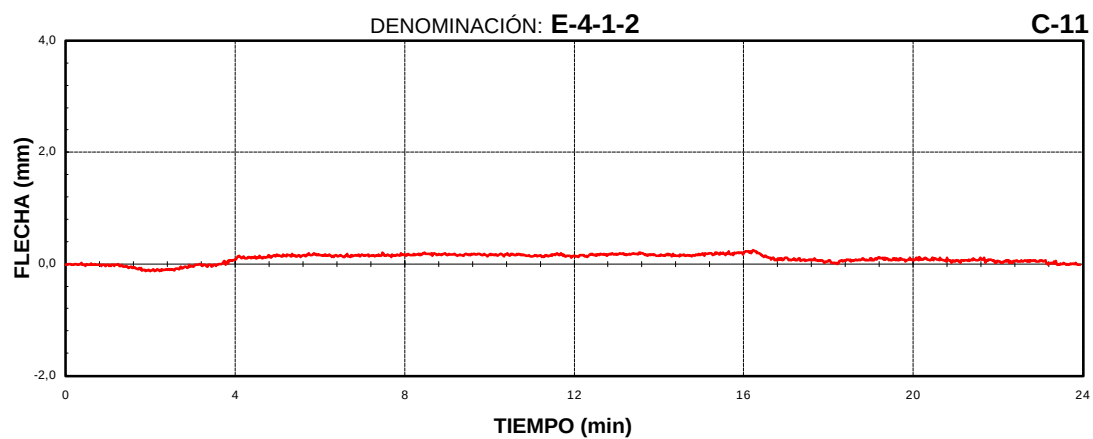
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**23VI04. ACEQUIA QUINTOS DE EBRO.**  
**HIPÓTESIS 7.**



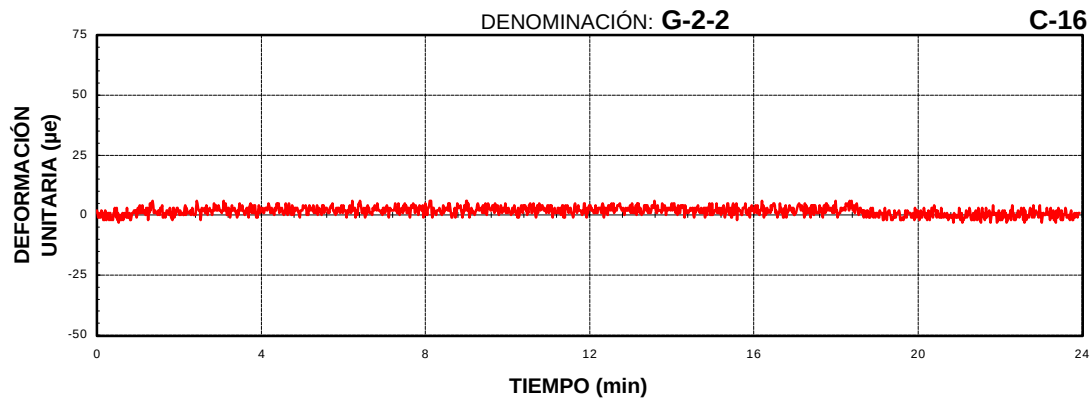
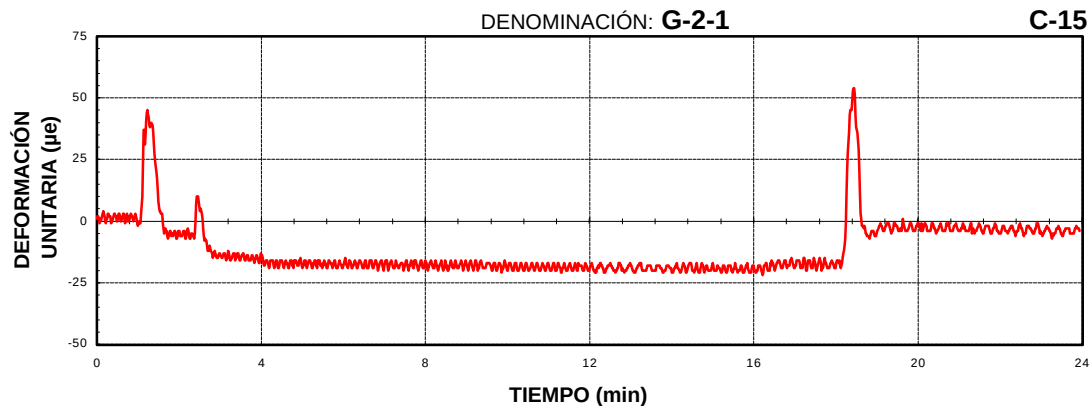
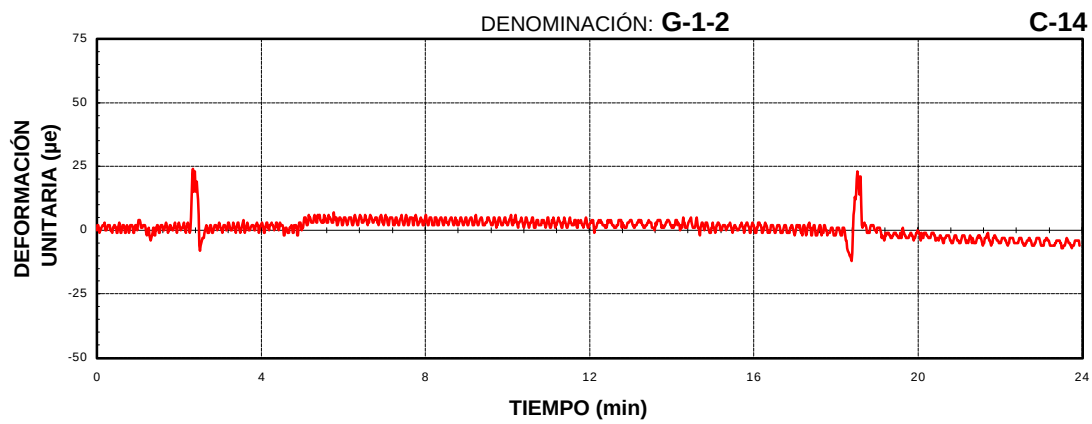
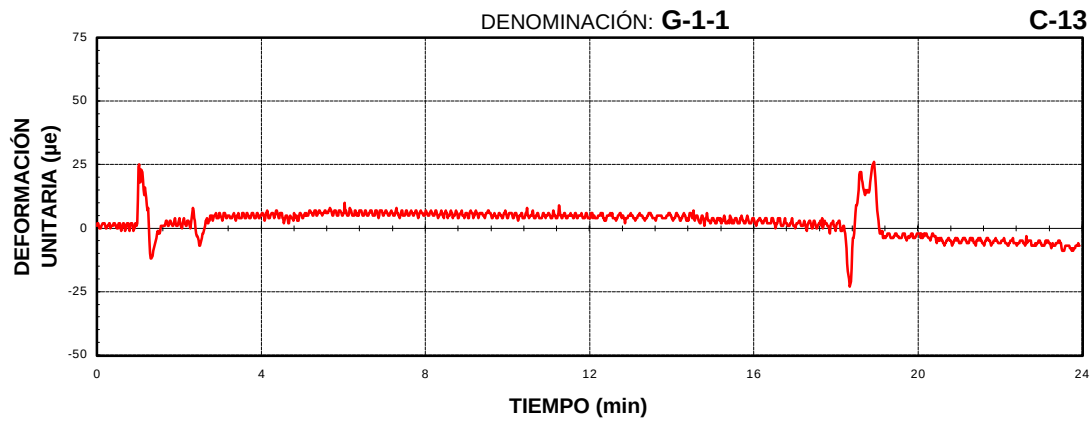
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HIPÓTESIS 7.



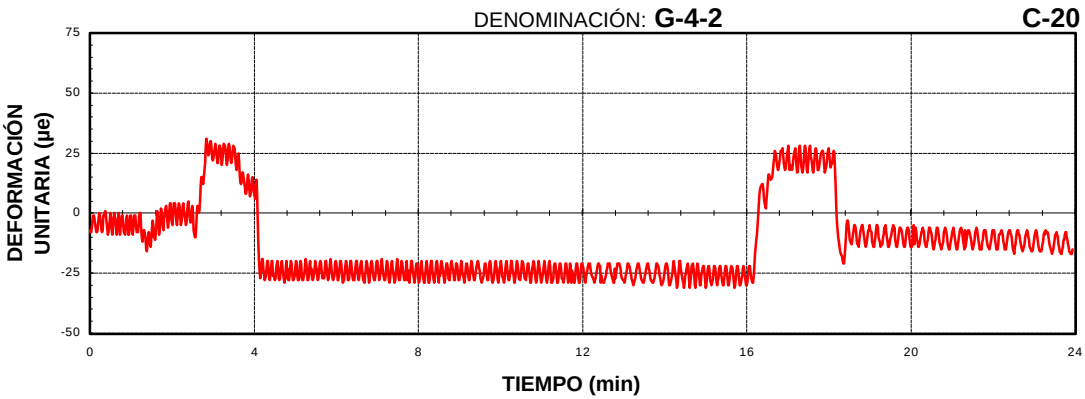
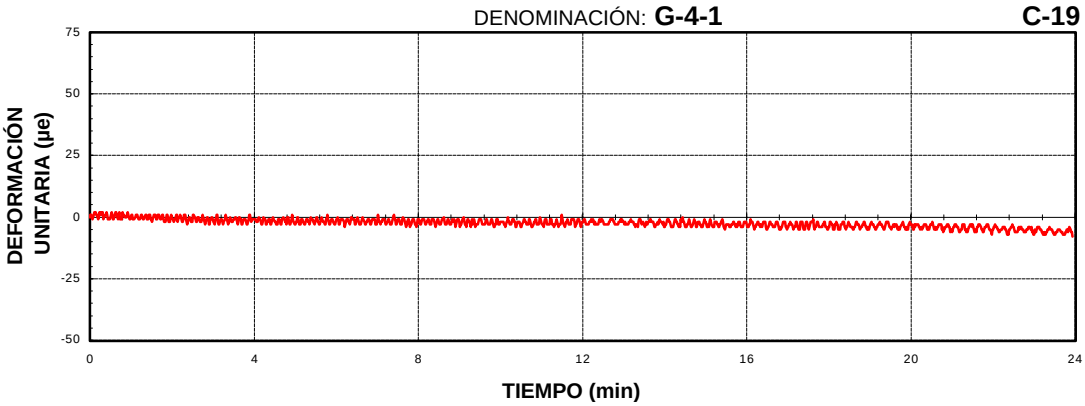
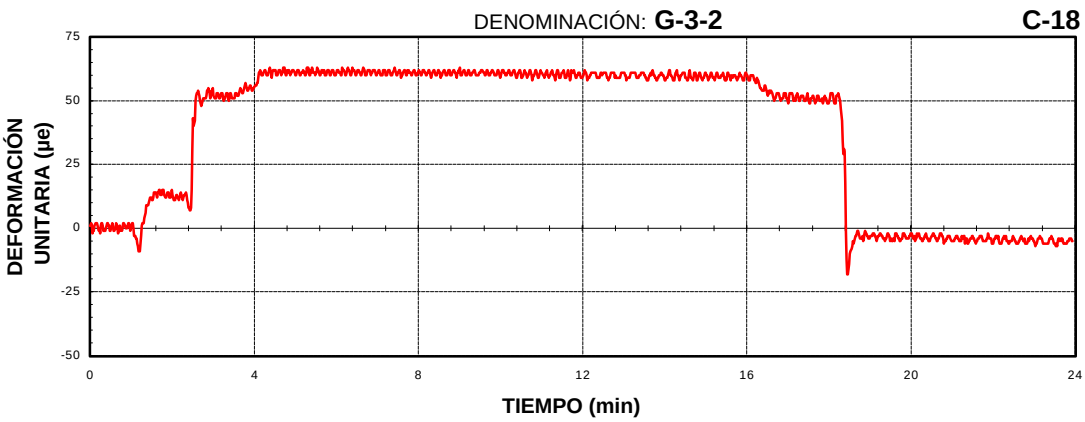
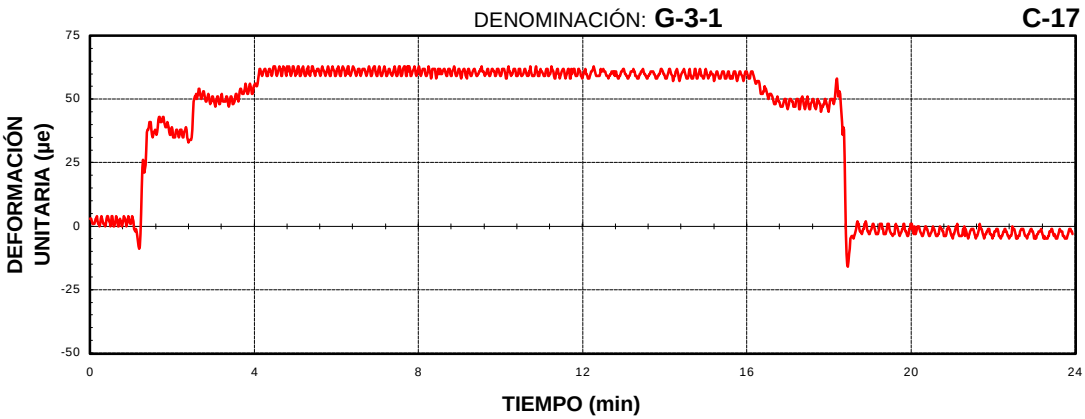
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**HIPÓTESIS 7.**



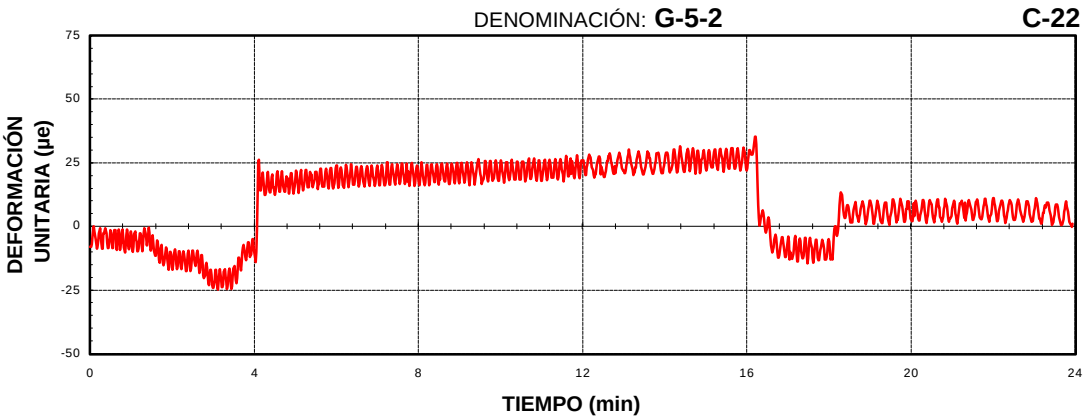
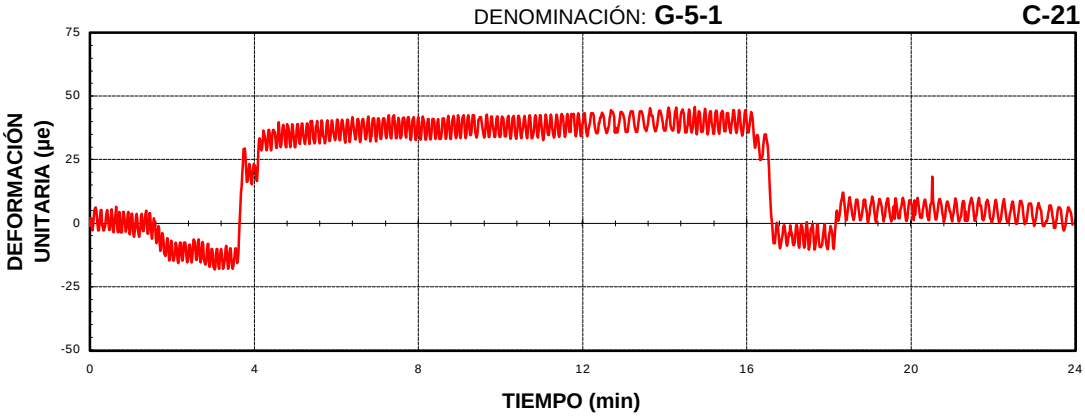
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HIPÓTESIS 7.



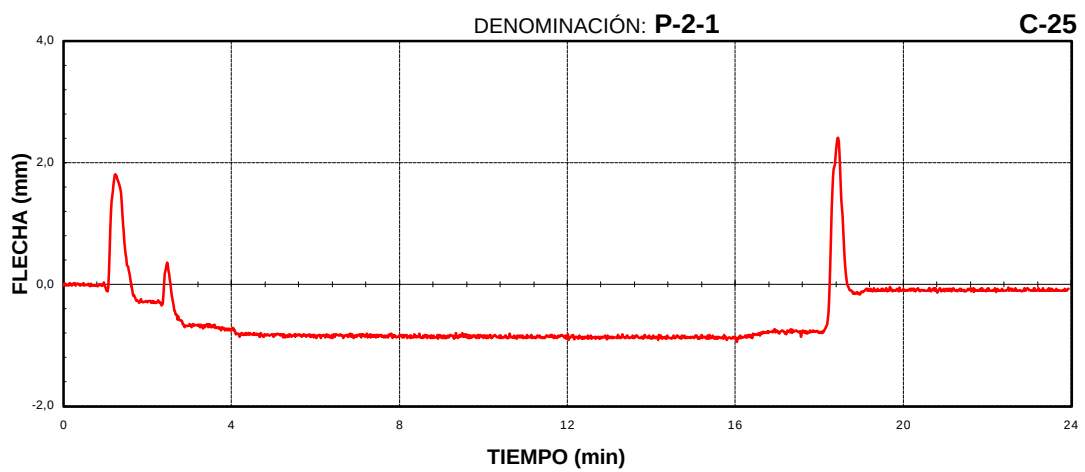
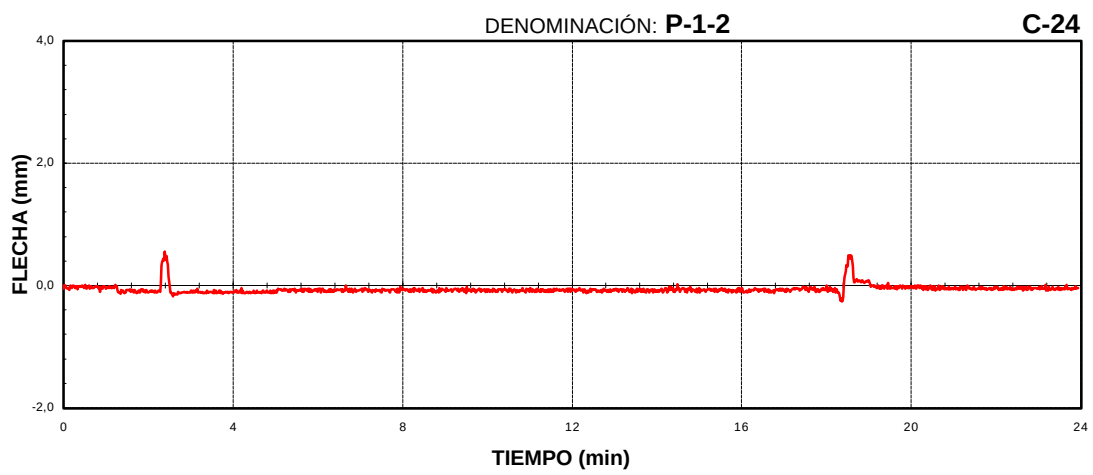
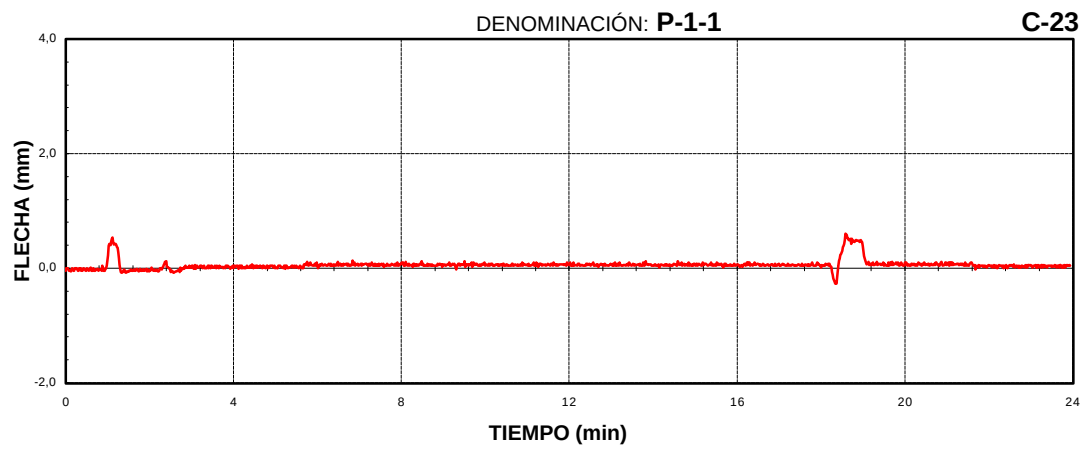
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 7.



GIF VIA AVE  
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HIPÓTESIS 7.

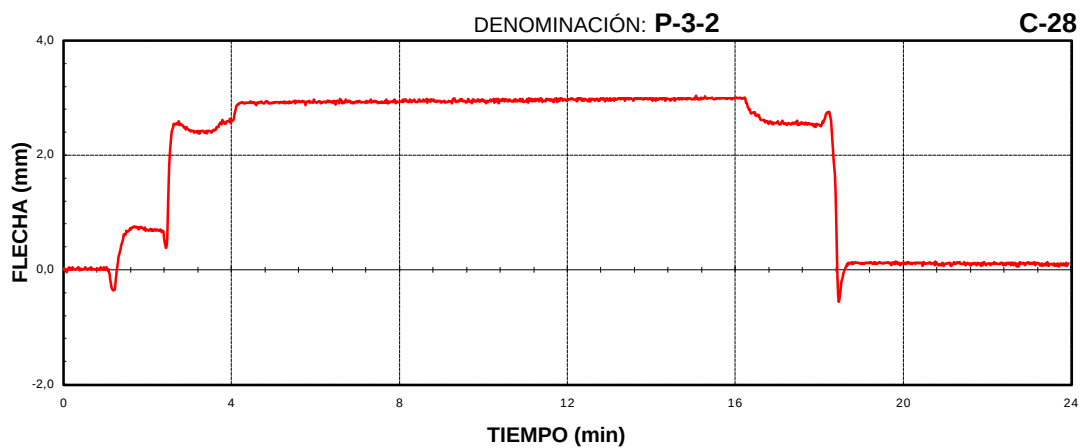
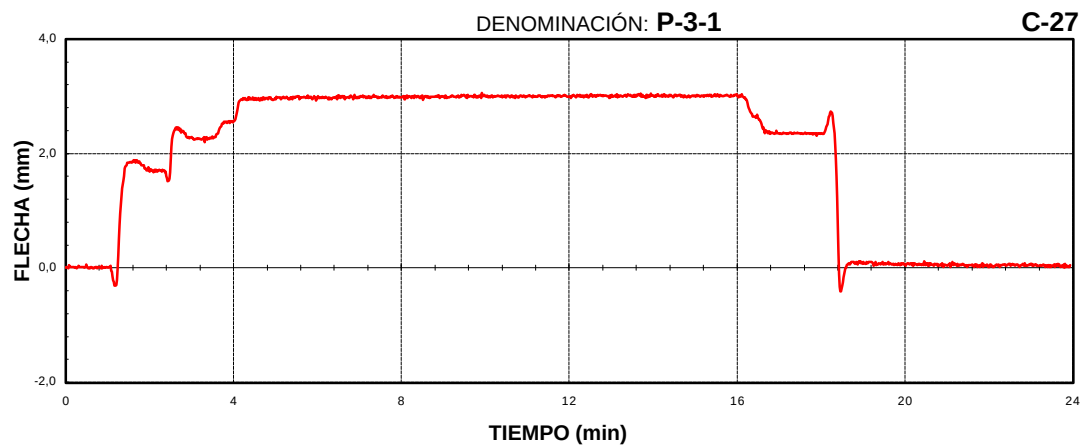
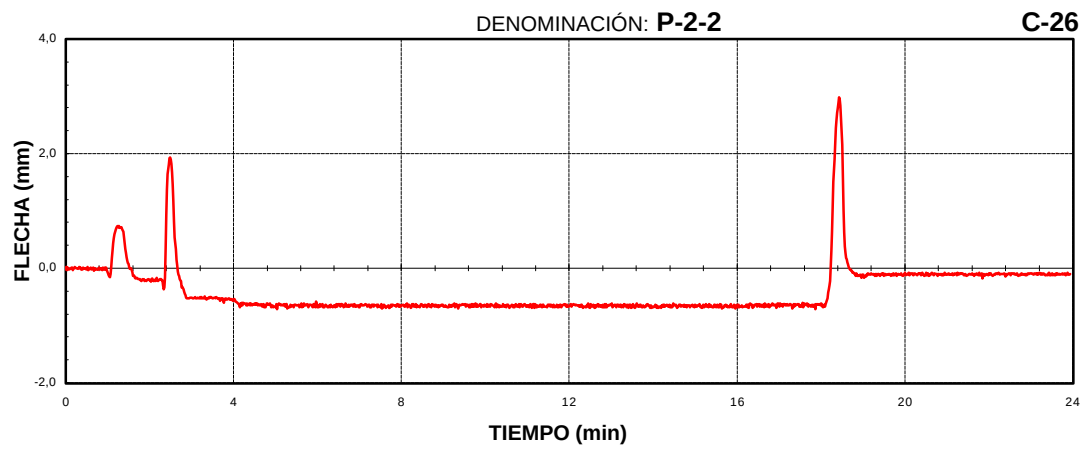


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HIPÓTESIS 7.

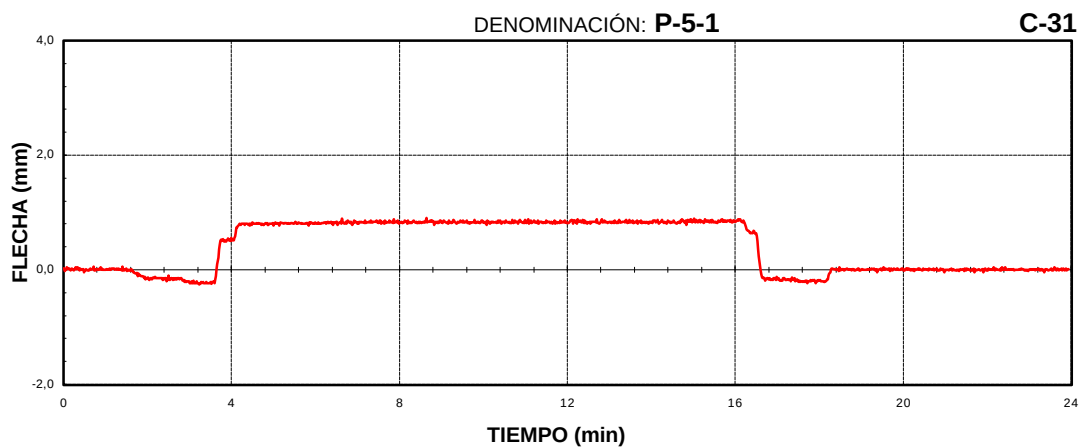
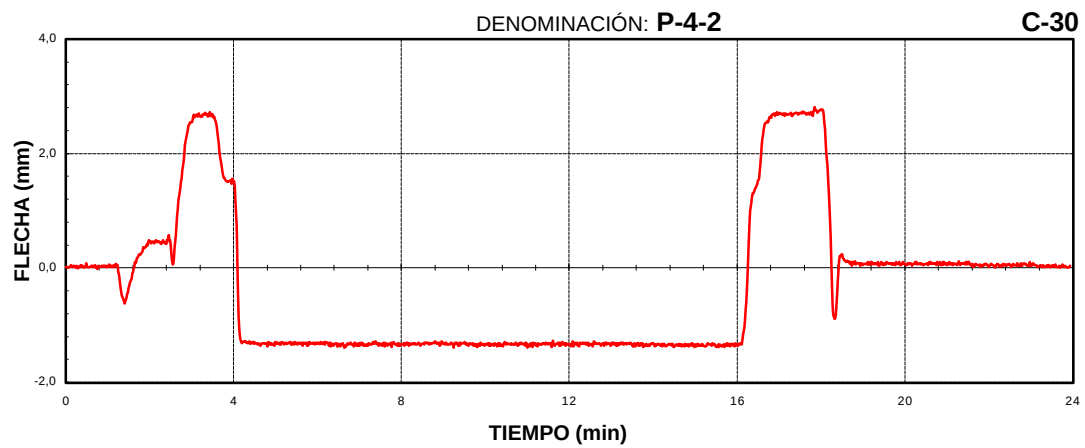
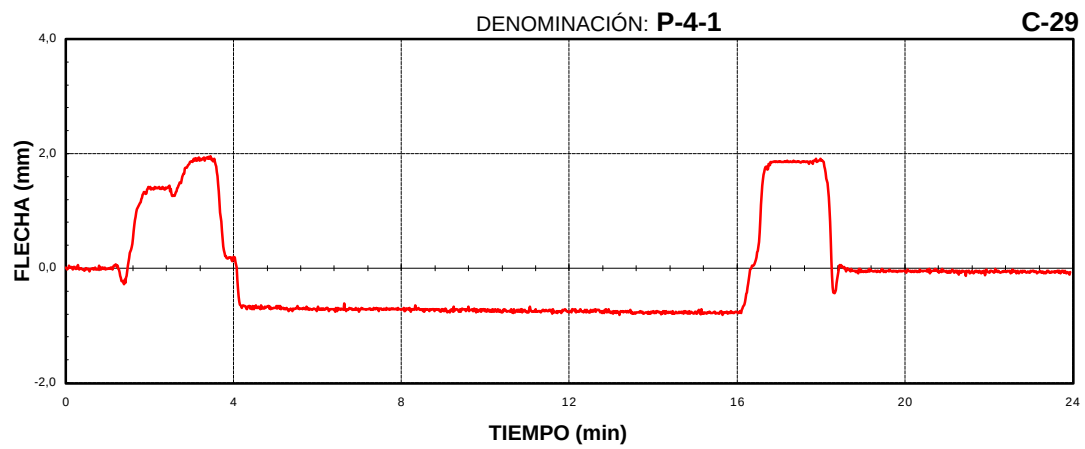




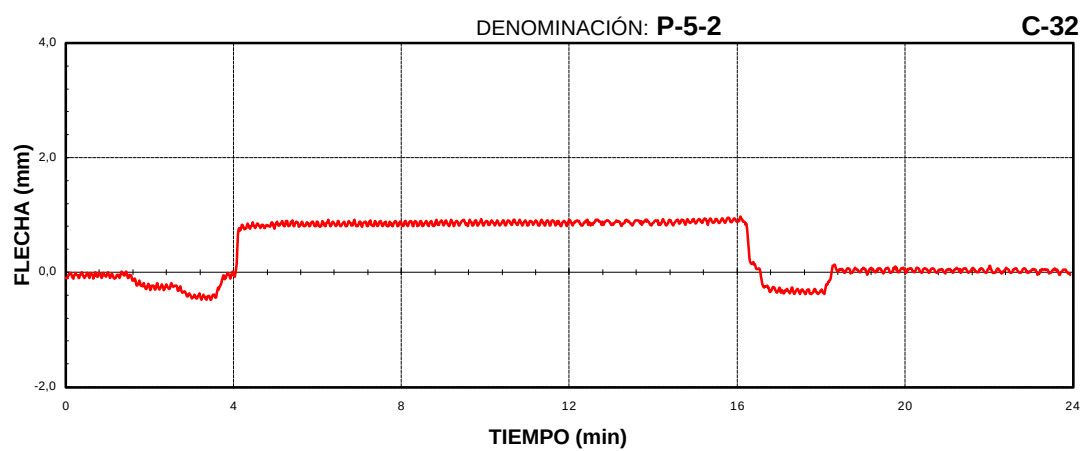
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23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 7.



**GIF VIA AVE**  
**23VI04. ACEQUIA QUINTOS DE EBRO.**  
**HIPÓTESIS 7.**



GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.  
HIPÓTESIS 7.

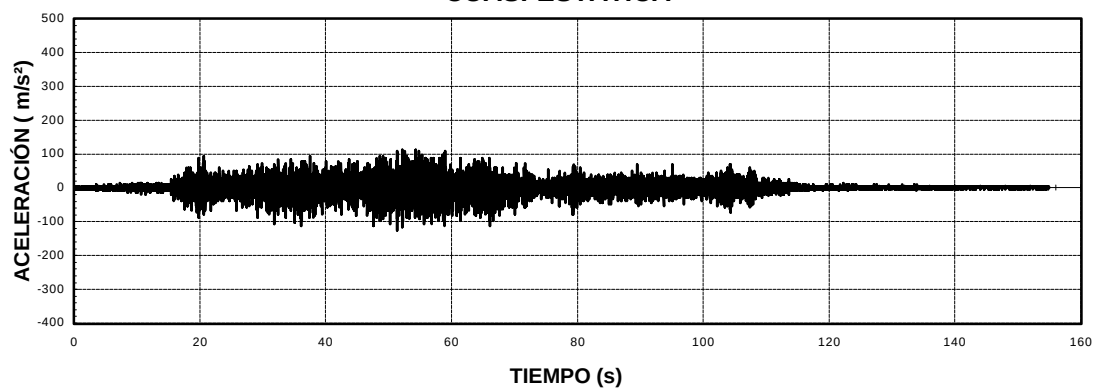


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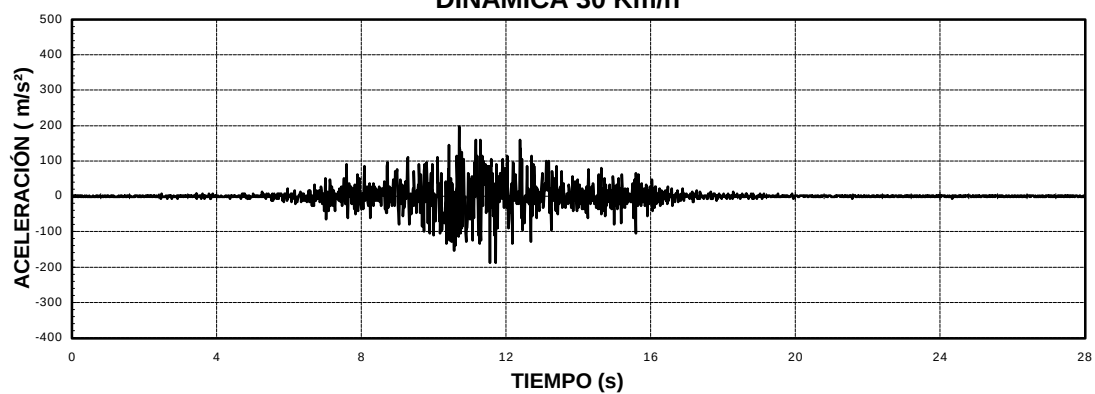
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**PRUEBAS DINÁMICAS**

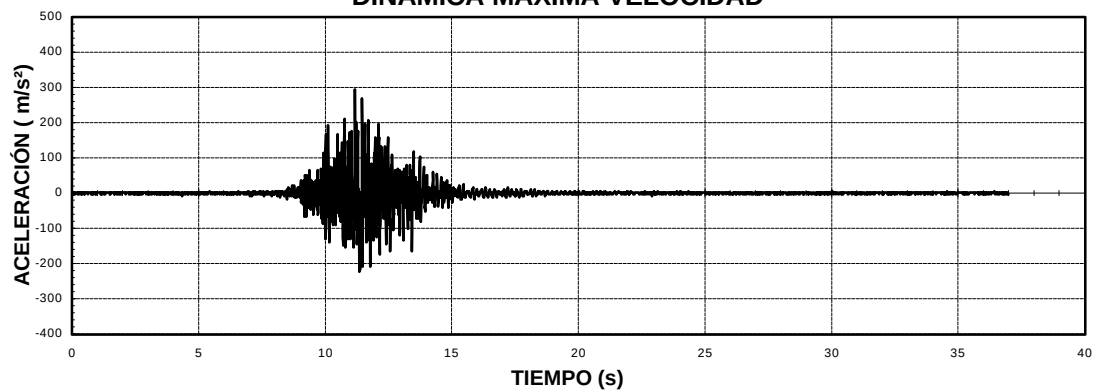
## CUASI-ESTÁTICA



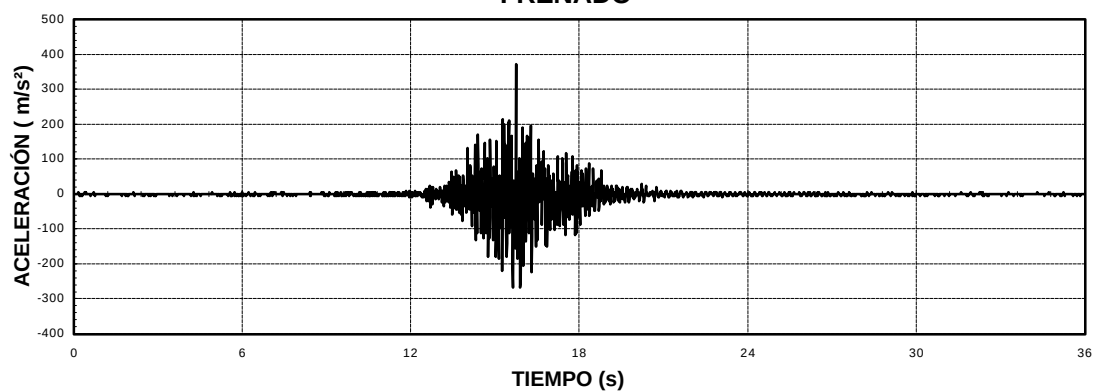
## DINÁMICA 30 Km/h

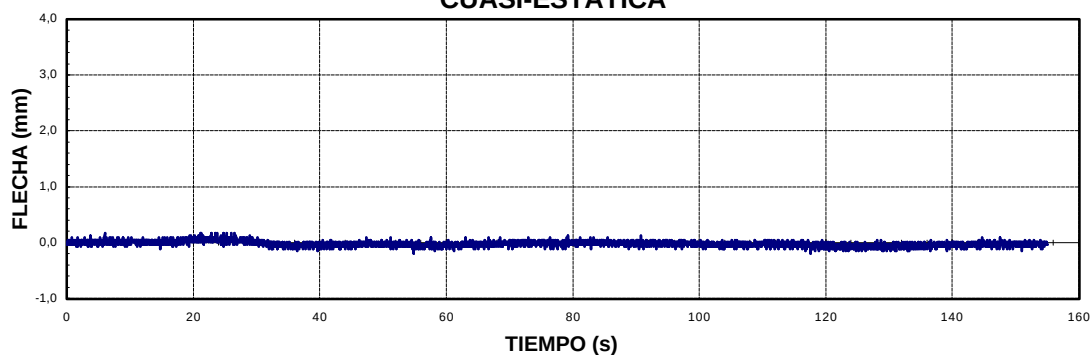
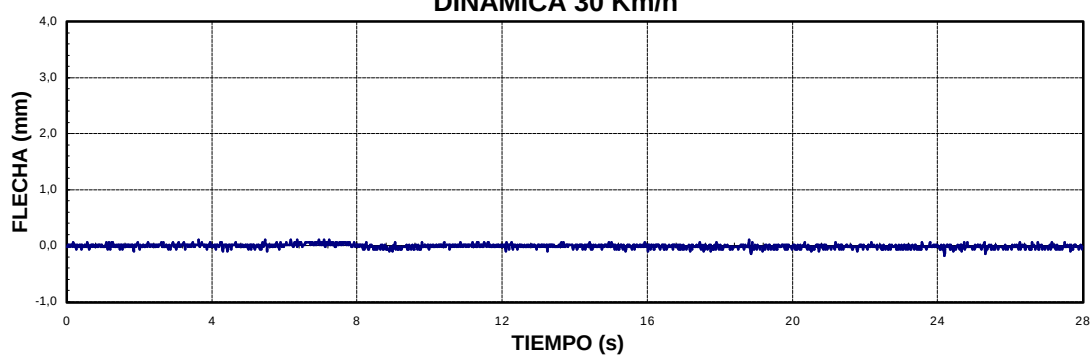
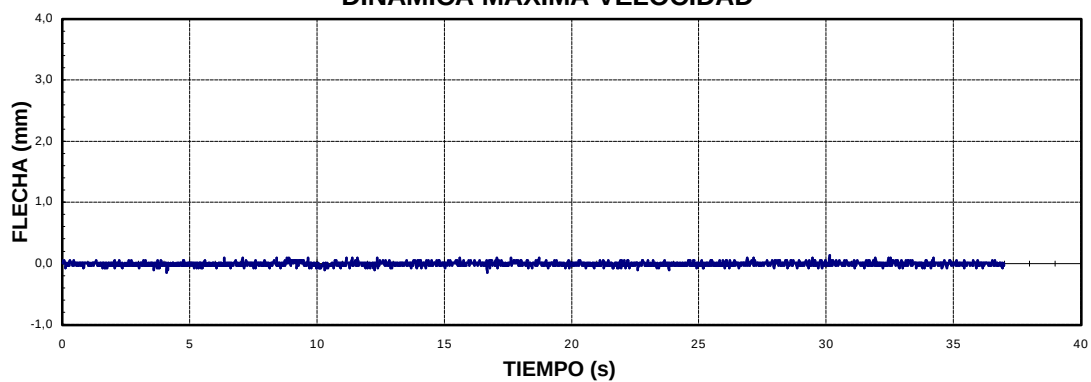
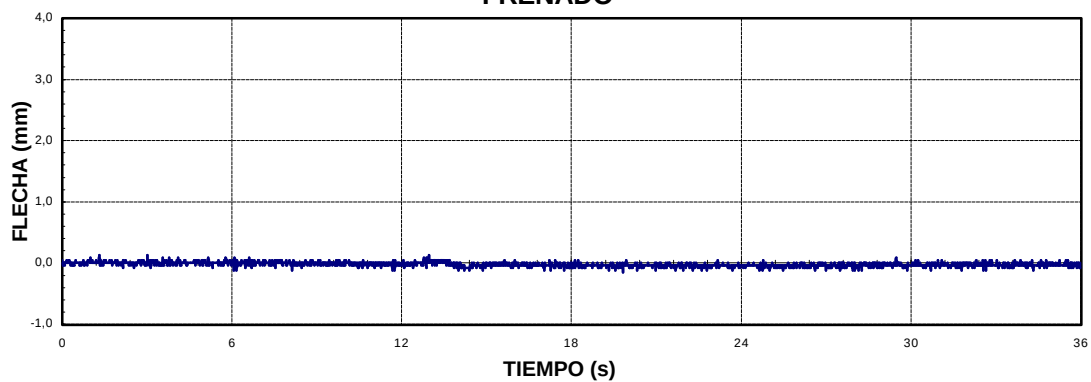


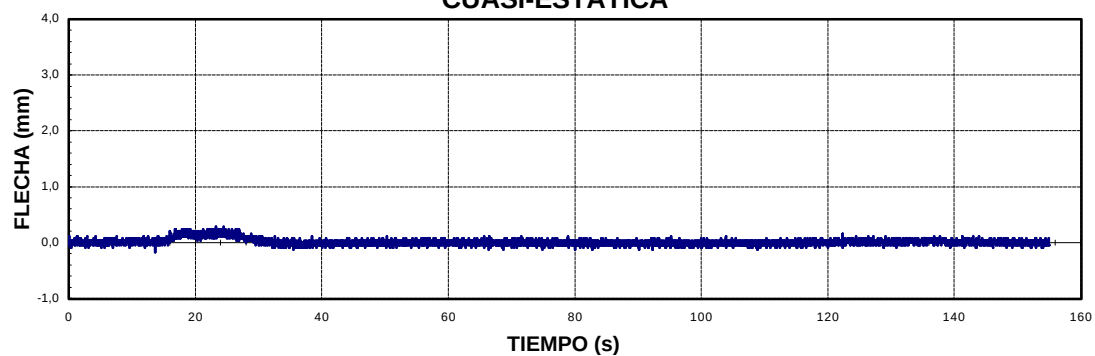
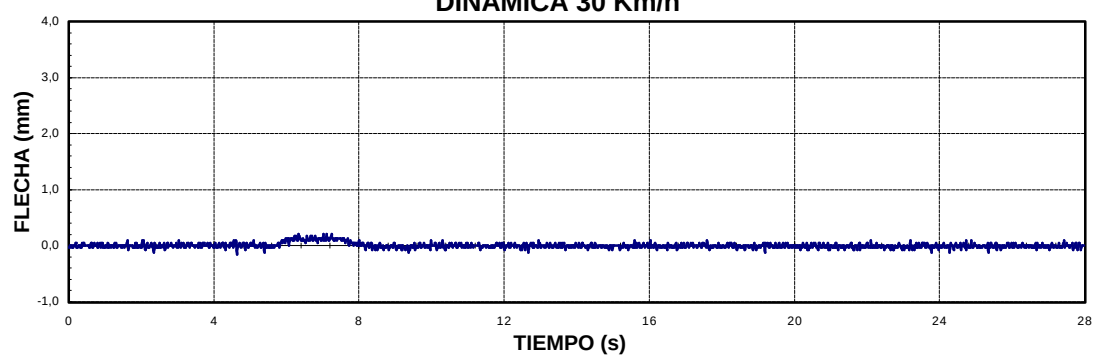
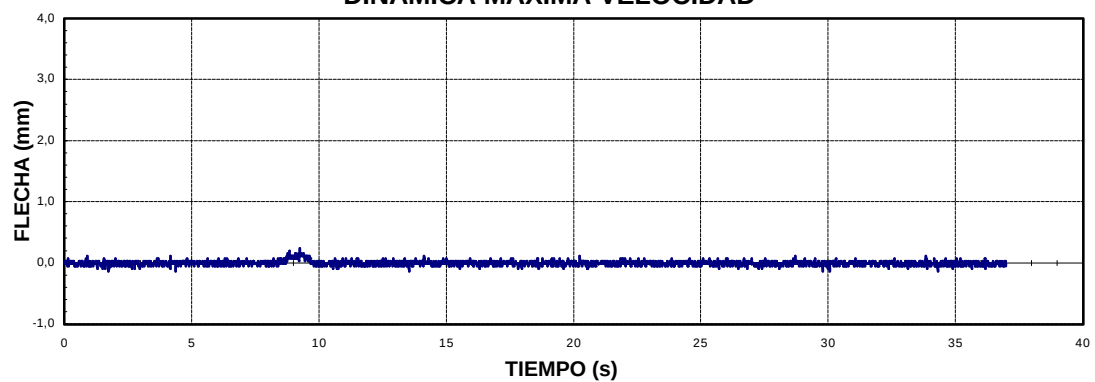
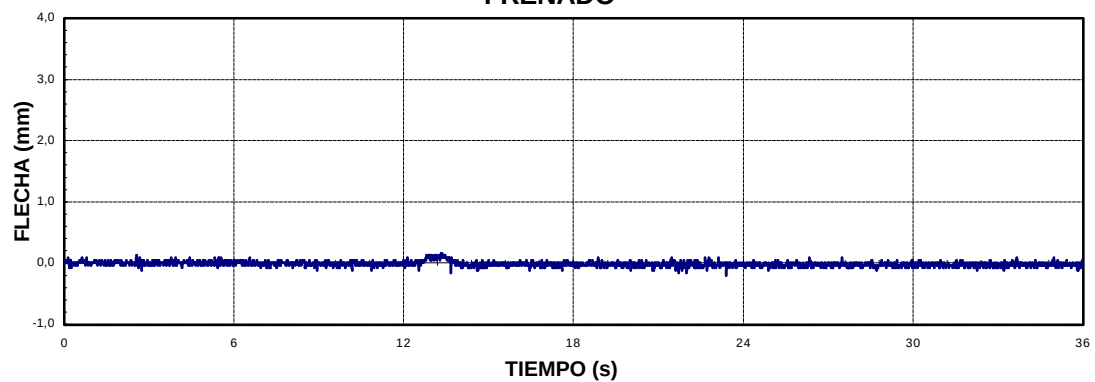
## DINÁMICA MÁXIMA VELOCIDAD

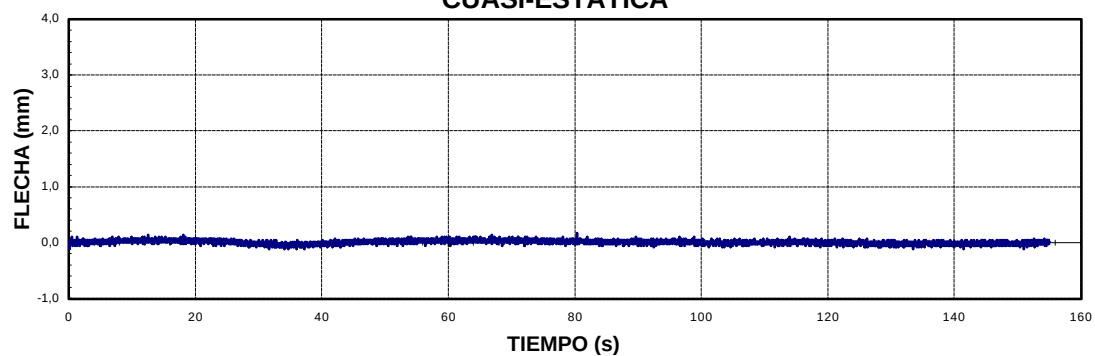
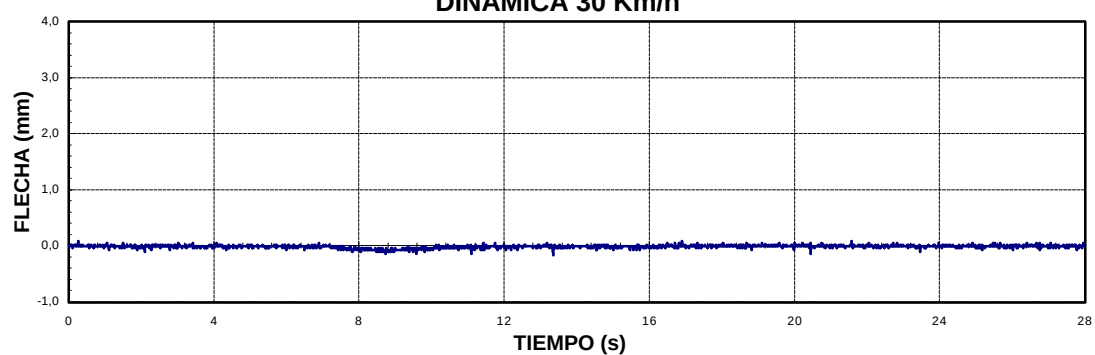
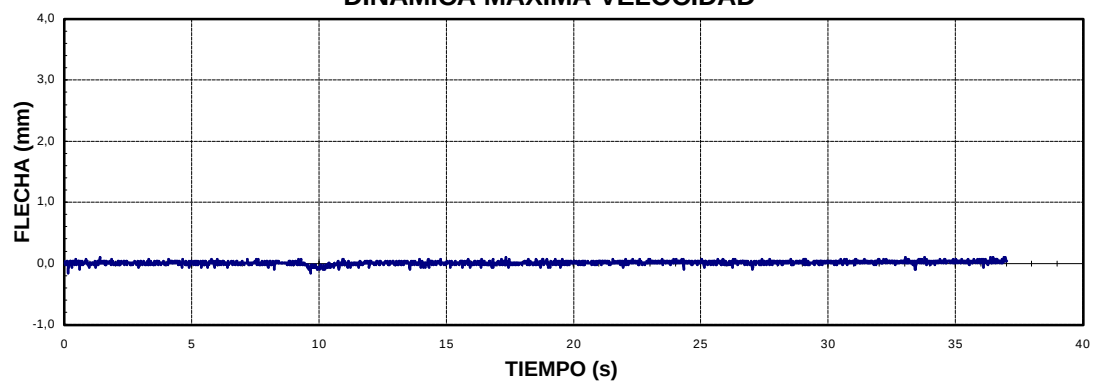
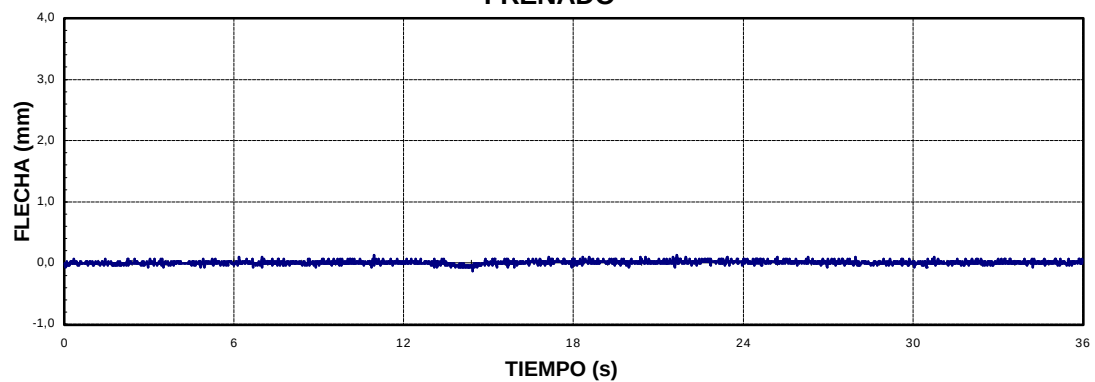


## FRENADO

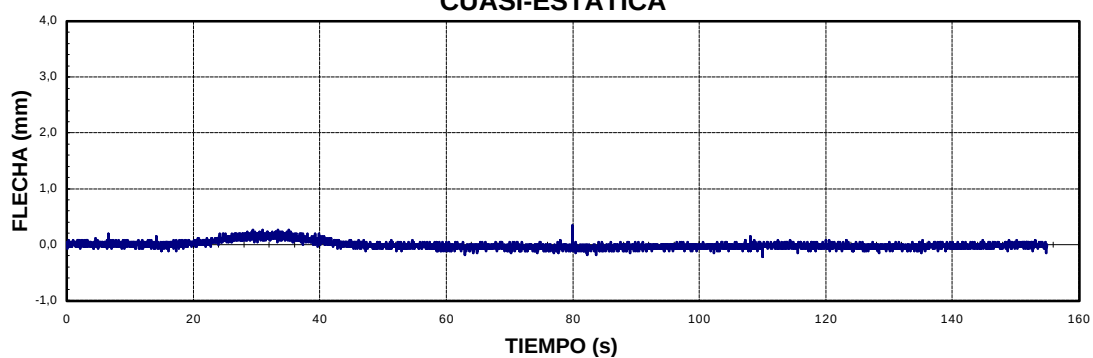
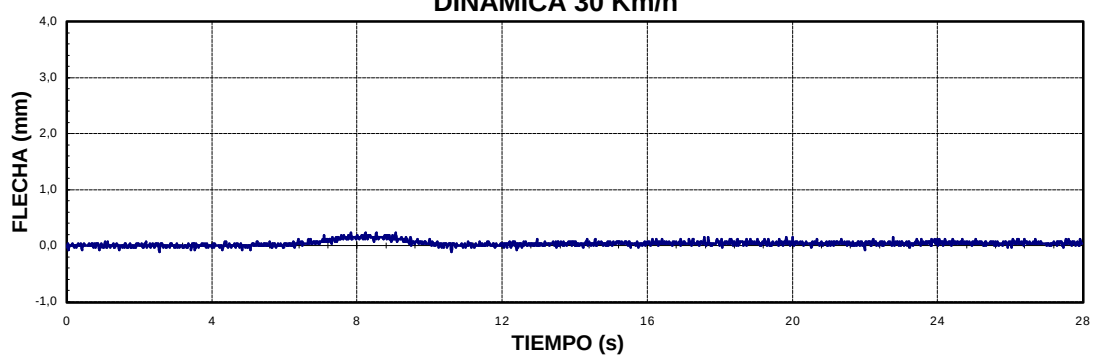
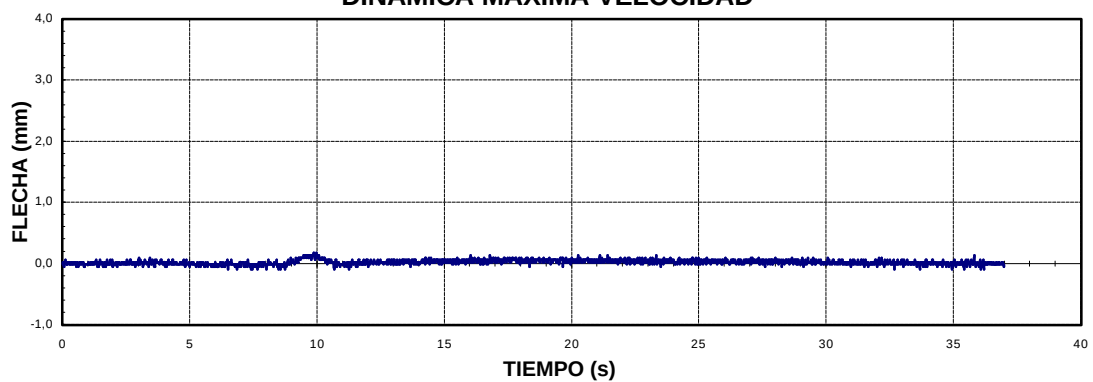
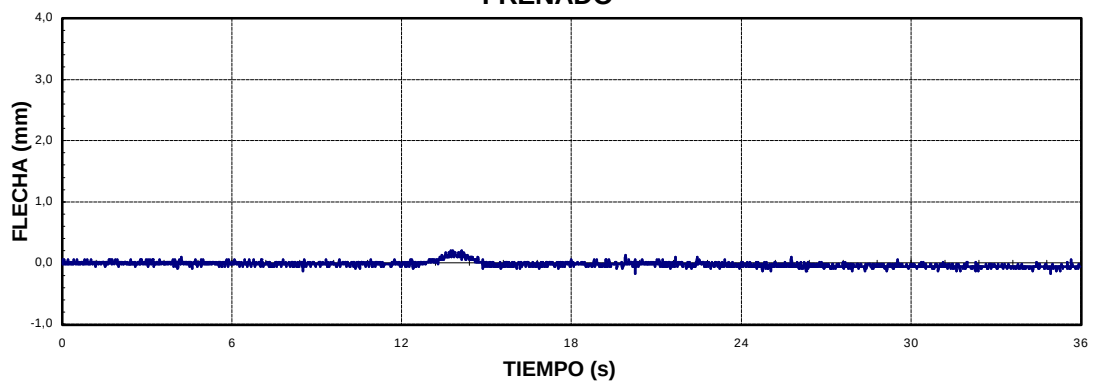


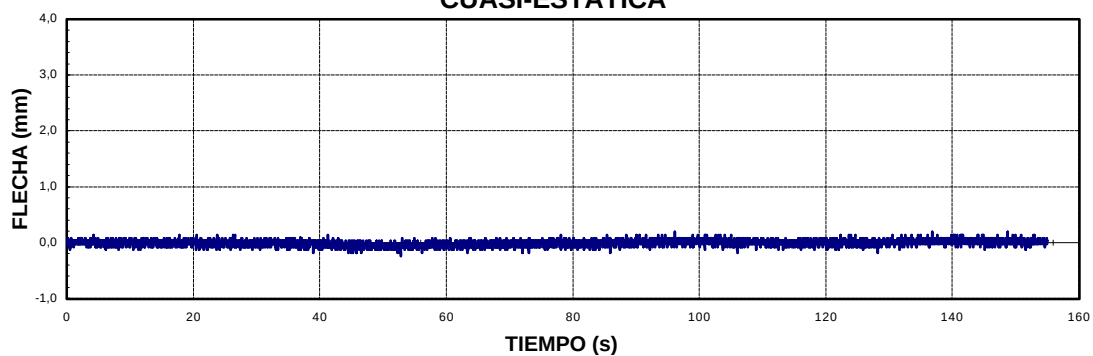
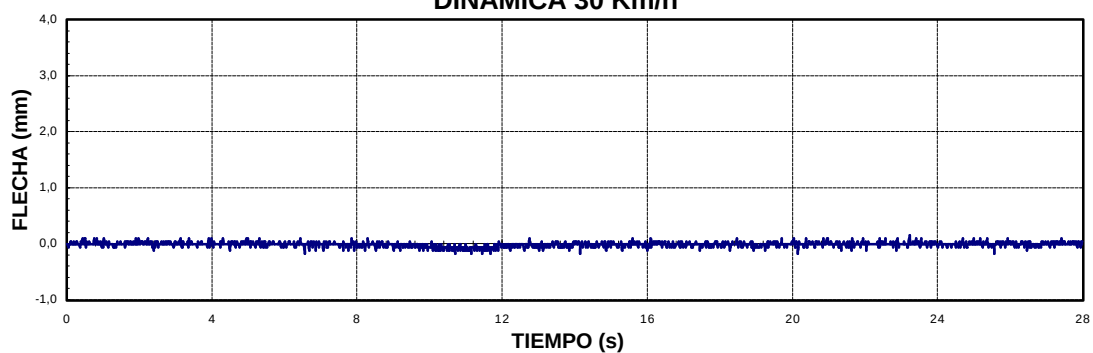
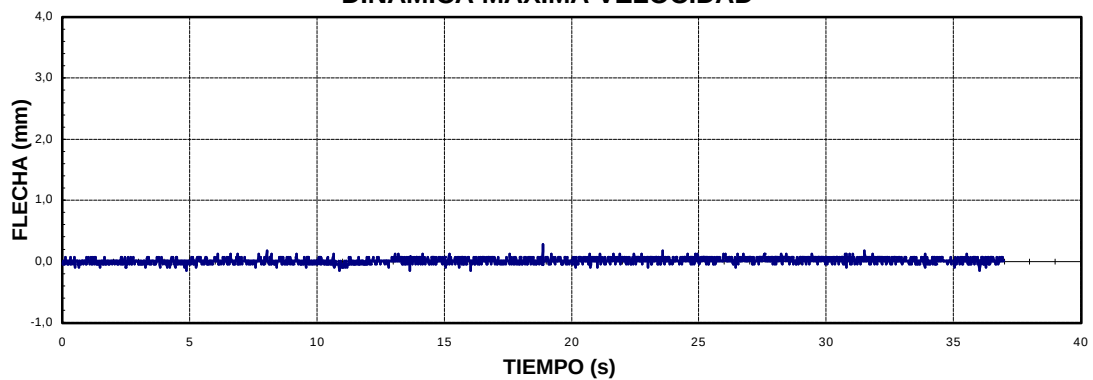
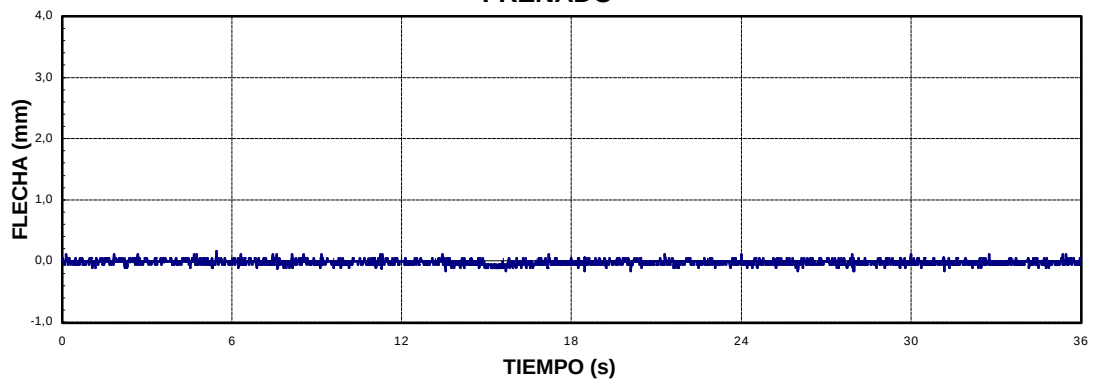
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

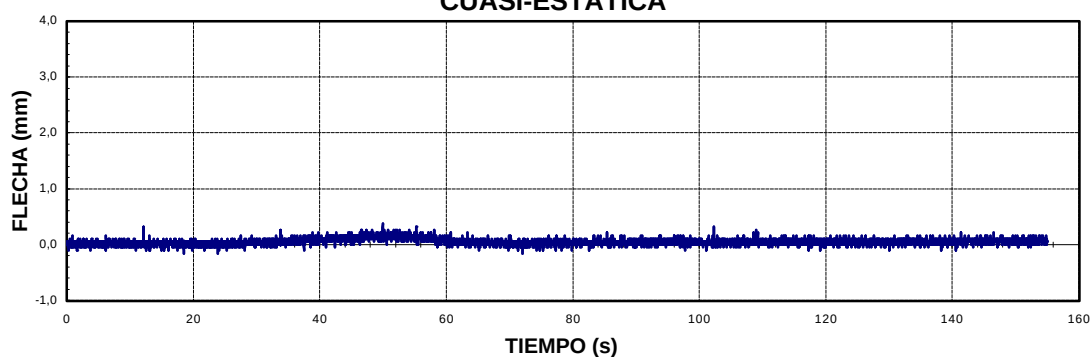
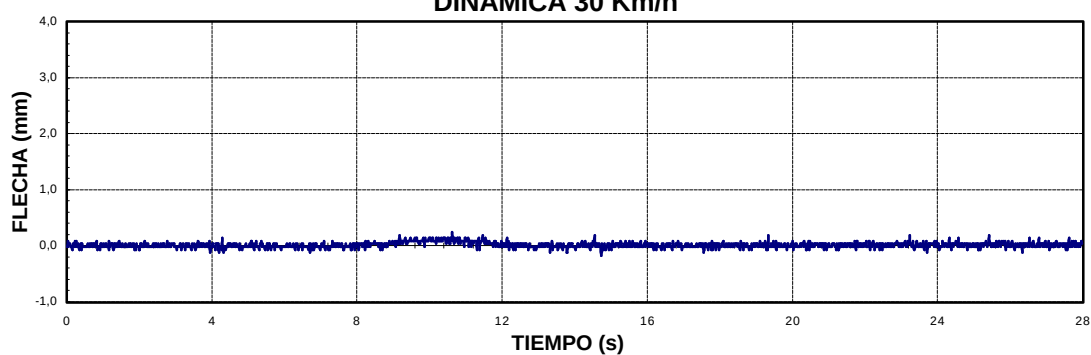
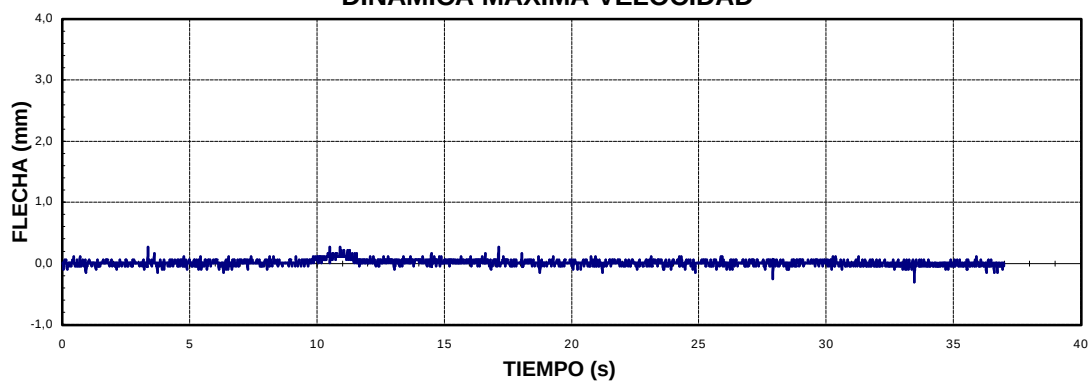
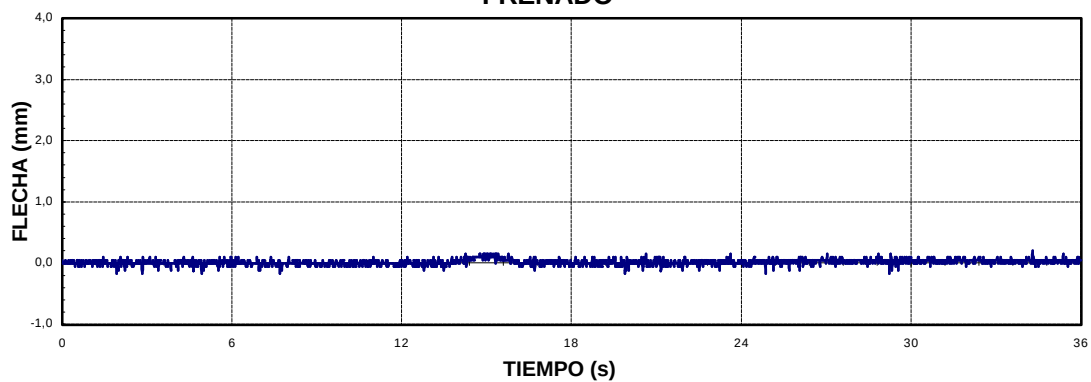
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

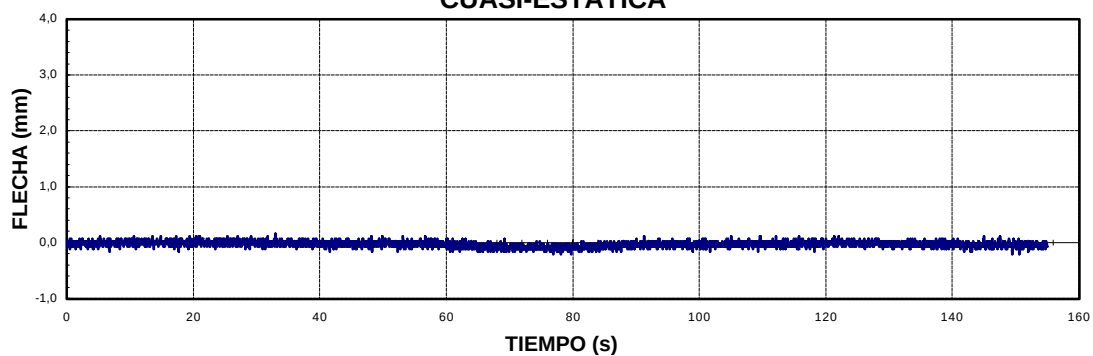
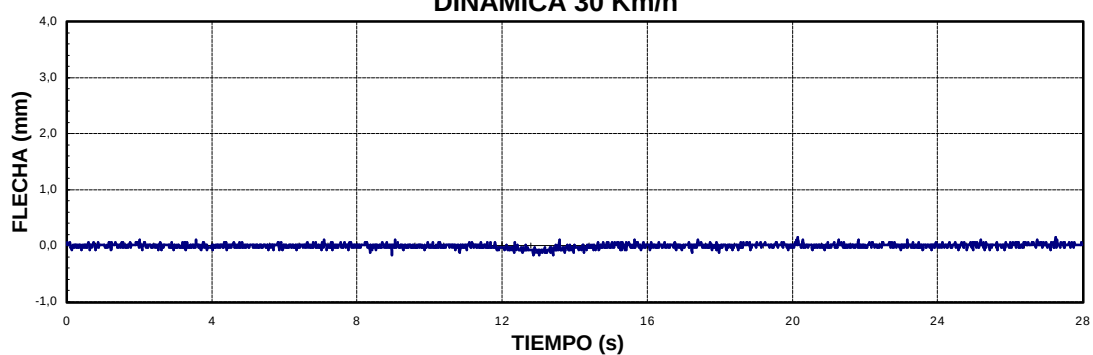
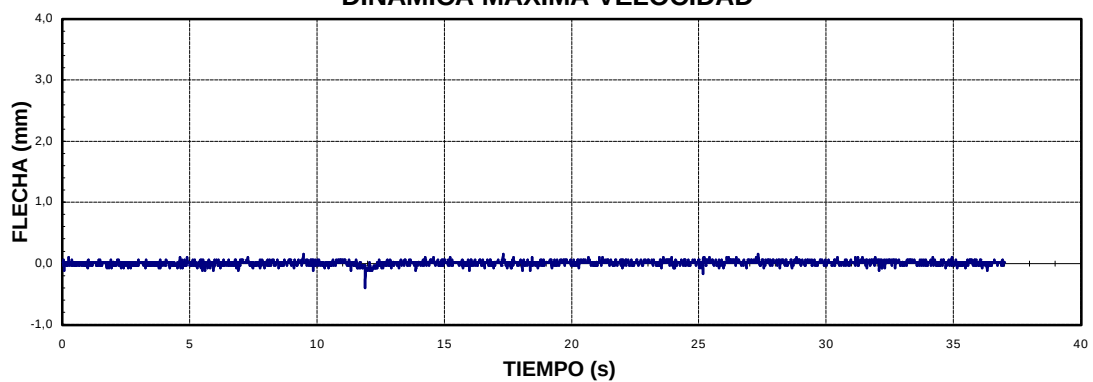
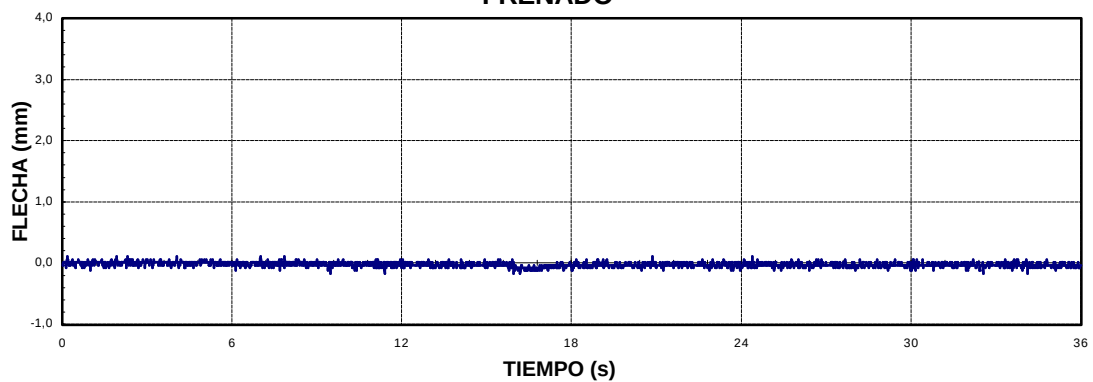
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

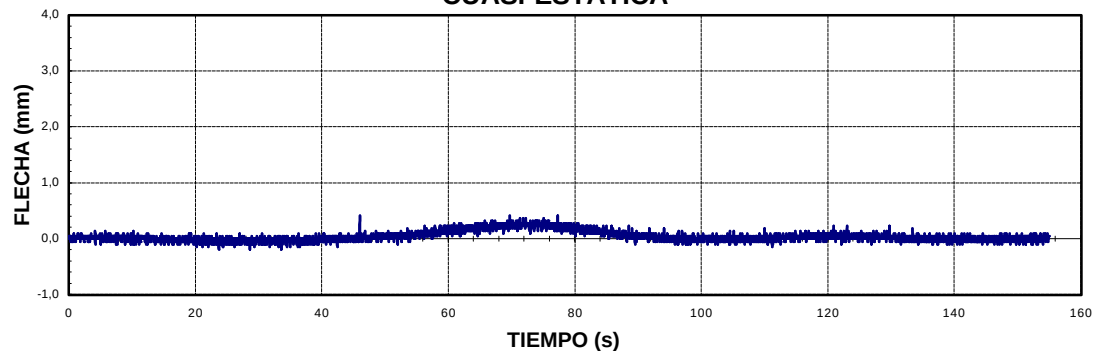
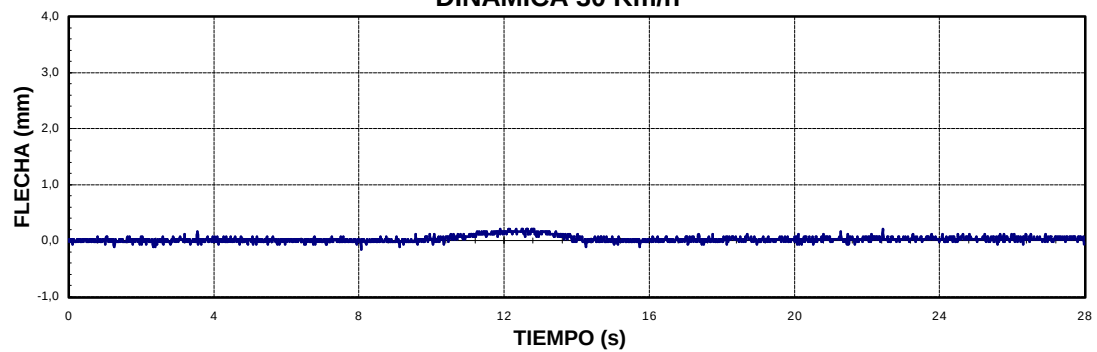
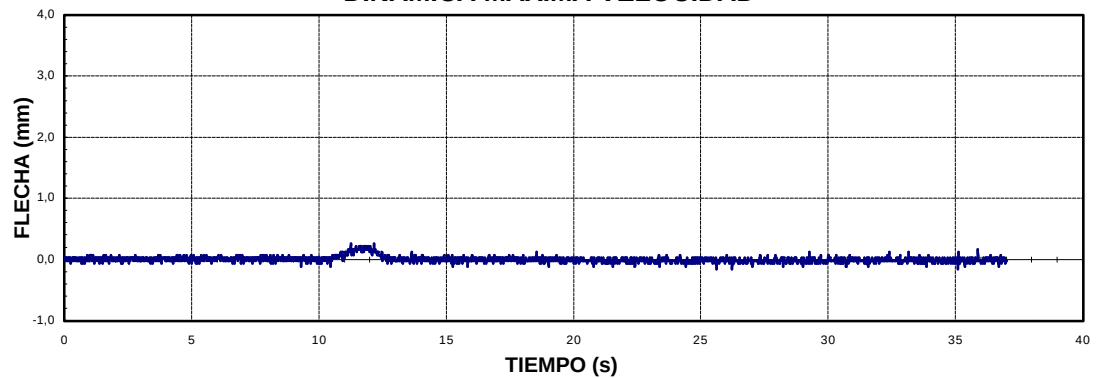
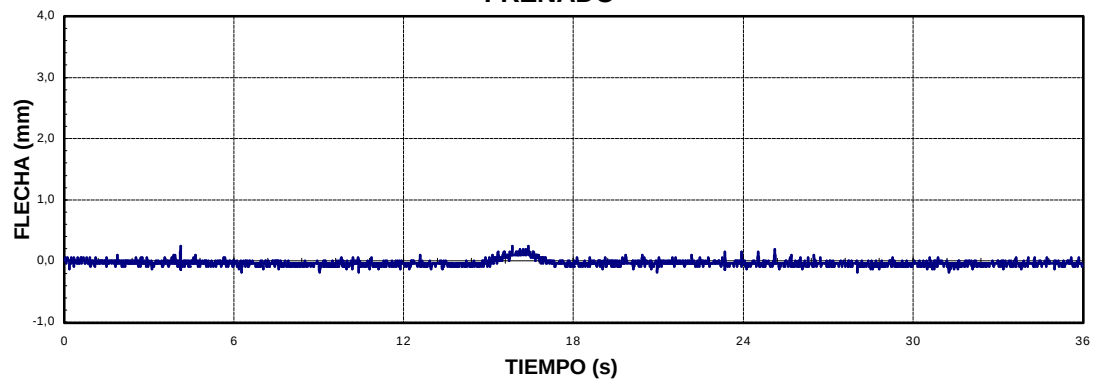


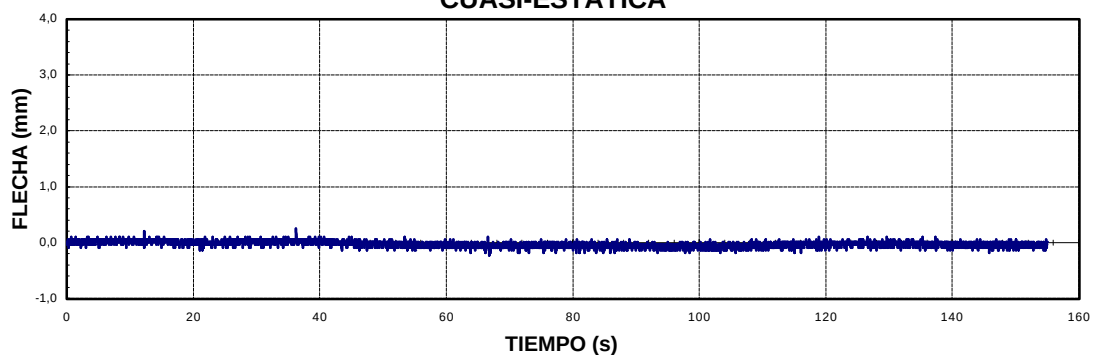
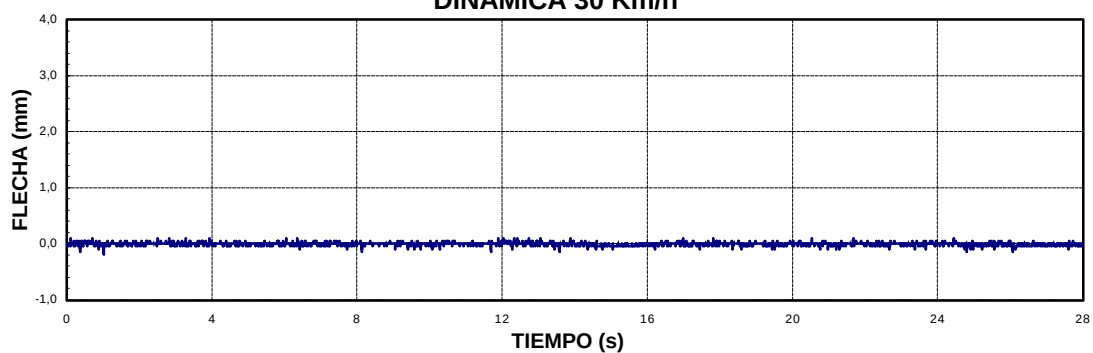
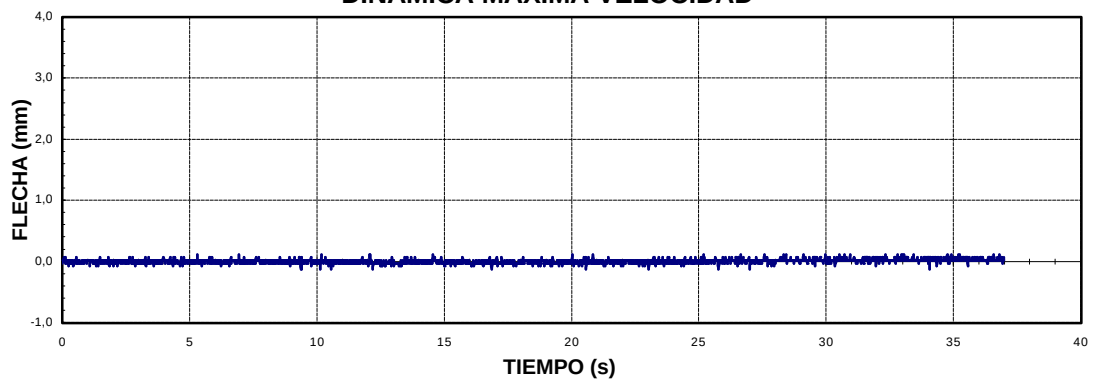
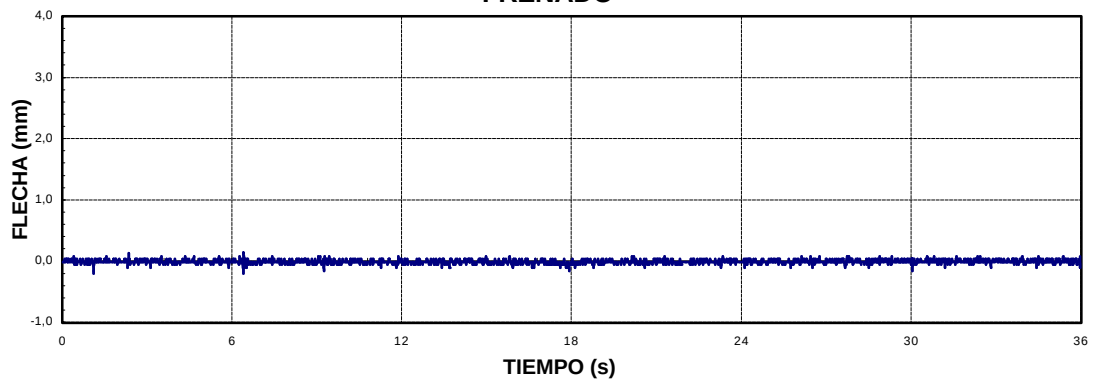
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

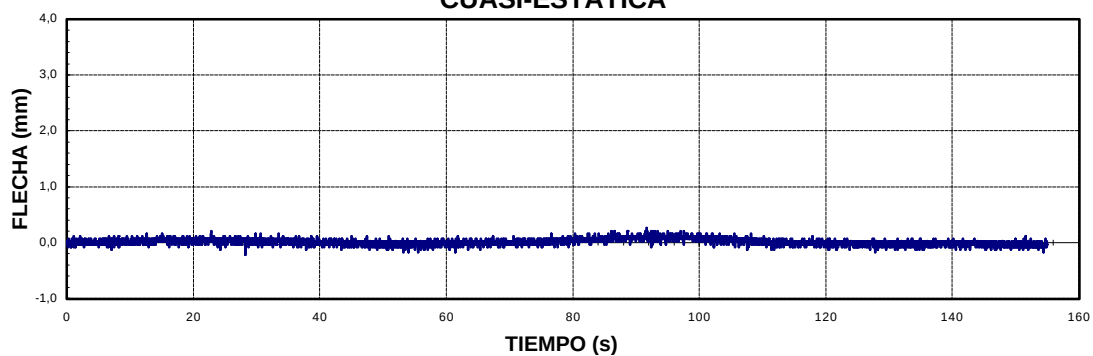
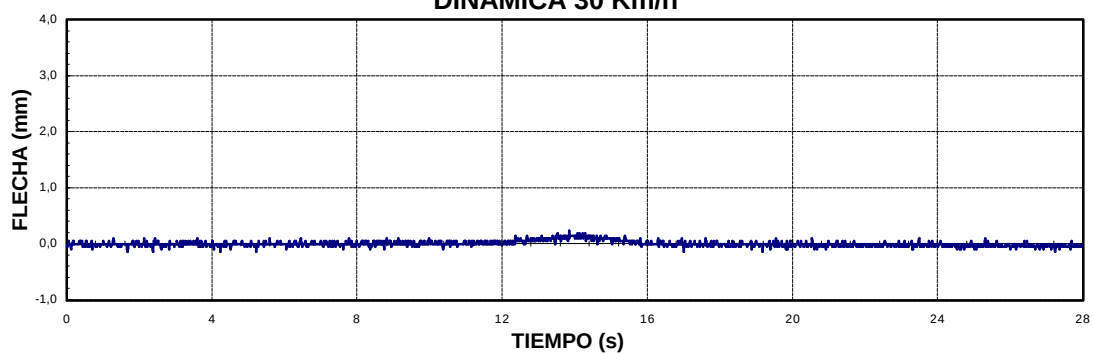
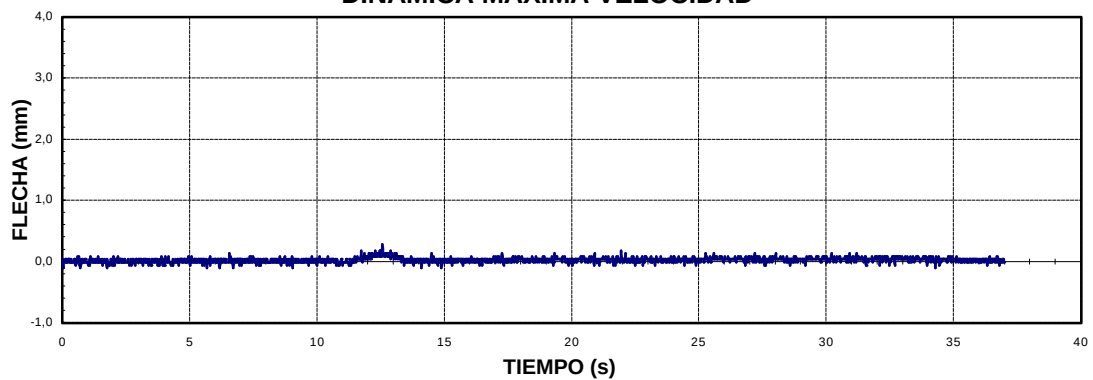
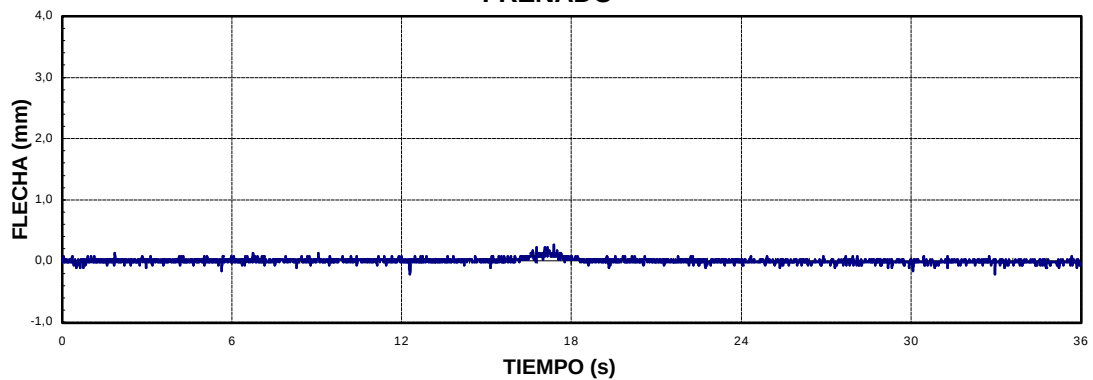
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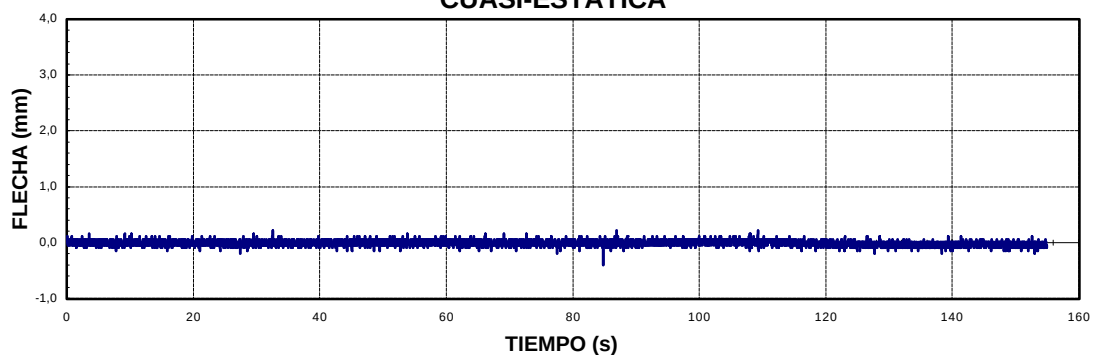
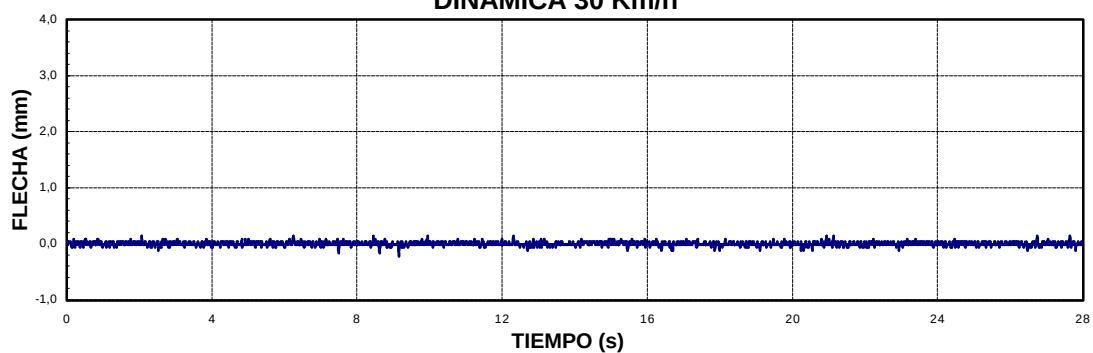
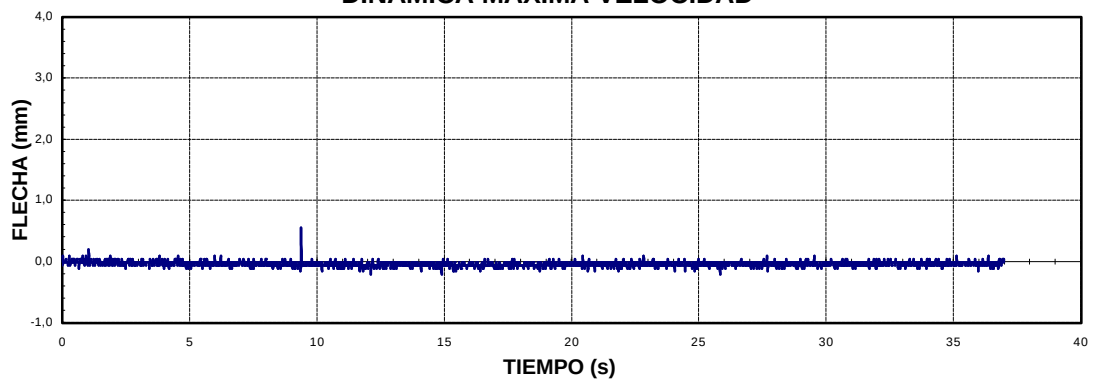
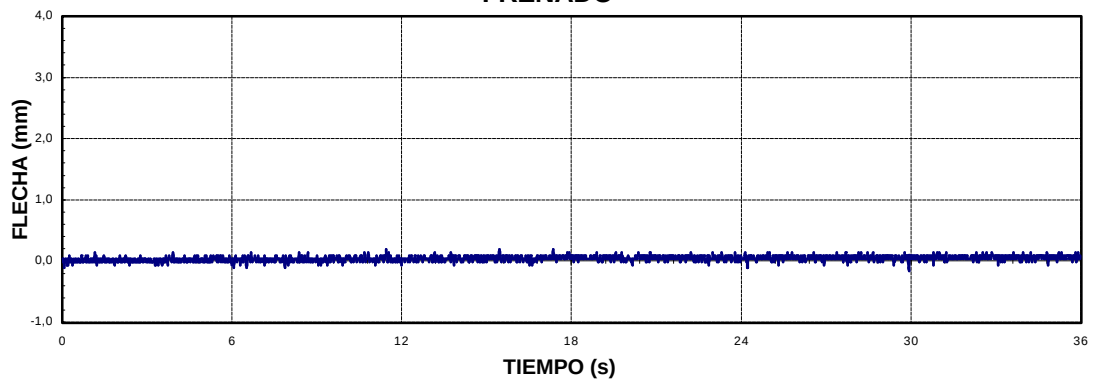
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**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

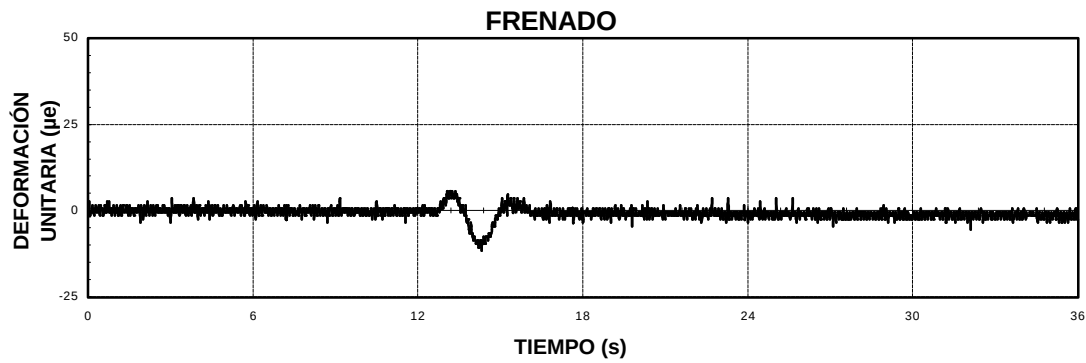
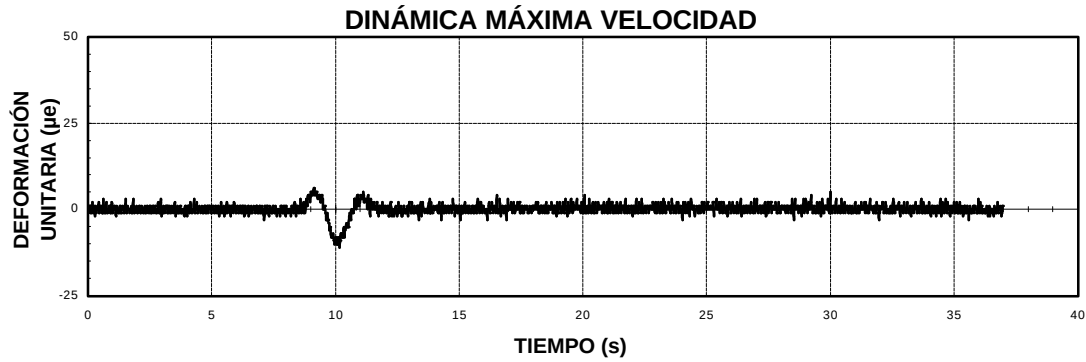
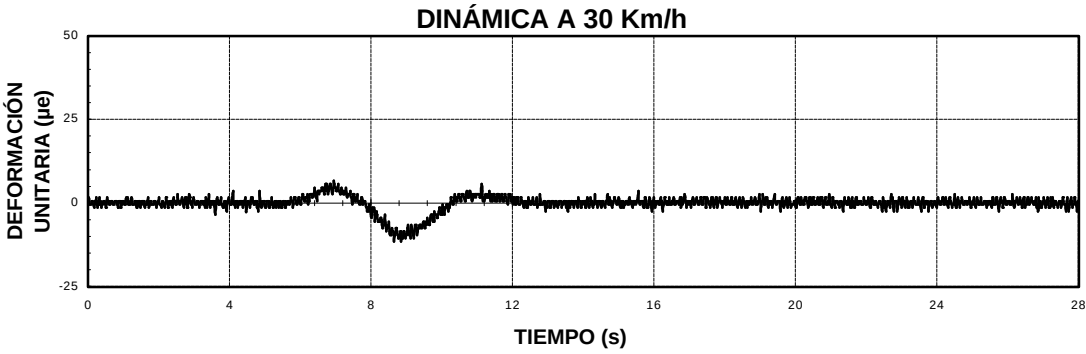
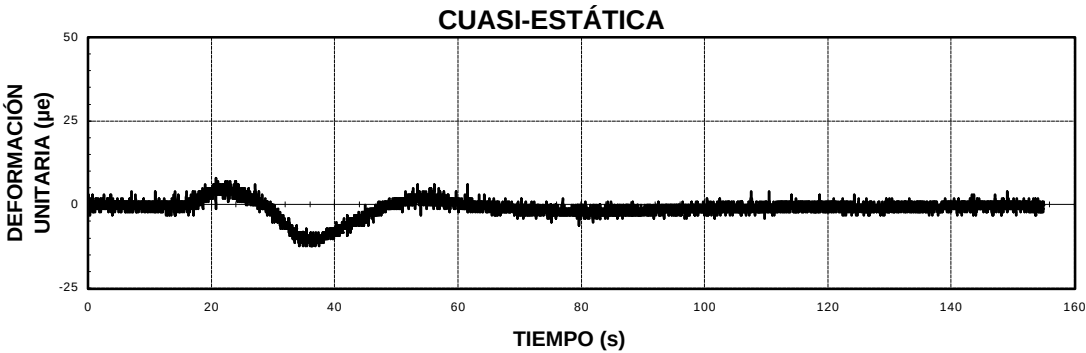
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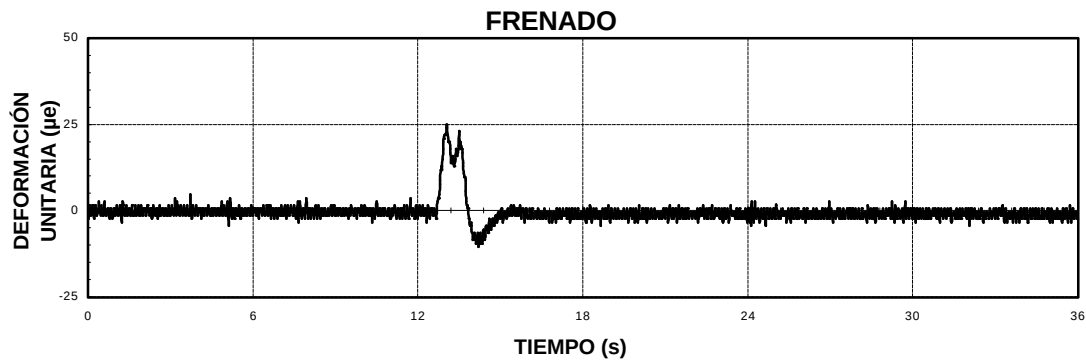
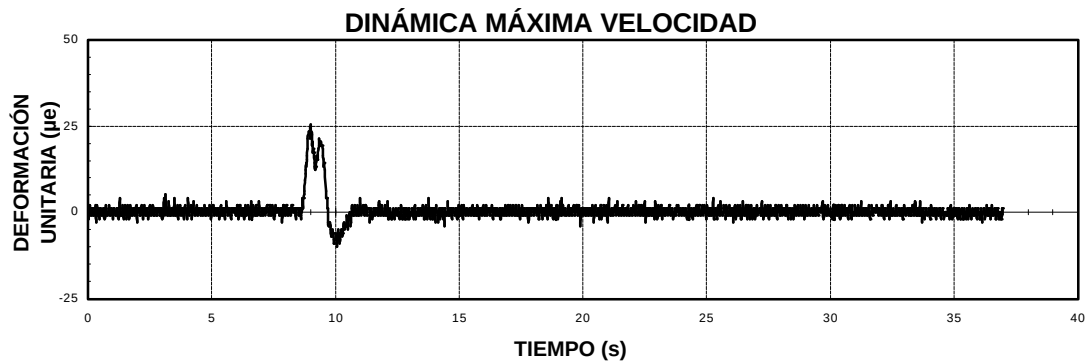
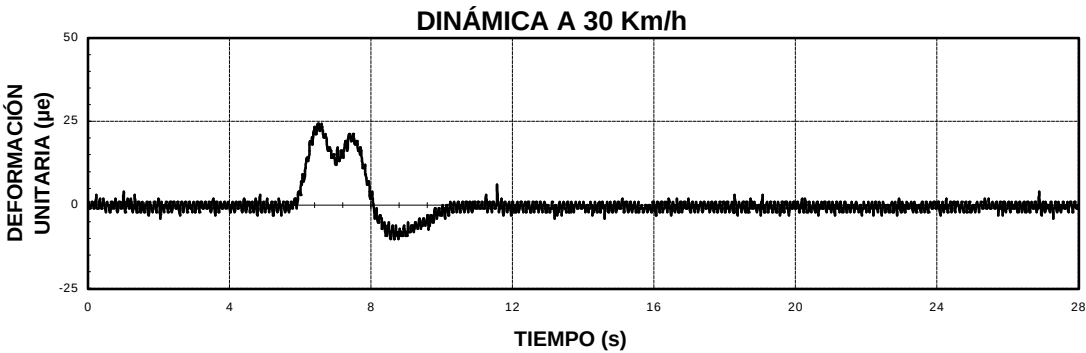
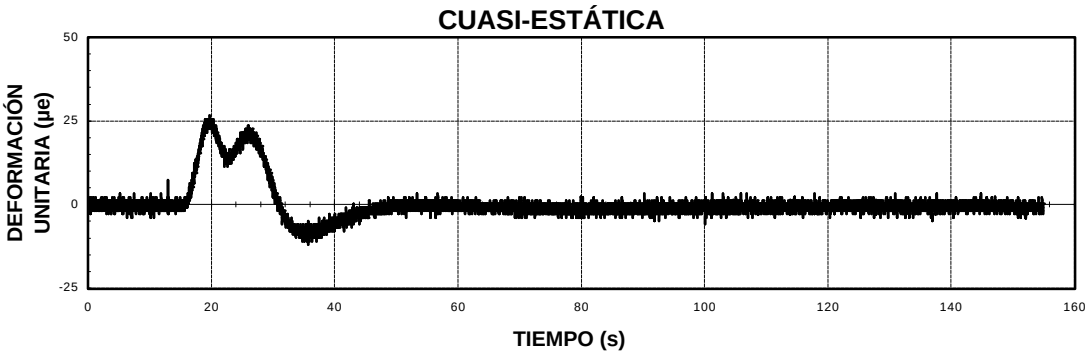
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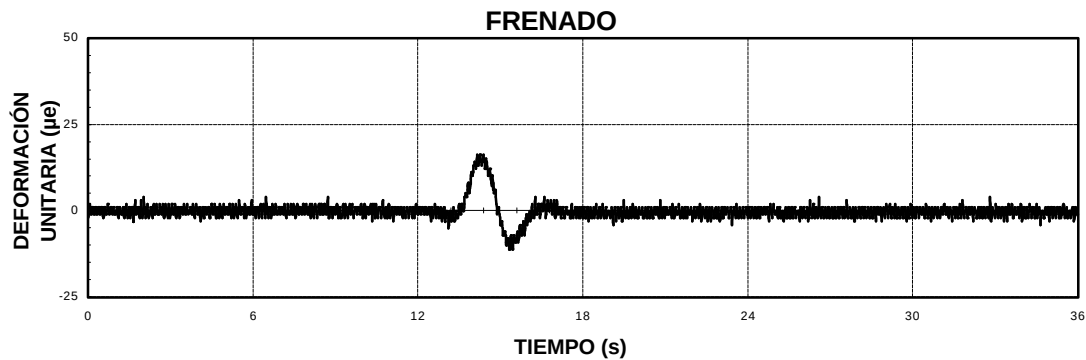
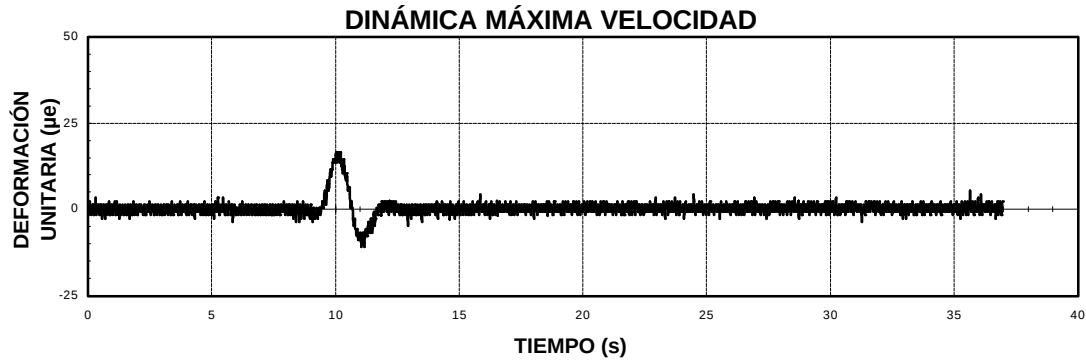
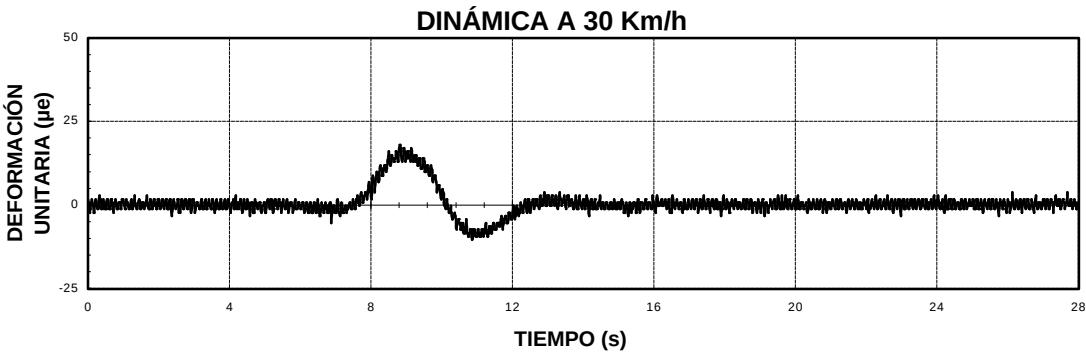
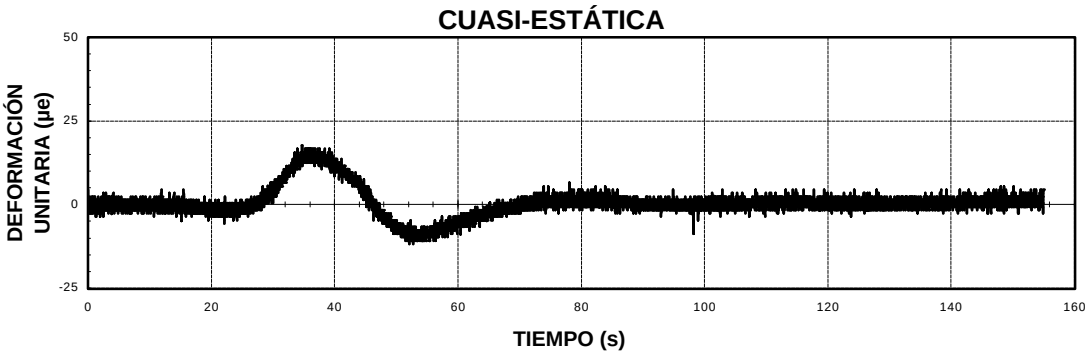
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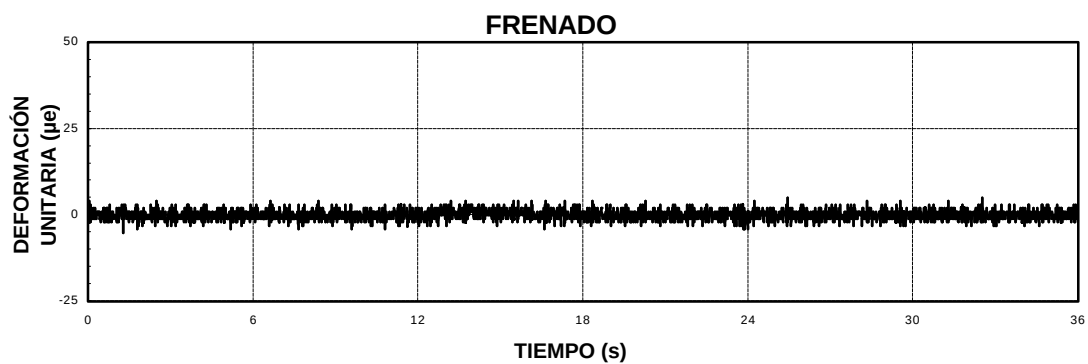
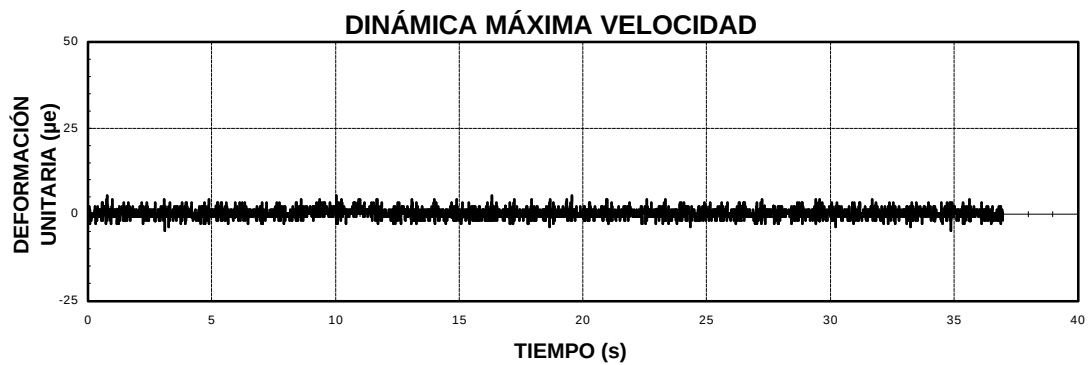
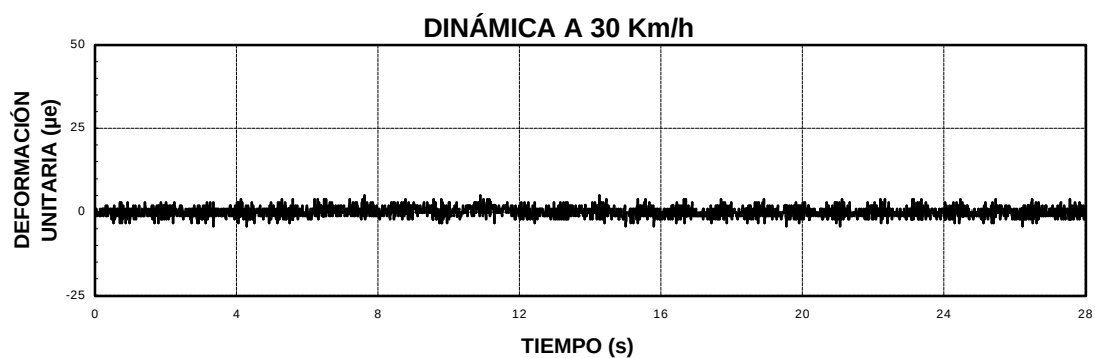
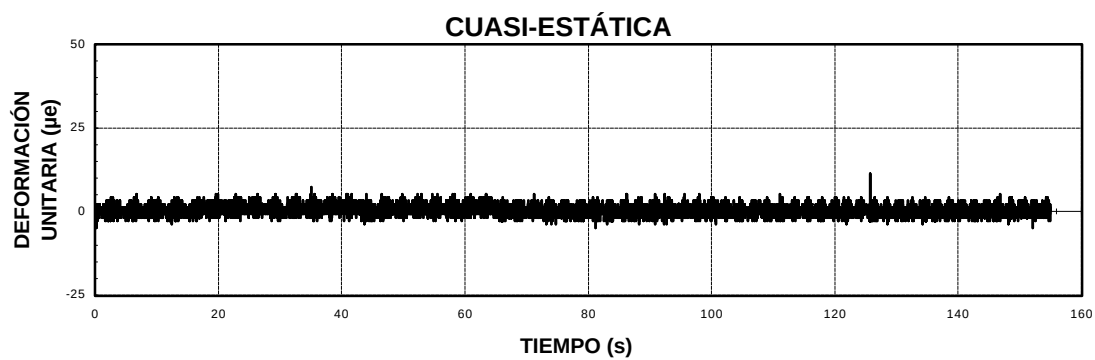
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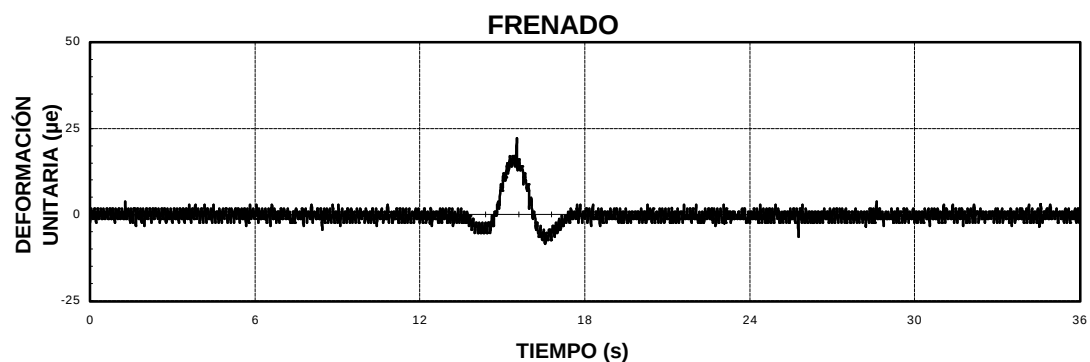
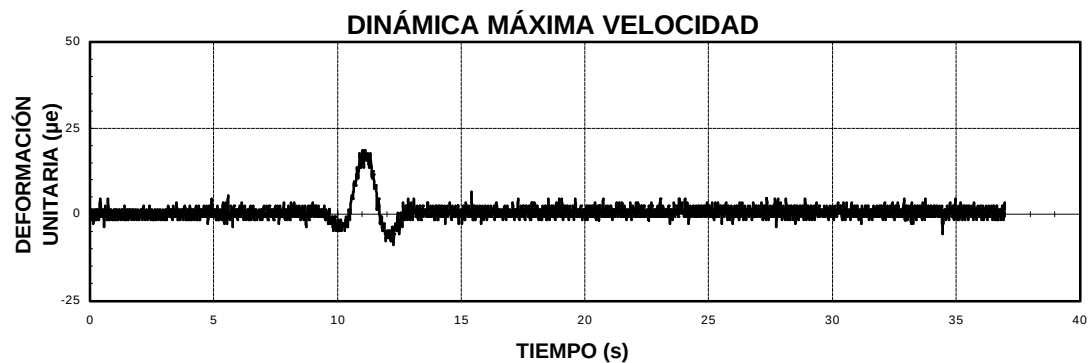
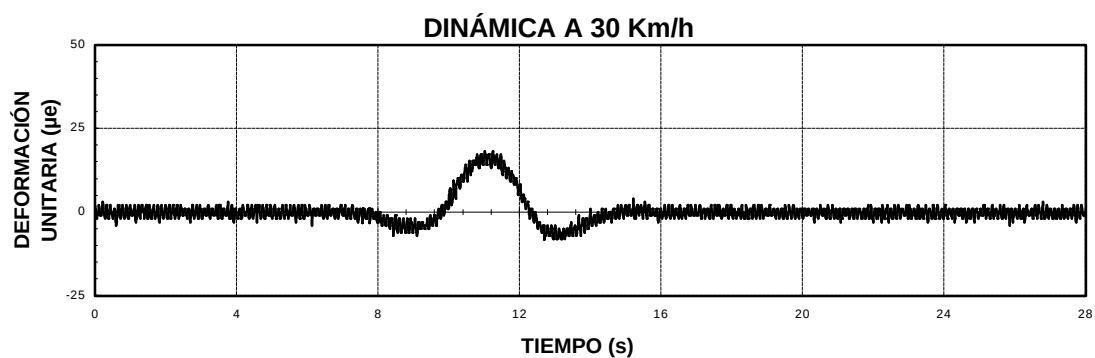
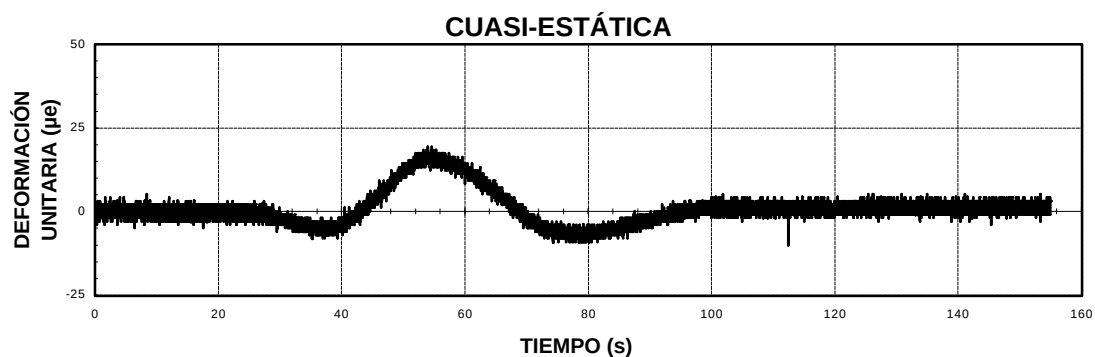


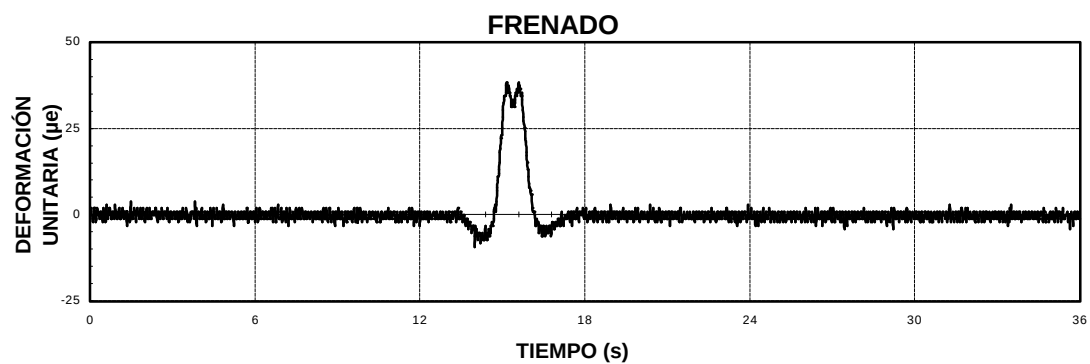
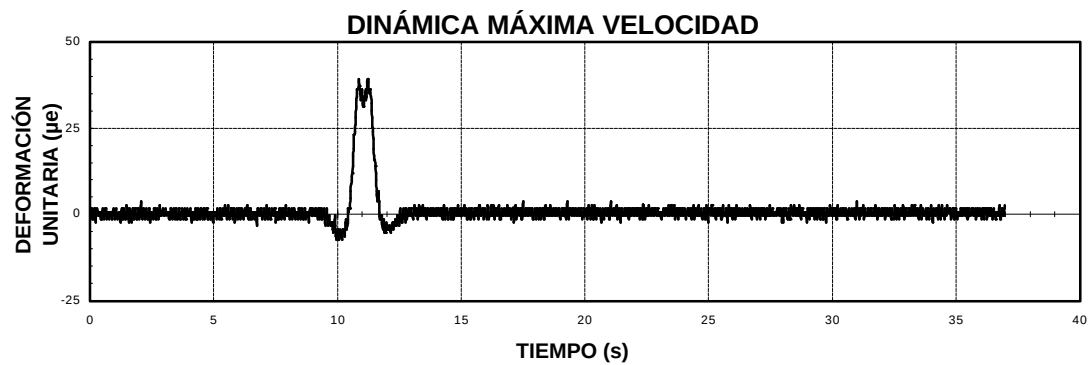
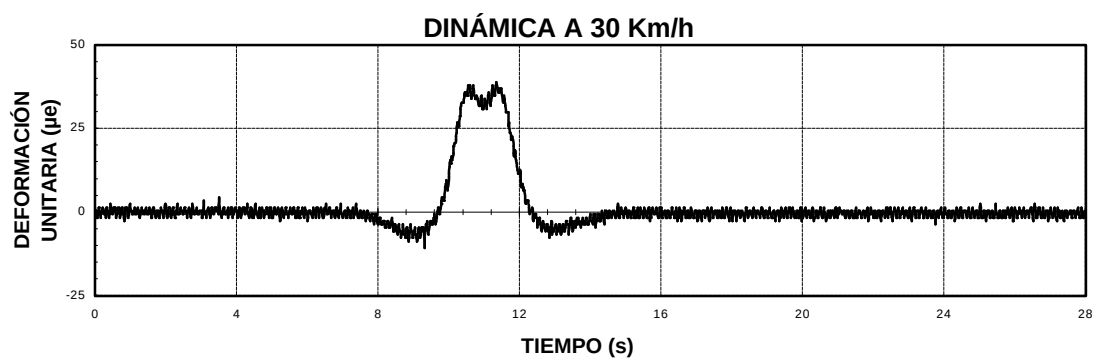
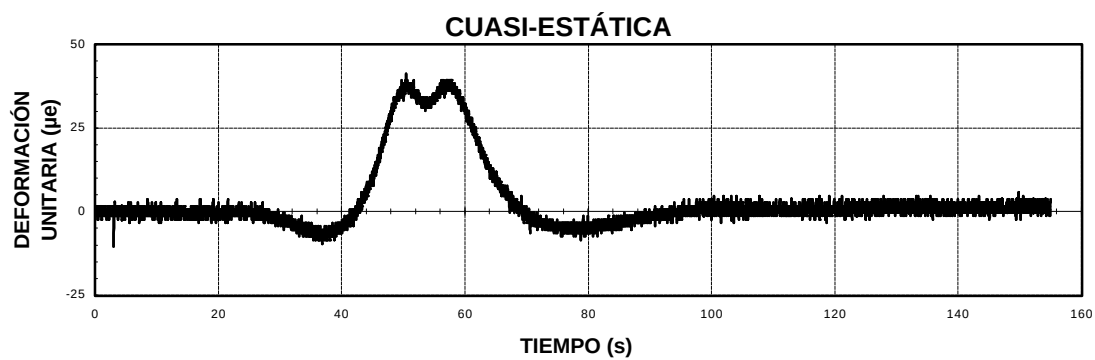


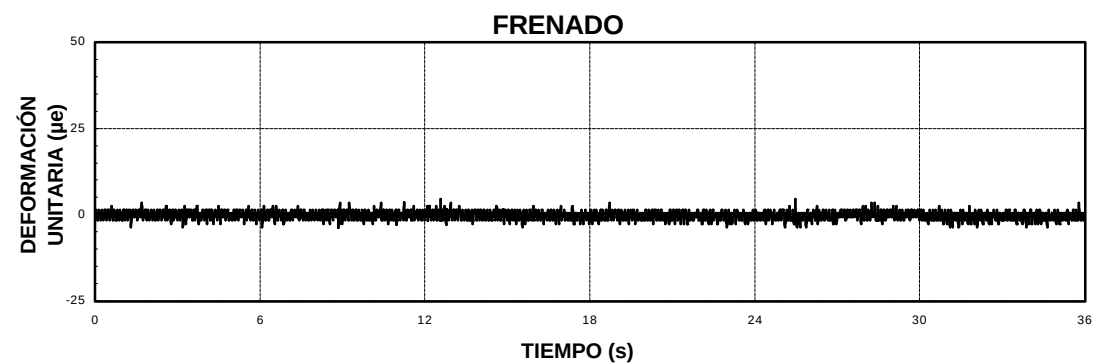
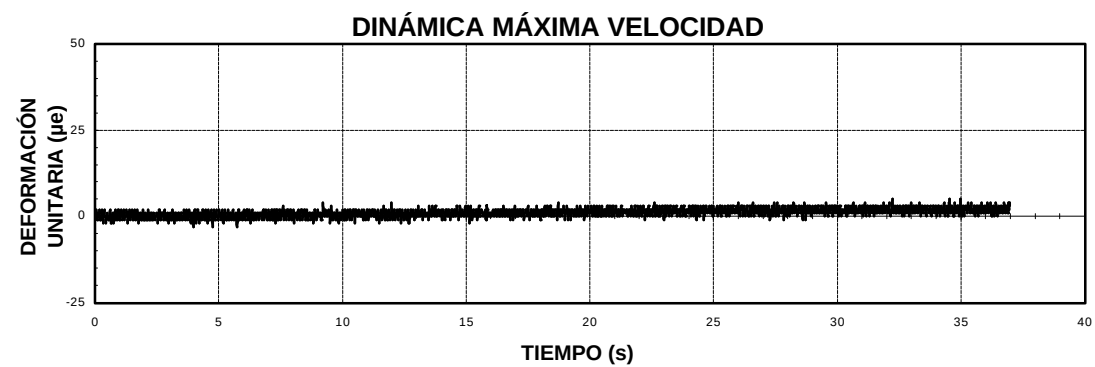
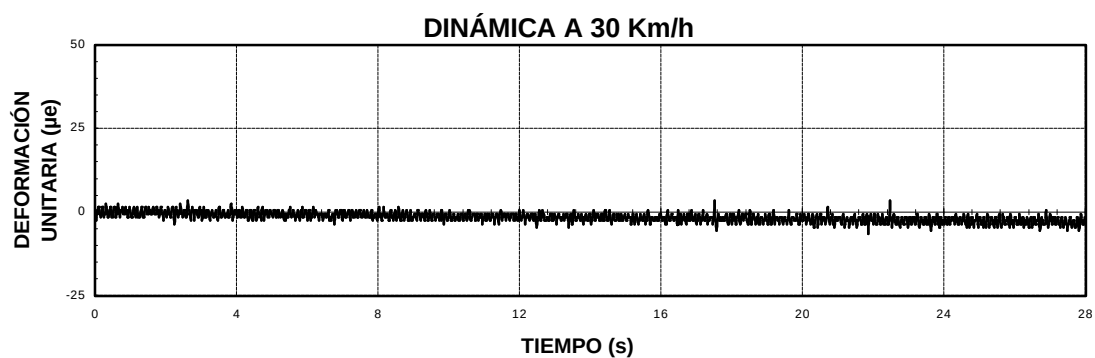
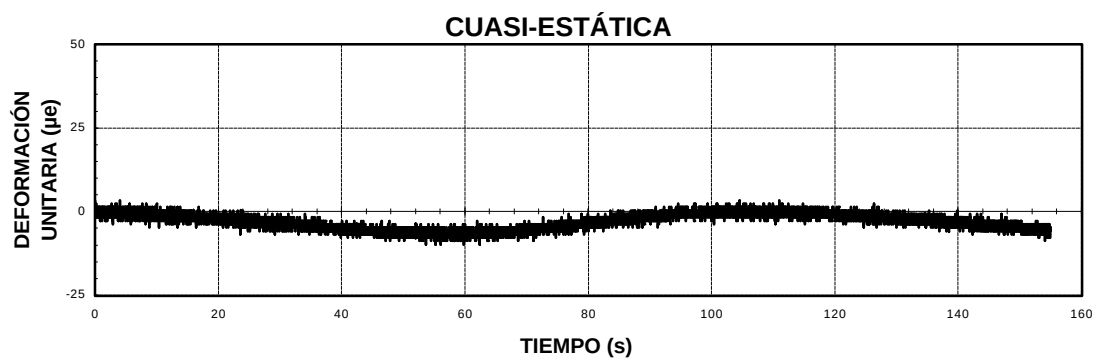


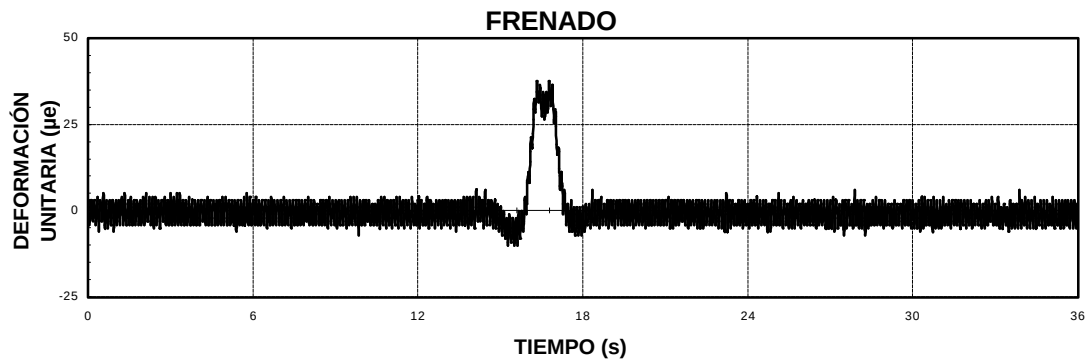
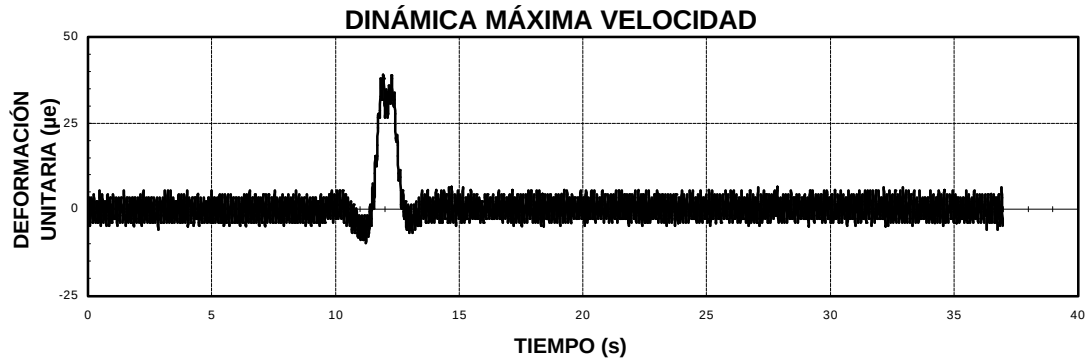
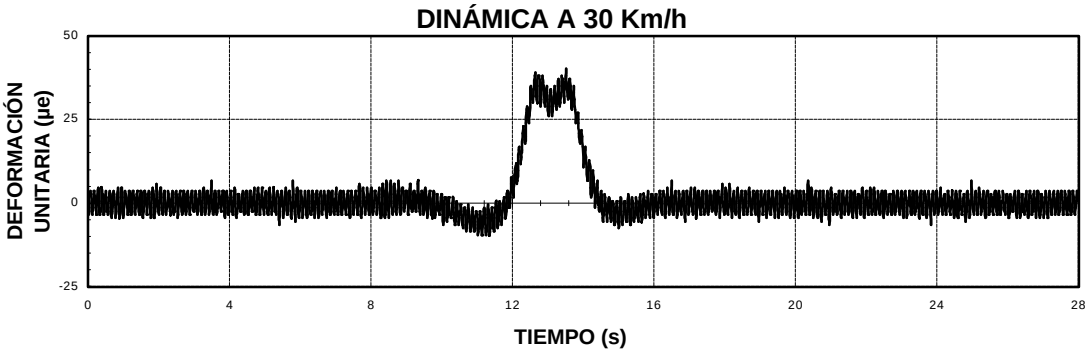
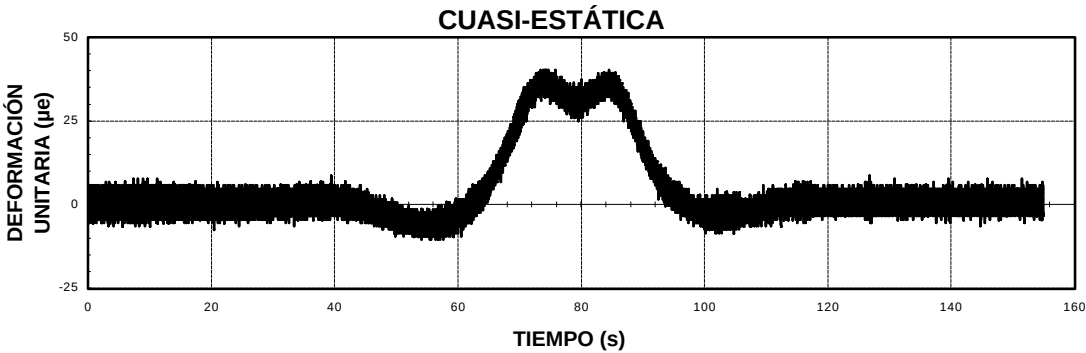




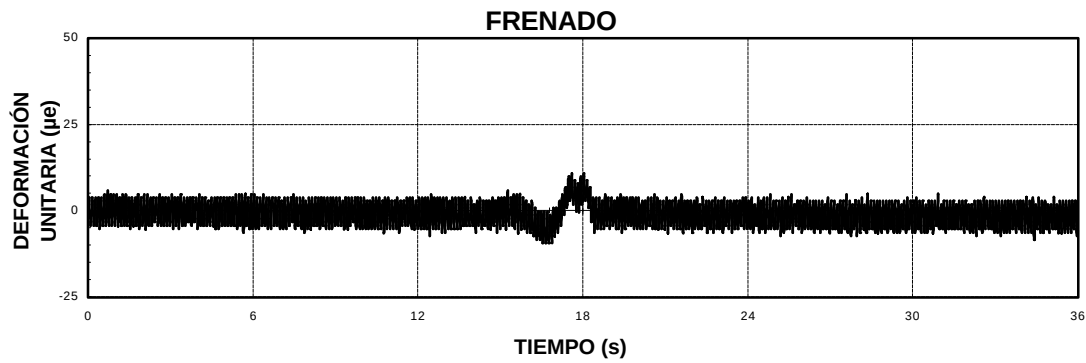
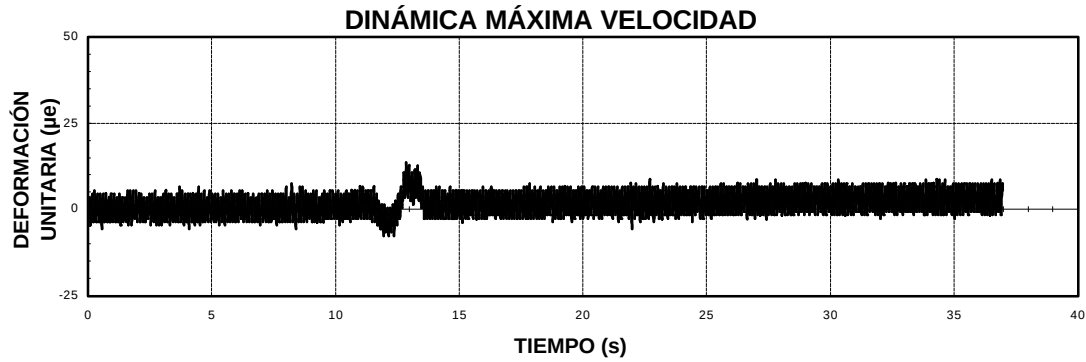
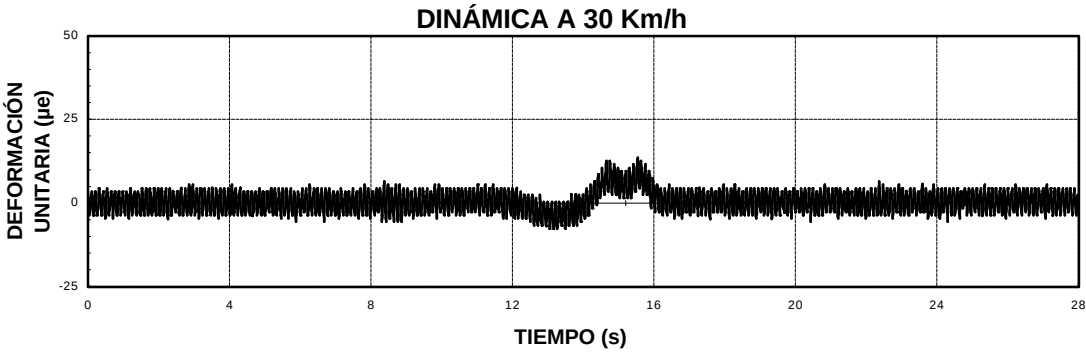
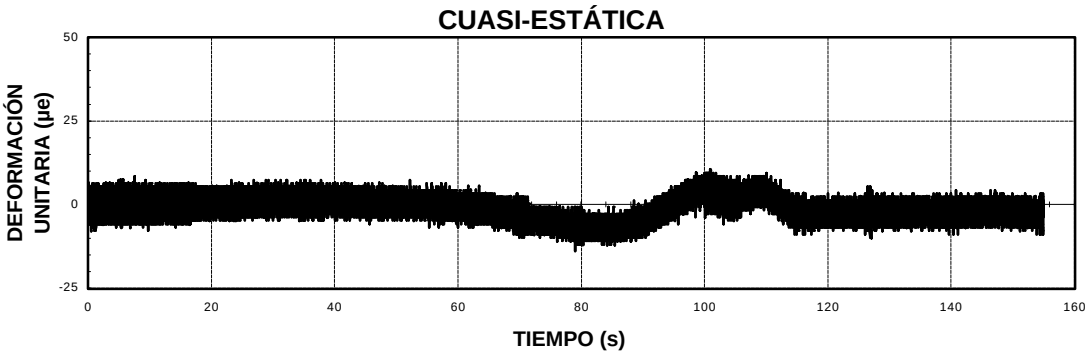


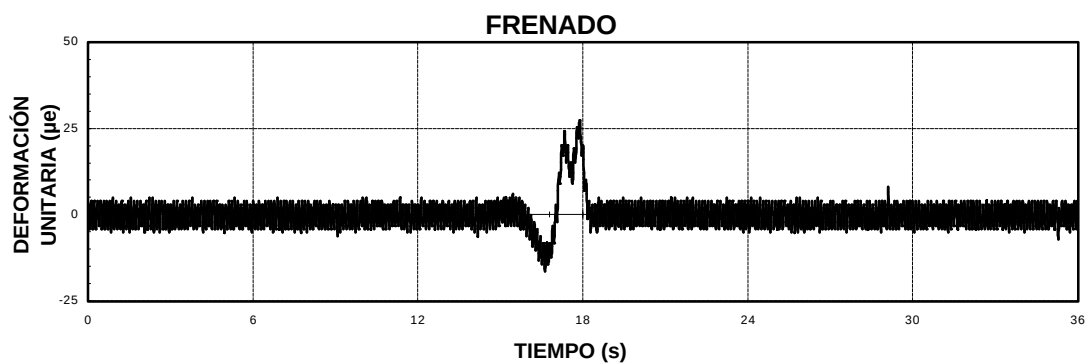
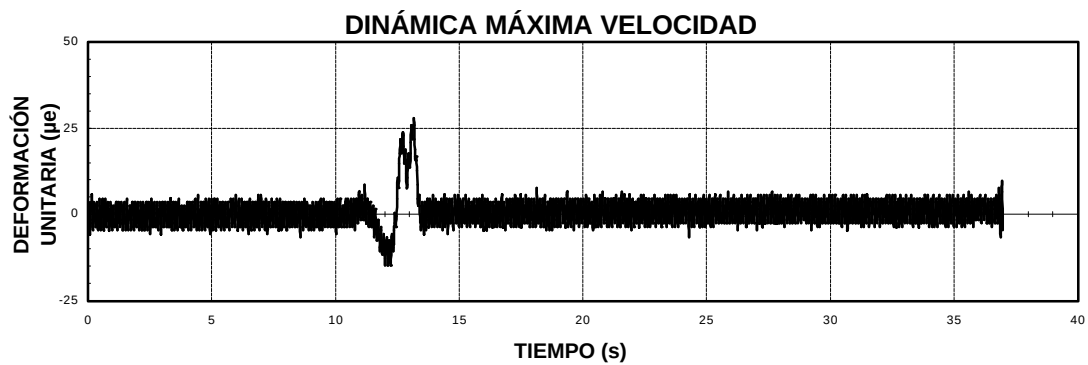
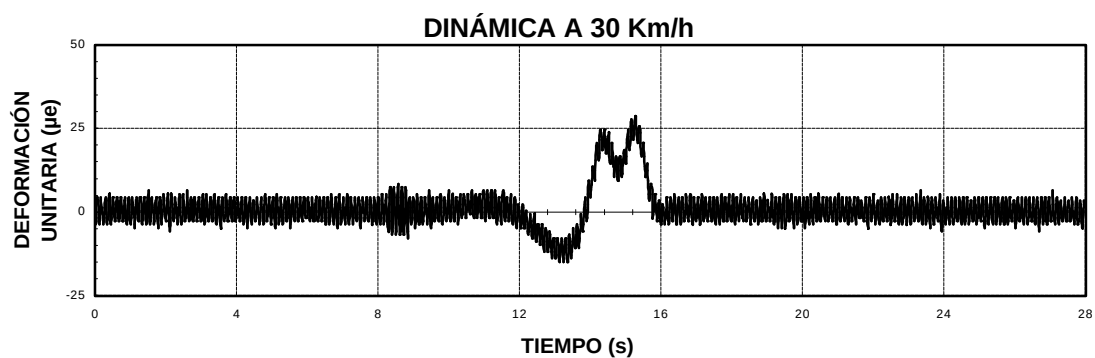
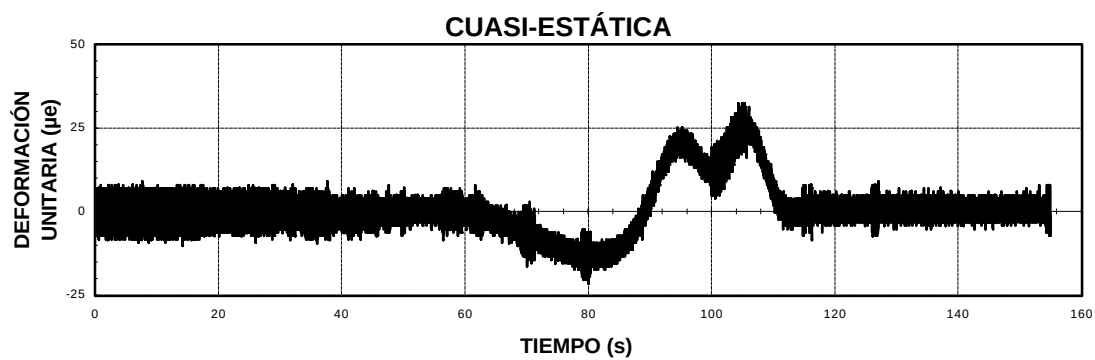


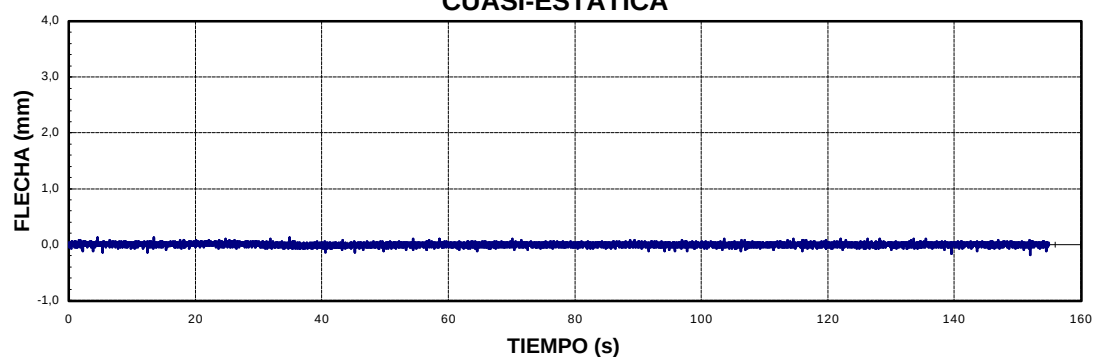
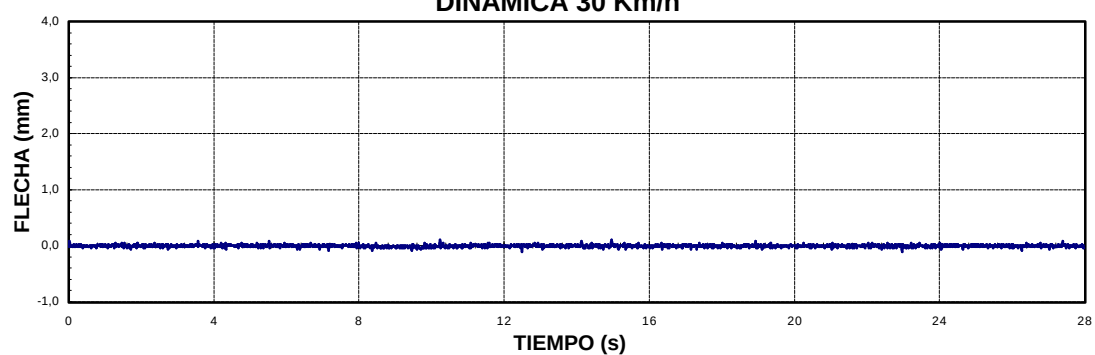
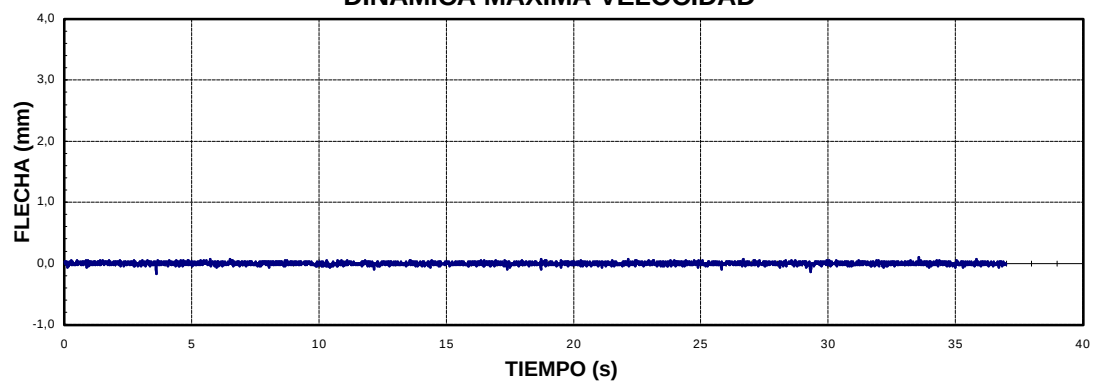
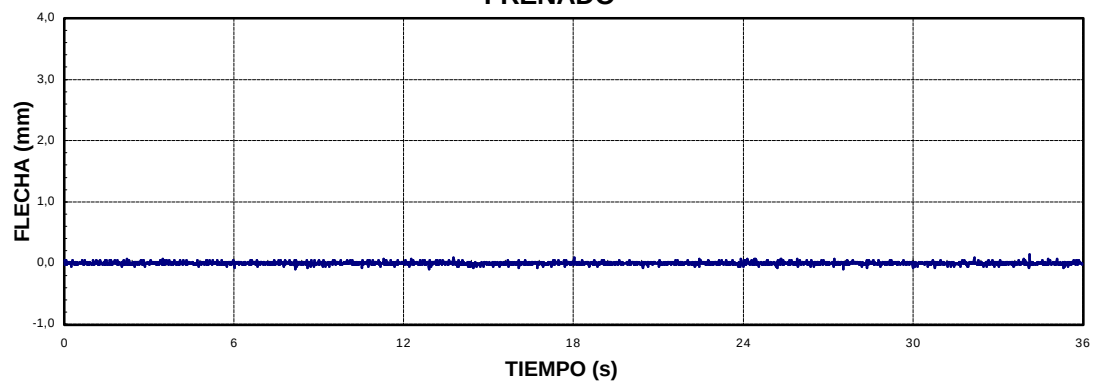


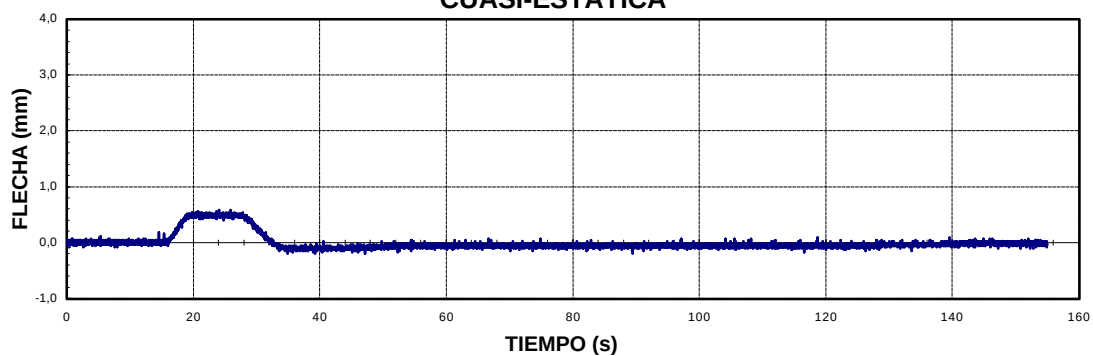
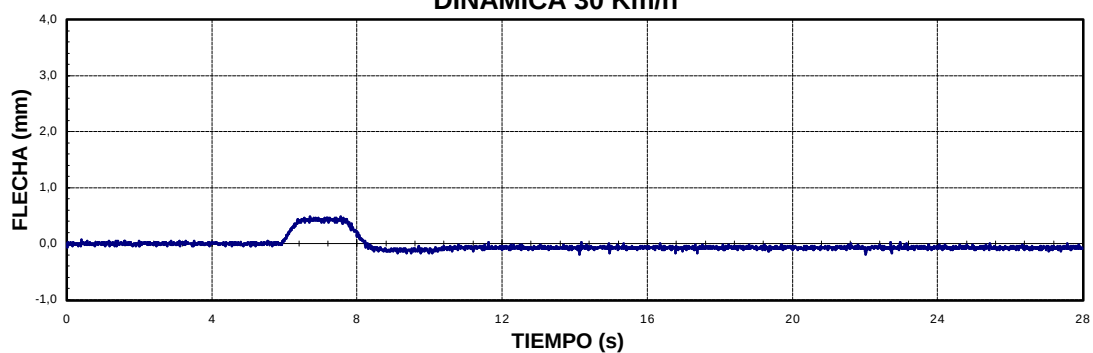
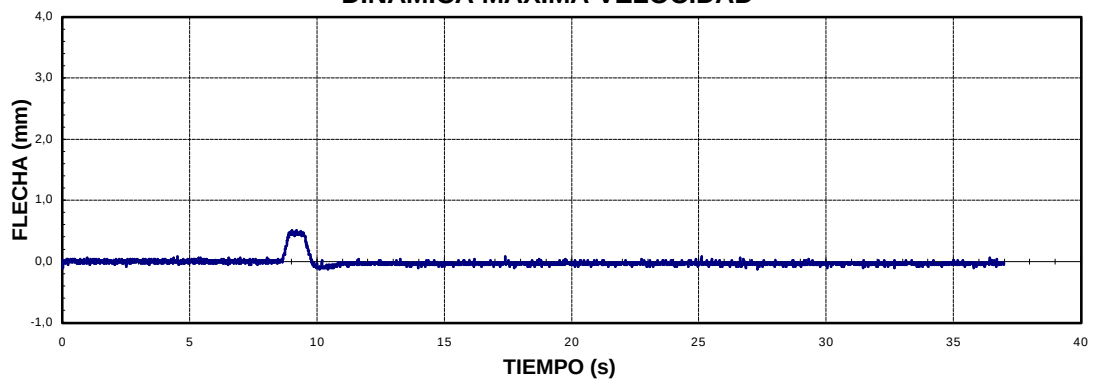
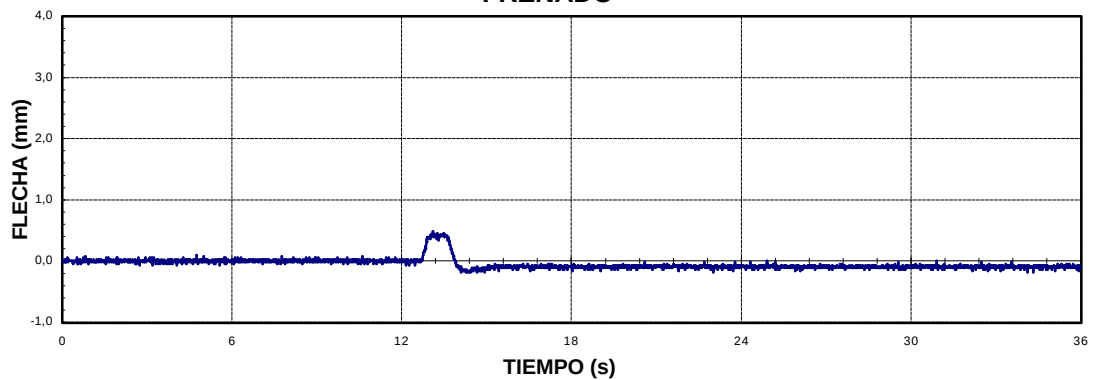




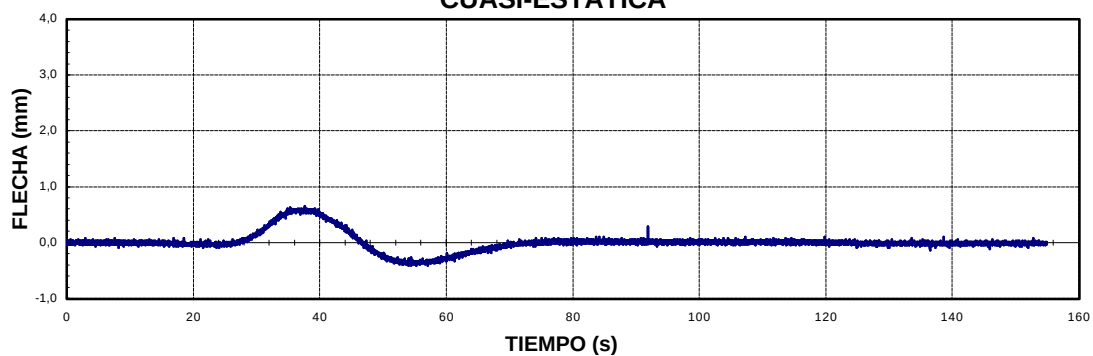




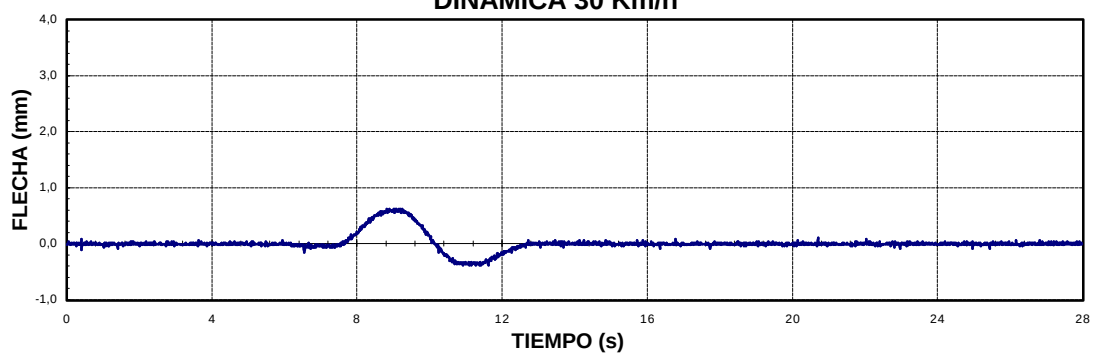
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

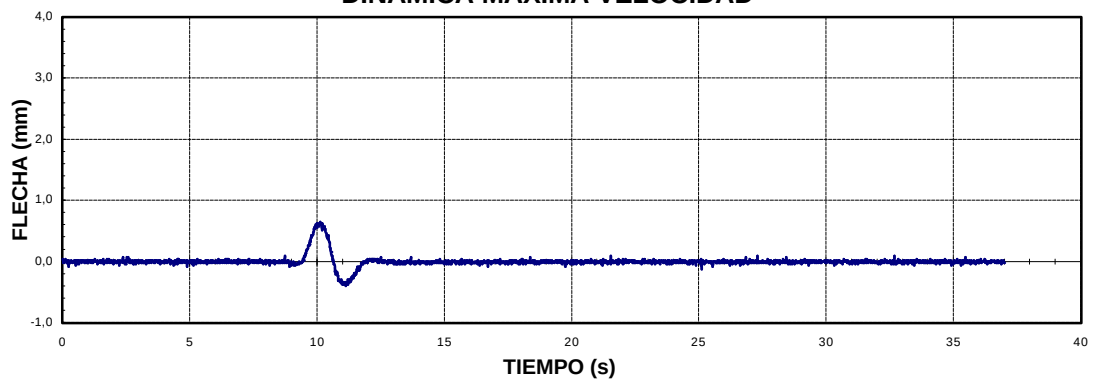
## CUASI-ESTÁTICA



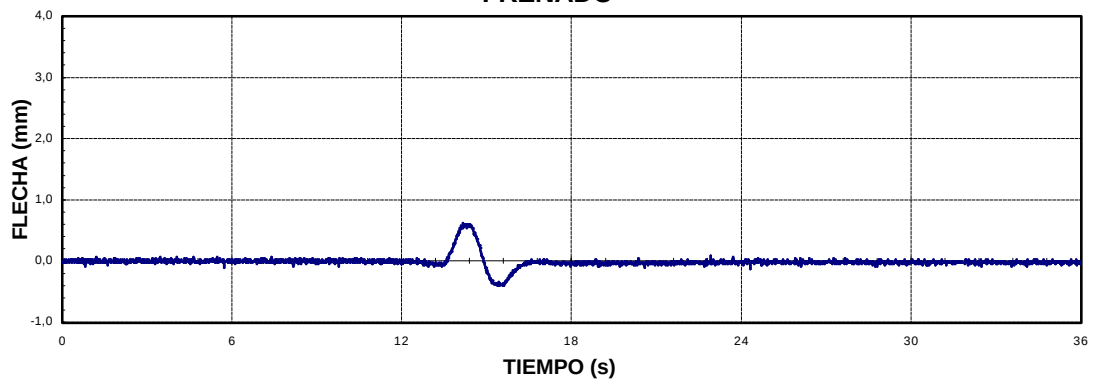
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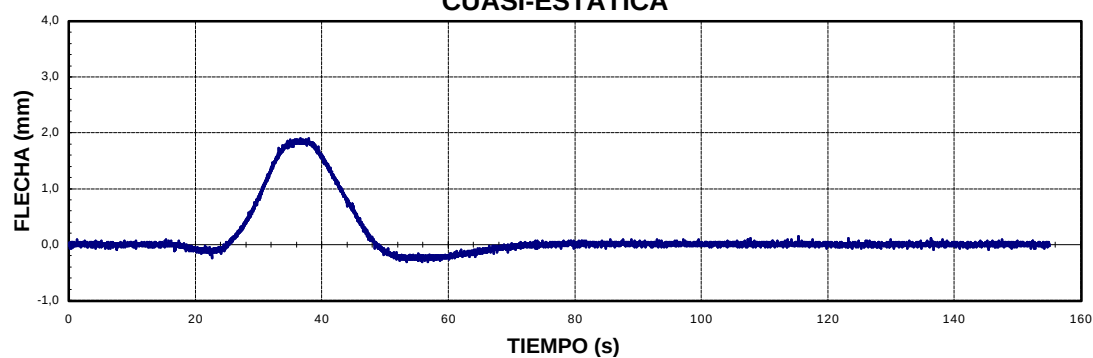
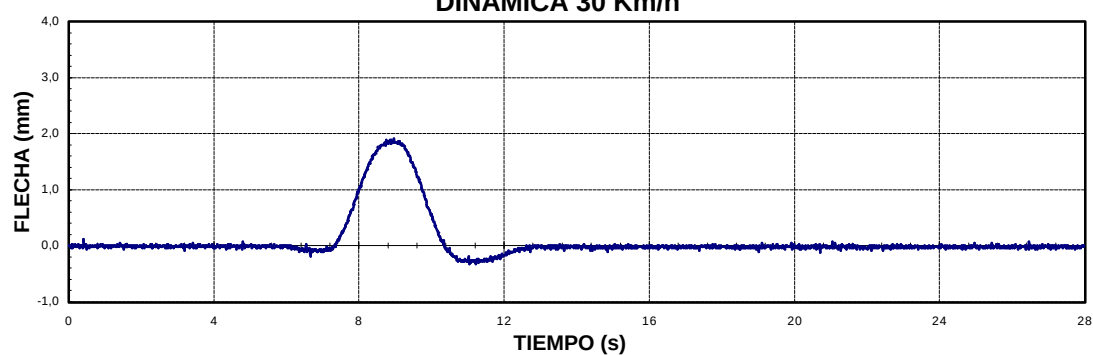
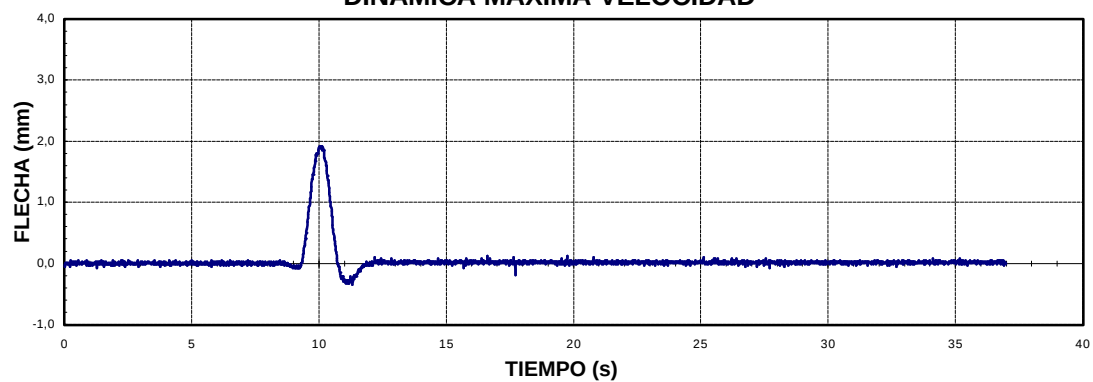
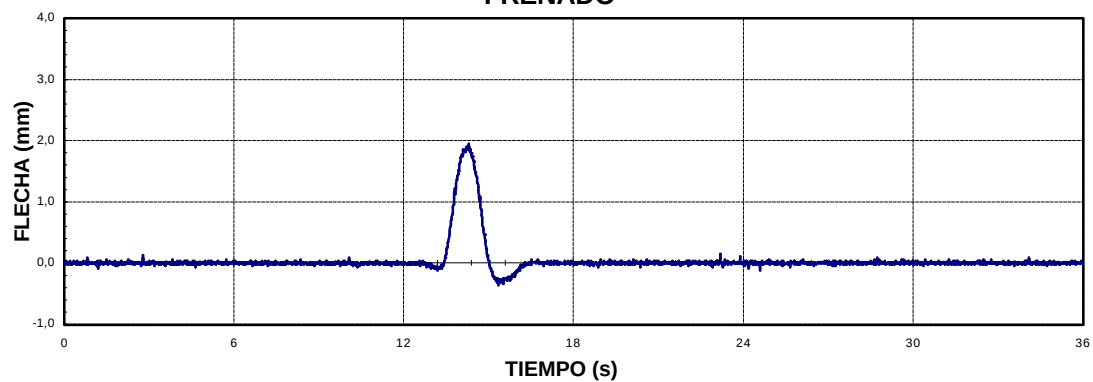


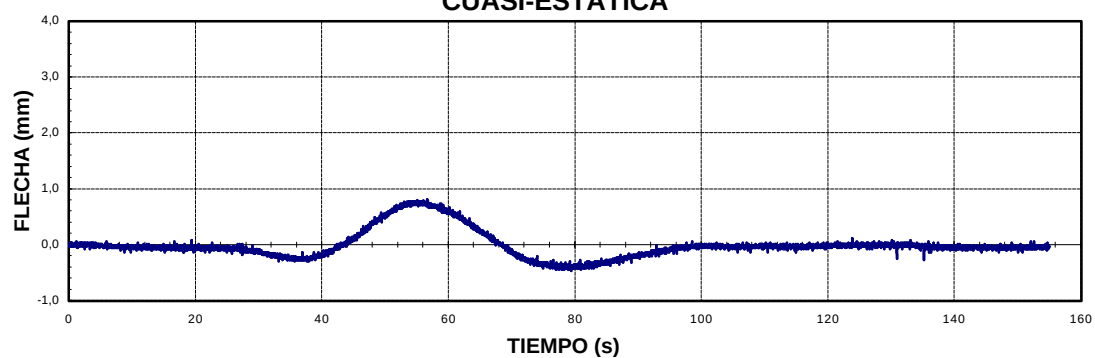
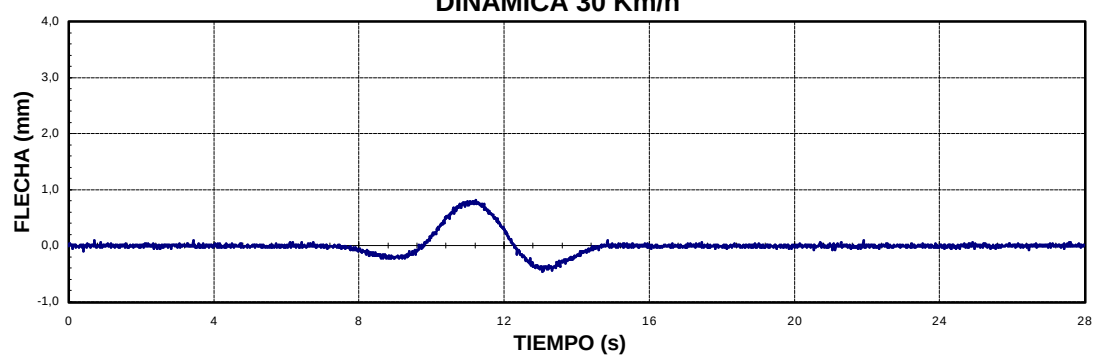
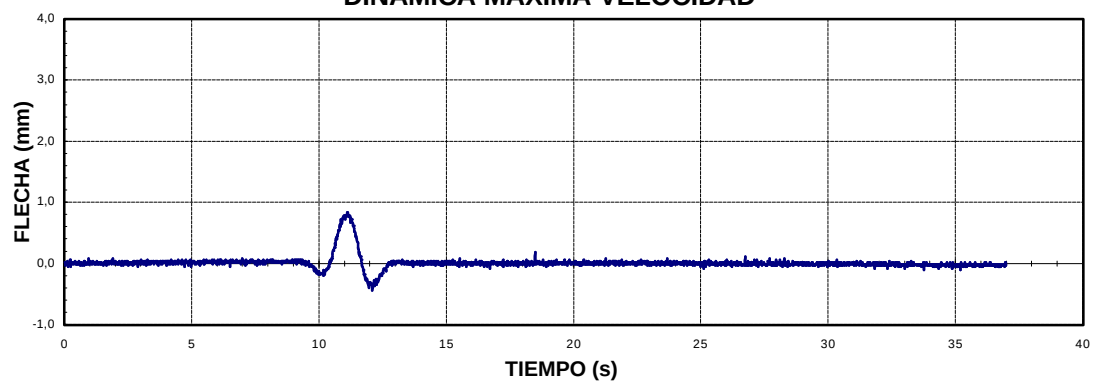
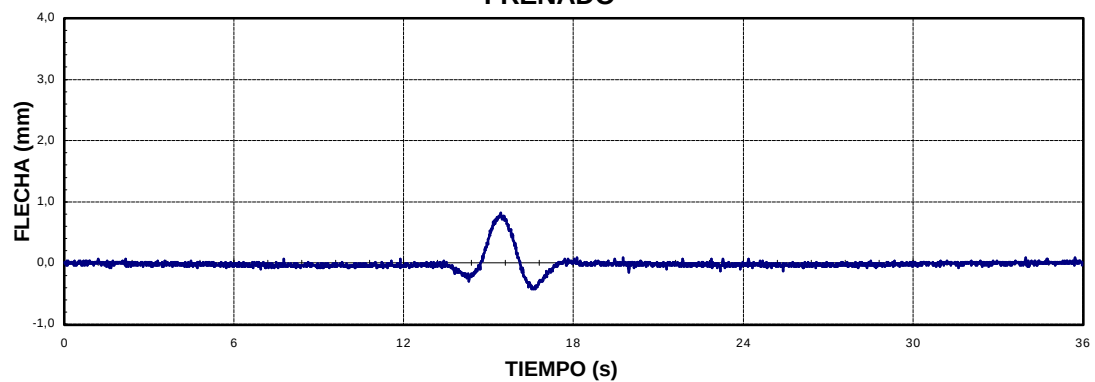
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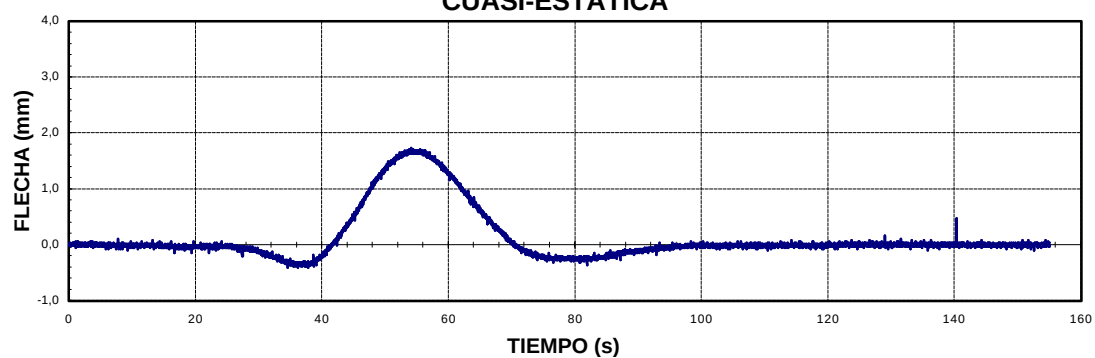
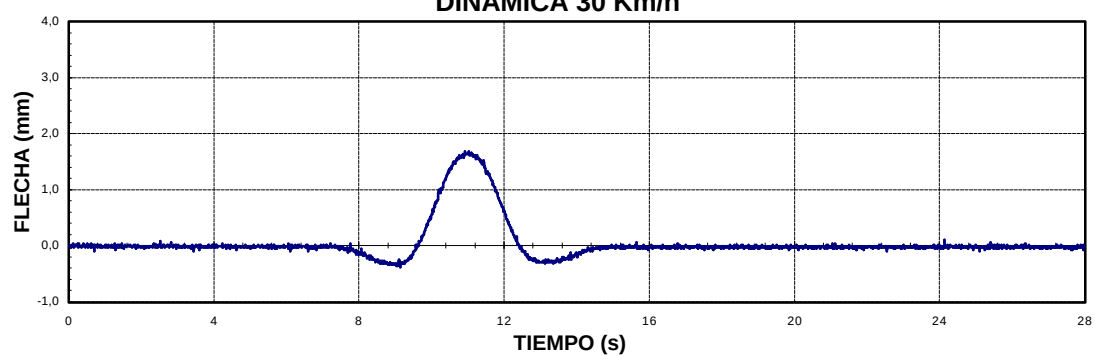
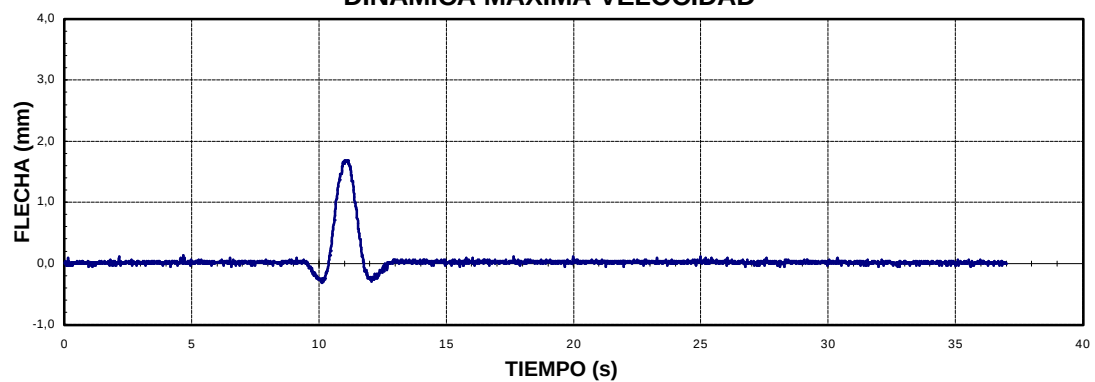
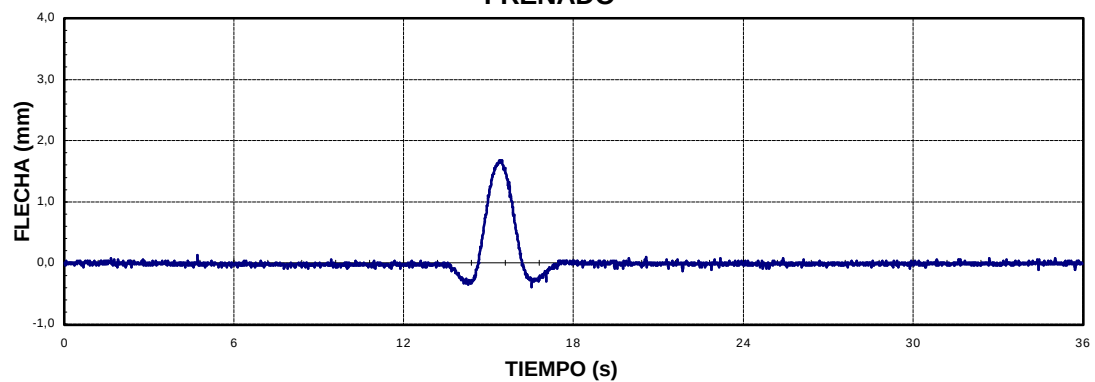


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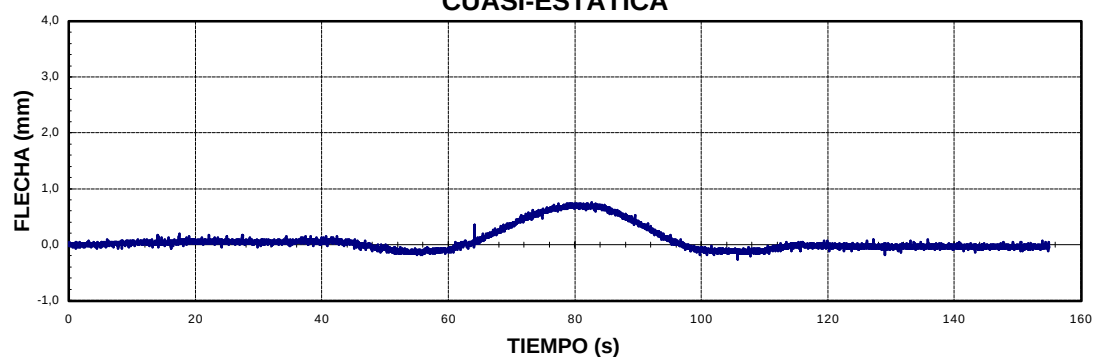
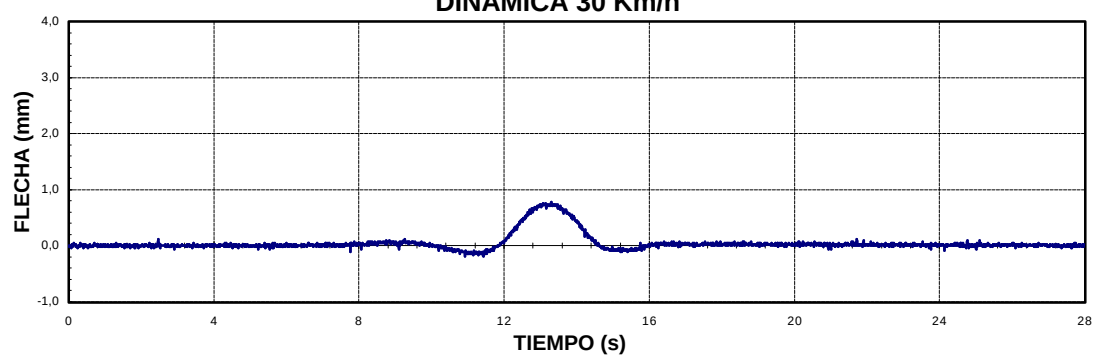
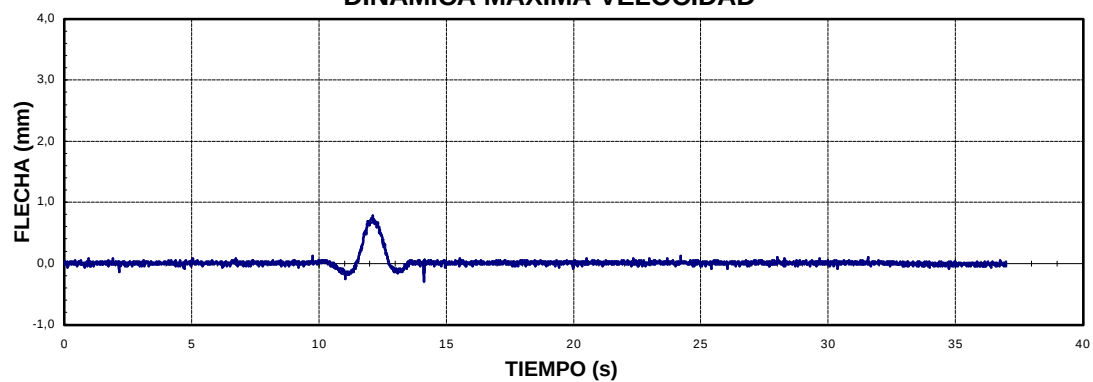
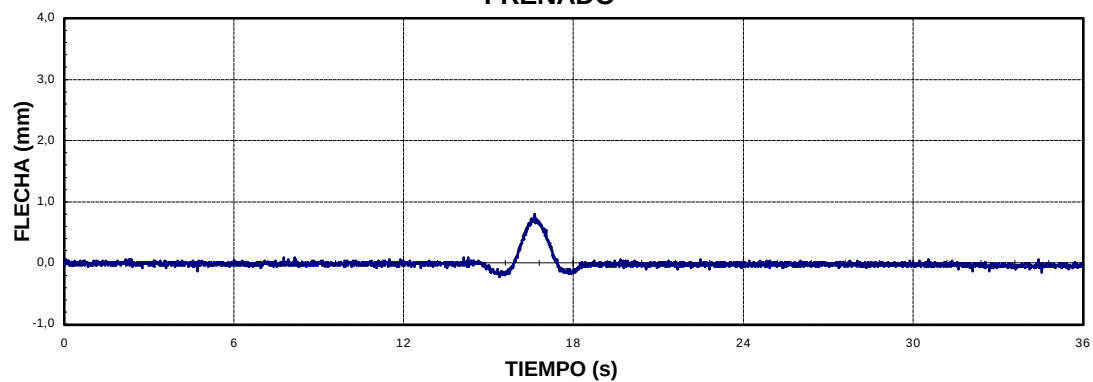


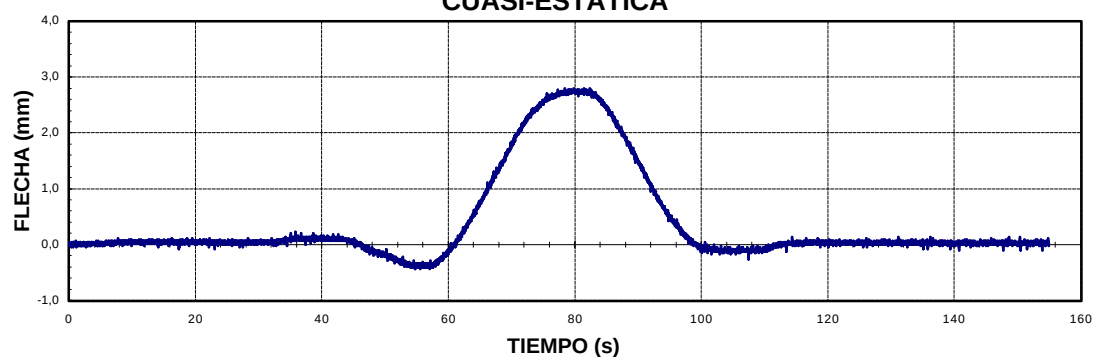
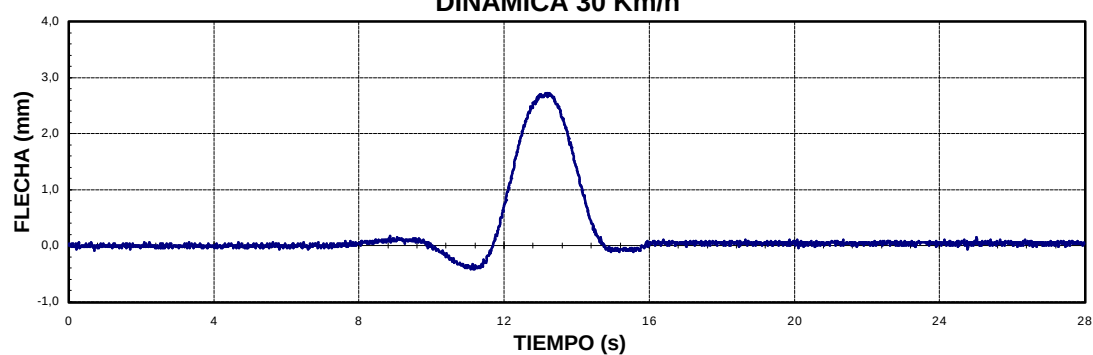
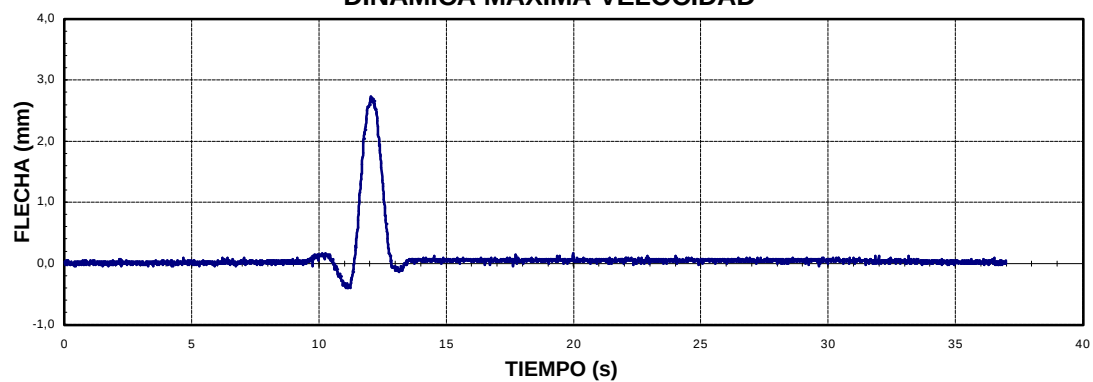
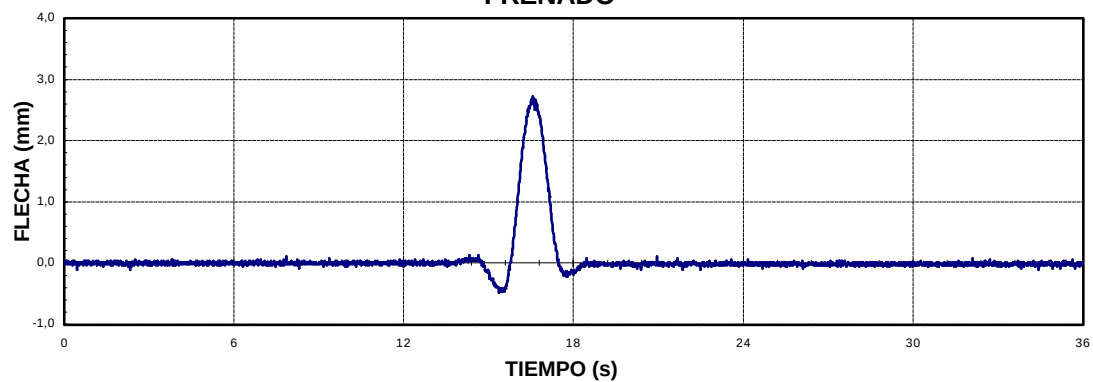
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

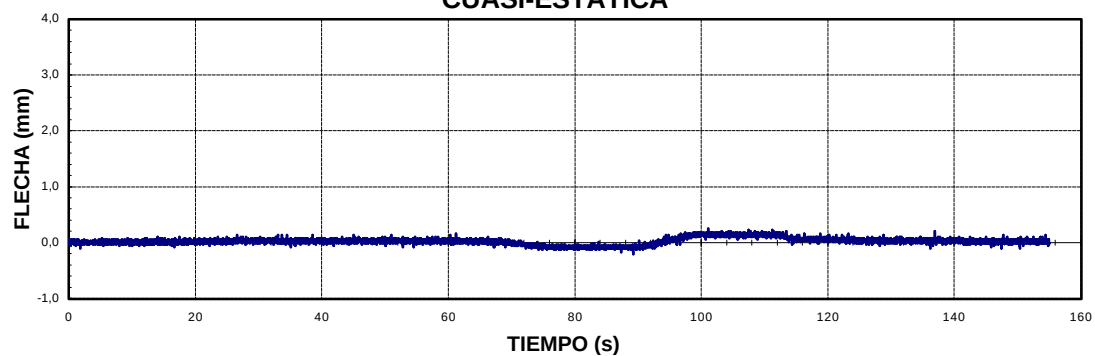
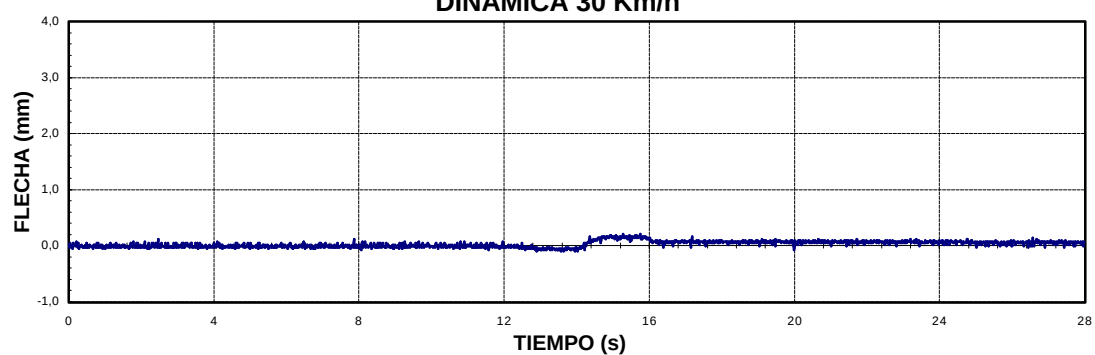
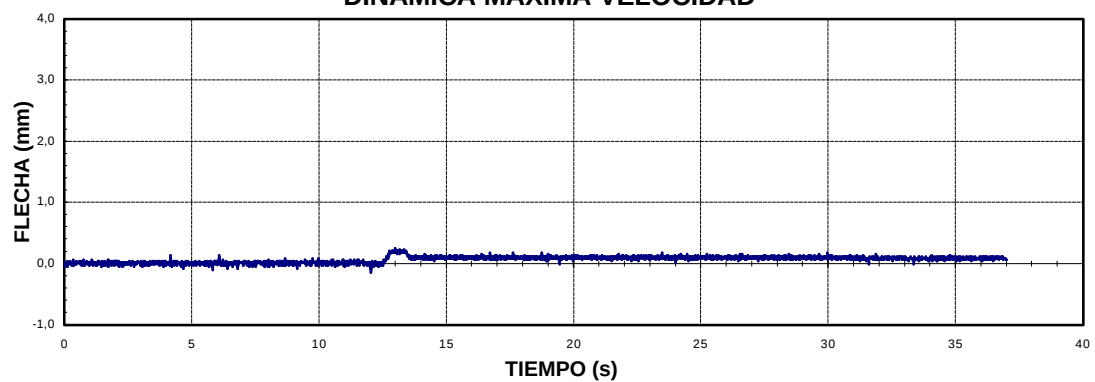
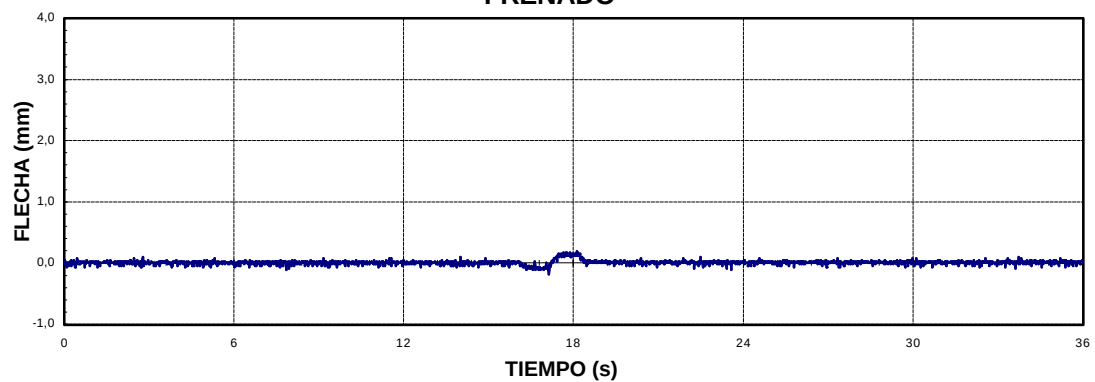
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

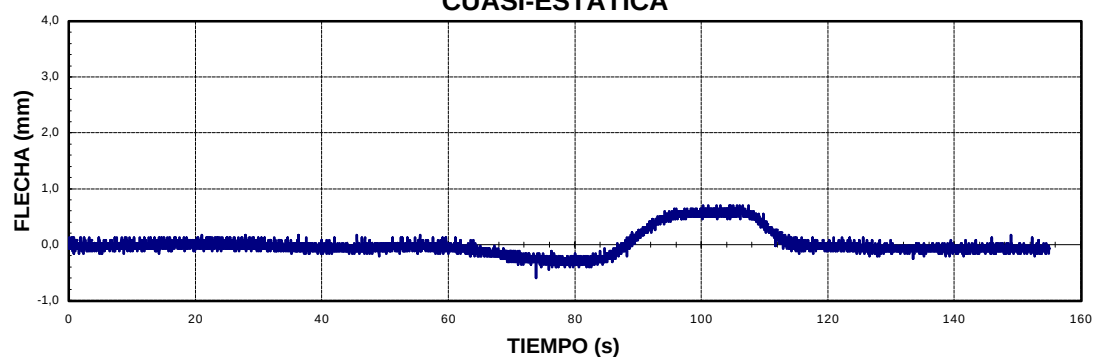
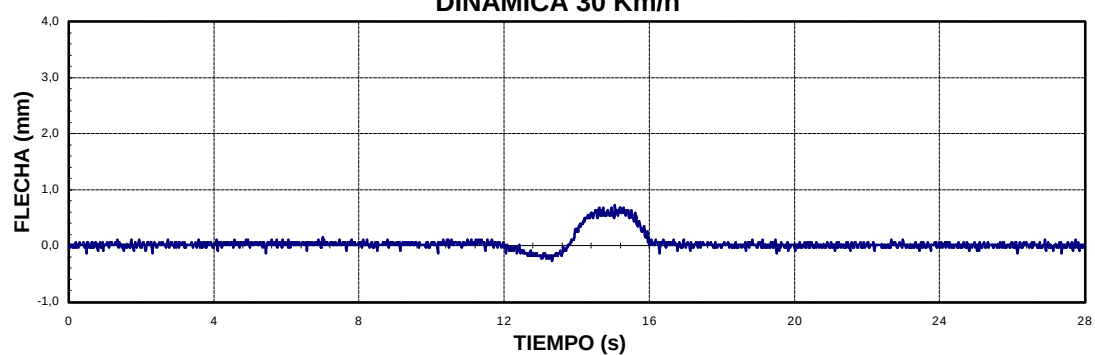
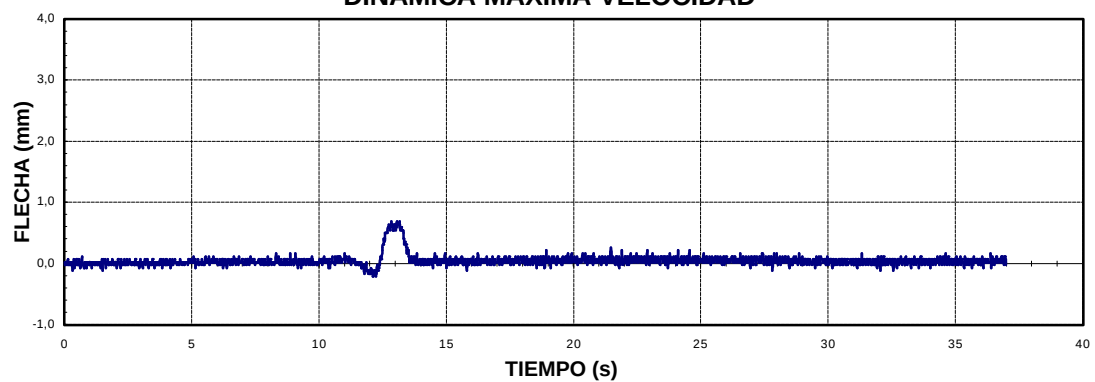
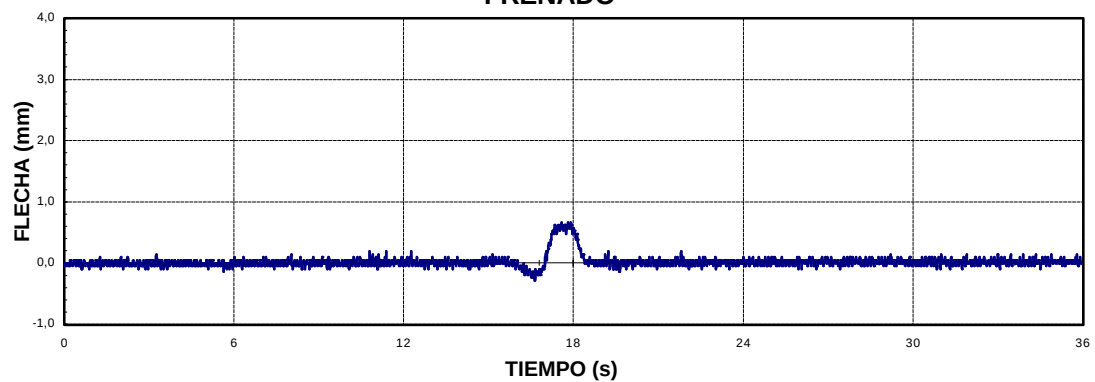
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**



**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

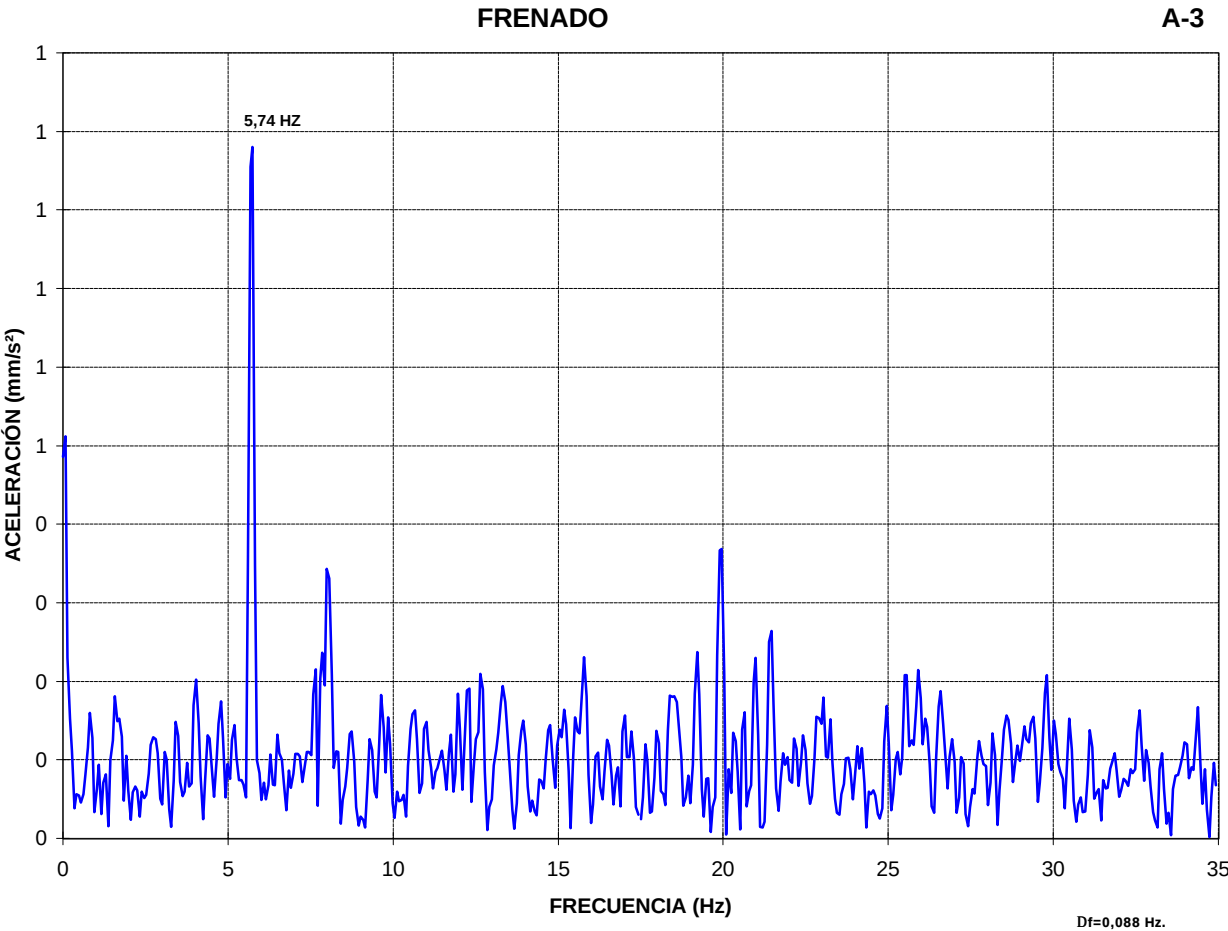
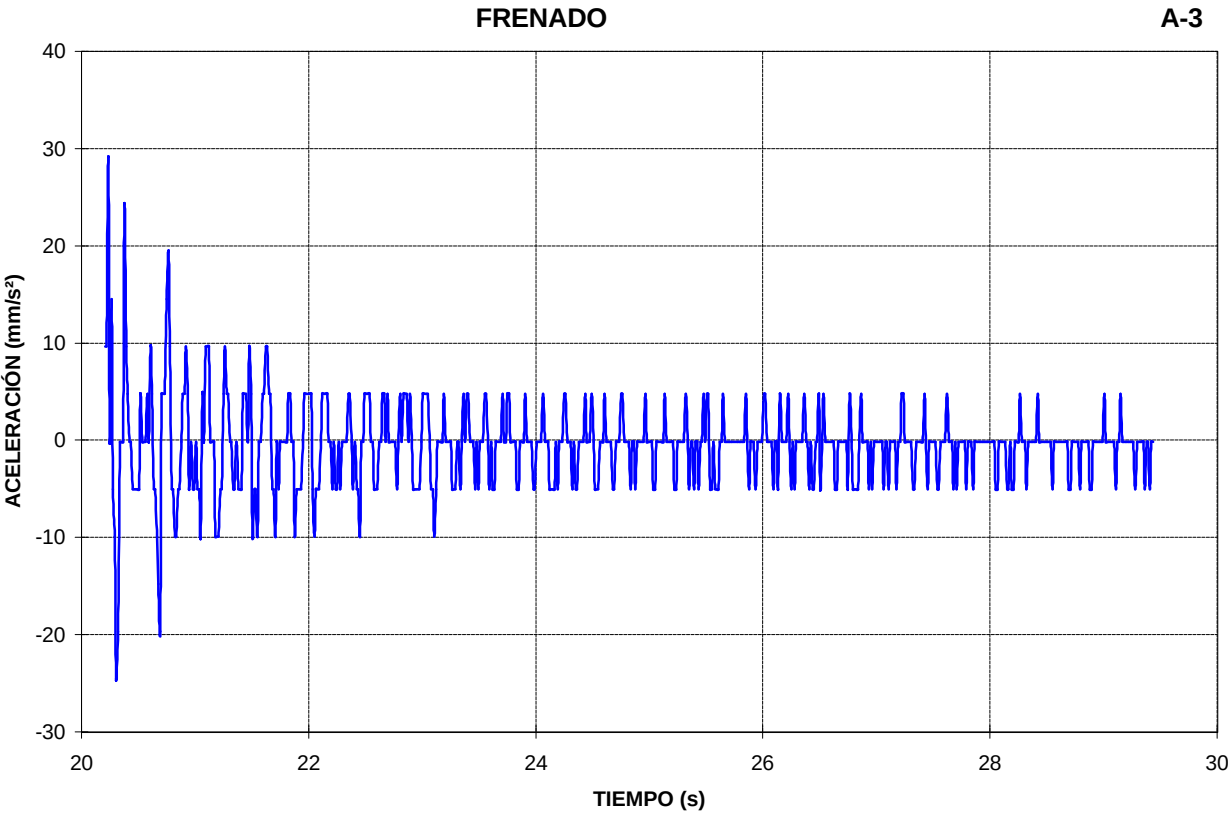
**CUASI-ESTÁTICA****DINÁMICA 30 Km/h****DINÁMICA MÁXIMA VELOCIDAD****FRENADO**

GIF VIA AVE

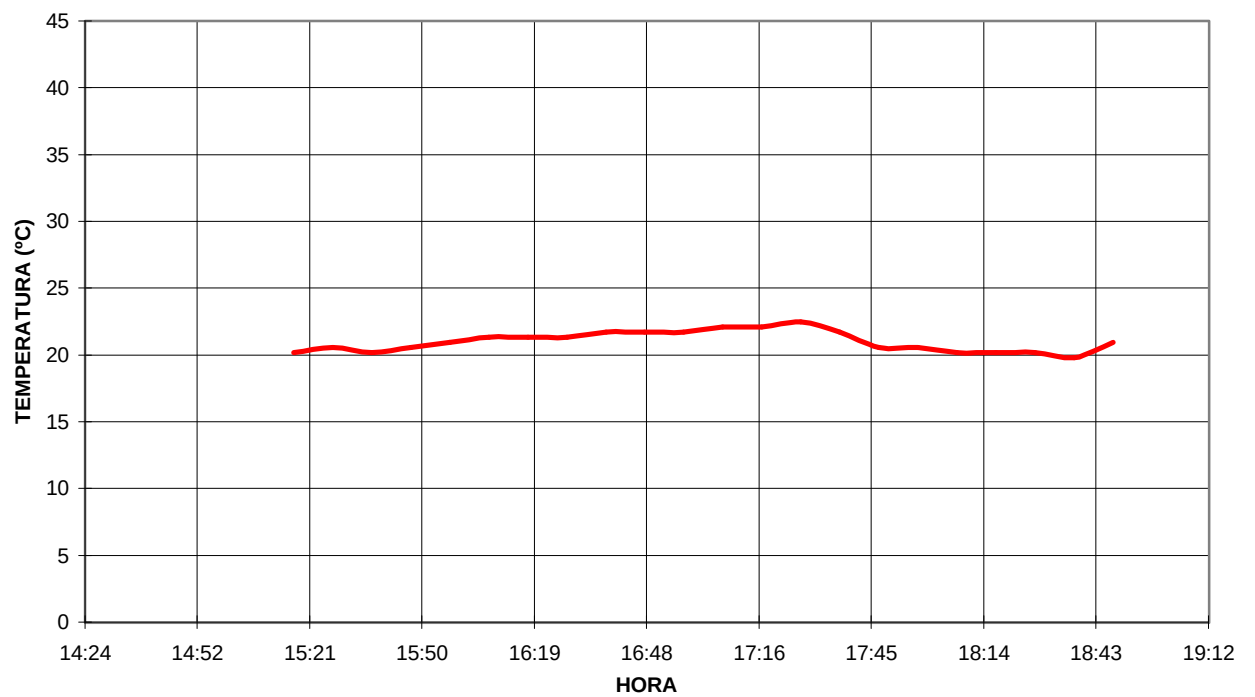
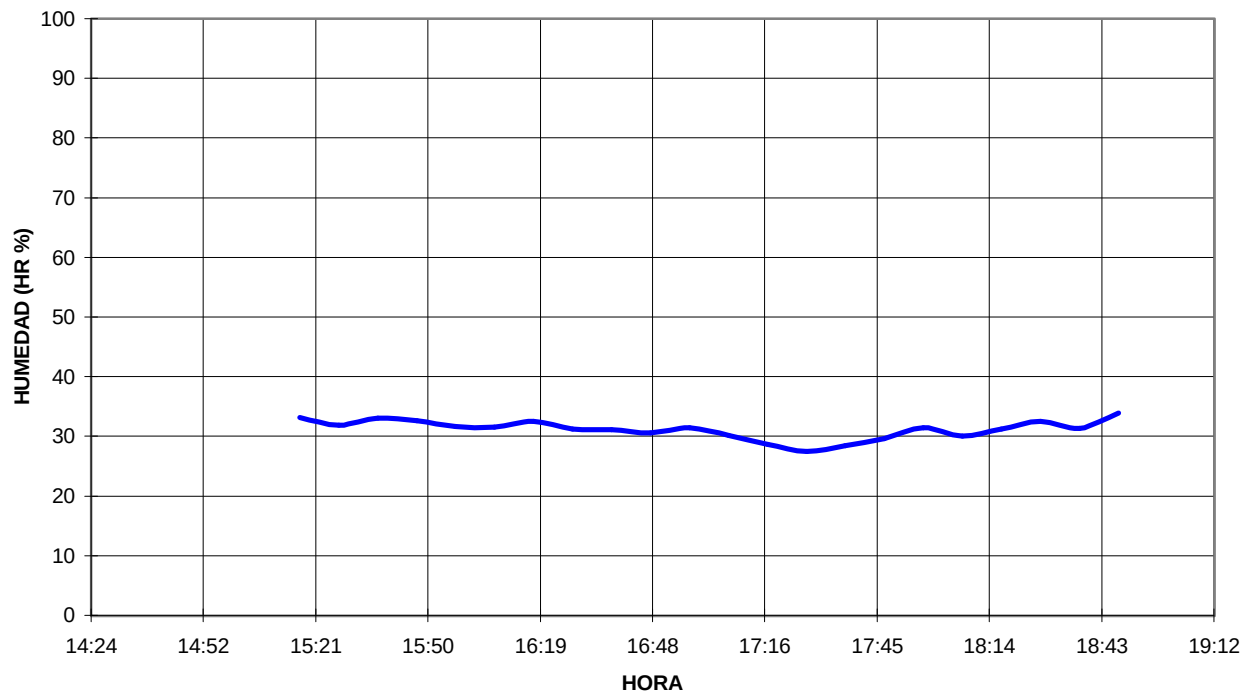
23VI04. ACEQUIA QUINTOS DE EBRO.

**ANÁLISIS FRECUENCIAL**

GIF VIA AVE  
ANÁLISIS FRECUENCIAL



GIF VIA AVE  
23VI04. ACEQUIA QUINTOS DE EBRO.



**ANEJO 5: REPORTAJE FOTOGRÁFICO.**



## RELACIÓN DE FOTOGRAFÍAS

- Nº 1.- Vista general de la estructura.
- Nº 2.- Prueba estática en vanos 1 y 2.
- Nº 3.- Prueba estática en vanos 2 y 3.
- Nº 4.- Prueba estática en vanos 3 y 4.
- Nº 5.- Prueba estática en vanos 4 y 5.
- Nº 6.- Prueba estática en vanos 3 y 5.
- Nº 7.- Prueba dinámica.



**Nº 1.- Vista general de la estructura**



**Nº 2.- Prueba estática en vanos 1 y 2.**



**Nº 3.- Prueba estática en vanos 2 y 3.**



**Nº 4.- Prueba estática en vanos 3 y 4.**



**Nº 5.- Prueba estática en vanos 4 y 5.**





**Nº 6.- Prueba estática en vanos 3 y 5.**



**Nº 7.- Prueba dinámica.**

**ANEJO 6: ACTA DE LA PRUEBA DE CARGA.**

## ACTA DE LA PRUEBA DE CARGA

| IDENTIFICACIÓN ESTRUCTURA |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LÍNEA DE ALTA VELOCIDAD   | MADRID - BARCELONA - FRONTERA FRANCESA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| TRAMO                     | MADRID - LLEIDA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P.K.                      | 336+300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| IDENTIFICACIÓN INVENTARIO | 23VI04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| NOMBRE                    | Viaducto sobre la acequia de Fuentes de Ebro                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| DESCRIPCIÓN ESTRUCTURA    | Se trata de una estructura hiperestática de planta recta sin esviaje, compuesta por cinco vanos de 15+25x3+15 metros de luz de cálculo y un ancho total de 14 m.<br>La solución estructural consiste en un tablero compuesto por dos vigas artesa de hormigón pretensado y losa superior in situ. El tablero está apoyado en los estribos y en las pilas mediante apoyos tipo POT. La losa de compresión tiene un canto medio de 0'25 metros. El canto total del tablero es de 1'70 metros. El tipo de hormigón de las vigas del tablero es HP-50 y la losa HA-30. |

| ASISTENTES                |                              |
|---------------------------|------------------------------|
| D. CARLOS RODRIGUEZ LÓPEZ | ORGANISMO EMPRESA<br>GEOCISA |

| CONDICIONES ATMOSFÉRICAS                                                          |                                 |                    |            |                   |                |
|-----------------------------------------------------------------------------------|---------------------------------|--------------------|------------|-------------------|----------------|
| Temperatura                                                                       |                                 | 22 °C              |            |                   |                |
| Humedad relativa                                                                  |                                 | 30 %               |            |                   |                |
| INSTRUMENTACIÓN INSTALADA<br>(según Informe de Prueba de Carga para la Recepción) |                                 |                    |            |                   | UNIDADES       |
| CONTROL DE FLECHAS                                                                | EQUIPO ÓPTICO LASER             |                    |            |                   |                |
|                                                                                   | TRANSDUCTORES DE DESPLAZAMIENTO |                    |            |                   | 22             |
| GRADO TENSIONAL DE LAS VIGAS                                                      | GALGAS EXTENSOMÉTRICAS          |                    |            |                   | 10             |
| REGISTRO DE VIBRACIONES                                                           | ACELERÓMETROS                   |                    |            |                   | 1              |
| TRENES DE CARGA UTILIZADOS                                                        |                                 |                    |            |                   |                |
|                                                                                   | VEHÍCULO                        | NÚMERO             | TIPO       | PESO UNITARIO (t) | PESO TOTAL (t) |
| C1: COMPOSICIÓN UTILIZADA EN VÍA 1<br>(CIRCULACIÓN LLEIDA - ZARAGOZA)             | LOCOMOTORA                      | 1                  | SERIE 37   | 120,0             | 280,0          |
|                                                                                   | TOLVAS                          | 2                  | TIPO GIF   | 80,0              |                |
| C2: COMPOSICIÓN UTILIZADA EN VÍA 2<br>(CIRCULACIÓN ZARAGOZA - LLEIDA)             | LOCOMOTORA                      | 1                  | SERIE 37   | 120,0             | 280,0          |
|                                                                                   | TOLVAS                          | 2                  | TIPO GIF   | 80,0              |                |
| SENTIDO CIRCULACIÓN PARA PRUEBAS DIÁMICAS                                         |                                 | MADRID-LLEIDA      |            |                   |                |
| PRUEBAS DE CARGA REALIZADAS                                                       |                                 |                    |            |                   |                |
|                                                                                   | VELOCIDAD                       | GRUPO 1 (24/10/02) |            |                   |                |
|                                                                                   |                                 | HORA COMIENZO      | HORA FINAL |                   |                |
| Prueba estática                                                                   |                                 | 15:40              | 18:40      |                   |                |
| Prueba cuasi-estática a                                                           | 5 km/h                          | 15:16              | 15:19      |                   |                |
| Prueba a máxima velocidad                                                         | 80 km/h                         | 15:21              | 15:25      |                   |                |
| Prueba de frenado a máxima velocidad                                              |                                 | 15:27              | 15:31      |                   |                |

| RESULTADOS BÁSICOS ALCANZADOS EN LA ESTRUCTURA                        |                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resultados prueba                                                     | En ocasiones difieren con los teóricos previstos en el Proyecto de Prueba de Carga, debido a una imperfección en el modelo empleado para el cálculo de la estructura, ya que las vigas no tienen continuidad sobre apoyos y en el proyecto se supuso que sí la tenían. |
| Recuperaciones                                                        | Superiores al 89 % en todos los casos<br>Comportamiento de la estructura: Elástico                                                                                                                                                                                     |
| Anomalías detectadas en la inspección visual previa                   | Ninguna                                                                                                                                                                                                                                                                |
| Anomalías detectadas durante el proceso de carga y al final del mismo | Ninguna                                                                                                                                                                                                                                                                |
| Otros datos de Interés                                                | Ninguno                                                                                                                                                                                                                                                                |
| Comportamiento resistente de la estructura                            | Correcto durante la realización de las pruebas de carga                                                                                                                                                                                                                |
| Observaciones                                                         | Ninguna                                                                                                                                                                                                                                                                |

**ANEJO 7: FICHA DE SEGUIMIENTO**

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTIERA FRANCESA**

**IDENTIFICACIÓN**

|                                         |                        |   |
|-----------------------------------------|------------------------|---|
| ID (Identificador de la estructura)     | 23VI04                 |   |
| P.K. INICIAL (sentido Madrid-Barcelona) | 336+300                |   |
| P.K. FINAL (sentido Madrid-Barcelona)   | 336+405                |   |
| TIPO                                    | Viaducto ( luz > 50 m) | ▼ |
| SUBTRAMO                                | ZARAGOZA-LLEIDA: II-a  | ▼ |
| FECHA DE LA INSPECCIÓN                  | 18/02/03               |   |
| OBSERVACIONES                           |                        |   |



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTA FRANCESA**

**ID (Identificador de la estructura)**

**23VI04**

**FECHA DE LA INSPECCIÓN**

**18/02/03**

**DATOS GENERALES**

|                               |                                           |
|-------------------------------|-------------------------------------------|
| NOMBRE                        | Viaducto sobre Acequia de Fuentes de Ebro |
| TIPOLOGÍA GENERAL             | TABLERO DE VIGAS ▼                        |
| TIPOLOGÍA ESTRUCTURAL         | ESTRUCTURA CONTINUA ▼                     |
| Nº DE VÍAS                    | 2                                         |
| VELOCIDAD MÁXIMA (km/h)       |                                           |
| TIPO DE ACCESO                | VEHÍCULO AUTOMOVIL ▼                      |
| OBSTÁCULO SALVADO             | CANAL ▼                                   |
| NOMBRE OBSTÁCULO SALVADO      | Acequia de Fuente de Ebro                 |
| OTRO OBSTÁCULO SALVADO        | CAMINO, VÍA PECUARIA O PASO DE FAUNA ▼    |
| NOMBRE OTRO OBSTÁCULO SALVADO |                                           |
| OBSERVACIONES                 |                                           |

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA**

|                                            |                 |
|--------------------------------------------|-----------------|
| <b>ID (Identificador de la estructura)</b> | <b>23VI04</b>   |
| <b>FECHA DE LA INSPECCIÓN</b>              | <b>18/02/03</b> |

**PARÁMETROS GEOMÉTRICOS**

|                                                              |                     |             |
|--------------------------------------------------------------|---------------------|-------------|
| LONGITUD TOTAL (m)                                           | 105,00              |             |
| Nº DE VANOS                                                  | 5                   |             |
| LONGITUD MEDIA DEL VANO (m)                                  | 21,00               |             |
| LUZ DE CADA VANO (m)                                         | 15'00+25'00X3+15'00 |             |
| ALTURA MÁXIMA DE ESTRIBOS (m)                                | 10,80               |             |
| ANCHURA MÁXIMA DE ESTRIBOS (m)                               | 14,00               |             |
| ALTURA MÁXIMA DE PILAS (m)                                   | 10,75               |             |
| ANCHURA MÁXIMA DE PILAS (m)                                  | 2,30                |             |
| ESPESOR MÁXIMO DE PILAS (m)                                  | 2,29                |             |
| GÁLIBO INFERIOR (m)                                          | 9,16                |             |
| ANCHURA MÁXIMA DE TRAMOS (m)                                 | 14,00               |             |
| CANTO MÁXIMO DE TRAMOS EN CENTRO DE VANOS (m)                | 1,70                |             |
| Nº DE ELEMENTOS PRINCIPALES EN EL TRAMO                      | 2                   |             |
| SEPARACIÓN ENTRE ELEMENTOS PRINCIPALES (m)                   | 5,00                |             |
| CANTO DE ELEMENTOS PRINCIPALES                               | VARIABLE            | ▼           |
| CANTO MÁXIMO DE ELEMENTOS PRINCIPALES EN CENTRO DE VANOS (m) | 1,40                |             |
| GÁLIBO IZQUIERDO (m)                                         | 3,90                |             |
| GÁLIBO DERECHO (m)                                           | 3,90                |             |
| ENTREVÍA (m)                                                 | 4,70                |             |
| TRAZADO DE VÍA EN PLANTA (m)                                 |                     | R (recto) ▼ |
| PERALTE DE VÍA DE ENTRADA (m)                                |                     |             |
| PERALTE DE VÍA DE CENTRO (m)                                 |                     |             |
| PERALTE DE VÍA DE SALIDA (m)                                 |                     |             |

**OBSERVACIONES**

La viga derecha se encuentra retranqueada 4.95 m respecto de la viga izquierda.

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**MATERIALES**

MATERIAL CONSTITUYENTE

**TRAMOS**

TIPOLOGÍA DE TRAMOS

TIPOLOGÍA ESTRUCTURAL DE TRAMOS

MATERIAL EN TRAMOS

IMPERMEABILIZACIÓN DE ESTRUCTURA DE TRAMOS

ELEMENTOS DE DRENAJE EN TRAMOS

**ESTRIBOS**

TIPOLOGÍA DE ESTRIBOS

MATERIAL BASE EN ESTRIBOS

PROTECCIÓN EN PIE DE ESTRIBOS

TIPOLOGÍA DE CIMENTACIÓN EN ESTRIBOS

MATERIAL BASE EN CIMENTACIÓN DE ESTRIBOS

**PILAS**

TIPOLOGÍA DE PILAS

SECCIÓN DE PILAS

TAJAMARES

MATERIAL BASE EN PILAS

TIPOLOGÍA DE CIMENTACIÓN EN PILAS

MATERIAL BASE EN CIMENTACIÓN DE PILAS

**APARATOS Y JUNTAS DE DILATACIÓN**

APARATOS DE APOYO

JUNTAS DE DILATACIÓN

TIPOLOGÍA DE JUNTAS DE DILATACIÓN

APARATOS DE DILATACIÓN DE CARRILES

**VARIOS**

PASEOS DE SERVICIO

OBSERVACIONES

|                                     |   |
|-------------------------------------|---|
| HORMIGÓN EN MASA O ARMADO           | ▼ |
| TABLERO DE VIGAS                    | ▼ |
| ESTRUCTURA CONTINUA                 | ▼ |
| HORMIGÓN ARMADO O EN MASA           | ▼ |
| SI                                  | ▼ |
| TRANSVERSALES                       | ▼ |
| MUROS FRONTAL Y EN VUELTAS          | ▼ |
| HORMIGÓN ARMADO O EN MASA           | ▼ |
| NO EXISTE                           | ▼ |
| CIMENTACIÓN DIRECTA                 | ▼ |
| HORMIGÓN ARMADO O EN MASA           | ▼ |
| TABIQUE HUECO O EN CAJÓN            | ▼ |
| VARIABLE                            | ▼ |
| NO                                  | ▼ |
| HORMIGÓN ARMADO O EN MASA           | ▼ |
| ENCEPADO Y PILOTES                  | ▼ |
| HORMIGÓN ARMADO O EN MASA           | ▼ |
| TIPO POT                            | ▼ |
| AMBOS ESTRIBOS                      | ▼ |
| MURETES GUARDABALASTO Y CUBREJUNTAS | ▼ |
| SALIDA                              | ▼ |
| AMBOS LADOS                         | ▼ |

El material de la losa es hormigón armado y el hormigón del cajón prefabricado es pretensado. Existe chapa metálica protegiendo canaletas en junta del estribo 2 y barandilla antivandalismo en el lado derecho.

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**ESTADO ACTUAL ESTRIBOS**

|                                           |                                                |   |
|-------------------------------------------|------------------------------------------------|---|
| Punzonado bajo apoyos                     | 0: No existen defectos                         | ▼ |
| Daños en unión frente y laterales         | 0: No existen defectos                         | ▼ |
| Juntas degradadas                         | 0: No existen defectos                         | ▼ |
| Golpes y roturas                          | 0: No existen defectos                         | ▼ |
| Fisuras y grietas                         | 2: Defectos con riesgo de evolución patológica | ▼ |
| Coqueras y nidos de grava                 | 1: Defectos con incidencia en la estética      | ▼ |
| Meteorización y degradación               | 0: No existen defectos                         | ▼ |
| Desprendimientos                          | 0: No existen defectos                         | ▼ |
| Carbonatación y desagregación             | 0: No existen defectos                         | ▼ |
| Armaduras vistas someras                  | 2: Defectos con riesgo de evolución patológica | ▼ |
| Corrosión y disgregación                  | 0: No existen defectos                         | ▼ |
| Humedades y filtraciones                  | 0: No existen defectos                         | ▼ |
| Incrustaciones calcáreas y eflorescencias | 0: No existen defectos                         | ▼ |
| Desagüe de mechinales                     | 0: No existen defectos                         | ▼ |
| Abombamientos                             | 0: No existen defectos                         | ▼ |
| Desplomes o basculamientos                | 0: No existen defectos                         | ▼ |
| Asentamientos                             | 0: No existen defectos                         | ▼ |
| Descalces                                 | 0: No existen defectos                         | ▼ |
| Socavaciones                              | 0: No existen defectos                         | ▼ |
| Depósitos en coronación                   | 0: No existen defectos                         | ▼ |
| Daños en coronación                       | 0: No existen defectos                         | ▼ |
| Daños en espaldón                         | 0: No existen defectos                         | ▼ |
| Balasto encastrado                        | 2: Defectos con riesgo de evolución patológica | ▼ |
| Daños en protección de pie de estribos    | 0: No existen defectos                         | ▼ |
| Daños en cimentaciones vistas             | 0: No existen defectos                         | ▼ |
| Vegetación aflorando                      | 0: No existen defectos                         | ▼ |
| Vegetación adosada                        | 0: No existen defectos                         | ▼ |

OBSERVACIONES ESTRIBOS

**ESTADO GENERAL ESTRIBOS**

2: Defectos con riesgo de evolución patológica



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA**

**ID (Identificador de la estructura)**

**23VI04**

**FECHA DE LA INSPECCIÓN**

**18/02/03**

**ESTADO ACTUAL ALETAS O MUROS DE ACOMPAÑAMIENTO**

|                                           |                                                |   |
|-------------------------------------------|------------------------------------------------|---|
| Daños en unión frente y laterales         | 0: No existen defectos                         | ▼ |
| Juntas degradadas                         | 0: No existen defectos                         | ▼ |
| Golpes y roturas                          | 0: No existen defectos                         | ▼ |
| Fisuras y grietas                         | 2: Defectos con riesgo de evolución patológica | ▼ |
| Coqueras y nidos de grava                 | 2: Defectos con riesgo de evolución patológica | ▼ |
| Meteorización y degradación               | 0: No existen defectos                         | ▼ |
| Desprendimientos                          | 0: No existen defectos                         | ▼ |
| Carbonatación y desagregación             | 0: No existen defectos                         | ▼ |
| Armaduras vistas someras                  | 3: Defectos inicio evolución patológica        | ▼ |
| Corrosión y disgregación                  | 0: No existen defectos                         | ▼ |
| Humedades y filtraciones                  | 2: Defectos con riesgo de evolución patológica | ▼ |
| Incrustaciones calcáreas y eflorescencias | 0: No existen defectos                         | ▼ |
| Desagüe de mechinales                     | 0: No existen defectos                         | ▼ |
| Abombamientos                             | 0: No existen defectos                         | ▼ |
| Desplomes o basculamientos                | 0: No existen defectos                         | ▼ |
| Asentamientos                             | 0: No existen defectos                         | ▼ |
| Descalces                                 | 0: No existen defectos                         | ▼ |
| Socavaciones                              | 0: No existen defectos                         | ▼ |
| Depósitos en coronación                   | 0: No existen defectos                         | ▼ |
| Daños en coronación                       | 0: No existen defectos                         | ▼ |
| Daños en protección de pie de estribos    | 0: No existen defectos                         | ▼ |
| Daños en cimentaciones vistas             | 0: No existen defectos                         | ▼ |
| Vegetación aflorando                      | 0: No existen defectos                         | ▼ |
| Vegetación adosada                        | 0: No existen defectos                         | ▼ |

OBSERVACIONES ESTRIBOS

**ESTADO GENERAL ALETAS**

2: Defectos con riesgo de evolución patológica

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTA FRANCESA**

**ID (Identificador de la estructura)**

**23VI04**

**FECHA DE LA INSPECCIÓN**

**18/02/03**

**ESTADO ACTUAL PILAS**

|                                           |                                           |   |
|-------------------------------------------|-------------------------------------------|---|
| Punzonado bajo apoyos                     | 0: No existen                             | ▼ |
| Daños en unión frente y laterales         | 0: No existen                             | ▼ |
| Juntas degradadas                         | 0: No existen                             | ▼ |
| Golpes y roturas                          | 1: Defectos con incidencia en la estética | ▼ |
| Fisuras y grietas                         | 0: No existen                             | ▼ |
| Coqueras y nidos de grava                 | 1: Defectos con incidencia en la estética | ▼ |
| Meteorización y degradación               | 0: No existen                             | ▼ |
| Desprendimientos                          | 0: No existen                             | ▼ |
| Carbonatación y desagregación             | 0: No existen                             | ▼ |
| Armaduras vistas someras                  | 0: No existen                             | ▼ |
| Corrosión y disgregación                  | 0: No existen                             | ▼ |
| Humedades y filtraciones                  | 0: No existen                             | ▼ |
| Incrustaciones calcáreas y eflorescencias | 0: No existen                             | ▼ |
| Abombamientos                             | 0: No existen                             | ▼ |
| Desplomes o basculamientos                | 0: No existen                             | ▼ |
| Asentamientos                             | 0: No existen                             | ▼ |
| Descalces                                 | 0: No existen                             | ▼ |
| Socavaciones                              | 0: No existen                             | ▼ |
| Depósitos en coronación                   | 0: No existen                             | ▼ |
| Daños en coronación                       | 0: No existen                             | ▼ |
| Daños en cimentaciones vistas             | 0: No existen                             | ▼ |
| Vegetación aflorando                      | 0: No existen                             | ▼ |
| Vegetación adosada                        | 0: No existen                             | ▼ |

**OBSERVACIONES PILAS**

**ESTADO GENERAL PILAS**

1: Defectos con incidencia en la estética



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**ESTADO ACTUAL APARATOS DE APOYO**

|                                |               |   |
|--------------------------------|---------------|---|
| Envejecimiento                 | 0: No existen | ▼ |
| Corrosión                      | 0: No existen | ▼ |
| Suciedad y aterramiento        | 0: No existen | ▼ |
| Bloqueo o encastramiento       | 0: No existen | ▼ |
| Desplazamiento o deslizamiento | 0: No existen | ▼ |
| Aplastamiento                  | 0: No existen | ▼ |
| Reglaje incorrecto             | 0: No existen | ▼ |
| Desnivelaciones                | 0: No existen | ▼ |
| Falta de contacto              | 0: No existen | ▼ |
| Cunas de apoyo deterioradas    | 0: No existen | ▼ |
| Vegetación adosada             | 0: No existen | ▼ |

OBSERVACIONES APARATOS DE APOYO

**ESTADO GENERAL APARATOS DE APOYO**

0: No existen



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**ESTADO ACTUAL ESTRUCTURA DE TRAMOS**

|                                                           |                                                |   |
|-----------------------------------------------------------|------------------------------------------------|---|
| Pintura envejecida y desprendida                          | 0: No existen                                  | ▼ |
| Oxidación superficial                                     | 0: No existen                                  | ▼ |
| Corrosiones locales activas                               | 0: No existen                                  | ▼ |
| Entalladuras y pérdidas de sección                        | 0: No existen                                  | ▼ |
| Elementos metálicos deformados o rotos                    | 0: No existen                                  | ▼ |
| Tornillos flojos o faltan                                 | 0: No existen                                  | ▼ |
| Soldaduras fisuradas                                      | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales bóvedas                  | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales clave                     | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales riñones                   | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales arranques                 | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales tímpanos                 | 0: No existen                                  | ▼ |
| Fisuras y grietas verticales tímpanos                     | 0: No existen                                  | ▼ |
| Separación y filtraciones tímpano-bóveda                  | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales losas                    | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales losas                     | 3: Defectos inicio evolución patológica        | ▼ |
| Fisuras y grietas verticales losas                        | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales en alas superiores vigas | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales en alas superiores vigas  | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales conexión alas-alma       | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales alma vigas                | 0: No existen                                  | ▼ |
| Fisuras y grietas inclinadas alma vigas                   | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales alma vigas               | 0: No existen                                  | ▼ |
| Fisuras y grietas longitudinales ala inferior             | 0: No existen                                  | ▼ |
| Fisuras y grietas transversales ala inferior              | 0: No existen                                  | ▼ |
| Fisuras y daños en testeros                               | 0: No existen                                  | ▼ |
| Golpes y roturas                                          | 3: Defectos inicio evolución patológica        | ▼ |
| Coqueras y nidos de grava                                 | 0: No existen                                  | ▼ |
| Meteorización y degradación                               | 0: No existen                                  | ▼ |
| Desprendimientos                                          | 0: No existen                                  | ▼ |
| Carbonatación y desagregación                             | 0: No existen                                  | ▼ |
| Armaduras vistas someras                                  | 2: Defectos con riesgo de evolución patológica | ▼ |
| Corrosión y disgregación                                  | 0: No existen                                  | ▼ |
| Humedades y filtraciones                                  | 0: No existen                                  | ▼ |
| Desagües obturados                                        | 0: No existen                                  | ▼ |
| Incrustaciones calcáreas y eflorescencias                 | 3: Defectos inicio evolución patológica        | ▼ |
| Abombamientos                                             | 0: No existen                                  | ▼ |
| Asentamientos y desnivelaciones                           | 0: No existen                                  | ▼ |
| Juntas longitudinales degradadas                          | 0: No existen                                  | ▼ |
| Juntas transversales degradadas                           | 0: No existen                                  | ▼ |
| Vegetación aflorando                                      | 0: No existen                                  | ▼ |
| Vegetación adosada                                        | 0: No existen                                  | ▼ |

OBSERVACIONES ESTRUCTURA DE TRAMOS



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**ESTADO ACTUAL RESTO DE ELEMENTOS**

|                          |               |   |
|--------------------------|---------------|---|
| Impermeabilización       | 0: No existen | ▼ |
| Drenaje longitudinal     | 0: No existen | ▼ |
| Drenaje transversal      | 0: No existen | ▼ |
| Muretes guardabalasto    | 0: No existen | ▼ |
| Juntas de dilatación     | 0: No existen | ▼ |
| Juntas de longitudinales | 0: No existen | ▼ |
| Conducciones y canaletas | 0: No existen | ▼ |
| Anclajes de postes       | 0: No existen | ▼ |
| Barandillas              | 0: No existen | ▼ |

OBSERVACIONES RESTO DE ELEMENTOS

Se observan armaduras vistas en hormigón de paseo de servicio.

**ESTADO GENERAL RESTO DE ELEMENTOS**

1: Defectos con incidencia en la estética



**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTERA FRANCESA**

**ID (Identificador de la estructura)**  
**FECHA DE LA INSPECCIÓN**

**23VI04**  
**18/02/03**

**ESTADO ACTUAL**

**ESTADO GENERAL**

ESTADO GENERAL ESTRIBOS

ESTADO GENERAL ALETAS

ESTADO GENERAL PILAS

ESTADO GENERAL APARATOS DE APOYO

ESTADO GENERAL ESTRUCTURA DE TRAMOS

ESTADO GENERAL RESTO DE ELEMENTOS

OBSERVACIONES

|                                                |   |
|------------------------------------------------|---|
| 2: Defectos con riesgo de evolución patológica | ▼ |
| 2: Defectos con riesgo de evolución patológica |   |
| 2: Defectos con riesgo de evolución patológica |   |
| 1: Defectos con incidencia en la estética      |   |
| 0: No existen                                  |   |
| 2: Defectos con riesgo de evolución patológica |   |
| 1: Defectos con incidencia en la estética      |   |

**INSPECCIONES ESTRUCTURAS**  
**L.A.V. MADRID-ZARAGOZA-BARCELONA-FRONTIERA FRANCESA**

**ID (Identificador de la estructura)**

**23VI04**

**FECHA DE LA INSPECCIÓN**

**18/02/03**

**IDENTIFICACIÓN ARCHIVOS FOTOGRÁFICOS**

**NOMBRE ARCHIVO**

|                  |                                                         |   |              |
|------------------|---------------------------------------------------------|---|--------------|
| FOTOGRAFÍA Nº 1  | ALZADO DERECHO                                          | ▼ | 23VI0401.jpg |
| FOTOGRAFÍA Nº 2  | ALZADO IZQUIERDO                                        | ▼ | 23VI0402.jpg |
| FOTOGRAFÍA Nº 3  | VISTA SUPERIOR DESDE ENTRADA                            | ▼ | 23VI0403.jpg |
| FOTOGRAFÍA Nº 4  | VISTA SUPERIOR DESDE SALIDA                             | ▼ | 23VI0404.jpg |
| FOTOGRAFÍA Nº 5  | ESTRIBO DE ENTRADA                                      | ▼ | 23VI0405.jpg |
| FOTOGRAFÍA Nº 6  | ESTRIBO DE SALIDA                                       | ▼ | 23VI0406.jpg |
| FOTOGRAFÍA Nº 7  | VISTA INFERIOR                                          | ▼ | 23VI0407.jpg |
| FOTOGRAFÍA Nº 8  | DESCONCHÓN CON ARMADURA VISTA EN ENCOFRADO PERDIDO DE V | ▼ | 23VI0408.jpg |
| FOTOGRAFÍA Nº 9  | FISURA CON EFLORESCENCIA EN ENCOFRADO PERDIDO DE V      | ▼ | 23VI0409.jpg |
| FOTOGRAFÍA Nº 10 | ARMADURA VISTA POR EJECUCIÓN DE SUMIDERO EN TABLER      | ▼ | 23VI0410.jpg |
| FOTOGRAFÍA Nº 11 | DESCONCHÓN CON ARMADURA VISTA EN VIGA DERECHA DE        | ▼ | 23VI0411.jpg |
| FOTOGRAFÍA Nº 12 | ARMADURA VISTA EN ESTRIBO 1                             | ▼ | 23VI0412.jpg |
| FOTOGRAFÍA Nº 13 | EFLORESCENCIA EN ALETA IZQUIERDA DE ESTRIBO 1           | ▼ | 23VI0413.jpg |
| FOTOGRAFÍA Nº 14 | ARMADURA VISTA EN ALETA DERECHA DE ESTRIBO 1            | ▼ | 23VI0414.jpg |
| FOTOGRAFÍA Nº 15 |                                                         | ▼ |              |

OBSERVACIONES

**ANEJO 8: PLANIMETRÍA Y NIVELACIÓN DE LA ESTRUCTURA.**

**ESTRUCTURA 23VI04**

**RESEÑAS VÉRTICES Y BASES**

# 

**Proyecto** CONTROL DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DEL AVE EN ZARAGOZA

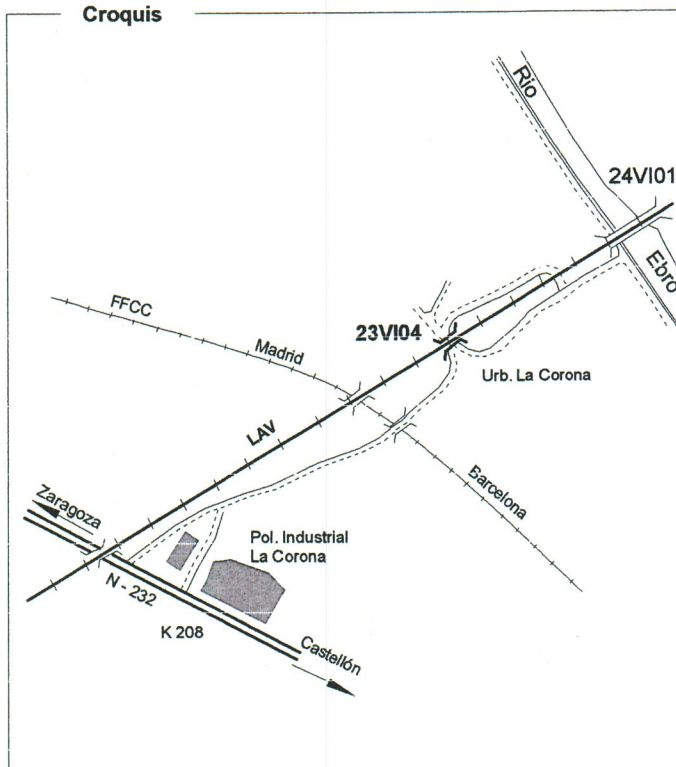
Número ..... 1  
Estructura ..... 23VI04  
Hoja MTN ..... 384 IV

Municipio..... Fuentes de Ebro  
Provincia ..... Zaragoza  
Fecha ..... Abril 2003

Fotografía



Croquis



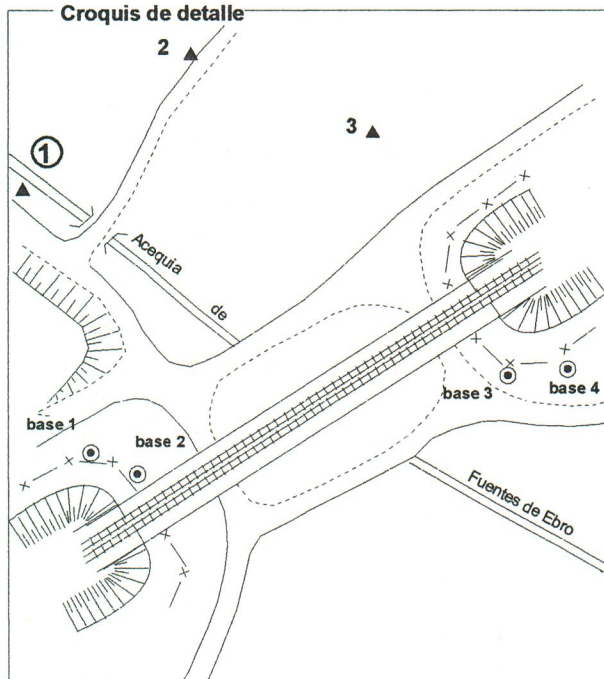
Tipo de señal

Vértice geodésico de control con centrado forzoso.

Situación

Situado al Norte de la estructura, frente al estribo Oeste, entre camino y acequia de Fuentes de Ebro.

Croquis de detalle



Horizonte GPS

Despejado



# 

### 

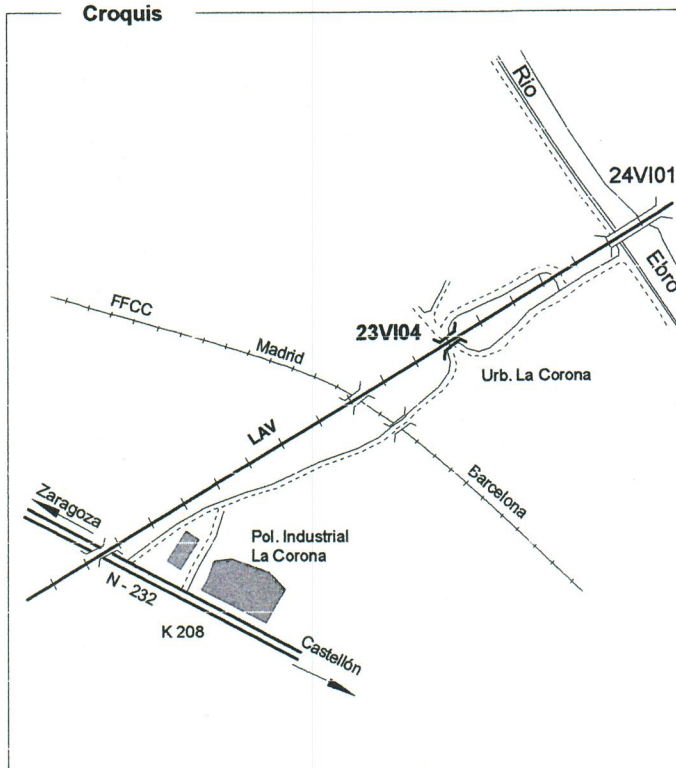
Número ..... Base 3  
Estructura ..... 23VI04  
Hoja MTN ..... 384 IV

Municipio..... Fuentes de Ebro  
Provincia ..... Zaragoza  
Fecha ..... Abril 2003

Fotografía



Croquis



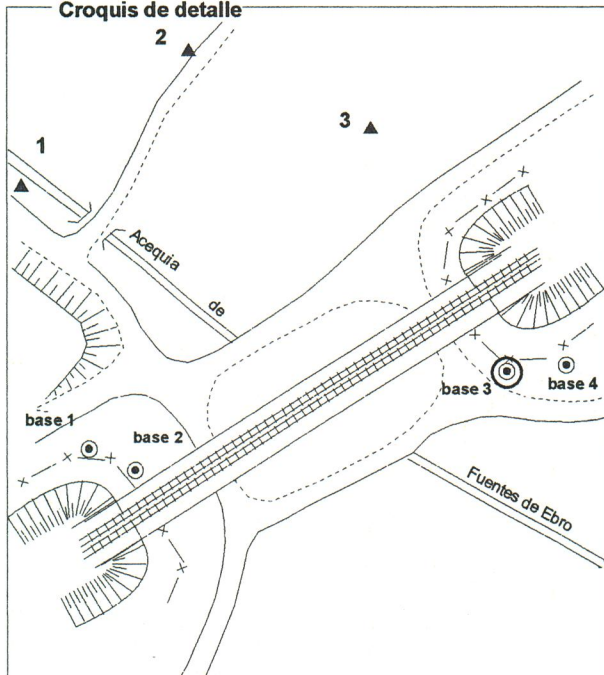
Tipo de señal

Arqueta metálica cilíndrica con taparecibida en dado de hormigón con clavo de latón en el interior.

Situación

Situada al Sur de la estructura, al pie de poste de la valla-cerramiento, en quiebro de la misma.

Croquis de detalle



Horizonte GPS



# 

**Proyecto** CONTROL DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DEL AVE EN ZARAGOZA

Número ..... 2

Estructura ..... 23VI04

Hoja MTN ..... 384 IV

Municipio.....

Provincia .....

Fecha .....

Fuentes de Ebro

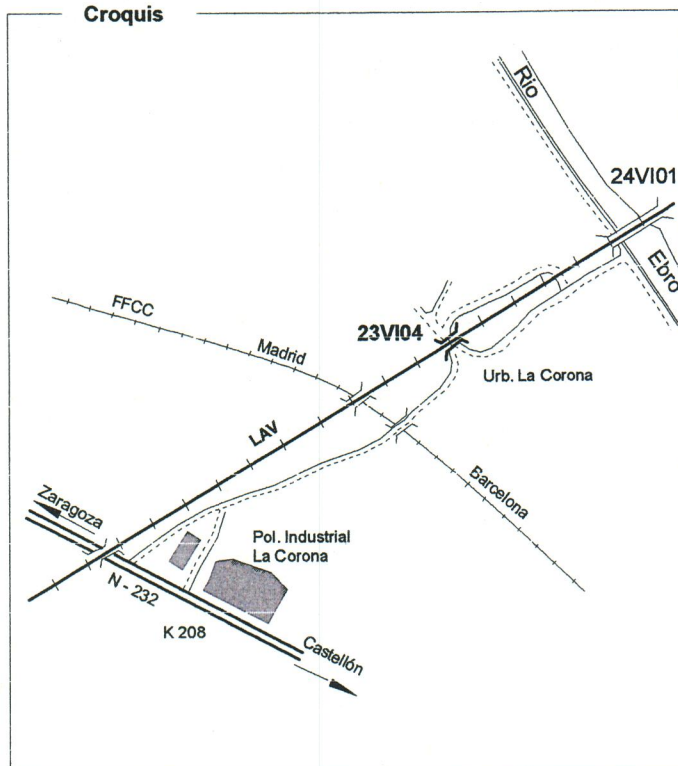
Zaragoza

Abril 2003

Fotografía



Croquis



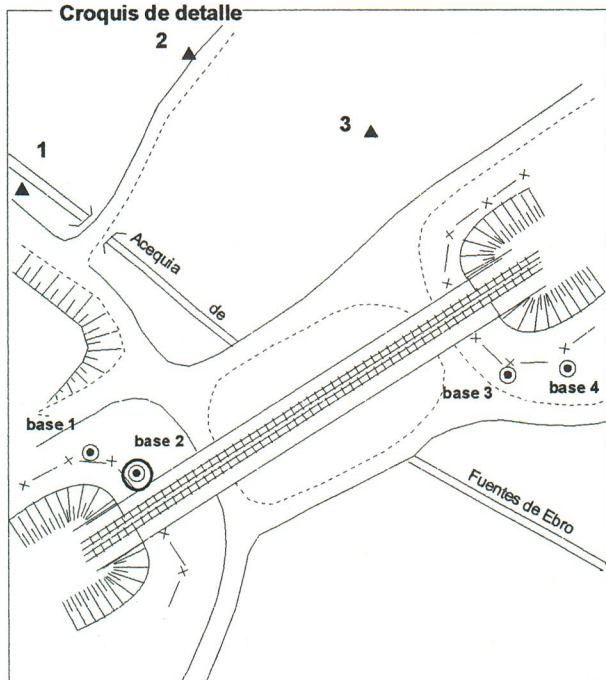
Tipo de señal

Arqueta metálica cilíndrica con taparecibida en dado de hormigón con clavo de latón en el interior.

Situación

Situada al Norte de la estructura, al pié de poste de la valla-cerramiento.

Croquis de detalle



Horizonte GPS

# 

### 

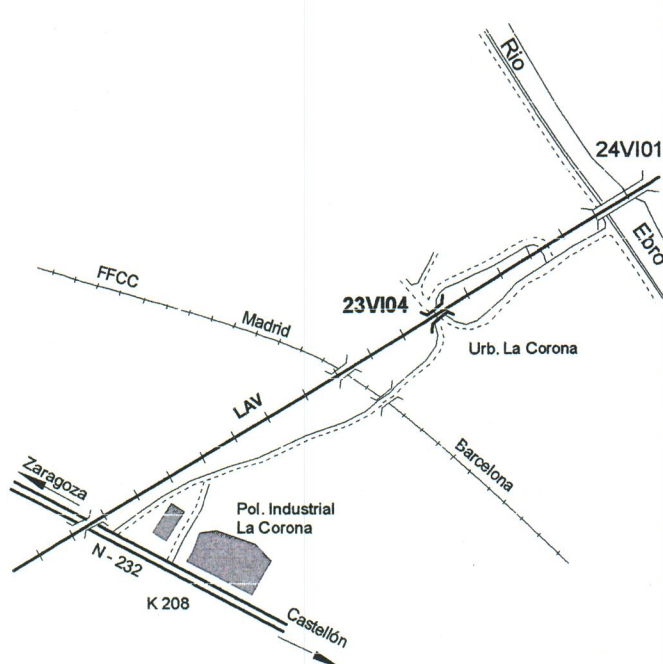
Número ..... 1  
Estructura ..... 23VI04  
Hoja MTN ..... 384 IV

Municipio..... Fuentes de Ebro  
Provincia ..... Zaragoza  
Fecha ..... Abril 2003

Fotografía



Croquis



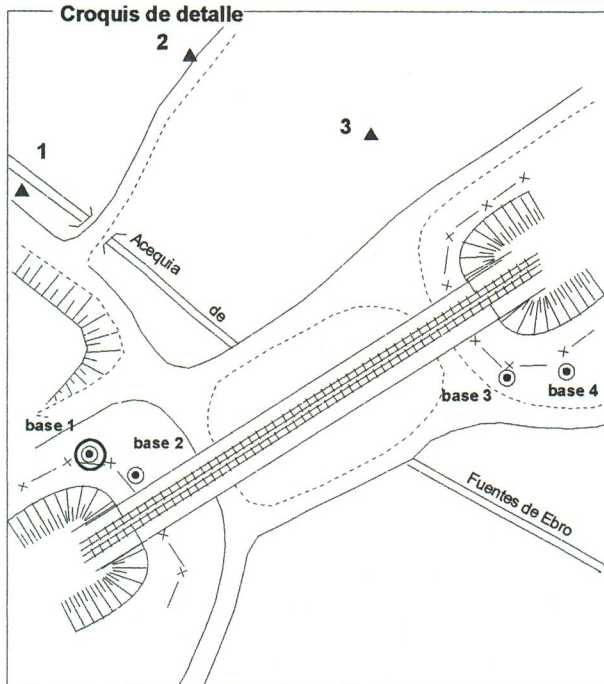
Tipo de señal

Arqueta metálica cilíndrica con taparecibida en dado de hormigón con clavo de latón en el interior.

Situación

Situada al Norte de la estructura, junto quiebro de valla-cerramiento del estribo Oeste, al pié del primer poste al Oeste después del quiebro..

Croquis de detalle



Horizonte GPS



# 

**Proyecto** CONTROL DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DEL AVE EN ZARAGOZA

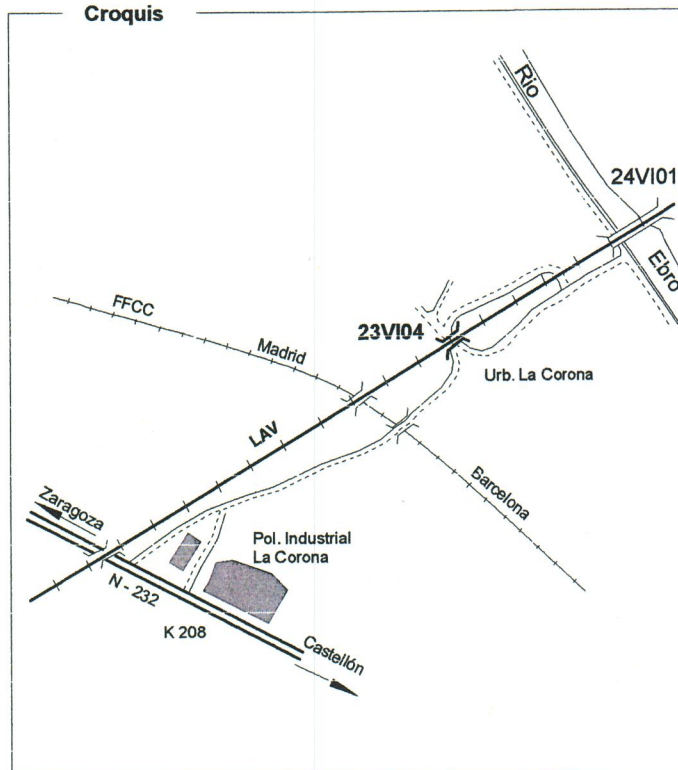
Número ..... 3  
Estructura ..... 23VI04  
Hoja MTN ..... 384 IV

Municipio..... Fuentes de Ebro  
Provincia ..... Zaragoza  
Fecha ..... Abril 2003

Fotografía



Croquis



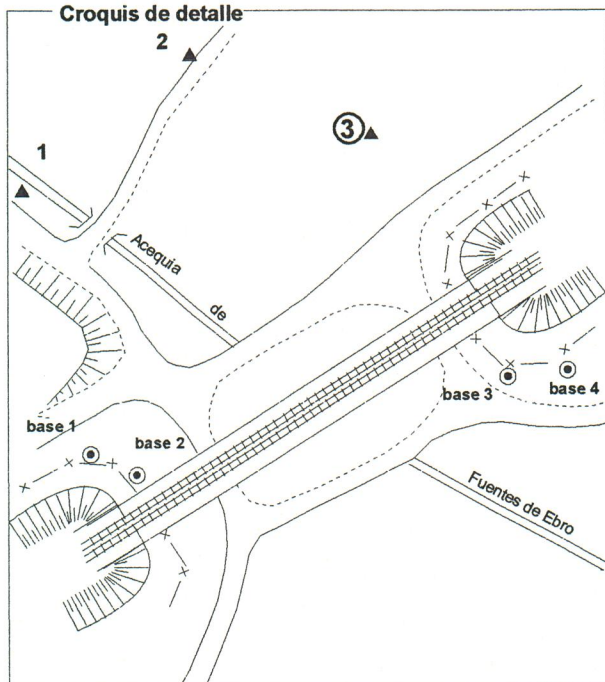
Tipo de señal

Vértice geodésico de control con centrado forzoso.

Situación

Situado al Norte de la estructura, en terreno erial junto lindes labor, y frente al estribo Este de la estructura.

Croquis de detalle



Horizonte GPS

Despejado

# 

**Proyecto** CONTROL DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DEL AVE EN ZARAGOZA

Número ..... 2

Estructura ..... 23VI04

Hoja MTN ..... 384 IV

Municipio.....

Fuentes de Ebro

Provincia .....

Zaragoza

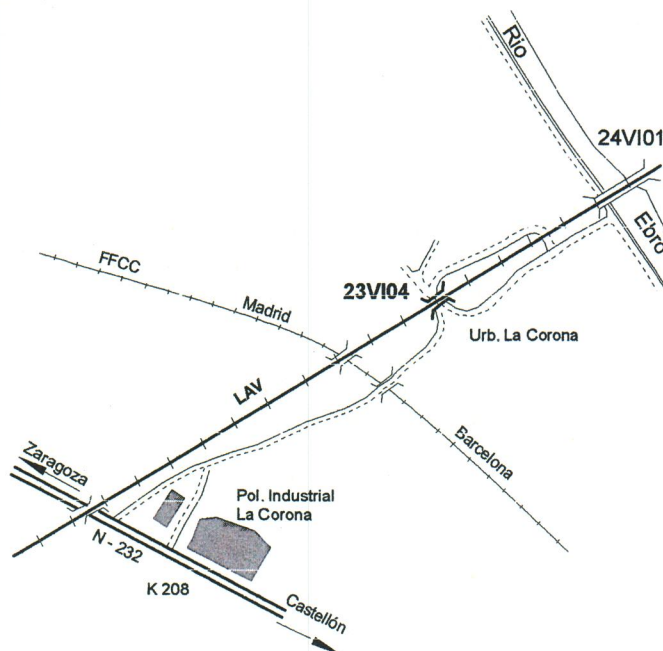
Fecha .....

Abril 2003

**Fotografía**



**Croquis**



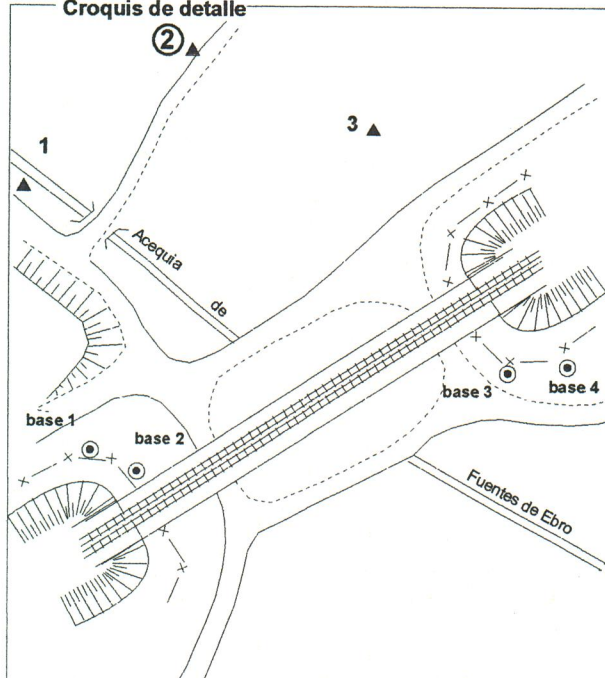
**Tipo de señal**

Vértice geodésico de control con centrado forzoso.

**Situación**

Situado al Norte de la estructura, frente a la pila 2 de la estructura, en linde fincas junto a camino.

**Croquis de detalle**



Horizonte GPS

Despejado



# 

**Proyecto** CONTROL DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DEL AVE EN ZARAGOZA

Número ..... Base 4

Estructura ..... 23VI04

Hoja MTN ..... 384 IV

Municipio.....

Provincia .....

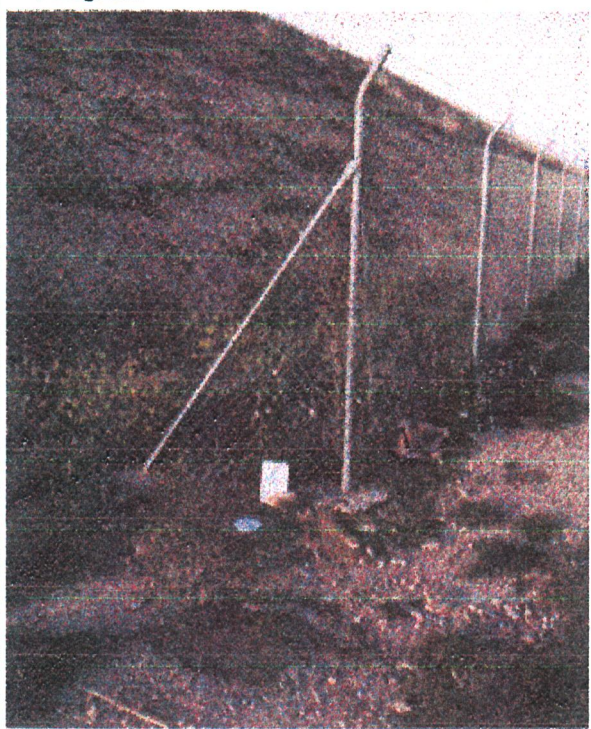
Fecha .....

Fuentes de Ebro

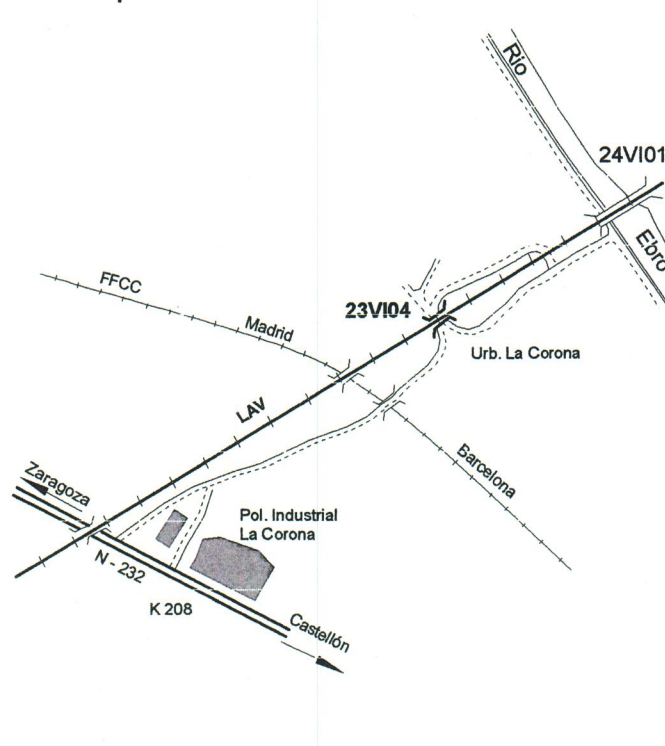
Zaragoza

Abril 2003

Fotografía



Croquis



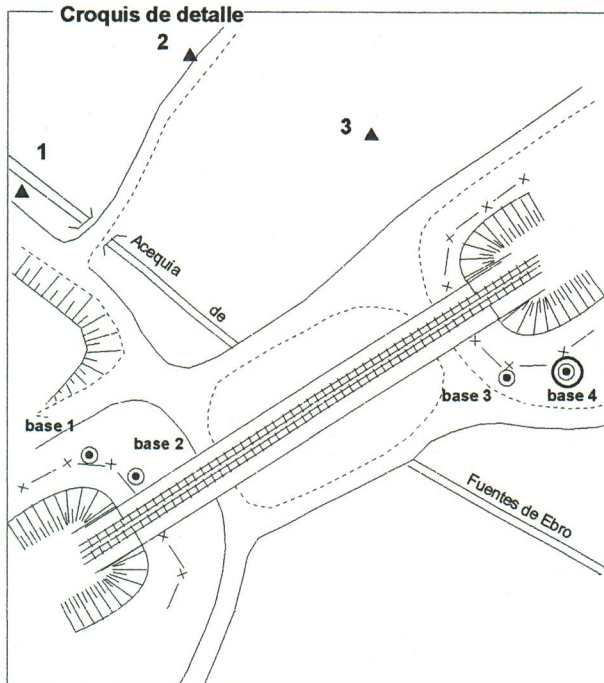
Tipo de señal

Arqueta metálica cilíndrica con taparecibida en dado de hormigón con clavo de latón en el interior.

Situación

Situada al Sur de la estructura, al pie de poste de la valla-cerramiento, en quiebro de la misma, y a unos 24 metros de la base 3.

Croquis de detalle



Horizonte GPS

**OBSERVACIÓN RED LOCAL**

**AJUSTE RED LOCAL**  
**OBSERVACION GPS**

```

*****
**
**          M O V E 3  Versión 3.1.5
**
**          Diseño y Ajuste
**          de
**          Redes Geodésicas de 3D 2D y 1D
**
**          www.MOVE3.com
**          (c) 1993-2002 Grantmij Geo Informatie bv
**          Bajo licencia de Leica Geosystems AG
**
**          28-04-2003 20:09:55 **
** Z7
*****

```

3D Red ajustada on WGS 84 ellipsoid

#### ESTACIONES

|                                               |   |
|-----------------------------------------------|---|
| Número de estaciones (parcialmente) conocidas | 1 |
| Número de estaciones desconocidas             | 2 |
| Total                                         | 3 |

#### OBSERVACIONES

|                                  |    |                 |
|----------------------------------|----|-----------------|
| Direcciones                      | 0  |                 |
| Distancias                       | 0  |                 |
| Ángulos cenitales                | 0  |                 |
| Ángulos azimutales               | 0  |                 |
| Diferencias de altura            | 0  |                 |
| Diferencias de coordenadas GPS   | 9  | (3 líneas base) |
| Coordenadas conocidas            | 3  |                 |
| Parámetros de transformación GPS | 0  |                 |
| Total                            | 12 |                 |

#### INCÓGNITAS

|                                          |   |
|------------------------------------------|---|
| Coordenadas                              | 9 |
| Orientaciones                            | 0 |
| Factores de escala                       | 0 |
| Coeficientes de refracción vertical      | 0 |
| Offsets de azimuth                       | 0 |
| Parámetros de transformación GPS         | 0 |
| Deflexiones de la vertical               | 0 |
| Parámetros adicionales de transformación | 0 |
| Total                                    | 9 |

|                    |   |
|--------------------|---|
| Grados de libertad | 3 |
|--------------------|---|

#### AJUSTE

|                                                  |   |          |
|--------------------------------------------------|---|----------|
| Número de iteraciones                            | 1 |          |
| Corrección máx. de coord. en la última iteración |   | 0.0000 m |



# PRUEBAS

|                                            |                |
|--------------------------------------------|----------------|
| Alfa (multi dimensional)                   | 0.1291         |
| Alfa 0 (unidimensional)                    | 0.0500         |
| Beta                                       | 0.80           |
| Valor crítico de Prueba W                  | 1.96           |
| Valor crítico de Prueba T (tridimensional) | 1.89           |
| Valor crítico de Prueba T (bidimensional)  | 2.42           |
| Valor crítico de Prueba T                  | 1.89           |
| Prueba F                                   | 0.004 aceptado |

Resultados basados en el factor de varianza a posteriori

## CONSTANTES DEL ELIPSOIDE

|                |                |
|----------------|----------------|
| Elipsoide      | WGS 84         |
| Semi-eje mayor | 6378137.0000 m |
| Achatamiento   | 298.257223563  |

## COORDENADAS (RED AJUSTADA)

| Estación |          | Coordenada        | Corr    | Prec(68.3%) |
|----------|----------|-------------------|---------|-------------|
| 23VI041  | Latitud  | 41 30 40.26079 N  | -0.0001 | 0.0002 m    |
|          | Longitud | 0 35 26.57232 W   | -0.0002 | 0.0001 m    |
|          | Altura   | 219.1960          | 0.0003  | 0.0003 m    |
| 23VI042  | Latitud  | 41 30 41.37994 N* | 0.0000  | fijo m      |
|          | Longitud | 0 35 24.58892 W*  | 0.0000  | fijo m      |
|          | Altura   | 218.4165*         | 0.0000  | fijo m      |
| 23VI043  | Latitud  | 41 30 40.94939 N  | -0.0002 | 0.0002 m    |
|          | Longitud | 0 35 22.46915 W   | 0.0003  | 0.0001 m    |
|          | Altura   | 217.5885          | 0.0002  | 0.0003 m    |

## FIABILIDAD EXTERNA

| Estación | Fiab Ext |              | Estación | Pto a medir |
|----------|----------|--------------|----------|-------------|
| 23VI041  | Latitud  | -0.0008 m DX | 23VI042  | 23VI041     |
|          | Longitud | 0.0006 m DY  | 23VI042  | 23VI041     |
|          | Altura   | 0.0009 m DX  | 23VI042  | 23VI041     |
| 23VI042  | Latitud  | 0.0000 m DX  | 23VI042  | 23VI043     |
|          | Longitud | -0.0000 m DY | 23VI042  | 23VI041     |
|          | Altura   | -0.0000 m DX | 23VI042  | 23VI041     |
| 23VI043  | Latitud  | -0.0008 m DX | 23VI042  | 23VI043     |
|          | Longitud | 0.0006 m DY  | 23VI042  | 23VI043     |
|          | Altura   | 0.0009 m DX  | 23VI042  | 23VI043     |

## REGIONES DE CONFIANZA ABSOLUTA (ELIPSES DE ERROR) 2D - 39.4% 1D - 68.3%

| Estación | A      | B        | A/B | Phi      | Alt(68.3%) |
|----------|--------|----------|-----|----------|------------|
| 23VI041  | 0.0002 | 0.0001 m | 1.5 | -11 grad | 0.0003 m   |
| 23VI042  | 0.0000 | 0.0000 m | 0.0 | 100 grad | 0.0000 m   |
| 23VI043  | 0.0002 | 0.0001 m | 1.5 | -11 grad | 0.0003 m   |

REGIONES DE CONFIANZA RELATIVA (ELIPSES DE ERROR) 2D - 39.4%

| Estación | Estación | A      | B        | A/B | Psi      | Alt(68.3%) |
|----------|----------|--------|----------|-----|----------|------------|
| 23VI041  | 23VI043  | 0.0002 | 0.0001 m | 1.5 | -87 grad | 0.0004 m   |
| 23VI042  | 23VI041  | 0.0002 | 0.0001 m | 1.5 | -63 grad | 0.0003 m   |
| 23VI042  | 23VI043  | 0.0002 | 0.0001 m | 1.5 | 64 grad  | 0.0003 m   |

PRUEBA DE COORDENADAS CONOCIDAS

| Estación |          | MDB       | BNR   | Prueba W | Prueba T |
|----------|----------|-----------|-------|----------|----------|
| 23VI042  | Latitud  | 99.9999 m | 999.9 | 0.00     | 0.00     |
|          | Longitud | 99.9999 m | 999.9 | 0.00     |          |
|          | Altura   | 99.9999 m | 999.9 | 0.00     |          |

OBSERVACIONES AJUSTADAS

|    | Estación | Pto a medir | Obs. Ajus. | Resid   | Resid(ENA) | Desv. Est. |
|----|----------|-------------|------------|---------|------------|------------|
| DX | 23VI041  | 23VI043     | -14.3032   | -0.0002 | 0.0002     | 0.0003 m   |
| DY |          |             | 95.3056    | 0.0002  | 0.0001     | 0.0002 m   |
| DZ |          |             | 14.8432    | -0.0000 | -0.0002    | 0.0003 m   |
| DX | 23VI042  | 23VI041     | 22.9926    | -0.0001 | 0.0001     | 0.0003 m   |
| DY |          |             | -46.2349   | 0.0001  | 0.0001     | 0.0001 m   |
| DZ |          |             | -25.3388   | -0.0000 | -0.0001    | 0.0002 m   |
| DX | 23VI042  | 23VI043     | 8.6894     | 0.0001  | -0.0001    | 0.0003 m   |
| DY |          |             | 49.0707    | -0.0001 | -0.0001    | 0.0001 m   |
| DZ |          |             | -10.4956   | 0.0000  | 0.0001     | 0.0003 m   |

RESIDUALES DE LINEAS BASE GPS

|    | Estación | Pto a medir | Ajust. vector | Resid    | Resid ppm |
|----|----------|-------------|---------------|----------|-----------|
| DV | 23VI041  | 23VI043     | 97.5093       | 0.0003 m | 3.1 ppm   |
| DV | 23VI042  | 23VI041     | 57.5185       | 0.0002 m | 3.2 ppm   |
| DV | 23VI042  | 23VI043     | 50.9274       | 0.0002 m | 3.7 ppm   |

PRUEBA DE OBSERVACIONES

|    | Estación | Pto a medir | MDB      | Red | BNR | Prueba W | Prueba T |
|----|----------|-------------|----------|-----|-----|----------|----------|
| DX | 23VI041  | 23VI043     | 0.0017 m | 45  | 3.1 | -0.77    | 1.00     |
| DY |          |             | 0.0008 m | 45  | 3.1 | 1.58     |          |
| DZ |          |             | 0.0014 m | 44  | 3.1 | 0.45     |          |
| DX | 23VI042  | 23VI041     | 0.0017 m | 27  | 4.6 | -0.77    | 1.00     |
| DY |          |             | 0.0008 m | 27  | 4.6 | 1.58     |          |
| DZ |          |             | 0.0014 m | 27  | 4.6 | 0.45     |          |
| DX | 23VI042  | 23VI043     | 0.0017 m | 28  | 4.4 | 0.77     | 1.00     |
| DY |          |             | 0.0008 m | 28  | 4.4 | -1.58    |          |
| DZ |          |             | 0.0014 m | 28  | 4.5 | -0.45    |          |

[End of file]

**OBSERVACIÓN PLACAS DE PUNTERIA**

**AJUSTE PLACAS DE PUNTERÍA**  
**OBSERVACION PLANIMÉTRICA**

Trabajo: 23VI04

COMPASS

Empresa: GVS

Fecha : 05/2003

Sistema de coordenadas UTM

Red Planimétrica

Observaciones angulares

Número de vértices fijos

:3

Número de vértices a ajustar

:12

Numero de incogintas

:27

Trabajo: 23VI04  
 COMPASS  
 Empresa: GVS  
 Fecha : 05/2003

| Est.  | Vis.  | Lec.Hz.  | Lec.V.   | Dis.g. | m     | i     |
|-------|-------|----------|----------|--------|-------|-------|
| 23041 | 23042 | 300.4075 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 23043 | 327.4194 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 6     | 354.0213 | 95.7894  | 0.000  | 0.000 | 0.285 |
| 23041 | 1     | 14.0912  | 92.7120  | 0.000  | 0.000 | 0.285 |
| 23041 | 101   | 13.9756  | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 5     | 29.2706  | 91.2524  | 0.000  | 0.000 | 0.285 |
| 23041 | 105   | 29.5192  | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 106   | 354.0163 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 4     | 361.8683 | 95.9573  | 0.000  | 0.000 | 0.285 |
| 23041 | 104   | 361.7141 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 3     | 374.6819 | 95.0280  | 0.000  | 0.000 | 0.285 |
| 23041 | 103   | 374.6031 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 2     | 392.6876 | 93.3479  | 0.000  | 0.000 | 0.285 |
| 23041 | 102   | 392.3820 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23042 | 103   | 60.8518  | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 2     | 79.2932  | 93.8345  | 0.000  | 0.000 | 0.277 |
| 23042 | 102   | 79.0439  | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 1     | 93.8896  | 94.3580  | 0.000  | 0.000 | 0.277 |
| 23042 | 101   | 93.8229  | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 5     | 102.9545 | 93.8919  | 0.000  | 0.000 | 0.277 |
| 23042 | 105   | 103.0718 | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 23041 | 142.2008 | 99.0867  | 57.516 | 0.120 | 0.277 |
| 23042 | 4     | 41.9513  | 94.4905  | 0.000  | 0.000 | 0.277 |
| 23042 | 104   | 41.6796  | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 3     | 60.9562  | 94.2212  | 0.000  | 0.000 | 0.277 |
| 23042 | 23043 | 0.0006   | 100.5273 | 0.000  | 0.320 | 0.277 |
| 23042 | 106   | 29.3543  | 0.0000   | 0.000  | 0.000 | 0.277 |
| 23042 | 6     | 29.3389  | 93.8959  | 0.000  | 0.000 | 0.277 |
| 23043 | 102   | 316.7553 | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 103   | 303.3123 | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 101   | 325.0387 | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 1     | 325.0733 | 94.4904  | 0.000  | 0.000 | 0.276 |
| 23043 | 2     | 316.9072 | 93.3825  | 0.000  | 0.000 | 0.276 |
| 23043 | 23042 | 0.0009   | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 5     | 330.5262 | 94.3289  | 0.000  | 0.000 | 0.276 |
| 23043 | 105   | 330.5764 | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 4     | 281.6709 | 90.8573  | 0.000  | 0.000 | 0.276 |
| 23043 | 6     | 262.2981 | 88.0689  | 0.000  | 0.000 | 0.276 |
| 23043 | 23041 | 369.2149 | 99.1576  | 97.500 | 0.320 | 0.276 |
| 23043 | 106   | 262.3554 | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 3     | 303.4098 | 92.5169  | 0.000  | 0.000 | 0.276 |
| 23043 | 104   | 281.2664 | 0.0000   | 0.000  | 0.000 | 0.276 |

Trabajo: 23VI04  
 COMPASS  
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# RESIDUOS

| Est.  | Vis.  | Observación | Error<br>a priori | Peso  | Residuo<br>Ponderado | Residuo<br>(m/cc) |
|-------|-------|-------------|-------------------|-------|----------------------|-------------------|
| 23041 | 23042 | dirección   | 77.64             | 0.013 | 0.24                 | 18.9 cc           |
| 23041 | 23043 | dirección   | 45.98             | 0.022 | -0.18                | -8.1 cc           |
| 23041 | 6     | dirección   | 40.06             | 0.025 | -0.00                | -0.1 cc           |
| 23041 | 1     | dirección   | 63.50             | 0.016 | -0.03                | -2.0 cc           |
| 23041 | 101   | dirección   | 63.50             | 0.016 | -0.01                | -0.7 cc           |
| 23041 | 5     | dirección   | 64.56             | 0.015 | -0.02                | -1.2 cc           |
| 23041 | 105   | dirección   | 64.48             | 0.016 | -0.01                | -0.6 cc           |
| 23041 | 106   | dirección   | 40.08             | 0.025 | 0.08                 | 3.3 cc            |
| 23041 | 4     | dirección   | 44.12             | 0.023 | -0.01                | -0.3 cc           |
| 23041 | 104   | dirección   | 44.01             | 0.023 | -0.03                | -1.2 cc           |
| 23041 | 3     | dirección   | 52.32             | 0.019 | 0.03                 | 1.4 cc            |
| 23041 | 103   | dirección   | 52.27             | 0.019 | 0.02                 | 0.9 cc            |
| 23041 | 2     | dirección   | 60.26             | 0.017 | -0.01                | -0.8 cc           |
| 23041 | 102   | dirección   | 60.17             | 0.017 | -0.00                | -0.3 cc           |
| 23042 | 103   | dirección   | 54.44             | 0.018 | -0.03                | -1.5 cc           |
| 23042 | 2     | dirección   | 50.76             | 0.020 | 0.02                 | 1.2 cc            |
| 23042 | 102   | dirección   | 50.84             | 0.020 | 0.01                 | 0.4 cc            |
| 23042 | 1     | dirección   | 44.86             | 0.022 | 0.06                 | 2.7 cc            |
| 23042 | 101   | dirección   | 44.90             | 0.022 | 0.02                 | 1.0 cc            |
| 23042 | 5     | dirección   | 41.70             | 0.024 | 0.04                 | 1.6 cc            |
| 23042 | 105   | dirección   | 41.62             | 0.024 | 0.02                 | 0.7 cc            |
| 23042 | 23041 | dirección   | 77.64             | 0.013 | 0.26                 | 20.1 cc           |
| 23042 | 4     | dirección   | 53.55             | 0.019 | 0.01                 | 0.6 cc            |
| 23042 | 104   | dirección   | 53.49             | 0.019 | 0.04                 | 2.3 cc            |
| 23042 | 3     | dirección   | 54.43             | 0.018 | -0.04                | -2.3 cc           |
| 23042 | 23043 | dirección   | 87.65             | 0.011 | -0.36                | -31.7 cc          |
| 23042 | 106   | dirección   | 52.46             | 0.019 | -0.15                | -7.6 cc           |
| 23042 | 6     | dirección   | 52.43             | 0.019 | 0.00                 | 0.2 cc            |
| 23043 | 102   | dirección   | 51.87             | 0.019 | -0.01                | -0.3 cc           |
| 23043 | 103   | dirección   | 66.46             | 0.015 | 0.02                 | 1.2 cc            |
| 23043 | 101   | dirección   | 41.71             | 0.024 | -0.01                | -0.6 cc           |
| 23043 | 1     | dirección   | 41.66             | 0.024 | -0.04                | -1.6 cc           |
| 23043 | 2     | dirección   | 51.68             | 0.019 | -0.02                | -0.8 cc           |
| 23043 | 23042 | dirección   | 87.65             | 0.011 | -0.03                | -2.3 cc           |
| 23043 | 5     | dirección   | 37.10             | 0.027 | -0.02                | -0.8 cc           |
| 23043 | 105   | dirección   | 37.02             | 0.027 | -0.01                | -0.4 cc           |
| 23043 | 4     | dirección   | 83.63             | 0.012 | -0.01                | -0.6 cc           |
| 23043 | 6     | dirección   | 97.50             | 0.010 | -0.00                | -0.2 cc           |
| 23043 | 23041 | dirección   | 45.98             | 0.022 | 0.08                 | 3.6 cc            |
| 23043 | 106   | dirección   | 97.58             | 0.010 | 0.08                 | 8.2 cc            |
| 23043 | 3     | dirección   | 66.38             | 0.015 | 0.03                 | 1.8 cc            |
| 23043 | 104   | dirección   | 83.85             | 0.012 | -0.03                | -2.2 cc           |

m : 0.2

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
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DESPLAZAMIENTO DE LAS COORDENADAS

| Número | X'          | dx      | Y'           | dy      | Z'       | Z      |
|--------|-------------|---------|--------------|---------|----------|--------|
| 23041  | 701166.7660 | 0.0000  | 4598518.0260 | 0.0000  | 169.3860 | 0.0000 |
| 23042  | 701211.7840 | 0.0000  | 4598553.8260 | 0.0000  | 168.6060 | 0.0000 |
| 23043  | 701261.2960 | 0.0000  | 4598541.9190 | 0.0000  | 168.1380 | 0.0000 |
| 1      | 701197.8340 | -0.0058 | 4598454.8520 | -0.0095 | 177.7640 | 0.0000 |
| 2      | 701219.6450 | -0.0012 | 4598465.9600 | -0.0009 | 177.4520 | 0.0000 |
| 3      | 701242.0720 | -0.0013 | 4598477.3920 | -0.0022 | 176.3660 | 0.0000 |
| 4      | 701264.0710 | -0.0049 | 4598488.6120 | 0.0004  | 176.1330 | 0.0000 |
| 5      | 701181.7830 | -0.0078 | 4598450.4350 | -0.0103 | 179.2430 | 0.0000 |
| 6      | 701277.2620 | -0.0051 | 4598499.0260 | -0.0010 | 177.0940 | 0.0000 |
| 101    | 701197.9480 | -0.0058 | 4598454.9090 | -0.0090 | 0.0000   | 0.0000 |
| 102    | 701219.9760 | -0.0015 | 4598466.1350 | -0.0009 | 0.0000   | 0.0000 |
| 103    | 701242.1950 | -0.0008 | 4598477.4460 | -0.0023 | 0.0000   | 0.0000 |
| 104    | 701264.4020 | -0.0053 | 4598488.7700 | 0.0005  | 0.0000   | 0.0000 |
| 105    | 701181.5360 | -0.0076 | 4598450.2970 | -0.0101 | 0.0000   | 0.0000 |
| 106    | 701277.2050 | 0.0009  | 4598499.0450 | -0.0030 | 0.0000   | 0.0000 |



Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

PRECISIONES Y PARAMETROS DE LAS ELIPSES DE ERROR

| Número | mx     | my     | mz     | $\hat{\sigma}_{\max.}$ | $\hat{\sigma}_{\min.}$ | Acimut   |
|--------|--------|--------|--------|------------------------|------------------------|----------|
| 23041  | 0.0000 | 0.0000 | 0.0000 | 0.0000                 | 0.0000                 | 0.0000   |
| 23042  | 0.0000 | 0.0000 | 0.0000 | 0.0000                 | 0.0000                 | 0.0000   |
| 23043  | 0.0000 | 0.0000 | 0.0000 | 0.0000                 | 0.0000                 | 0.0000   |
| 1      | 0.0009 | 0.0018 | 0.0000 | 0.0018                 | 0.0009                 | 0.7184   |
| 2      | 0.0009 | 0.0015 | 0.0000 | 0.0015                 | 0.0009                 | 189.5489 |
| 3      | 0.0010 | 0.0014 | 0.0000 | 0.0014                 | 0.0009                 | 178.9952 |
| 4      | 0.0011 | 0.0014 | 0.0000 | 0.0016                 | 0.0009                 | 164.9579 |
| 5      | 0.0010 | 0.0021 | 0.0000 | 0.0022                 | 0.0009                 | 9.8516   |
| 6      | 0.0014 | 0.0015 | 0.0000 | 0.0019                 | 0.0009                 | 152.1143 |
| 101    | 0.0009 | 0.0018 | 0.0000 | 0.0018                 | 0.0009                 | 0.6551   |
| 102    | 0.0009 | 0.0015 | 0.0000 | 0.0015                 | 0.0009                 | 189.3943 |
| 103    | 0.0010 | 0.0014 | 0.0000 | 0.0014                 | 0.0009                 | 178.9317 |
| 104    | 0.0011 | 0.0014 | 0.0000 | 0.0016                 | 0.0009                 | 164.7035 |
| 105    | 0.0010 | 0.0021 | 0.0000 | 0.0022                 | 0.0009                 | 9.9944   |
| 106    | 0.0014 | 0.0015 | 0.0000 | 0.0018                 | 0.0009                 | 152.1470 |

Trabajo: 23VI04  
 COMPASS  
 Empresa: GVS  
 Fecha : 05/2003

TEST DE BAARDA (Estudio de errores groseros (@))

| Est.  | Vis.  | Observación | Error<br>a priori | Residuo<br>(m/cc) | Error<br>Obs. | Error<br>Residuo | Residuo<br>Tipif. |
|-------|-------|-------------|-------------------|-------------------|---------------|------------------|-------------------|
| 23041 | 23042 | dirección   | 77.64             | 18.9              | 5.4           | 10.5             | 1.79              |
| 23041 | 23043 | dirección   | 45.98             | -8.1              | 5.4           | 4.5              | 1.79              |
| 23041 | 6     | dirección   | 40.06             | -0.1              | 5.5           | 2.6              | 0.04              |
| 23041 | 1     | dirección   | 63.50             | -2.0              | 8.9           | 3.7              | 0.53              |
| 23041 | 101   | dirección   | 63.50             | -0.7              | 8.9           | 3.7              | 0.19              |
| 23041 | 5     | dirección   | 64.56             | -1.2              | 9.1           | 3.7              | 0.33              |
| 23041 | 105   | dirección   | 64.48             | -0.6              | 9.1           | 3.7              | 0.16              |
| 23041 | 106   | dirección   | 40.08             | 3.3               | 5.5           | 2.6              | 1.30              |
| 23041 | 4     | dirección   | 44.12             | -0.3              | 6.0           | 3.0              | 0.11              |
| 23041 | 104   | dirección   | 44.01             | -1.2              | 6.0           | 3.0              | 0.39              |
| 23041 | 3     | dirección   | 52.32             | 1.4               | 7.1           | 3.6              | 0.38              |
| 23041 | 103   | dirección   | 52.27             | 0.9               | 7.1           | 3.6              | 0.26              |
| 23041 | 2     | dirección   | 60.26             | -0.8              | 8.3           | 3.8              | 0.22              |
| 23041 | 102   | dirección   | 60.17             | -0.3              | 8.3           | 3.8              | 0.07              |
| 23042 | 103   | dirección   | 54.44             | -1.5              | 5.8           | 5.9              | 0.26              |
| 23042 | 2     | dirección   | 50.76             | 1.2               | 5.4           | 5.6              | 0.22              |
| 23042 | 102   | dirección   | 50.84             | 0.4               | 5.4           | 5.6              | 0.07              |
| 23042 | 1     | dirección   | 44.86             | 2.7               | 4.7           | 5.0              | 0.53              |
| 23042 | 101   | dirección   | 44.90             | 1.0               | 4.7           | 5.0              | 0.19              |
| 23042 | 5     | dirección   | 41.70             | 1.6               | 4.3           | 4.6              | 0.33              |
| 23042 | 105   | dirección   | 41.62             | 0.7               | 4.3           | 4.6              | 0.16              |
| 23042 | 23041 | dirección   | 77.64             | 20.1              | 4.7           | 10.9             | 1.85              |
| 23042 | 4     | dirección   | 53.55             | 0.6               | 5.6           | 5.9              | 0.11              |
| 23042 | 104   | dirección   | 53.49             | 2.3               | 5.6           | 5.9              | 0.39              |
| 23042 | 3     | dirección   | 54.43             | -2.3              | 5.8           | 5.9              | 0.38              |
| 23042 | 23043 | dirección   | 87.65             | -31.7             | 4.7           | 12.5             | 2.53              |
| 23042 | 106   | dirección   | 52.46             | -7.6              | 5.4           | 5.9              | 1.30              |
| 23042 | 6     | dirección   | 52.43             | 0.2               | 5.4           | 5.9              | 0.04              |
| 23043 | 102   | dirección   | 51.87             | -0.3              | 6.9           | 3.8              | 0.07              |
| 23043 | 103   | dirección   | 66.46             | 1.2               | 8.9           | 4.7              | 0.26              |
| 23043 | 101   | dirección   | 41.71             | -0.6              | 5.6           | 2.9              | 0.19              |
| 23043 | 1     | dirección   | 41.66             | -1.6              | 5.6           | 2.9              | 0.53              |
| 23043 | 2     | dirección   | 51.68             | -0.8              | 6.9           | 3.8              | 0.22              |
| 23043 | 23042 | dirección   | 87.65             | -2.3              | 5.6           | 12.1             | 0.19              |
| 23043 | 5     | dirección   | 37.10             | -0.8              | 5.1           | 2.5              | 0.33              |
| 23043 | 105   | dirección   | 37.02             | -0.4              | 5.1           | 2.5              | 0.16              |
| 23043 | 4     | dirección   | 83.63             | -0.6              | 11.5          | 5.5              | 0.11              |
| 23043 | 6     | dirección   | 97.50             | -0.2              | 13.4          | 6.3              | 0.04              |
| 23043 | 23041 | dirección   | 45.98             | 3.6               | 5.6           | 4.3              | 0.84              |
| 23043 | 106   | dirección   | 97.58             | 8.2               | 13.5          | 6.3              | 1.30              |
| 23043 | 3     | dirección   | 66.38             | 1.8               | 8.9           | 4.7              | 0.38              |
| 23043 | 104   | dirección   | 83.85             | -2.2              | 11.5          | 5.5              | 0.39              |

Trabajo: 23VI04  
COMPASS

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|                                   |         |
|-----------------------------------|---------|
| Número de Observaciones angulares | :42     |
| Redundancia de la Red             | :15     |
| Redundancia de las incognitas     | :0.56   |
| Apreciación angular               | :5.0 cc |
| Desviación típica a priori        | : 1.0   |
| Desviación típica a posteriori    | : 0.2   |

**AJUSTE PLACAS DE PUNTERÍA**  
**OBSERVACION ALTIMÉTRICA**

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

Sistema de coordenadas UTM  
Red Altimétrica  
Número de vértices fijos :3  
Número de vértices a ajustar :6  
Numero de incogintas :6

Trabajo: 23VI04  
 COMPASS  
 Empresa: GVS  
 Fecha : 05/2003

| Est.  | Vis.  | Lec.Hz.  | Lec.V.   | Dis.g. | m     | i     |
|-------|-------|----------|----------|--------|-------|-------|
| 23041 | 23042 | 300.4075 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 23043 | 327.4194 | 0.0000   | 0.000  | 0.000 | 0.285 |
| 23041 | 6     | 354.0213 | 95.7894  | 0.000  | 0.000 | 0.285 |
| 23041 | 1     | 14.0912  | 92.7120  | 0.000  | 0.000 | 0.285 |
| 23041 | 5     | 29.2706  | 91.2524  | 0.000  | 0.000 | 0.285 |
| 23041 | 4     | 361.8683 | 95.9573  | 0.000  | 0.000 | 0.285 |
| 23041 | 3     | 374.6819 | 95.0280  | 0.000  | 0.000 | 0.285 |
| 23041 | 2     | 392.6876 | 93.3479  | 0.000  | 0.000 | 0.285 |
| 23042 | 2     | 79.2932  | 93.8345  | 0.000  | 0.000 | 0.277 |
| 23042 | 1     | 93.8896  | 94.3580  | 0.000  | 0.000 | 0.277 |
| 23042 | 5     | 102.9545 | 93.8919  | 0.000  | 0.000 | 0.277 |
| 23042 | 23041 | 142.2008 | 99.0867  | 57.516 | 0.120 | 0.277 |
| 23042 | 4     | 41.9513  | 94.4905  | 0.000  | 0.000 | 0.277 |
| 23042 | 3     | 60.9562  | 94.2212  | 0.000  | 0.000 | 0.277 |
| 23042 | 23043 | 0.0006   | 100.5273 | 0.000  | 0.320 | 0.277 |
| 23042 | 6     | 29.3389  | 93.8959  | 0.000  | 0.000 | 0.277 |
| 23043 | 1     | 325.0733 | 94.4904  | 0.000  | 0.000 | 0.276 |
| 23043 | 2     | 316.9072 | 93.3825  | 0.000  | 0.000 | 0.276 |
| 23043 | 23042 | 0.0009   | 0.0000   | 0.000  | 0.000 | 0.276 |
| 23043 | 5     | 330.5262 | 94.3289  | 0.000  | 0.000 | 0.276 |
| 23043 | 4     | 281.6709 | 90.8573  | 0.000  | 0.000 | 0.276 |
| 23043 | 6     | 262.2981 | 88.0689  | 0.000  | 0.000 | 0.276 |
| 23043 | 23041 | 369.2149 | 99.1576  | 97.500 | 0.320 | 0.276 |
| 23043 | 3     | 303.4098 | 92.5169  | 0.000  | 0.000 | 0.276 |

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

DESNIVELES

| Estación | Visado | Desnivel |
|----------|--------|----------|
| 23041    | 6      | 7.711    |
| 23041    | 1      | 8.380    |
| 23041    | 5      | 9.860    |
| 23041    | 4      | 6.749    |
| 23041    | 3      | 6.982    |
| 23041    | 2      | 8.067    |
| 23042    | 2      | 8.847    |
| 23042    | 1      | 9.159    |
| 23042    | 5      | 10.639   |
| 23042    | 4      | 7.529    |
| 23042    | 3      | 7.761    |
| 23042    | 6      | 8.489    |
| 23043    | 1      | 9.625    |
| 23043    | 2      | 9.313    |
| 23043    | 5      | 11.103   |
| 23043    | 4      | 7.995    |
| 23043    | 6      | 8.955    |
| 23043    | 3      | 8.227    |

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

RESIDUOS

| Est.  | Vis. | Observación | Error<br>a priori | Peso  | Residuo<br>Ponderado | Residuo<br>(m/cc) |
|-------|------|-------------|-------------------|-------|----------------------|-------------------|
| 23041 | 6    | desnivel    | 0.0112            | 89.2  | -0.32                | -0.0036 m         |
| 23041 | 1    | desnivel    | 0.0070            | 142.0 | -0.14                | -0.0010 m         |
| 23041 | 5    | desnivel    | 0.0069            | 144.4 | -0.16                | -0.0011 m         |
| 23041 | 4    | desnivel    | 0.0102            | 98.4  | -0.14                | -0.0014 m         |
| 23041 | 3    | desnivel    | 0.0086            | 116.9 | -0.17                | -0.0014 m         |
| 23041 | 2    | desnivel    | 0.0074            | 134.8 | -0.08                | -0.0006 m         |
| 23042 | 2    | desnivel    | 0.0088            | 113.4 | -0.07                | -0.0006 m         |
| 23042 | 1    | desnivel    | 0.0100            | 100.0 | -0.02                | -0.0002 m         |
| 23042 | 5    | desnivel    | 0.0108            | 92.9  | -0.01                | -0.0001 m         |
| 23042 | 4    | desnivel    | 0.0084            | 119.6 | -0.14                | -0.0012 m         |
| 23042 | 3    | desnivel    | 0.0082            | 121.6 | -0.06                | -0.0005 m         |
| 23042 | 6    | desnivel    | 0.0085            | 117.1 | -0.11                | -0.0010 m         |
| 23043 | 1    | desnivel    | 0.0108            | 92.8  | 0.23                 | 0.0024 m          |
| 23043 | 2    | desnivel    | 0.0087            | 115.4 | 0.16                 | 0.0014 m          |
| 23043 | 5    | desnivel    | 0.0121            | 82.5  | 0.29                 | 0.0035 m          |
| 23043 | 4    | desnivel    | 0.0053            | 187.3 | 0.16                 | 0.0009 m          |
| 23043 | 6    | desnivel    | 0.0046            | 218.5 | 0.19                 | 0.0009 m          |
| 23043 | 3    | desnivel    | 0.0067            | 148.5 | 0.18                 | 0.0012 m          |

m : 0.2



Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

DESPLAZAMIENTO DE LAS COORDENADAS

| Número | X'          | dx     | Y'           | dy     | Z'       | Z        |
|--------|-------------|--------|--------------|--------|----------|----------|
| 23041  | 701166.7660 | 0.0000 | 4598518.0260 | 0.0000 | 169.3860 | 169.3860 |
| 23042  | 701211.7840 | 0.0000 | 4598553.8260 | 0.0000 | 168.6060 | 168.6060 |
| 23043  | 701261.2960 | 0.0000 | 4598541.9190 | 0.0000 | 168.1380 | 168.1380 |
| 1      | 701197.8282 | 0.0000 | 4598454.8425 | 0.0000 | 177.7640 | 177.7652 |
| 2      | 701219.6438 | 0.0000 | 4598465.9591 | 0.0000 | 177.4520 | 177.4528 |
| 3      | 701242.0707 | 0.0000 | 4598477.3898 | 0.0000 | 176.3660 | 176.3661 |
| 4      | 701264.0661 | 0.0000 | 4598488.6124 | 0.0000 | 176.1330 | 176.1335 |
| 5      | 701181.7752 | 0.0000 | 4598450.4247 | 0.0000 | 179.2430 | 179.2450 |
| 6      | 701277.2569 | 0.0000 | 4598499.0250 | 0.0000 | 177.0940 | 177.0936 |

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

PRECISIONES Y PARAMETROS DE LAS ELIPSES DE ERROR

| Número | mx     | my     | mz     | Ômax.  | Ômin.  | Acimut |
|--------|--------|--------|--------|--------|--------|--------|
| 23041  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23042  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 23043  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| 1      | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0000 | 0.0000 |
| 2      | 0.0000 | 0.0000 | 0.0010 | 0.0000 | 0.0000 | 0.0000 |
| 3      | 0.0000 | 0.0000 | 0.0009 | 0.0000 | 0.0000 | 0.0000 |
| 4      | 0.0000 | 0.0000 | 0.0008 | 0.0000 | 0.0000 | 0.0000 |
| 5      | 0.0000 | 0.0000 | 0.0011 | 0.0000 | 0.0000 | 0.0000 |
| 6      | 0.0000 | 0.0000 | 0.0008 | 0.0000 | 0.0000 | 0.0000 |

Trabajo: 23VI04  
 COMPASS  
 Empresa: GVS  
 Fecha : 05/2003

TEST DE BAARDA (Estudio de errores groseros (@)

| Est.  | Vis. | Observación | Error<br>a priori | Residuo<br>(m/cc) | Error<br>Obs. | Error<br>Residuo | Residuo<br>Tipif. |
|-------|------|-------------|-------------------|-------------------|---------------|------------------|-------------------|
| 23041 | 6    | desnivel    | 0.0112            | -0.0036           | 0.0008        | 0.0021           | 1.68              |
| 23041 | 1    | desnivel    | 0.0070            | -0.0010           | 0.0010        | 0.0010           | 0.97              |
| 23041 | 5    | desnivel    | 0.0069            | -0.0011           | 0.0011        | 0.0009           | 1.18              |
| 23041 | 4    | desnivel    | 0.0102            | -0.0014           | 0.0008        | 0.0019           | 0.73              |
| 23041 | 3    | desnivel    | 0.0086            | -0.0014           | 0.0009        | 0.0015           | 0.97              |
| 23041 | 2    | desnivel    | 0.0074            | -0.0006           | 0.0010        | 0.0012           | 0.50              |
| 23042 | 2    | desnivel    | 0.0088            | -0.0006           | 0.0010        | 0.0015           | 0.39              |
| 23042 | 1    | desnivel    | 0.0100            | -0.0002           | 0.0010        | 0.0018           | 0.09              |
| 23042 | 5    | desnivel    | 0.0108            | -0.0001           | 0.0011        | 0.0019           | 0.07              |
| 23042 | 4    | desnivel    | 0.0084            | -0.0012           | 0.0008        | 0.0015           | 0.78              |
| 23042 | 3    | desnivel    | 0.0082            | -0.0005           | 0.0009        | 0.0014           | 0.36              |
| 23042 | 6    | desnivel    | 0.0085            | -0.0010           | 0.0008        | 0.0016           | 0.62              |
| 23043 | 1    | desnivel    | 0.0108            | 0.0024            | 0.0010        | 0.0019           | 1.27              |
| 23043 | 2    | desnivel    | 0.0087            | 0.0014            | 0.0010        | 0.0015           | 0.92              |
| 23043 | 5    | desnivel    | 0.0121            | 0.0035            | 0.0011        | 0.0022           | 1.57              |
| 23043 | 4    | desnivel    | 0.0053            | 0.0009            | 0.0008        | 0.0007           | 1.23              |
| 23043 | 6    | desnivel    | 0.0046            | 0.0009            | 0.0008        | 0.0005           | 1.69              |
| 23043 | 3    | desnivel    | 0.0067            | 0.0012            | 0.0009        | 0.0010           | 1.21              |

Trabajo: 23VI04  
COMPASS  
Empresa: GVS  
Fecha : 05/2003

|                                 |         |
|---------------------------------|---------|
| Redundancia de la Red           | :12     |
| Redundancia de las incognitas   | :2.00   |
| Error kilométrico en desniveles | :100 mm |
| Desviación típica a priori      | : 1.0   |
| Desviación típica a posteriori  | : 0.2   |

## **CALCULO DE COORDENADAS**

| CONTROL GEODESICO DEL MOVIMIENTO DE LAS ESTRUCTURAS DE LA LINEA<br>DE ALTA VELOCIDAD (AVE) ENTRE ZARAGOZA Y LERIDA |         |        |      |             |
|--------------------------------------------------------------------------------------------------------------------|---------|--------|------|-------------|
| ESTRUCTURA                                                                                                         | CAMPAÑA | FECHA  | HORA | TEMPERATURA |
| 23VI04                                                                                                             | 2003    | 26-abr | 18 h | 18°         |
|                                                                                                                    |         |        |      |             |

| CONTROL GEODESICO DEL MOVIMIENTO DE LAS ESTRUCTURAS DE LA LINEA<br>DE ALTA VELOCIDAD (AVE) ENTRE ZARAGOZA Y LERIDA |         |        |      |             |
|--------------------------------------------------------------------------------------------------------------------|---------|--------|------|-------------|
| ESTRUCTURA                                                                                                         | CAMPAÑA | FECHA  | HORA | TEMPERATURA |
| 23VI04                                                                                                             | 2003    | 26-abr | 18 h | 18°         |
|                                                                                                                    |         |        |      |             |

[illegible]

# CONTROL GEODESICO DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DE LA LINEA DE ALTA VELOCIDAD (AVE) ENTRE ZARAGOZA Y LERIDA

## POLISECCION

| ESTRUCTURA |  | CAMPAÑA | FECHA  | HORA | TEMPERATURA |
|------------|--|---------|--------|------|-------------|
| 23VI04     |  | 2003    | 26-abr | 18 h | 18°         |
|            |  |         |        |      |             |

[illegible]

NOTA: Las precisiones de las coordenadas obtenidas, se pueden ver en la salida del cálculo

**NIVELACION DE ALTA PRECISION**



|                          |  |                           |  |                                          |  |
|--------------------------|--|---------------------------|--|------------------------------------------|--|
| Hoja : 1                 |  | Lado: Izquierdo           |  | Estructura 23VI04                        |  |
| <b>TRABAJO:</b>          |  | Punto de partida : BASE 1 |  | Punto de llegada : BASE 4                |  |
| <b>Hora de comienzo:</b> |  | 07:50 AM                  |  | <b>Hora término:</b> 08:30 AM            |  |
|                          |  |                           |  | <b>Precisión (mm. por raíz de K) :</b> 2 |  |
| <b>Fecha:</b> 16-Mayo-03 |  | <b>Nivel:</b> Automático. |  | <b>Número:</b> 21                        |  |
|                          |  |                           |  | <b>Cuña:</b> 21                          |  |
|                          |  |                           |  | <b>Operador:</b> J DE FRUTOS             |  |

| NIVELADA DE ESPALDA |                 |             |                   |          |           |              |
|---------------------|-----------------|-------------|-------------------|----------|-----------|--------------|
| SENAL               | L.HILOS ESTADI. | DIST. ESPA. | L.HIL.NIVELADORES |          | DESNIV. 1 | DESFA. ESCAL |
|                     |                 |             | Escala 1          | Escala 2 |           |              |
| SUMA ANT.:          |                 |             | 0,00              | 0,00000  | 0,00000   | 0,00000      |
| BASE 1              | 4,48960         |             | 4,43632           | 1,42078  | 0,19172   | Correg.      |
| BASE 1              | 4,38300         | 10,66       | 4,43632           | 1,42078  | 0,19172   |              |
| BASE 2              | 4,35250         |             | 4,30373           | 1,28819  | 0,47343   | Correg.      |
| BASE 2              | 4,25480         | 9,77        | 4,30373           | 1,28819  | 0,47343   |              |
| PILA 1              | 4,09800         |             | 4,01151           | 0,99601  | -0,42679  | Correg.      |
| PILA 1              | 3,92490         | 17,31       | 4,01151           | 0,99601  | -0,42679  |              |
| PILA 2              | 3,25820         |             | 3,14875           | 0,13320  | -1,31297  | Correg.      |
| PILA 2              | 3,03920         | 21,90       | 3,14875           | 0,13320  | -1,31297  |              |
| PILA 3              | 4,03930         |             | 3,93915           | 0,92369  | -0,45523  | Correg.      |
| PILA 3              | 3,83880         | 20,05       | 3,93915           | 0,92369  | -0,45523  |              |
| PILA 4              | 5,34230         |             | 5,28430           | 2,26884  | 0,34452   | Correg.      |
| PILA 4              | 5,22650         | 11,58       | 5,28430           | 2,26884  | 0,34452   |              |
| BASE 3              | 4,72030         |             | 4,65170           | 1,63627  | 0,12550   | Correg.      |
| BASE 3              | 4,58340         | 13,69       | 4,65170           | 1,63627  | 0,12550   |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
|                     |                 |             |                   |          |           | Correg.      |
|                     |                 |             |                   |          |           |              |
| SUMAS:              |                 |             | 104,96            | 59,55092 | 17,33396  | -2,11964     |

| NIVELADA DE FRENTE |                 |             |                   |          |           |              |          |
|--------------------|-----------------|-------------|-------------------|----------|-----------|--------------|----------|
| SENAL              | L.HILOS ESTADI. | DIST. FREN. | L.HIL.NIVELADORES |          | DESNIV. 2 | DESFA. ESCAL | NUM EST. |
|                    |                 |             | Escala 1          | Escala 2 |           |              |          |
| SUMA ANT.:         |                 |             | 0,00              | 0,00000  | 0,00000   | 0,00000      |          |
| BASE 2             | 4,29550         |             | 4,24460           | 1,22906  | 0,19172   | Correg.      |          |
| BASE 2             | 4,19360         | 10,19       | 4,24460           | 1,22906  | 0,19172   |              | 1        |
| PILA 1             | 3,88140         |             | 3,83030           | 0,81470  | 0,47349   | Correg.      |          |
| PILA 1             | 3,77920         | 10,22       | 3,83030           | 0,81470  | 0,47349   |              | 2        |
| PILA 2             | 4,51660         |             | 4,43830           | 1,42285  | -0,42684  | Correg.      |          |
| PILA 2             | 4,36020         | 15,64       | 4,43830           | 1,42285  | -0,42684  |              | 3        |
| PILA 3             | 4,56480         |             | 4,46172           | 1,44623  | -1,31303  | Correg.      |          |
| PILA 3             | 4,36020         | 20,46       | 4,46172           | 1,44623  | -1,31303  |              | 4        |
| PILA 4             | 4,49680         |             | 4,39438           | 1,37910  | -0,45541  | Correg.      |          |
| PILA 4             | 4,29220         | 20,46       | 4,39438           | 1,37910  | -0,45541  | *            | 5        |
| BASE 3             | 4,99710         |             | 4,93978           | 1,92423  | 0,34461   | Correg.      |          |
| BASE 3             | 4,88240         | 11,47       | 4,93978           | 1,92423  | 0,34461   |              | 6        |
| BASE 4             | 4,60150         |             | 4,52620           | 1,51070  | 0,12557   | Correg.      |          |
| BASE 4             | 4,45090         | 15,06       | 4,52620           | 1,51070  | 0,12557   |              | 7        |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
|                    |                 |             |                   |          |           | Correg.      |          |
|                    |                 |             |                   |          |           |              |          |
| SUMAS:             |                 |             | 103,50            | 61,67056 | 19,45374  | -2,11978     | 7        |



23V104

BASE 4

1,5

J DE FRUTOS

-



**RESUMEN :** Estructura 23VI04

Precisión (por raíz de K) a priori : 1,50 mm. Precisión (por raíz de K) a posteriori : 0,43 mm.

Fecha: 15-Mayo-03 Nivel automá.: 21 Nivel digital: Cálculo: Ingeniero Técnico en Topografía D. J. de Frutos

Punto de partida : BASE 1 Punto de llegada: BASE 4

Desnivel de IDA : -1,05985 metros. Tipo de nivel: A

Desnivel de VUELTA : 1,05966 metros. Tipo de nivel: A

Error de cierre : -0,00019 metros. Equivalente a : 0,43 mm. por raíz de K

Promedio : -1,059758 metros.

Altitud de BASE 1 168,63500 metros. Clase:

Altitud de BASE 4 167,57524 metros.

Número de estaciones : 14 (ida y vuelta)

Longitud total nivelada : 414,15 metros. (ida y vuelta)

Longitud promedio por eje : 29,5821429 metros.

Tipo de nivel : A indica nivel automático, o de lectura por operador - D indica nivel digital, o de lectura en miras de código de barras y registro por el propio nivel.

# CONTROL GEODESICO DE LOS MOVIMIENTOS DE LAS ESTRUCTURAS DE LA LINEA DE ALTA VELOCIDAD (AVE) ENTRE ZARAGOZA Y LERIDA

## NIVELACION DE ALTA PRECISION

|            |         |          |       |             |
|------------|---------|----------|-------|-------------|
| ESTRUCTURA | CAMPAÑA | FECHA    | HORA  | TEMPERATURA |
| 23VI04     | 2003    | 16/05/03 | 07:56 | 10 °C       |
|            |         |          |       |             |

[illegible]